NOTICE INVITING SEALED BIDS
DC ST-180 Lab Mechanical Upgrades

Sealed Bids will be received until 3:00 P.M. (Tucson Time), August 15, 2013, by Pima County Community College District ("Owner"), to do the work required for the Owner's Project known as DC ST-180 Lab Mechanical Upgrades ("Project"), which is located in Pima County, Arizona.

A MANDATORY Pre-Bid Conference will be held July 23, 2013 at 10:00 (Tucson Time) at the following location Pima Community College Downtown Campus, 1255 N. Stone, Tucson, AZ 85705, CO Building Room 112. Attendees will have fifteen minutes after the start of the meeting to sign in. After that the sign in sheet will close.

Questions pertaining to this bid must be communicated in writing and be received via email by August 2, 2013 at 3:00 P.M. (Tucson Time) Questions must be sent to the email address below and include the specified Bid Number, Project Name and Buyer’s name in the subject field of the email. Any questions should include a reference to the appropriate page and section number of the bid. E-Mail questions to: DO-Staff-FO-Procur@pima.edu. Answers will be posted as an addendum to our website by 5:00 P.M. (Tucson Time) on August 9, 2013.

Buyers Name / Title: Jan Posz, C.P.M., Sr. Buyer

Bids will be opened publicly at the Owner's office, 4905D East Broadway Blvd, Room D232, Tucson Arizona, at 3:00 P.M. (Tucson Time), August 15, 2013, and read aloud by a representative of the Owner. All information and Bids submitted by bidders will be made available for public inspection during regular business hours after an award is made, if any. Any bid received after the date and time listed above will be returned and not considered.

Two sets of plans and specifications for the work are available for pick up at Reproductions Inc., 234 E. 6th Street, Tucson, AZ 85705, phone (520) 622-7747. (Additional sets are at vendors own expense).

Copies of the NOTICE INVITING SEALED BIDS, Bid Documents and Forms as well as the College’s CONTRACT AND GENERAL CONDITIONS BETWEEN OWNER AND CONTRACTOR are available on the Pima Community College Website:

http://www.pima.edu/administrative-services/purchasing/current-requests-for-proposals-bids-quotes.html

The Owner intends to contract, if at all, with the lowest responsive and responsible bidder whose bid conforms in all material respects to the requirements of the bid documents, including the Plans and Specifications. "Responsive Bidder" means the bidder who submits a bid that conforms in all material respects to this Notice Inviting Sealed Bids, Instructions to Bidders and the Plans and Specifications which are incorporated herein by this reference. "Responsible Bidder" means the bidder who has the capability to perform the contract requirements and the integrity and reliability to assure complete and good faith performance and who submits the lowest bid. In order for the bid to be considered, bidders must complete and submit the Bid form and all other required forms, which are incorporated herein by reference.
Bid No. B13/9823

A certified or cashier's check or Bid bond for ten percent (10%) of the Contract Amount proposed by the bidder must accompany each Bid as a guarantee that the bidder will enter into a contract to perform the work in accordance with the Plans and Specifications or as liquidated damages in the event of the bidder's failure or refusal to enter into a contract. The check or bond will be returned to the unsuccessful bidders. The successful bidder's check or bond will be returned upon the execution of satisfactory bonds and a contract as described by the bid documents.

It shall be mandatory on the contractor to whom the Contract is awarded, and upon any subcontractor under him, to comply in every respect with the applicable provisions of the Arizona Revised Statutes and with all other requirements of the laws of Arizona.

The bidder to whom the Contract is awarded shall furnish the Owner, within five (5) days after the award, satisfactory Payment and Performance Bonds in an amount equal to one hundred percent (100%) of the Contract Amount stated in the Bid. Individual surety bonds are not acceptable.

The Owner reserves the right to reject any or all Bids, to withhold the award of a contract for any reason it may determine and to hold any or all Bids for a period of forty-five (45) days. Any bid protests concerning this bid must be filed with the District Purchasing Director no later than the tenth calendar day following the date of award.

The Owner reserves the right to waive any irregularities in any Bid if such action is determined by the Owner, in its sole discretion, to be in the best interest of the Owner.

Thomas E. Harrington, C.P.M.
Director of Purchasing
Pima County Community College District
District Office – Purchasing
4905 East Broadway, Room 232
Tucson, Arizona 85709-1420
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SECTION ONE
INSTRUCTIONS TO BIDDERS

1. BIDS

To be entitled to consideration, Bids must be made in accordance with the following instructions:

a. Before submitting a Bid, each bidder shall examine the Notice Inviting Sealed Bids, these Instructions to Bidders, the Drawings, Specifications, Contract and General Conditions Between Owner and Contractor, and all other documents comprising the Contract Documents, and fully inform himself of all existing conditions and limitations, and include in the Bid a sum to cover the cost of all work required by the Contract Documents. The failure of any bidder to receive or examine any form, instrument, addendum, or other document, or visit the site and acquaint himself with conditions existing there, shall in no way relieve any bidder from obligations with respect to his Bid or the Contract Documents. Failure to attend the mandatory Pre-Bid Conference on July 23, 2013 at 10:00 (Arizona Time) will disqualify Bids received from any bidder not in attendance.

b. Bids shall be made only upon the form provided therefor. All blank spaces in the form shall be filled in completely. If some spaces do not apply, so state. Monetary amounts shall be stated both in writing and in numerals and, in case of any discrepancy between the two, the amounts in writing shall take precedence. The signature shall be in longhand and shall be that of an individual legally authorized to sign such form and bind the bidder. The completed form shall be without interlineation, alteration, or erasure.

c. Bids shall not contain any recapitulation of the work to be done. No oral, telegraphic, fax or telephonic bids or modifications shall be considered.

d. Bids shall be delivered to the place designated in the Notice Inviting Sealed Bids on or before the date and hour set for the opening of bids. Bids shall be enclosed in an opaque, sealed envelope, bearing the Bid Number, the title of the Project and the name of the bidder, except for that portion of the Bid bearing the title "List of Subcontractors and Material Vendors," which shall be enclosed in a separate, opaque, sealed envelope, as hereinafter specified in these Instructions to Bidders. It is the sole responsibility of the bidder to deliver his bid before the scheduled closing time. Any bids received after the scheduled closing time will be returned unopened.

e. The Contract Amount quoted is to include the furnishing of all materials, plant, equipment, tools, and all other facilities called for in the Contract Documents, and the performance of all labor and services necessary or proper for the completion of the Project, except such as may be otherwise expressly provided for in the Contract Documents.

f. The Bid form must be used without alteration.

2. LIST OF SUBCONTRACTORS AND MATERIAL VENDORS

a. For use of the Owner in determining competency and capability of those who will work on the Owner's Project, and quality and workmanship of those who will supply material to the Owner's Project, each bidder is required to submit with his bid a list naming the subcontractors who will be used
in performing the work. The list shall include any subcontractor that might be used in the event any or all of the various alternates are chosen by the Owner. The circumstances under which each subcontractor will be used must be specifically set forth by identifying alternates for which a particular subcontractor would be used.

b. ONE, and only one, subcontractor shall be submitted for each portion of the work for the Base Bid. The listing of more than one Subcontractor for any separate portion of the work shall be considered grounds for rejection of the bid by the Owner at the Owner's sole discretion.

c. The list shall be filled out and enclosed in a separate, opaque, sealed envelope bearing the title "List of Subcontractors," and the name of the bidder, and the envelope then inserted in the general bid envelope with the other forms. The list submitted by the successful bidder will be privately opened and will be retained by the Owner for record as a part of the Bid. The lists of other bidders will be returned unopened.

d. No subcontractor not named in such list and approved by the Owner may be employed on the Owner's Project without express written permission of the Owner, notwithstanding any other provision of the Contract Documents which may be interpreted to the contrary. Should a change in the approved list become necessary in the opinion of the successful bidder, a written request shall be submitted to the Owner stating the reason for the change, and written approval of the Owner must be obtained before such change is made. This provision shall apply to work listed to be performed by the bidder, as well as work listed to be performed by vendors or subcontractors.

e. By this requirement of a List of Subcontractors, the Owner does not establish any contractual relation between the Owner and any subcontractor, nor will the Owner inquire into contractual or other relations of the bidder with any subcontractor, nor does this list establish limits to the contracts between the bidder and any subcontractor. The sole purpose and function of such requirement is set forth in the first sentence of the first paragraph of this section.

f. If prior to the signing of the Contract the Owner has a reasonable objection to any person or organization on the List of Subcontractors, the Owner shall notify the apparent successful bidder in writing of such objection. Failure of the Owner to make an objection to any person or organization on the list prior to the award shall constitute acceptance of such person or organization except in the case where a subcontractor is later found not to be qualified by law.

g. If, prior to the signing of the Contract, regardless of whether the Owner has evidenced any intention to award the Contract to Contractor or not, the Owner has a reasonable and substantial objection to any person or organization on such list, and refuses in writing to accept such person or organization except where such refusal is a result of the failure of a subcontractor to qualify by law, the apparent successful bidder may, prior to the signing, withdraw his bid without forfeiture of bid security. If the bidder submits an acceptable substitute the Owner may, at his discretion, accept or disqualify the bid.

3. BASE BID AND ALTERNATES

The Base Bid shall include all work as set forth on the Drawings, in the Specifications, and in all Contract Documents, plus the specified Contingency Reserve Fund and Cash Allowance, if any. Alternate bid items are described in the Specifications and indicated on the Bid. The Owner shall have
the right to accept Alternates in any order or combination and to determine the low bidder on the basis of the sum of the Base Bid and the Alternates accepted.

4. **BID SECURITY**

All Bids shall be accompanied by the bid security in the form and amount as published in the Notice Inviting Sealed Bids and as acceptable to the Owner, and shall be payable without conditions to the Owner as a guarantee that the bidder, if awarded the Contract, will promptly execute such Contract in accordance with the Bid and in the manner and form required by the Contract Documents, and will furnish good and sufficient bonds for the faithful performance of the work and payment of all claimants supplying labor or materials. The bid security must be enclosed in the same envelope with the Bid.

Note: The Notice Inviting Sealed Bids requires that this bid security will also serve as liquidated damages in the event the Contractor fails or refuses to enter into a contract. Mistake shall not excuse any failure or refusal to enter into a contract.

5. **WITHDRAWAL OF BID**

Any bidder may withdraw his Bid, either personally or by telegraphic or written request, at any time before the scheduled closing time for receipt of Bids. No bid may be withdrawn for at least forty-five (45) days after the date the bids are opened, nor may any bid be withdrawn between the scheduled closing time for receipt of Bids and the time the bids are actually opened.

6. **INTERPRETATIONS AND ADDENDA**

Following the Mandatory Pre-Bid Conference, all prospective bidders shall have an opportunity to submit questions or request clarifications to drawings or other Contract Documents in writing to the Owner regarding the Project. The due date for these questions or clarifications is specified on the NOTICE INVITING SEALED BIDS for the project. The Owner shall post a response or Addendum to the Bid documentation on the College website under the Bid Number. The bidder submitting a request for interpretations will be responsible for its prompt delivery. All requests for interpretations shall be made in writing. The Owner will not be responsible for any explanations or interpretations except those duly issued in the form of written addenda. Receipt of any addenda so issued during the time of bidding shall be included in the bid and shall be acknowledged in the Bid and be made a part of the Contract Documents.

7. **APPROVAL OF EQUAL ITEMS OF EQUIPMENT AND/OR MATERIALS BEFORE SUBMISSION OF BIDS**

Products are generally specified by reference standard and/or manufacturer's name and model number or trade name. When specified only by reference standard, the bidder may select any product meeting this standard by any manufacturer. When several products or manufacturers are specified as being equally acceptable, the bidder has the option of using any product and manufacturer combination listed.

When a specific manufacturer, installer (where pre-qualification is required), trade name or material is specified, or indicated, it is to establish a standard of quality and shall not be construed as
limiting competition. If the bidder desires to use other than that specified, he shall request approval of such substitution in the manner specified below:

a. **Prior Approvals:** Substitutions will be considered only when a written request has been submitted by a bidder, who shall be a general contractor qualified to submit a bid to the Owner, for approval at least fourteen (14) calendar days prior to the original date for receipt of bids. No approvals will be granted to suppliers, distributors or subcontractors. Each request shall include all information requested hereinafter. If the Owner approves any proposed substitution, such approval shall be set forth in an Addendum.

b. **Submittal Requirements:** All requests shall contain sufficient information, descriptive brochures, drawings, performance and test data, samples or other data as is necessary for complete evaluation and shall indicate by direct comparison how the proposed substitution compares with the specified equipment or material in every material respect with that specified. Each submittal shall be well marked and identified as to the type and kind of items proposed to be substituted. It is the sole responsibility of the bidder to submit complete descriptive and technical information so that the Owner can make a complete evaluation. Lack of sufficient information will be cause for rejection. References to catalogs will not be acceptable. Submittals shall be accompanied by a written statement from the manufacturer or contractor on his letterhead certifying that the proposed substitution meets or exceeds that specified in all aspects and that it will coordinate properly with related construction. Any redesign necessitated by the substitution shall be paid for by the Contractor.

c. As set forth in the Specifications, the bidder’s request for prior approval shall include, without limitation:

   (1) Complete data substantiating compliance of the proposed substitution with the Contract Documents.

   (2) Product identification, including manufacturer's name, address and telephone number.

   (3) A tabulation comparing the specified product manufacturer’s complete product description, performance test data and reference standards with the same information for the proposed products.

   (4) Samples and colors of the proposed products.

   (5) Names and addresses of similar projects in which the proposed product was used and the date of installation.

   (6) For construction methods, include a detailed description for proposed method and drawings illustrating same.

   (7) Accurate cost data on proposed substitution in comparison with product or method specified.

d. Any bidders, other than the bidder who requested a particular substitution, who choose to utilize a prior approved item, as approved by Addendum, shall comply with all terms and conditions of
the original prior approval submittal. All provisions of this Paragraph 8 regarding using of substitutions shall apply to any bidder who chooses to utilize such substitution.

8. BIDDERS INTERESTED IN MORE THAN ONE BID

No person, firm, or corporation shall be allowed to make, file, or be interested in more than one bid for the same work. A person, firm, or corporation who has submitted a sub-bid to a bidder, or who has quoted prices on materials to a bidder, is not thereby disqualified from submitting a sub-bid or quoting prices to other bidders.

9. ACCEPTANCE OR REJECTION OF BIDS

The Owner reserves the right to reject any or all bids and to waive any informalities in the Bids received. The award of the Contract, if made by the Owner, will be made to the responsible and qualified bidder submitting the lowest bid, but the Owner shall determine in its own discretion whether a bidder is responsible and qualified to perform the Contract, what bid is the lowest, and whether it is in the interest of the Owner to accept the bid.

10. AGREEMENT AND BONDS

The form of agreement which the successful bidder will be required to execute, and the forms and amounts of surety bonds required at the time of execution of the agreement, are included in the Contract Documents and must be carefully examined by the bidder. As noted in the instructions, all bids must include any exceptions requested from the Contract Documents; subsequent requests for deviation from the Contract Document will not be considered. All sureties must be authorized to do business in Arizona, listed on the U.S. Department of Treasury's list of approved sureties, and must be satisfactory to the Owner. No individual sureties are acceptable. The successful bidder must furnish the required bonds and insurance certificates and commence work within five (5) days after issuance of the Notice of Intent to Award and Notice to Proceed. By submission of a Bid, a bidder will be deemed, and agrees to be so treated, to have actual notice of every term of every Contract Document.

11. NON-COLLUSION AFFIDAVIT

The successful bidder, before the award of the Contract, shall submit to the Owner non-collusion affidavits covering the bidder and all subcontractors.

12. LIST OF COMPARABLE PROJECTS

If requested by Owner, the bidder must submit, within 24 hours after bid opening, a list of all projects undertaken within the three (3) years immediately preceding the bid date and a Contractor's Qualification Statement in the form of AIA A-305. Such list shall include the name, address and phone number of the owner and the architect of each project, the contract amount, and the starting date. Bidder consents to the use of the list and Qualification Statement by Owner to inquire into bidder's fitness, capabilities and responsibility in connection with Owner's consideration of the bid. Bidder agrees to hold harmless the Owner, the Architect, and each owner and architect listed from any action or claim that might arise from any adverse report received by Owner concerning bidder's performance on the projects listed. Failure to furnish a complete list and Qualification Statement as required herein may be considered grounds for rejection of the bid by the Owner, at the Owner's sole discretion.
13. **BID PROTESTS**

Any bid protests concerning this bid must be filed with the District Purchasing Director no later than the tenth calendar day following the date of award at: 4905D East Broadway Blvd, Tucson, Arizona 85708-1420.
SECTION TWO
CONTRACT AND GENERAL CONDITIONS
BETWEEN OWNER AND CONTRACTOR

THIS AGREEMENT, made this _____ day of ____________, 201__, by and between __________________________________________________________, hereinafter called the "Contractor," and Pima County Community College District, operating in Pima County, hereinafter called the "Owner":

W I T N E S S E T H:

That the Contractor and the Owner agree as follows:

ARTICLE 1
THE CONTRACT DOCUMENTS

1.1 CONTRACT DOCUMENTS.

1.1.1 The following listed documents constitute the Contract Documents, and they are all as fully a part of the Contract and General Conditions as if herein repeated:

1. This Contract and General Conditions between Owner and Contractor.
2. Notice of Award and Receipt of Notice
3. Notice to Proceed and Receipt of Notice
4. Performance Bond and Payment Bond.
5. Addenda Nos. __________________ dated ______________.
6. Specifications and Drawings (as modified by the above-referenced Addenda and selected alternates as listed herein, if any) as set forth in Exhibit A to this Contract.
8. Instructions to Bidders.
10. Certificates of Insurance.

1.1.2 In the event of any inconsistency between any of the terms of the before enumerated documents, such inconsistencies shall be resolved by giving precedence to the terms of the lowest numbered of the above numbered documents. Anything in these Contract Documents to the contrary notwithstanding, the provisions of all pertinent general public laws of the State of Arizona in effect at the time of the execution of this Contract shall be a part of the Contract between the parties and shall take precedence over all of the other Contract Documents.
ARTICLE 2  
SCOPE OF WORK  

2.1 As required by the Contract Documents, the Contractor shall furnish and install all of the materials and labor and perform all of the work for the Owner's Project known as DC ST-180 Lab Mechanical Upgrades ("Project" herein).

ARTICLE 3  
CONTRACT AMOUNT, TIME, LIQUIDATED DAMAGES AND EARLY COMPLETION BONUS  

3.1 CONTRACT AMOUNT. The Owner shall pay the Contractor the sum of ____________________________ Dollars ($__________) for the Base Bid and alternate number one, which is the Contract Amount. This sum is subject to additions or deductions made in accordance with the provisions of the Contract Documents.  

3.2 CONTRACT TIME. The Contract Time as used and defined in Article 11 herein shall be One Hundred Twenty One (121) calendar days.  

3.3 LIQUIDATED DAMAGES AND EARLY COMPLETION BONUS.  

3.3.1 Liquidated damages N/A  

3.3.2 An Early Completion Bonus N/A  

3.4 CHANGE ORDERS. Limits on the amount of overhead and profit allowed on Change Orders are specified in Article 15. An item of additional work or change in Plans and Specifications which involves an extra cost shall be valid only if authorized by Change Order in accordance with Article 15 of this Contract and General Conditions. 

ARTICLE 4  
DEFINITIONS AND GENERAL PROVISIONS  

4.1 OWNER, OWNER'S REPRESENTATIVE AND CONTRACTOR. The Owner, Owner's Representative and the Contractor are those herein defined in this Contract and General Conditions. They are treated throughout the Contract Documents as though each were of the singular number and masculine gender.  

4.2 SUBCONTRACTOR. See Article 8.  

4.3 NOTICE. See Articles 7 and 10.  

4.4 TIME. See Articles 3 and 11.  

4.5 COST. The term "Cost" shall include all charges, costs, losses and expenditures of every kind whatsoever for the Work, or portion thereof to which reference is made with respect to this term.
4.6 **FINISH, SUBSTANTIAL COMPLETION AND FINAL COMPLETION DATES.** See Article 11.

4.7 **MODIFICATIONS.** See also Article 1. A Modification is:

- A written amendment to the Contract and General Conditions signed by all parties;
- A Change Order properly signed by all parties pursuant to Paragraph 15.1; or
- A Field Order for a minor change in the Work issued by the Owner pursuant to Paragraph 15.4.

A Modification may be made only after execution of the Contract and General Conditions.

4.8 **CONTRACT.** The Contract consists of all the Contract Documents enumerated in Article 1. The Contract represents the entire and integrated agreement between the parties hereto and supersedes all prior negotiations, representations or agreements, either written or oral. The Contract may be amended or modified only by a Modification as defined in Paragraph 4.7.

4.9 **WORK.** The term "Work" includes, without limitation, furnishing all labor, administrative services and supervision necessary to produce the construction required by the Contract Documents and furnishing and installing all materials and equipment incorporated, or to be incorporated, in such construction to complete the Project.

4.10 **PROJECT.** The Project is the total construction designed by the Owner of which the Work performed under the Contract Documents may be the whole or a part.

4.11 **EXECUTION, CORRELATION, INTENT AND INTERPRETATIONS OF THE CONTRACT DOCUMENTS.**

4.11.1 The Contract and General Conditions shall be signed by the Owner and the Contractor. By executing the Contract and General Conditions, each party accepts and agrees to be bound by each of the Contract Documents listed in Article 1.

4.11.2 By executing the Contract and General Conditions, the Contractor represents and warrants that he has visited the site, has familiarized himself with the local conditions under which the Work is to be performed, including any and all relevant weather conditions or records or both, and correlated all of his observations with the requirements of the Contract Documents.

4.11.3 The Contract Documents are complementary, and what is required by any one shall be as binding as if required by all. The intention of the Contract Documents is to include, without limitation, all labor, materials, equipment and other items as provided in Subparagraph 7.4.1 necessary for the proper execution and completion of the Work. Words and abbreviations which have well known technical or trade meanings are used herein in accordance with such recognized meanings.
4.11.4 The organization of the Specifications into divisions, sections and articles, and the arrangements of Drawings shall not control the Contractor in dividing the Work among Subcontractors or in establishing the extent of Work to be performed by any trade, or constituting part of the Contract or having any legal or contractual significance.

4.11.5 Written interpretations necessary for the proper execution or progress of the Work, in the form of drawings or otherwise, will be issued with reasonable promptness by the Owner in accordance with any schedule agreed upon, or with reasonable promptness in any case. Such interpretations shall be consistent with and reasonably inferable from the Contract Documents.

4.12 COPIES FURNISHED AND OWNERSHIP.

4.12.1 The Contractor will be furnished, free of charge, all copies of Contract Documents reasonably necessary for the execution of the Work as determined by the Owner in his sole discretion.

4.12.2 All Drawings, Specifications and other data, and copies thereof, furnished to the Contractor are and shall remain the property of the Owner. They are not to be used on any other project, and, with the exception of one set for each party to the Contract, are to be returned to the Owner upon request at the completion of the Work.

4.12.3 It shall be the responsibility of the Contractor to ensure that each Subcontractor, Sub-subcontractor and supplier has a current set of those portions of the Construction Documents that may be required for proper execution of their respective portions of the Work.

ARTICLE 5
OWNER’S REPRESENTATIVE

Drawings and Specifications for this Project were prepared by NTD Architects (Owner’s Representative, hereinafter referred to as ‘OR’), who shall act as OR pursuant to the Contract Documents.

5.1 OR: DEFINITION

5.1.1 The OR is the person or organization identified as such in this Contract and General Conditions, and the term OR means the OR or his authorized representative.

5.1.2 Nothing contained in the Contract Documents shall create any contractual relationship between the OR and the Contractor.

5.2 ADMINISTRATION OF THE CONTRACT.

5.2.1 The OR will be the Owner's representative during construction, until final payment and including the warranty period. The OR will have authority to act on behalf of the Owner, unless otherwise modified by written instrument which will be shown to the Contractor. The OR will advise and consult with the Owner, and all of the Owner's instructions to the Contractor shall be issued through the OR, except where the Owner deems direct communication with the Contractor necessary. Any direct communication between Owner and Contractor shall be copied to the OR. The OR and any person
designated by Owner as Special Agent shall be Special Agents acting for and on behalf of the Owner for the duration of this Contract.

5.2.2 The OR shall at all times have access to the Work wherever it is in preparation and progress. The Contractor shall provide facilities for such access so the OR may perform their functions under the Contract Documents.

5.2.3 Neither the OR's authority to act under this Contract, nor any decision made by him in good faith either to exercise or not to exercise such authority, shall give rise to any duty of responsibility of the OR to the Contractor, any Subcontractor or material supplier, any of their agents or employees, or any other performing any of the Work.

5.2.4 The duties, responsibilities and limitations of authority of the OR as the Owner's representative during construction as set forth in Articles 1 through 18, inclusive, of this Contract and General Conditions will not be modified or extended without written consent of the Owner and the OR, notice of which will be given to the Contractor.

5.2.5 The OR will not be responsible for the acts or omissions of the Contractor, any Subcontractors or Material Vendors, or any of their agents or employees, or any other persons performing any of the Work.

5.2.6 In case of the termination of the employment of the OR, the Owner shall appoint a successor, whose status under the Contract Documents shall be that of the former OR.

ARTICLE 6
OWNER – CONTRACT ADMINISTRATION

6.1 DEFINITION. The Owner is the person or organization identified as such in the Contract and General Conditions.

6.2 ADMINISTRATION OF THE CONTRACT.

6.2.1 The OR will provide general administration of this Contract, including performance of the functions hereinafter described.

6.2.2 The Owner and the OR shall at all times have access to the Work wherever it is in preparation and progress. The Contractor shall provide facilities for such access so the Owner and the OR may perform their functions under the Contract Documents.

6.2.3 The OR shall make periodic visits to the site to observe the progress and quality of the Work and to determine if the Work is proceeding in accordance with the Contract Documents. These visits shall be of the frequency necessary to adequately observe the progress of the Work. On the basis of his on-site observations, he shall endeavor to guard against defects and deficiencies in the Work of the Contractor. The Owner shall not be responsible for the Contractor's ways and means, methods, techniques and procedures in the construction of the Project or for enforcement of safety requirements on the Project.
6.2.4 Based on such observations and the Contractor's Applications for Payment, the OR will make recommendations as to the amounts owing to the Contractor and will issue Certificates for Payment in such amounts, as provided in Subparagraph 12.4.1.

6.2.5 The OR will be, in the first instance, the interpreter of the requirements of the Contract Documents and the judge of the performance thereunder by the Contractor, except where otherwise provided herein. The OR will promptly render such interpretations as he may deem necessary for the proper execution or progress of the Work.

6.2.6 All claims, disputes and other matters in question relating to the execution or progress of the Work, payment, time extension or interpretation of the Contract Documents shall be submitted to the Owner in the manner provided by Subparagraph 12.4.4, within the time limits prescribed in Subparagraph 15.2.1, for decision by the Owner, as the subject of the matter may require, which will be rendered in writing within a reasonable time.

6.2.7 The Owner's decisions in matters relating to artistic effect will be final if consistent with the intent of the Contract Documents.

6.2.8 If a decision of the Owner states that it is final but subject to appeal, no claim, dispute or other matter covered by such decision may be made later than thirty (30) days after the date on which the party making the demand received the decision.

6.2.9 The OR shall have authority to reject Work which does not conform to the Contract Documents. Whenever, in the OR's reasonable opinion, he considers it necessary or advisable to ensure the proper implementation of the intent of the Contract Documents, he will require the Contractor to stop the Work or any portion thereof, or to require special inspection or testing of the Work as provided in Subparagraph 10.8.2, whether or not such Work be then fabricated, installed or completed.

6.2.10 The OR will review Shop Drawings, Product Data and Samples promptly as provided in Subparagraphs 7.12.1 through 7.12.8, inclusive.

6.2.11 The OR will prepare Change Orders in accordance with Article 15 and will have authority to order minor changes in the Work not involving extra cost as provided in Subparagraph 15.3.

6.2.12 The OR will conduct inspections to determine the date or dates of Substantial Completion and Final Completion and shall issue a Certificate of Substantial Completion and of Final Completion. He will receive written guarantees, record drawings, maintenance manuals and related documents required by the Contract and assembled by the Contractor.

6.2.13 The Owner will not be responsible for the acts or omissions of the Contractor, any Subcontractors or Material Vendors, or any of their agents or employees, or any other persons performing any of the Work.

6.3 INFORMATION AND SERVICES REQUIRED OF THE OWNER.

6.3.1 The Owner shall furnish all surveys describing the physical characteristics, legal limits and utility locations for the site of the Project.
6.3.2  Information or services under the Owner's control shall be furnished by the Owner with promptness to avoid delay in the orderly progress of the Work.

6.3.3  All final decisions concerning Change Orders, Payments, Substantial Completion, Final Completion, Liquidated Damages and Contract Time shall be reserved to the Owner, and this provision of the Contract shall take precedence over any other term hereof.

6.3.4  The foregoing are in addition to other duties and responsibilities of the Owner enumerated herein and especially those in respect to Work by Owner or by separate contractors, payments, completion and insurance in Articles 9, 12 and 14, respectively.

ARTICLE 7
CONTRACTOR

7.1 DEFINITION.

7.1.1  The Contractor is the person or organization identified as such in this Contract and General Conditions and the term "Contractor" means the Contractor or his authorized representative. The Contractor, and all Subcontractors employed on the Project, shall possess valid Arizona Contractor's Licenses as required by law.

7.1.2  Whenever the words "as may be directed," "suitable," "or equal," "as approved," or other words of similar intent and meaning are used within the Contract Documents implying that judgment or discretion is to be exercised or a decision is to be made, it is understood that it is the judgment, discretion or decision of the OR to which reference is made.

7.1.3  All materials and articles of any kind necessary for this Work are subject to the approval of the Owner as provided in the Contract Documents.

7.1.4  After execution of the Contract, changes of brand named, trade named, trademarked, patented articles, or any other substitutions will be allowed only by written order signed by the Owner, in which case the Owner shall receive all benefit of the difference in cost involved, except where choice of material or method is designated "or equal" or "acceptable alternates" in the Specifications.

7.2 REVIEW OF CONTRACT DOCUMENTS AND EXAMINATION OF SITE.

7.2.1  By executing this Contract, the Contractor warrants that he has examined the site and carefully studied and compared the Contract and General Conditions, Drawings, Specifications, Addenda, and all other Contract Documents before so executing the Contract. The Contractor shall at once report to the Owner any error, inconsistency or omission he may discover. The Contractor shall not be liable to the Owner for any damage resulting from any such errors, inconsistencies or omissions so long as the Owner is notified thereof, unless discovery of such error, inconsistency or omission should have been made by careful examination of the Contract Documents prior to submitting a Bid. The Contractor shall do no Work without appropriate Contract Documents, or where required, approved Shop Drawings, Product Data, Samples or interpretations from the Owner.
7.2.2  The Contractor shall be required to use for data and dimensions, figures marked on the drawings in preference to what the drawings may measure to scale. In the absence of figured dimensions, the Owner shall be notified and the dimensions provided within a reasonable time. Drawings shall not be scaled in the absence of figured dimensions.

7.2.3  The Contractor shall verify all dimensions shown and check all measurements in connection with any present building or buildings, levels of grades, walks, driveways, or other existing conditions, before executing any work. Contractor shall immediately report to the Owner any discrepancies between the Plans and actual field conditions. Failure to report any discrepancy within 24 hours after discovery will constitute a waiver of any claim arising out of such discrepancy. This provision shall have precedence over any other notice provisions contained herein.

7.3  SUPERVISION AND CONSTRUCTION PROCEDURES. The Contractor shall supervise the Work, using his best skill and attention. He shall be solely responsible for all construction means, methods, techniques, sequences and procedures and for coordinating all portions of the Work under the Contract.

7.4  LABOR AND MATERIALS.

7.4.1  Unless otherwise specifically noted, the Contractor shall provide and pay for all labor, materials, equipment, tools, construction equipment and machinery, heat, utilities, transportation and any other facilities and services necessary for the proper execution and completion of the Work, whether temporary or permanent and whether or not incorporated or to be incorporated in the Work. No materials shall be incorporated into this Work that contains any asbestos.

7.4.2  Any work necessary to be performed after regular working hours, on Sundays or legal holidays, shall be performed without additional expense to the Owner unless approved in advance by Change Order.

7.4.3  The Contractor shall at all times enforce strict discipline and good order among his employees and shall not employ on the Work any unfit person or anyone not skilled in the task assigned to him. When requested by the Owner, the Contractor shall remove from the Project any person who commits trespass or is, in the opinion of the Owner, disorderly, dangerous, insubordinate, incompetent or violates any policies of the Owner. The owner will document the request within 1 work day if requested by the Contractor. The Contractor shall keep the Owner harmless from damages or claims for compensation that may occur in the enforcement of this requirement. The Contractor shall not permit the use of tobacco products (except in designated areas), alcohol or illegal drugs on the project site.

7.5  WARRANTY.

7.5.1  The Contractor warrants to the Owner that all materials and equipment furnished under this Contract will be new unless otherwise specified, and that all Work will be of good quality, free from faults and defects and in conformance with the Contract Documents. All Work not so conforming to these standards may be considered defective. If required by the Owner, the Contractor shall furnish satisfactory evidence as to the kind and quality of materials and equipment.
7.5.2 The warranty provided in Paragraphs 7.5 and 18.1 shall be in addition to and not in limitation of any other warranty or remedy available pursuant to law or the Contract Documents.

7.6 TAXES. The Contractor shall pay all sales, consumer, use, transaction privilege and other taxes required by law in connection with the performance of this Contract, whether in force as of the date of this Contract or later imposed. If the Contractor's principal place of business is not in Arizona, Contractor shall post a bond for taxes in compliance with A.R.S. § 42-5007 and furnish evidence of such bond to Owner prior to submitting any application for payment hereunder.

7.7 PERMITS, FEES AND NOTICES.

7.7.1 Unless otherwise provided in the Plans, Specifications or by Addendum, the Contractor shall secure and pay for all permits, fees, inspections and re-inspections necessary for the proper execution and completion of the Work, including, without limitation, the following permits and fees: building, plumbing, mechanical, electrical permits, water meters, water service fees, sewer connection fees, sewer fees or assessments, gas service fees and electric service fees payable to the utility companies. The Contractor shall procure and pay for all necessary utilities for the Project, including temporary utility hook-ups and utilities used in course of construction.

7.7.2 The Contractor shall give all notices and comply with all laws, ordinances, rules, regulations and orders of any public authority bearing on the performance of the Work. If the Contractor observes that any of the Contract Documents are at variance therewith in any respect, he shall promptly notify the Owner in writing. If the Contractor performs any Work knowing it to be contrary to such laws, ordinances, rules and regulations, and without such notice to the Owner, he shall assume full responsibility therefor and shall bear all costs attributable thereto, including any attorneys’ fees incurred by Owner in connection therewith.

7.8 SUPERINTENDENT. The Contractor shall employ a competent Superintendent and necessary assistants who shall be in attendance at the Project site during the progress of the Work. The Contractor shall assign to the Project a Superintendent prior to the pre-construction meeting and shall furnish to the Owner the Superintendent’s resume. The Superintendent shall be satisfactory to the Owner and shall not be changed except with the consent of the Owner, unless the Superintendent proves to be unsatisfactory to the Contractor and ceases to be in his employ. The Superintendent shall represent the Contractor, and all communications given to the Superintendent shall be as binding as if given to the Contractor. Important communications will be confirmed in writing. Other communications will be so confirmed on written request in each case.

7.9 RESPONSIBILITY FOR THOSE PERFORMING THE WORK. The Contractor shall be responsible to the Owner for the acts and omissions of all his employees and all Subcontractors, their agents and employees, and all other persons performing any of the Work or supplying any material or equipment to be incorporated in the Work under a contract of any nature with the Contractor.

7.10 PROGRESS SCHEDULE AND REPORTS.

7.10.1 The Contractor, within fourteen (14) days after being awarded the Contract, shall prepare and submit for the Owner's review his planned Construction Progress Schedule for the Work as provided in the Specifications. The Construction Progress Schedule shall be related to the entire Project and shall
indicate the dates for the starting and completion of the various components and phases of construction and shall be revised monthly or as required by the conditions of the Work, upon request of and subject to the review of the Owner. The Contractor shall comply with the requirements of the Specifications in connection with the preparation and revision of the Construction Progress Schedule. The Contractor agrees to promptly respond to all inquiries by the Owner concerning significant deviation of the progress of construction from the Construction Progress Schedule. Failure to timely respond to such request or significant delay from the Construction Progress Schedule may result in progress payments being withheld. Approval of the Construction Progress Schedule by the Owner shall not relieve the Contractor from his obligation to complete the Project within the Contract Time.

The Contractor shall furnish to the Owner four (4) copies of a complete list of all major items of architectural, mechanical, plumbing and electrical equipment and materials within fourteen (14) days of the Start Date. Include projected dates of submittal of all items of material for which submittals are required and delivery dates of all items of material and equipment that are considered by the Owner, in his sole discretion, critical or which may require, in order to obtain, long lead time. Submit a complete list. A partial list will not be acceptable unless prior permission is obtained from the Owner. The Contractor shall prepare and provide to the Owner a weekly Construction Schedule Status Report which will inform the Owner that, with respect to each category of the Construction Progress Schedule and each item on the material delivery date list, the work or delivery is: (a) on schedule; (b) behind schedule, but will not interfere with the completion of the Project within the Contract Time specified in the Contract; or (c) behind schedule and may prevent the completion of the Project within the Contract Time. In the event that the Construction Schedule Status Report indicates that a delay has occurred or may occur that may prevent the completion of the Project within the Contract Time because the Work in a particular category is behind schedule or a delay in material deliveries is anticipated, the Construction Schedule Status Report shall contain a statement of what corrective measures are being undertaken by the Contractor.

7.10.2 For purposes of determining time extensions resulting from additional work ordered by the Owner, adverse weather or other delays, all float or slack time in the Construction Progress Schedule shall be owned and controlled by the Owner. The Owner shall allow use of such float or slack time by the Contractor as long as such allocation of float or slack time does not adversely affect the completion date of the Project. No additional time shall be allowed for claims for delay, whether or not caused by or the fault of the Owner, if such delay is less than the available float or slack time available for the particular task.

7.11 DRAWINGS AND SPECIFICATIONS AT THE SITE.

7.11.1 The Contractor shall maintain at the site for the Owner one (1) copy of all Drawings, Specifications, Addenda, approved Shop Drawings, Change Orders, other Modifications, and manufacturers' printed specifications and recommendations, in good order and marked carefully, legibly and accurately to record on a daily basis all changes made during construction, all of which shall be available to the Owner at all times. These Drawings shall be delivered to the OR upon completion of the Work. The Drawings indicating the changes shall be maintained throughout the duration of the Project and are the Record Drawings which shall be transferred to electronic media by the Owner.
7.11.2 The Contractor shall also submit to the Owner for his record three (3) copies each (unless otherwise specified) of all manufacturers' maintenance manuals, printed specifications and recommendations, which by reference in the several divisions of the Specifications are a part thereof.

7.12 SHOP DRAWINGS, PRODUCT DATA AND SAMPLES.

7.12.1 Shop Drawings and Product Data are drawings, diagrams, illustrations, schedules, performance charts, brochures and other data which are required by the Contract Documents and are prepared by the Contractor or any Subcontractor, Sub-subcontractor, manufacturer, supplier or distributor, and which illustrate or describe some portion of the Work.

7.12.2 Samples are physical examples furnished by the Contractor to illustrate materials, equipment or workmanship, and to establish standards by which the Work will be judged.

7.12.3 The Contractor shall review, correct any errors, stamp with his approval and submit, with promptness and in orderly sequence so as to cause no delay in the Work or in the work of any other contractor, all Shop Drawings, Product Data and Samples required by the Contract Documents or subsequently by the OR as covered by Modifications. Shop Drawings, Product Data and Samples shall be properly identified as specified, or as the OR may require. At the time of submission, the Contractor shall inform the Owner in writing of any deviation in the Shop Drawings, Product Data or Samples from the requirements of the Contract Documents. The OR's responsibility for reviewing Shop Drawings, Product Data, Samples and other submissions of the Contractor are limited to those required by the Contract Documents or Modifications to the Contract Documents.

7.12.4 By approving and submitting Shop Drawings, Product Data and Samples, the Contractor thereby represents that he has determined and verified all field measurements, field construction criteria, materials, catalog numbers and similar data, and that he has checked and coordinated all Shop Drawings, Product Data and Samples with the requirements of the Work and of the Contract Documents.

7.12.5 The OR will review and take other appropriate action with respect to Shop Drawings, Product Data and Samples with reasonable promptness so as to cause no delay, but only for conformance with the Contract Documents.

7.12.6 The Contractor shall make any corrections required by the OR to comply with the Contract Documents and shall resubmit the required number of corrected copies of Shop Drawings, Product Data or new Samples until approved. The Contractor shall direct specific attention in writing or on resubmitted Shop Drawings and Product Data to revisions other than the corrections requested by the Owner on previous submissions.

7.12.7 The OR's review of Shop Drawings, Product Data or Samples shall not relieve the Contractor of responsibility for any deviation from the requirements of the Contract Documents unless the Contractor has informed the Owner in writing of such deviation at the time of submission and the OR has given written approval to the specific deviation, nor shall the Owner's approval relieve the Contractor from responsibility for errors or omissions in the Shop Drawings, Product Data or Samples.
7.12.8 No portion of the Work requiring a Shop Drawing, Product Data or Sample submission shall be commenced until the submission has been approved by the Owner. All such portions of the Work shall be in accordance with approved Shop Drawings, Product Data and Samples.

7.13 CUTTING AND PATCHING OF WORK. Any cutting and patching required shall be performed in accordance with instructions contained in the technical specifications of this project.

7.14 CLEANING UP.

7.14.1 The Contractor at all times during the progress of the Work shall keep the buildings and site free from accumulation of waste materials or rubbish caused by his operations. At the completion of the Work, he shall remove all his waste materials and rubbish from and about the Project, as well as all his tools, construction equipment, machinery and surplus materials not specified to be left at the site, and shall clean all glass surfaces and other areas or materials as specified, and leave the Work "broom-clean" or its equivalent, except where more stringent cleaning requirements are provided by the Contract Documents.

7.14.2 If the Contractor fails to satisfactorily clean up, the Owner will do so and the cost thereof shall be charged to the Contractor as provided in Paragraph 10.6.

7.15 COMMUNICATIONS. The Contractor shall forward all written communications to the OR except where otherwise required herein.

7.16 INDEMNIFICATION. To the fullest extent permitted by law, the Contractor shall defend, indemnify and hold harmless the District, its agents, representatives, officers, directors, officials and employees from and against all claims, damages, losses and expenses (including but not limited to attorney fees, court costs, and the cost of appellate proceedings), relating to, arising out of, or alleged to have resulted from the acts, errors, mistakes, omissions, work or services of the Contractor, its employees, agents, or any tier of subcontractors in the performance of this Contract. Contractor’s duty to defend, hold harmless and indemnify the District, its agents, representatives, officers, directors, officials and employees shall arise in connection with any claim, damage, loss or expense that is attributable to bodily injury, sickness, disease, death, or injury to, impairment, or destruction of property including loss of use resulting therefrom, caused by any acts, errors, mistakes, omissions, work or services in the performance of this Contract including any employee of the Contractor or any tier of subcontractor or any other person for whose acts, errors, mistakes, omissions, work or services the Contractor be legally liable.

The amount and type of insurance coverage requirements set forth herein will in no way be construed as limiting the scope of the indemnity in this paragraph.
ARTICLE 8
SUBCONTRACTORS

8.1  DEFINITION.

8.1.1  A Subcontractor is a person or organization who has a direct contract with the Contractor to supply materials or equipment or to perform any of the Work at the site. The term "Subcontractor" is referred to throughout the Contract Documents as if singular in number and masculine in gender and means a Subcontractor or his authorized representative.

8.1.2  A Sub-subcontractor is a person or organization who has a direct or indirect contract with the Subcontractor to perform any of the Work at the site, or to supply any materials or equipment to be used in the Project. The term "Sub-subcontractor" is referred to throughout the Contract Documents as singular in number and masculine in gender, and means a Sub-subcontractor or an authorized representative thereof.

8.1.3  Nothing contained in the Contract Documents shall create any contractual, master-servant or principal-agent relationship between the Owner, and any Subcontractor or Sub-subcontractor.

8.2  AWARD OF SUBCONTRACTS AND OTHER CONTRACTS FOR PORTIONS OF THE WORK.

8.2.1  If, after the actual signing of this Agreement, the Owner refuses to accept any person or organization on the Subcontractor and Material Vendor List for good and substantial reason, the Contractor shall submit an acceptable substitute and the Contract Amount shall be increased or decreased by the difference in cost occasioned by such substitution and an appropriate Change Order shall be issued. However, no increase in the Contract Amount shall be allowed for any such substitution unless the Contractor has acted promptly and responsively in submitting a name with respect thereto.

8.2.2  The Contractor shall not contract with any Subcontractor proposed to perform portions of the Work designated in the Construction Documents, or if none is so designated, with any Subcontractor proposed for the principal portions of the Work who has not been accepted by the Owner. The Contractor will not be required to contract with any Subcontractor against whom he has a reasonable objection.

8.2.3  If the Owner requires a change of any proposed Subcontractor previously accepted by it, the Contract Amount shall be increased or decreased by the difference in cost occasioned by such change and an appropriate Change Order shall be issued.

8.2.4  The Contractor shall not make any substitution for any Subcontractor who has been accepted by the Owner unless the substitution is approved in writing by the Owner.

8.2.5  Notwithstanding any provisions to the contrary in the Contract Documents, if any Subcontractor listed is found not to be qualified to perform public work as a matter of law, upon written notice from the Owner, the Contractor shall submit a qualified Subcontractor for the Owner's approval and shall substitute such qualified and approved Subcontractor at no additional cost to the Owner.
8.3 SUBCONTRACTUAL RELATIONS.

8.3.1 All work performed for the Contractor by a Subcontractor shall be pursuant to an appropriate written agreement between the Contractor and the Subcontractor (and where appropriate between Subcontractors and Sub-subcontractors) which shall contain provisions that:

.1 preserve and protect the rights of the Owner under the Contract with respect to the Work to be performed under the subcontract so that the subcontracting thereof will not prejudice such rights;

.2 require that such work be performed in accordance with the requirements of the Contract Documents;

.3 require submission to the Contractor of applications for payment under each subcontract to which the Contractor is a party, in reasonable time to enable the Contractor to apply for payment in accordance with Article 12;

.4 require that all claims for additional costs, extensions of time, damages for delays or otherwise with respect to subcontracted portions of the Work shall be submitted to the Contractor (via any Subcontractor or Sub-Subcontractor where appropriate) in the manner provided in the Contract Documents for like claims by the Contractor upon the Owner;

.5 waive all rights the contracting parties may have against one another for damages caused by fire or other perils covered by the property insurance described in Article 14, except such rights as they may have to the proceeds of such insurance held by the Owner as trustee under Article 14; and

.6 obligate such Subcontractor specifically to consent to the provisions of this Paragraph 8.3.

8.4 PAYMENTS TO SUBCONTRACTORS.

8.4.1 The Owner may, on request and at his discretion, furnish to any Subcontractor, if practicable, information regarding percentages of completion certified to the Contractor on account of work done by such Subcontractors.

8.4.2 The Owner shall not have any obligation to pay or to see to the payment of any monies to any Subcontractor except as may otherwise be required by law.

ARTICLE 9
SEPARATE CONTRACTS

9.1 OWNER'S RIGHT TO AWARD SEPARATE CONTRACTS. The Owner reserves the right to award other contracts in connection with other portions of the Project under conditions similar to this Contract.
9.2 MUTUAL RESPONSIBILITY OF CONTRACTORS.

9.2.1 The Contractor shall afford other contractors reasonable opportunity for the introduction to the site and storage of their materials and equipment thereon and the execution of their work, and shall properly connect and coordinate his Work with theirs.

9.2.2 If any part of the Contractor's Work depends for proper execution or results upon the work of any other separate contractor, the Contractor shall inspect and promptly report to the Owner any apparent discrepancies or defects in such work that render it unsuitable for such proper execution and results. Failure of the Contractor to so inspect and report shall constitute an acceptance of the other contractor's work as fit and proper to receive his Work, except as to defects which may develop in the other separate contractor's work after the execution of the Contractor's Work.

9.2.3 Should the Contractor cause damage to the work or property of any separate contractor on the Project, the Contractor shall, upon written notice, promptly attempt to settle such other contractor's claim. If such separate contractor sues the Owner on account of any damage alleged to have been so sustained, the Owner shall promptly notify the Contractor, who shall defend such proceedings at the Contractor's expense, and if any judgment against the Owner arises therefrom, the Contractor shall promptly pay or satisfy it and shall immediately, upon presentation to it of a statement thereof, reimburse the Owner for all attorneys’ fees and court costs which the Owner has incurred.

9.3 CUTTING AND PATCHING UNDER SEPARATE CONTRACTS.

9.3.1 The Contractor shall do all cutting, fitting or patching of his Work that may be required to fit it to receive or be received by the work of other contractors indicated in the Contract Documents. The Contractor shall not endanger any work of any other contractors by cutting, excavating or otherwise altering any work and shall not cut or alter the work of any other contractor except with the written consent of the Owner.

9.3.2 Any costs caused by defective or ill-timed work shall be borne by the party responsible therefor.

9.4 OWNER'S RIGHT TO CLEAN UP. If a dispute arises between the separate contractors as to their responsibility for cleaning up as required by Paragraph 7.14, the Owner may clean up and charge the cost thereof to the several contractors as the Owner shall determine to be just.

ARTICLE 10
MISCELLANEOUS PROVISIONS

10.1 LAW OF THE PLACE. The Contract shall be governed by the law of the State of Arizona, and any other subordinate jurisdiction in which the Project is located.

10.2 SUCCESSORS AND ASSIGNS. The Owner and the Contractor each binds himself, his partners, successors, assigns and legal representatives to the other party hereto and to the partners, successors, assigns and legal representatives of such other party in respect to all covenants, agreements and obligations contained in the Contract Documents. Neither party to the Contract shall assign the Contract or any part hereof or sublet it as a whole or in part without the written consent of the other, nor
shall the Contractor assign or pledge any monies due or to become due to him hereunder without the previous written consent of the Owner.

10.3  WRITTEN NOTICE.  Written notice shall be deemed to have been duly served if delivered in person to the individual for whom it was intended or if delivered at or sent by registered or certified mail to the last business address known to him who gives the notice.

10.4  CLAIMS FOR DAMAGES.  Should either party to the Contract suffer injury or damage to person or property because of any act or omission of the other party or of any of his employees, agents or others for whose acts he is legally liable, which claim is not covered by Article 15 hereof, a claim shall be made in writing to such other party within a reasonable time after the first observance of such injury or damage.

10.5  PERFORMANCE BOND AND PAYMENT BOND.  The Contractor shall furnish and maintain performance and payment bonds as required by Arizona law covering the faithful performance of the Contract and the payment of all obligations arising thereunder in such form and amount as the Owner may prescribe and with such sureties as may be agreeable to the Owner.  The premiums shall be paid by the Contractor.  The Contractor shall, prior to commencement of the Work, submit such bonds to the Owner.  Individual sureties are not acceptable.

10.6  OWNER'S RIGHT TO COMPLETE THE WORK.  If the Contractor defaults or neglects to carry out the Work in accordance with the Contract Documents, or fails to perform any provision of the Contract, the Owner may, after seven (7) days written notice to the Contractor and/or his surety, if any, and without prejudice to any other remedy he may have, proceed to make such other necessary and reasonable arrangements to carry out the Work in accordance with the Contract Documents, all at the expense of the Contractor, including the Owner's attorneys' fees and other costs.

10.7  ROYALTIES AND PATENTS.  The Contractor shall pay all royalties and license fees. He shall defend all suits or claims from infringement of any patent right and shall save the Owner harmless from loss on account thereof, including Owner's attorneys' fees and court costs, except that Owner shall be responsible for all such loss when a particular design, process or product of a particular manufacturer or manufacturers is specified.  But, if the Contractor has reason to believe that the design, process or products specified is an infringement of a patent, he shall be responsible for such loss unless he promptly gives information to the Owner prior to starting the Work.

10.8  TESTS.

10.8.1  Where the Contract Documents, laws, ordinances, rules, regulations or orders of any public authority having jurisdiction require any of the Work to be inspected, tested or approved, the Contractor shall give the Owner timely notice of its readiness and of the date arranged so the Owner may observe such inspection, testing or approval.  The Owner shall pay the cost of all such tests, except where otherwise provided herein, and except for retest or re-inspection of Work which fails to comply with the Contract Documents.

10.8.2  All equipment and materials used in the construction of the Project, especially those upon which the strength and durability of the structure may depend, shall be subject to adequate inspection and testing in accordance with accepted standards to establish conformity with Specifications, applicable
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codes and standards and suitability for use intended, all as set forth more particularly in the Specifications.

10.8.3 If after the commencement of the Work the OR determines that any of the Work requires special inspection, testing or approval which Subparagraph 10.8.1 does not include, he will, upon written authorization from the OR, order such special inspection, testing or approval, and the Contractor shall give notice of readiness as in Subparagraph 10.8.1. If such special inspection or testing reveals a failure of the Work to comply:

.1 with the requirements of the Contract Documents, or

.2 with laws, ordinances, rules, regulations or orders of any public authority having jurisdiction over the Work,

the Contractor shall bear all costs thereof, including the cost of the Owner's additional services made necessary by such failure, and the costs of such inspection or testing and other expenses related thereto, including without limitation Owner's legal fees, if any, incurred in connection with advising Owner of such failure of compliance; otherwise, the Owner shall bear such costs.

10.8.4 Required certificates of re-inspections or testing to secure compliance with Clauses 10.8.3.1 or 10.8.3.2 above shall be paid for by the Contractor.

10.8.5 If the Owner wishes to observe the inspections, tests or approvals required by this Paragraph 10.8, he will do so promptly and, where appropriate, at the source of supply.

10.8.6 Neither the observations of the OR or the Owner in their administration of the Construction Contract, nor inspections, tests or approvals by persons other than the Contractor, shall relieve the Contractor from his obligations to perform the Work in accordance with the Contract Documents.

10.9 LEGAL FEES AND COSTS. The prevailing party shall be entitled to recover its attorneys’ fees, any costs of suit, any expert witness fees and the actual cost of any test or inspection incurred in connection with any effort undertaken to enforce any of the terms of this Contract.

ARTICLE 11
TIME AND LIQUIDATED DAMAGES

11.1 CONTRACT TIME, LIQUIDATED DAMAGES AND RELATED PROVISIONS.

11.1.1 It is understood and agreed that the construction of the Work under the Contract Documents shall be commenced on the date stated in the Notice to Proceed issued by the Owner and shall be Substantially Complete by the Contractor no later than the number of consecutive calendar days from that date, which number is the Contract Time as specified in Paragraph 3.2, herein. The Contract Time is the period of time from (1) the date specified in the Notice to Proceed as the date upon which the Contractor is to commence the Work (the "Start Date"), through (2) the date when the agreed time for Substantial Completion of the construction of the Project expires (the "Finish Date"). The date of beginning, rate of progress, and time for completion are essential conditions of the Contract, and the
Contractor agrees that said Work shall be prosecuted regularly, diligently and uninterruptedly at such rate of progress as will ensure full completion thereof within the Contract Time specified. It is expressly agreed that the Contract Time is reasonable.

11.1.2 If the Substantial Completion Date as defined in Subparagraph 11.1.3 for the Project or any Phase thereof occurs after the expiration of the Contract Time, the Contractor shall pay the Owner the amount or amounts stated in Article 3 as liquidated damages for each calendar day the Work remains incomplete after expiration of the Contract Time. These amounts are agreed upon because of the impracticability and extreme difficulty of ascertaining the actual damages the Owner would sustain. It is expressly agreed that the amounts of liquidated damages set forth herein are reasonable. Said amounts may be retained from time to time by the Owner from payments due the Contractor.

11.1.3 The date of the Substantial Completion of the Work, or designated portion thereof, is the date established by a Certificate of Substantial Completion prepared by the OR when construction is sufficiently complete, in accordance with the Contract Documents as they may have been modified by any Change Orders agreed to by the parties, so that the Owner may occupy the Project, or a designated portion thereof, if he so elects, for the use for which it is intended. Certification of a designated portion of the Work by the OR as being "Substantially Complete" and occupancy of that portion thereafter by the Owner shall neither release, or otherwise operate to excuse, the Contractor from his duty to complete the remainder of the Work within the Contract Time nor relieve the Contractor from any liability for not completing expeditiously the remainder of Work.

11.1.4 The Final Completion Date is the calendar date when all items of the Work are one hundred percent (100%) finished, with no items of any scope, large or small, outstanding and remaining to be completed, and all known defective work has been corrected. When the Owner certifies in writing, pursuant to the terms of Subparagraph 12.6.2, that the Final Completion Date is reached and it is approved by the Owner, the Contractor may make application for final payment pursuant to Subparagraph 12.6.2.

11.2 PROGRESS AND COMPLETION.

11.2.1 All time limits stated in the Contract Documents are of the essence of the Contract.

11.2.2 The Contractor shall begin the Work on the Start Date as defined in Subparagraph 11.1.1. He shall carry the Work forward expeditiously with adequate forces and shall complete it as required herein.

11.3 DELAYS AND EXTENSIONS OF TIME.

11.3.1 If the Contractor is delayed at any time in the progress of the Work by any cause which the OR determines may justify the delay, including, but not limited to, unforeseeable cause beyond the control and without the fault or negligence of the Contractor, its agents and employees and Subcontractors and Sub-subcontractors and their agents and employees, including, but not restricted to: acts of God, acts of the public enemy, acts of the Owner, acts of another contractor in performance of a contract with the Owner, fires, floods, epidemics, quarantine restrictions, strikes, freight embargoes and unusually severe weather over the entire Contract Time, then the Contract Time shall be extended by Change Order for such reasonable time as the OR may determine. No extension of the Contract Time...
pursuant to this paragraph shall relieve the Contractor from any obligation attendant upon him under any of the provisions of this Contract. It is expressly agreed that the Owner's liability for delay from any cause shall be limited to granting a time extension to the Contractor, and there is no other obligation, expressed or implied, on the part of the Owner to the Contractor for delay from any cause other than Owner caused delay. If the Contractor makes a claim for delay, as provided herein, for which he alleges that the Owner is responsible, which is unreasonable under the circumstances and which was not within the contemplation of the parties, the Owner agrees to negotiate with the Contractor the validity of such claim and the amount of damages incurred by the Contractor, if any.

11.3.2 The Contractor's Construction Progress Schedule must reflect the anticipated adverse weather delays on all weather dependent activities.

11.3.3 All claims for extension of time shall be made in writing to the Owner no more than fifteen (15) days after the occurrence of the delay; otherwise, they shall be waived. In the case of a continuing cause of delay, only one claim is necessary, and the Contractor shall promptly notify the Owner in writing of the date of the termination of the continuing cause of delay.

11.3.4 If no schedule or agreement is made stating the dates upon which written interpretations as set forth in Subparagraph 4.12.5 shall be furnished, then no claim for delay shall be allowed on account of failure to furnish such interpretations until fifteen (15) days after demand is made for them, and not then unless such claim is reasonable.

ARTICLE 12
PAYMENTS AND COMPLETION

12.1 CONTRACT AMOUNT. The Contract Amount is as stated in this Contract and General Conditions and is the total amount payable by the Owner to the Contractor for the performance of the Work under the Contract Documents, subject to credits or increases resulting from Change Orders.

12.2 SCHEDULE OF VALUES. Before the first Application for Payment, the Contractor shall submit to the Owner a schedule of values reflecting as nearly as reasonably possible the actual values of the various components of the Work aggregating the total Contract Amount, prepared in such form as Owner may require, and supported by such data to substantiate its correctness as the Owner may require. Each item in the schedule of values shall include its proper share of overhead and profit. This schedule shall be used only as a basis for the Contractor's Application for Payment.

12.3 PROGRESS PAYMENTS IF PRE-AUTHORIZED BY OWNER

12.3.1 On or about the first day of each calendar month during the course of construction, the Contractor shall submit to the OR an itemized Application for Payment, which shall be AIA Document G702 and G703, supported by such data substantiating the Contractor's right to payment as the Owner may require.

12.3.2 Payments shall be based on the Work actually performed during the preceding calendar month. Payment may be made for materials not incorporated in the Work but delivered and suitably stored at the site under such conditions agreed upon in writing by the Owner.
12.3.3 Material delivered and suitably stored at the site by the Contractor, Subcontractors, Sub-subcontractors, or Material Vendors shall be insured to the full value of the material and shall be suitably stored and protected. Only such material that is in accordance with the Contract Documents shall be installed into the Work. Until the Final Completion and acceptance of the Work by the Owner, it shall be the Contractor's responsibility to protect all materials installed in or delivered to the Project.

12.3.4 The Contractor warrants and guarantees that title for all work, materials and equipment covered by the Contract Documents shall pass to the Owner upon Final Completion and acceptance by the Owner and that such work, materials and equipment shall be free and clear of all liens, claims, security interests or encumbrances, hereinafter referred to in this Article 12 as "claims".

12.4 CERTIFICATION OF PAYMENT.

12.4.1 If the Contractor has made Application for Payment as above, the OR shall approve or modify the Application and forward for payment for such amount as the OR determines to be properly due, or state in writing the OR's reasons for withholding, in whole or in part, the amount applied for as provided in Subparagraph 12.5.1.

12.4.2 The Application for Payment will constitute a representation by the Contractor to the Owner, that:

1. the Work has progressed to the point indicated;

2. to the best of his knowledge, information and belief, the quality of the Work is in accordance with the Contract Documents (subject to an evaluation of the Work as a functioning whole upon Substantial Completion, to the results of any subsequent tests required by the Contract Documents, to minor deviations from the Contract Documents correctable prior to Final Completion, and to any specific qualifications stated in his certification of the Application for Payment); and

3. the Contractor is entitled to payment in the amount certified.

12.4.3 The Owner shall make a payment to the Contractor on the basis of the value of the Work actually performed during the preceding calendar month in accordance with Subparagraph 12.3.2, less the amount of retention specified in Subparagraph 12.4.5 hereof. Such payments shall be made within thirty (30) days after receipt of Application for Payment. If the Contractor has properly requested the Owner pursuant to Subparagraph 12.3.1 of this Contract and General Conditions to accept substitute security, the Owner shall pay to the Contractor one hundred percent (100%) of the value of the Work actually performed during the preceding calendar month in accordance with this Paragraph 12. If the Contractor did not request an acceptance of substitute security, made an incomplete or incorrect assignment or made a legally insufficient assignment of substitute security, as determined by Owner or Owner's attorney, the Owner shall retain the amount of such approved Application for Payment specified in Subparagraph 12.4.5 hereof as a guarantee of the complete performance of the Contract. Any amounts retained or any securities held by Owner shall be returned to the Contractor within sixty (60) days after the Final Completion Date as specified in Subparagraph 12.6.2 of this Contract and General Conditions, provided the Contractor has by that time duly furnished the Owner any and all documents indicated to be furnished by the close out requirements of the Specifications or required for
the proper maintenance and functioning of the Work as a whole. The Contractor shall submit along with the Application for Payment lien waivers from each subcontractor, materials or equipment supplier, the aggregate sum of which shall be the amount of the previous progress payment issued to the Contractor. If lien waivers from all subcontractors, materials or equipment suppliers do not equal the aggregate sum of the previous progress payment, the Contractor shall submit the following statement along with the current progress payment request: "I hereby certify as General Contractor on this project that I have paid all subcontractors, materials or equipment suppliers, for the Work provided in conjunction with the Project for which I have previously received payment."

12.4.4 In his Application for Payment, or in a separate notice, the Contractor shall include and itemize, and furnish such supporting particulars as the Owner shall require, all claims for additional compensation against the Owner arising under the Contract Documents or any covenant thereof, express or implied, or from any cause whatsoever, within the time limits prescribed in Subparagraph 15.2.1. It is expressly covenanted that the purpose of this provision is to guard the Owner against surprise claims, to permit the Owner to investigate claims as the same may arise, and to prevent vexatious litigation of claims. It is expressly covenanted that the Owner shall have no liability on any claim unless such claim was submitted in writing at the time and in the manner required hereby.

12.4.5 The Owner shall retain ten percent (10%) of the amount of each Application for Payment as insurance of proper performance of the Contract. Once the Contract is fifty percent (50%) complete, one-half of the retention then held shall be paid to the Contractor provided the Contractor is making satisfactory progress and there is no specific cause or claim requiring a greater amount to be retained. After the Contract is fifty percent (50%) completed, five percent (5%) of the amount of each subsequent Application for Payment shall be retained provided the Contractor is making satisfactory progress on the Project. If at any time the Owner determines that the Contractor is not making satisfactory progress, then the Owner may retain ten percent (10%) of all subsequent Applications for Payment.

12.4.6 No certificate for a progress payment, nor an acceptance of any security in lieu of the cash retention, nor any progress payment, nor any partial or entire use or occupancy of the Project by the Owner, shall constitute an acceptance of any Work not in accordance with the Contract Documents.

12.5 PAYMENTS WITHHELD.

12.5.1 The OR may decline to certify payment and may withhold his Certificate in whole or in part if, in his opinion, he is unable to make representations to the Owner as provided in Subparagraph 12.4.2. The OR may also decline to certify any Applications for Payment or, because of subsequently discovered evidence or subsequent inspections, he may nullify the whole or any part of any Certificate for Payment previously issued to such extent as may be necessary in his opinion to protect the Owner from loss because of:

  .1 defective work not remedied,
  .2 claims filed or reasonable evidence indicating probable filing of claims,
  .3 reasonable doubt that the Work can be completed for the unpaid balance of the Contract Amount,
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.4 damage to the Owner or another contractor,

.5 reasonable indication that the Work will not be completed within the Contract Time, or

.6 unsatisfactory prosecution of the Work by the Contractor.

12.5.2 When the grounds in Subparagraph 12.5.1 are removed, or in the case of 12.5.1.3 above, when the Owner is satisfied that the Contractor will complete the Project at the agreed upon price, payment shall be made for amounts withheld because of them.

12.6 SUBSTANTIAL COMPLETION AND FINAL PAYMENT.

12.6.1 When the Contractor believes that the Work or a designated portion thereof acceptable to the Owner is substantially complete, the Contractor shall prepare for submission to the OR a "punch list" of items to be completed or corrected. Any item on such list shall be completed or corrected before the Final Completion Date without regard to whether such item may be characterized by anyone as a "warranty item" or otherwise. The failure to include any items on such punch list does not alter the responsibility of the Contractor to complete all Work in accordance with the Contract Documents. When the OR, on the basis of an inspection, determines that the Work or a portion thereof is substantially complete, he will then prepare a Certificate of Substantial Completion, which shall be AIA Document G704, which shall state the responsibilities of the Owner and the Contractor for maintenance, heat, utilities and insurance. The Certificate(s) of Substantial Completion shall be submitted to the Owner for their written acceptance of the responsibilities assigned to them in such Certificate.

12.6.2 Upon receipt of written notice from the Contractor that the Work is ready for final inspection and acceptance, the OR will promptly make such inspection and, when the OR finds (1) the Work acceptable under the Contract Documents; (2) the Contract fully performed; and (3) the Final Completion Date has been reached, as that term is defined in Subparagraph 11.1.4, then, and only then, the Contractor shall promptly issue a final Invoice stating that, to the best of his knowledge, information and belief, and on the basis of observations and inspections, the Work has been fully completed in accordance with the terms and conditions of the Contract Documents, that the entire balance found to be due the Contractor is payable, and that any securities held by the Owner in lieu of a cash retention are returnable. The Contractor's written notice required by this Paragraph shall state the Date of Final Completion.

12.6.3 Neither the final payment nor the remaining retained percentage shall become due until the Contractor submits to the Owner (1) an affidavit that all payrolls, bills for materials and equipment, and other indebtedness connected with the Work for which the Owner or his property might in any way be responsible, have been paid or otherwise satisfied; (2) consent of surety to final payment; (3) if required by the Owner, other data establishing payment or satisfaction of all such obligations, to the extent and in such form as may be designated by the Owner; and (4) written certification by the Contractor, and such subcontractors, material suppliers and manufacturers as the Owner shall designate, that no materials have been incorporated into the Work which contain any asbestos.

12.6.4 The acceptance of final payment shall constitute a waiver of all claims by the Contractor except previously made in writing and still unsettled.
ARTICLE 13
PROTECTION OF PERSONS AND PROPERTY

13.1 SAFETY PRECAUTIONS AND PROGRAMS. The Contractor shall be responsible for initiating, maintaining and supervising all safety precautions and programs in connection with the Work in compliance with all local, state and federal laws and regulations.

13.2 SAFETY OF PERSONS AND PROPERTY.

13.2.1 The Contractor shall take all reasonable precautions for the safety of, and shall provide all reasonable protection to prevent damage, injury or loss, to:

1. all employees engaged in the Work and all other persons who may be affected thereby;

2. all the Work and all materials and equipment to be incorporated therein, whether in storage on or off the site, under the care, custody or control of the Contractor or any of his Subcontractors or Sub-subcontractors; and

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

13.2.2 The Contractor shall comply with all applicable laws, ordinances, rules, regulations and orders of any public authority having jurisdiction for the safety of persons or property or to protect them from damage, injury or loss. He shall erect and maintain, as required by existing conditions and the progress of the Work, all reasonable safeguards for safety and protection, including posting danger signs and other warnings against hazards, promulgating safety regulations and notifying owners and users of adjacent utilities.

13.2.3 When the use or storage of explosives or other hazardous materials or equipment is necessary for the execution of the Work, the Contractor shall exercise the utmost care and shall carry on such activities under the supervision of properly qualified personnel.

13.2.4 All damage or loss to any property referred to in Clauses 13.2.1.2 and 13.2.1.3 caused in whole or in part by the Contractor, any Subcontractor, any Sub-subcontractor, or anyone directly or indirectly employed by any of them, or by anyone for whose acts any of them may be liable, shall be remedied by the Contractor.

13.2.5 The Contractor shall designate a responsible member of his organization at the site whose duty shall be the prevention of accidents. This person shall be the Contractor's Superintendent unless otherwise designated in writing by the Contractor to the Owner.

13.2.6 The Contractor shall not load or permit any part of the Work to be loaded so as to endanger its safety.
13.3 EMERGENCIES. In any emergency affecting the safety of persons or property, the Contractor shall act, at his discretion, to prevent threatened damage, injury or loss. Any additional compensation or extension of time claimed by the Contractor on account of emergency work shall be determined as provided by the applicable provisions of the Contract Documents.

ARTICLE 14
CONTRACTOR'S INSURANCE

14.1 GENERAL REQUIREMENTS The Contractor, at Contractor’s own expense, shall purchase and maintain the herein stipulated minimum insurance with companies duly licensed to do business in the State of Arizona with policies and forms satisfactory to the District and possessing a current A.M. Best, Inc. Rating of B++6.

All insurance required herein shall be maintained in full force and effect until all work required to be performed under the terms of the Contract is satisfactorily completed and formally accepted; failure to do so may, at the sole direction of the District, constitute a material breach of the Contract.

The Contractor’s insurance shall be primary insurance, and any insurance or self-insurance maintained by the District shall not contribute to it.

Any failure to comply with the claim reporting provisions of the policies or any breach of an insurance policy warranty shall not affect coverage afforded under the policy to protect the District.

All policies, except Workers’ Compensation, shall contain a waiver of transfer rights of recovery (subrogation) against the District, its agents, representatives, directors, officers, and employees for any claims arising out of the Contractor’s work or service.

The insurance policies may provide coverage which contains deductibles or self-insured retentions. Such deductible and/or self-insured retentions shall not be applicable with respect to the coverage provided to the District under such policies. The Contractor shall be solely responsible for deductible and/or self-insured retention and the District, at its option, may require the Contractor to secure the payment of such deductible or self-insured retentions by a surety bond or an irrevocable and unconditional letter of credit.

The District reserves the right to request and to receive, within 10 working days, certified copies of any or all of the herein required insurance policies and/or endorsements. The District shall not be obligated, however, to review same or to advise Contractor of any deficiencies in such policies and endorsements, and such receipt shall not relieve Contractor from, or be deemed a waiver of the District’s right to insist on, strict fulfillment of Contractor’s obligations under the Contract.

The insurance policies, except Workers’ Compensation, required by the Contract shall name the District, its agents, representatives, officers, directors, officials, and employees as Additional Insureds.

14.2 REQUIRED COVERAGE

14.2.1 General Liability - Contractor shall maintain Commercial General Liability insurance with a limit of not less than $2,000,000 for each occurrence with a $2,000,000 Products and Completed
Operations Aggregate and $2,000,000 General Aggregate Limit. The Contractor’s policy shall be endorsed to include a separate designated construction project general aggregate limit applicable to this project with a per project limit of $1,000,000 which coverage will be at least as broad as Insurance Service Office, Inc. Policy Form CG 25030397. The policies shall include coverage for bodily injury, broad form property damage, personal injury, products/completed operations and blanket contractual coverage including, but not limited to, the liability assumed under the indemnification provisions of the Contract, which coverage will be at least as broad as Insurance Service Office, Inc. Policy Form CG 000211093 or any replacement thereof. The coverage shall not exclude X, C, U.

Such policies shall contain a severability of interest provision, and shall not contain a sunset provision or commutation clause, or any provision that would serve to limit third party action over claims.

The Commercial General Liability additional insured endorsement shall be at least as broad as the Insurance Service Office, Inc’s, Additional Insured, Form B CG20101185, and shall include coverage for Contractor’s operations and products and completed operations.

14.2.2 Certificates of Insurance - Prior to commencing Services under the Contract, Contractor shall furnish the District with Certificates of Insurance, or formal endorsements as required by the Contract, issued by Contractor’s insurer(s), as evidence that policies providing the required coverages, conditions and limits required by the Contract are in full force and effect.

In the event any insurance policy(ies) required by the contract is(are) written on a “claims made” basis, coverage shall extend for two years past completion and acceptance of the contractor’s work or services and as evidenced by annual Certificates of Insurance.

If a policy does expire during the life of the contract, a renewal certificate must be sent to the District thirty (30) days prior to the expiration date.

All Certificates of Insurance required by the Contract shall be identified with a bid serial number and title.

Insurance evidenced by these certificates shall not expire, be canceled, or materially changed without thirty (30) days prior written notice to the District.

14.2.3 Automobile Liability - Contractor shall maintain and cause any subcontractors to maintain Commercial/Business Automotive Liability insurance with a combined single limit for bodily injury and property damage of not less than $1,000,000 each occurrence with respect to the Contractor’s owned, hired, and non-owned vehicles assigned to or used in performance of the Contractor’s work. Coverage will be at least as broad as coverage code 1, “any auto”, (Insurance Service Office, Inc. Policy Form CA 00011293, or any replacements thereof). Such insurance shall include coverage for loading and off loading hazards. If hazardous substances, materials or wastes are to be transported, MCS 90 endorsement shall be included and $5,000,000 per accident limits for bodily injury and property damage shall apply.

14.2.4 Workers’ Compensation - This Contractor shall carry Workers’ Compensation insurance to cover obligations imposed by federal and state statutes having jurisdiction of Contractor’s employees
engaged in the performance of the work; and, Employer’s Liability insurance of not less than $2,000,000 for each accident, $1,000,000 disease for each employee, and $1,000,000 disease policy limit. In case any work is subcontracted, the Contractor will require the Subcontractor to provide Workers’ Compensation and Employer’s Liability to at least the same extent as required of the Contractor.

ARTICLE 15
CHANGES IN THE WORK AND CLAIMS

15.1 CHANGE ORDERS.

15.1.1 The Owner, without invalidating the Contract, may order changes in the Work within the general scope of the Contract consisting of additions, deletions or other revisions. The Contract Amount and/or the Contract Time shall be adjusted accordingly pursuant to the terms of the Contract Documents.

15.1.2 A Change Order is a written amendment to the Contract Documents signed by the Owner, OR and the Contractor, issued after the execution of the Contract, authorizing a change in the Work or an adjustment in the Contract Amount or the Contract Time. The Contract Amount and the Contract Time may be changed only by Change Order.

15.1.3 The debit or credit, as the case may be, to the Owner resulting from a change in the Work shall be determined in one or more of the following ways as mutually agreed:

.1 by a lump sum properly itemized and supported as described below in order to permit evaluation;

.2 by unit prices stated in the Contract Documents or subsequently agreed upon; or

.3 by actual cost and specified percentage fee covering overhead and profit.

The total amount of overhead and profit allowed on any Change Order, whether increase or decrease, shall not exceed 15% of the direct costs of the Change Order Work when the Work is performed by the Contractor, or 5% of the Direct Costs for the Contractor's overhead and profit and 15% for the Subcontractor's overhead and profit when the Work is performed by any level of Subcontractor or Sub-subcontractor. The aforesaid amounts shall include the general conditions, overhead and profit for both the Contractor, Subcontractor(s), and Sub-subcontractor(s), if any. The costs of bond premiums and sales tax shall be added, in that order, after calculation and addition of overhead and profit.

The overhead and profit margin shall cover the costs of any additional supervision and project management, including the Contractor's and any Subcontractor's job superintendent, project manager, estimator, field office support, home office support, small tools and all other general conditions items.

For each and every proposed change in the Contract Amount, the Contractor shall provide an itemized breakdown of direct costs, hereinafter called the cost breakdown, that: (1) clearly describes each item, location and scope of work; (2) identifies in detail all labor (by trade classification), materials, equipment and services required to complete the work; (3) lists and extends all respective man
hours (or unit hours), labor rates, quantities of materials, dimensions used to compute quantities, material units and unit prices, equipment time and rental rates. This cost breakdown shall be organized in a format that clearly identifies the subtotal of direct costs before overhead (if any), profit, bond and tax are added. The cost breakdown format is subject to the approval of the Owner.

Change bids from the Contractor shall include separate cost breakdowns as described above from any and all Subcontractors involved with the change. Subcontractor cost breakdowns are to be in writing on their letterhead and signed by the Subcontractor. Contractor shall provide any additional data needed to substantiate costs of changes, including invoices from suppliers and payroll information upon request of the Owner. The Contractor shall respond to requests for quotations from the Owner within five (5) calendar days.

The Direct Cost is defined as the lowest locally available cost to the Contractor or Subcontractor after all discounts, rebates and concessions are calculated. The Direct Cost is the basis for computing Contractor and Subcontractor overhead and profit margins. The Direct Costs that may be included in the price of a change are limited to the following items directly attributable to the change in the Work:

1. Costs of materials, including cost of delivery;
2. Cost of labor, including social security, old age and employment insurance, and fringe benefits required by agreement and workers’ compensation insurance;
3. Rental value of equipment used to perform the Work.

15.1.4 If unit prices are stated in the Contract Documents or subsequently agreed upon, and if the quantities originally contemplated are so changed in a proposed Change Order that application of the agreed unit prices to the quantities of Work proposed will create a hardship on the Owner or the Contractor, the applicable unit prices shall be equitably adjusted to prevent such hardship.

15.1.5 Should concealed conditions encountered in the performance of the Work below the surface of the ground be at variance with the conditions indicated by the Contract Documents or should unknown physical conditions below the surface of the ground of an unusual nature, differing materially from those ordinarily encountered and generally recognized as inherent in work of the character provided for in this Contract, be encountered, the Contract Amount shall be adjusted by Change Order upon claim by either party made in compliance with Subparagraph 12.4.4 and within the time limits prescribed in Subparagraph 15.2.1.

15.1.6 If the Contractor claims that additional cost or time is involved because of:

.1 any written interpretation issued pursuant to Subparagraph 4.12.5,
.2 any order by the Owner to stop the Work pursuant to Subparagraph 5.2.11 where the Contractor was not at fault, or
.3 any written order for a minor change in the Work issued pursuant to Paragraph 15.3,
the Contractor shall make such claim as provided in Paragraph 15.2.

15.2  CLAIMS FOR ADDITIONAL COST OR TIME. If the Contractor decides to make a claim for an increase in the Contract Amount or any other claim, except one for an extension of Contract Time, he shall give the Owner written notice thereof within fifteen (15) days after the occurrence of the event giving rise to such claim or include such notice in the Application for Payment for the month in which the event giving rise to the claim occurred, whichever is earlier. Notice of a claim for extension of Contract Time shall be given within fifteen (15) days of the occurrence of the event giving rise to such claim. Any notice other than one made for an extension of the Contract Time shall be given by the Contractor before proceeding to execute the Work which is the subject matter of the claim, except in an emergency endangering life or property, in which case the Contractor shall proceed in accordance with Subparagraph 13.3.1. All claims shall be made as provided in Subparagraph 12.4.4 within the time limits prescribed herein, and no such claim shall be valid unless so made. No change in the Contract Amount or Contract Time resulting from such claim shall be valid unless approved by the Owner and authorized by Change Order.

15.3  MINOR CHANGES IN THE WORK. The OR has authority to order minor changes in the Work not involving an adjustment in the Contract Amount or an extension of the Contract Time and not inconsistent with the intent of the Contract Documents.

15.4  FIELD INFORMATION MEMOS. The OR may issue written Field Information Memos which interpret the Contract Documents in accordance with Subparagraph 4.12.5 or which order minor changes in the Work in accordance with Paragraph 15.3 without change in Contract Amount or Contract Time. The Contractor shall carry out such changes specified in the Field Information Memos promptly.

ARTICLE 16
UNCOVERING AND CORRECTION OF WORK

16.1  UNCOVERING OF WORK.

16.1.1  If any Work should be covered contrary to the request of the OR, it must, if required by the OR, be uncovered for his observation and replaced, all at the Contractor's expense.

16.1.2  If any other Work has been covered which the OR has not specifically requested to observe prior to being covered, the OR may request to see such Work and it shall be uncovered by the Contractor. If such Work is found to be in accordance with the Contract Documents, the cost of uncovering and replacement after approval by the OR shall, by appropriate Change Order, be charged to the Owner. If such Work is found not to be in accordance with the Contract Documents, the Contractor shall pay such costs unless it is found that this condition was caused by a separate contractor employed as provided in Article 9, and in that event, the Owner shall be responsible for the payment of such costs.

16.2  CORRECTION OF WORK.

16.2.1  The Contractor shall promptly correct all Work rejected by the Owner as defective or as failing to conform to the Contract Documents whether observed before or after Final Completion and
whether or not fabricated, installed or completed. The Contractor shall bear all costs of correcting such rejected Work.

16.2.2 If, within two (2) years after acceptance of the Work by the Owner or within such longer period of time as may be prescribed by law or by the terms of any applicable special guarantee required by the Contract Documents, including the original conformance with the Contract Documents, any of the Work is found to be defective or not in accordance with the Contract Documents, the Contractor, without cost to the Owner, shall correct it promptly after receipt of a written notice from the Owner to do so. The Owner shall give such notice promptly after discovery of the condition.

16.2.3 All such defective or non-conforming Work under Subparagraphs 16.2.1 and 16.2.2 shall be removed from the site where necessary, and the Work shall be corrected to comply with the Contract Documents without cost to the Owner.

16.2.4 The Contractor shall bear the cost of making good all work of separate contractors destroyed or damaged by such removal or correction.

16.2.5 If the Contractor does not remove such defective or non-conforming Work within a reasonable time fixed by written notice from the Owner, the Owner may remove it and may store the materials or equipment at the expense of the Contractor. If the Contractor does not pay the cost of such removal and storage within ten (10) days after receipt of a statement of charges therefor, the Owner may, upon ten (10) additional days written notice, sell such Work at auction or at private sale and shall account for the net proceeds thereof after deducting all the costs that should have been borne by the Contractor, including compensation for additional architectural services and any attorneys' fees incurred by Owner in connection therewith. If such proceeds of sale do not cover all costs which the Contractor should have borne, the difference shall be charged to the Contractor and an appropriate Change Order shall be issued. If the payments then or thereafter due the Contractor are not sufficient to cover such amount, the Contractor shall pay the difference to the Owner, and all attorneys' fees and other costs that the Owner may incur in collecting same.

16.2.6 If the Contractor fails to correct such defective or non-conforming Work, the Owner may correct it in accordance with Paragraph 10.6.

16.2.7 The obligations of the Contractor under this Paragraph 16.2 shall be in addition to and not in limitation of any obligations imposed upon him by special guarantees required by the Contract Documents or otherwise prescribed by law.

16.3 ACCEPTANCE OF DEFECTIVE OR NON-CONFORMING WORK. If the Owner prefers to accept defective or non-conforming Work, he may do so instead of requiring its removal and correction, in which case a Change Order will be issued to reflect an appropriate reduction in the Contract Amount, or, if the amount is determined after final payment, it shall be paid by the Contractor.
ARTICLE 17
TERMINATION OF THE CONTRACT

17.1 TERMINATION BY THE CONTRACTOR. If the Work is stopped for a period of thirty (30) days, and the Owner is immediately notified of such stopping, under an order of any court or other public authority having jurisdiction through no act or fault of the Contractor or a Subcontractor or their agents or employees or any other persons performing any of the Work under a contract with the Contractor, and by reason of some act or omission of Owner, then the Contractor may, upon thirty (30) days written notice to the Owner, terminate the Contract and recover from the Owner payment for all Work executed and for any proven loss sustained upon any materials, equipment, tools, construction equipment and machinery, including the percentage profit stated in Paragraph 3.4 herein for Work accomplished through the date the notice of termination is given.

17.2 TERMINATION BY THE OWNER.

17.2.1 If the Contractor files or has filed against it any petition in bankruptcy, or if he makes a general assignment for benefit of his creditors, or if a receiver is appointed on account of his insolvency, or if he refuses or fails, except in cases for which extension of time is provided, to supply enough properly skilled workmen or sufficient and proper materials to complete the Work in accordance with the Progress Schedule and Contract Time, or he fails to make prompt payments to Subcontractors or for materials or labor, or disregards laws, ordinances, rules, regulations or orders of any public authority having jurisdiction, or otherwise is guilty of a material breach of any provision of the Contract Documents, then the Owner may, without prejudice to any other right or remedy and after giving the Contractor and/or his surety seven (7) days written notice, terminate the employment of the Contractor and take possession of the site and all materials, equipment, tools, construction equipment and machinery thereon owned by the Contractor and may finish the Work by whatever method he may deem expedient. In such case, the Contractor shall not be entitled to receive any further payment until the Work is finished. Termination of the Contract under this Subparagraph 17.2.1 shall not relieve the Contractor of any warranty obligations he would otherwise have on all Work performed hereunder, and such obligations shall survive termination of this Contract.

17.2.2 If the unpaid balance of the Contract Amount exceeds the costs of finishing the Work, including attorneys' fees and all other costs incurred by Owner in completion of the Contractor's obligations, such excess shall be paid to the Contractor. If such costs exceed such unpaid balance, the Contractor shall pay the difference to the Owner.

ARTICLE 18
WARRANTY AND SITE CONDITIONS

18.1 TWO-YEAR WARRANTY.

18.1.1 The Contractor shall warrant all Work under this Contract against defects of material and workmanship for a period of at least two (2) years from the Final Completion Date; provided, however, that those items of the Work specified as having longer warranties shall be warranted for the period specified.
18.1.2 The Contractor shall be responsible for the total cost of repairing and restoring such defective Work to a new condition, at no cost to Owner.

18.1.3 In any case where the subject matter of the defect relates to Work done under a subcontract between the Contractor and any Subcontractor, it is the responsibility of the Contractor, not the Owner, to secure the Subcontractor's performance in compliance with this Paragraph and, in the event of the Subcontractor's failure or refusal within a reasonable time to perform after notice, it shall be the Contractor's responsibility to repair and restore such defective Work to a new condition, at no cost to Owner.

18.1.4 In any case where the defective Work has been brought to the attention of the Contractor by the Owner and the Contractor fails or refuses to correct it, the Owner may elect, without precluding its use of any other remedy it may have available to it, to have the defective Work repaired and restored to a new condition in whatever manner it deems appropriate, regardless of the cost, and the Contractor shall be liable to the Owner for the total cost thereof, including, without limitation, any architectural and legal fees related to effecting the repair.

18.1.5 Material and workmanship made good through compliance with such warranty shall be subject to the same warranty period as the original materials and workmanship. Such warranty period shall begin on the date the replaced material and work is certified as acceptable in writing by the Owner.

18.2 USE OF PREMISES.

18.2.1 The Contractor shall confine his equipment and plant, the storage of materials, and the operations of his workmen to limits indicated by law, ordinances, permits, or directions of the Owner and shall not unreasonably encumber the premises with materials or equipment.

18.3 SEVERABILITY. In the event any provision in this Contract is held invalid by any court of competent jurisdiction, the remaining provisions in this Contract shall be deemed severable and shall remain in full force and effect.

18.4 IMMIGRATION LAW COMPLIANCE.

18.4.1 The Contractor warrants compliance with the Federal Immigration and Nationality Act (FINA) and all other Federal and State immigration laws and regulations related to the immigration status of its employees. Contractor shall obtain statements from its subcontractors of every tier certifying compliance and shall furnish the statements to the Owner upon request. These warranties shall remain in effect through the term of the Contract, and the Contractor and its subcontractors of every tier shall also maintain Employment Eligibility Verification forms (I-9) as required by the U.S. Department of Labor’s Immigration and Control Act for all employees performing work pursuant to this Contract. I-9 forms are available for download at USCIS.GOV.

18.4.2 The Owner may request, and the Contractor agrees to furnish, verification of compliance from the Contractor or its subcontractors of any tier performing work pursuant to this Contract. Should the Owner reasonably believe or discover that the Contractor or its subcontractors of any tier are not in compliance, the Owner may pursue any and all remedies allowed by law, including, but not limited to: suspension of work, termination of the Contract for default, and suspension and/or debarment of the Contractor or its subcontractors. All costs necessary to verify compliance are the responsibility of the Contractor.
18.5  COMPLIANCE WITH A.R.S. §§ 35-391.06 AND 35-393.06. Pursuant to A.R.S. §§ 35-391.06 and 35-393.06, the Contractor shall certify that it does not have a scrutinized business operation in either Sudan or Iran.

18.6  CANCELLATION. This Agreement is subject to cancellation by the Owner for violation of the provisions of Arizona Revised Statutes Section 38-511.

IN WITNESS WHEREOF, four (4) identical counterparts of this Agreement, each of which shall for all purposes be deemed an original thereof, have been duly executed by the parties hereinabove named, on the day and year first above written.

OWNER: Pima County Community College

By _________________________________ Date _______________
Its _________________________________

CONTRACTOR: _________________________________

By _________________________________ Date _______________
Its _________________________________
2. Drawings
PROJECT MANUAL

PCC DTC ST WEST
MECHANICAL UPGRADES

Pima Community College
Tucson, Arizona

NTD Architecture Project Number 2011-0230-01
June 7, 2013

2940 North Swan Road, Suite 214, Tucson, AZ, 85712 (520) 784-0975
PROJECT MANUAL

for the Construction
of
PCC DTC
ST West - Mechanical Upgrades

for
Pima Community College

Prepared By
NTD Architecture
2940 North Swan Road, Suite 214
Tucson, AZ 85712

NTD # 2011-0230-01

June 7, 2013
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Not used

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NTD Project No. 2011-0230-01

Pima Community College
District Office
4905 East Broadway Boulevard
Tucson, AZ 85709-1010
(520) 208-4500

NTD Architects
2940 North Swan Road, Suite 214
Tucson, AZ 85712
(520) 784-0975
(520) 784-0964 FAX

EXPIRES 03-31-2014

Holben, Martin & White
2950 North Country Club Road
Tucson, Arizona 85716
(520) 327-9491

Mechanical
Adams & Associates
4067 E. Grant Road, Suite 200
Tucson, AZ 85712
(520) 323-3858

Electrical
M3 Engineering and Technology
2051 W. Sunset Road, Suite 101,
Tucson, Arizona 85704
(520) 293-1488

PCC DTC
NTD Architecture
NTD # 2011-0230-01

ST West Mechanical Upgrades
DIRECTORY/CERTIFICATIONS
D-1
DIVISION 1 – GENERAL REQUIREMENTS

SECTION 01 11 00      SUMMARY OF THE WORK

01 11 00.01   GENERAL:

A. Requirements of "Instructions to Bidders" become a part of this work.

B. The scope of this contract consists of all supervision, labor, materials, equipment, appliances, transportation, tools, equipment rentals, fees, taxes and incidentals necessary to perform all operations required to install, alter, construct and complete, all in accordance with these specifications and the applicable drawings and documents, and work reasonably inferable from the specifications and drawings, and subject to the terms and conditions of the contract.

1. The work includes:
   a. Upgrading the mechanical system including makeup air unit, cooling tower replacement; distribution piping; electrical systems modifications; energy management system modifications; test, adjust and balance the mechanical systems; and mechanical yard work per plans and specifications.

2. Work by Owner:
   a. The Owner will hire a special inspection company to perform special inspections, and tests required by drawings and specifications per Article 10.

3. Contract Time: Refer also to Article 3.2

TABLE 01 11 00 – Contract Time

<table>
<thead>
<tr>
<th>TASK</th>
<th>DATES</th>
<th>DURATION</th>
</tr>
</thead>
<tbody>
<tr>
<td>Anticipated Date of Notice to Proceed</td>
<td>September 3, 2013</td>
<td></td>
</tr>
<tr>
<td>Submittal Process/No work on Site</td>
<td>September 4 - 29, 2013</td>
<td></td>
</tr>
<tr>
<td>Construction on Site begins</td>
<td>September 30, 2013</td>
<td></td>
</tr>
<tr>
<td>Mechanical Air unit placement on Roof</td>
<td>November 28 – Dec 1, 2013</td>
<td>Thanksgiving holiday break PCC School closed</td>
</tr>
<tr>
<td>Substantial Completion</td>
<td>December 20, 2013</td>
<td>NTP to Substantial Completion anticipated to be 109 days</td>
</tr>
<tr>
<td>Final Completion</td>
<td>January 2, 2014</td>
<td></td>
</tr>
</tbody>
</table>

4. If the Contractor is delayed at any time in the progress of the Work by an act or neglect of the Owner or Architect, or of an employee of either, which the Architect determines justifies relief, then Contract Time shall be extended by Change Order for such reasonable time as the Architect may determine.

5. An extension of time shall be the Contractor’s sole remedy for delay. The Contractor expressly agrees not to make, and hereby waives any claim for damages against the Owner on account of any delay, obstruction, or hindrance for any cause.
whatsoever, and agrees that the Contractor’s sole right and remedy in the case of delay shall be an extension of the time fixed for completion of the contract.

6. Contract Time shall not be adjusted unless a change affects the critical path of the Work.

C. Warranty: If, within two years after the date of Substantial Completion of the work, any of the work is found to be not in accordance with the requirements of the Contract Documents, the Contractor shall correct it promptly after receipt of written notice from the Owner. See also Section 01 78 36 “Warranties”.

D. Liquidated Damages: Refer also to Contract Article 3.3, Paragraph "Liquidated Damages" and Article 11 “Time and Liquidated Damages”.

1. If the Contractor neglects, fails or refuses to substantially complete the Work within the Contract Time, or any extension granted by Change Order, then the Contractor shall, as part consideration for the award of this contract, pay to the Owner a sum of not less than one hundred dollars ($250.00) per calendar day, not as a penalty, but as liquidated damages for such breach of contract, for each and every calendar day that the Contractor fails to substantially complete the work.

E. On the Owner’s behalf, the General Contractor shall apply for an energy rebate with Tucson Electric Power Commercial Energy Solutions program, for the mechanical system improvements covered under this Contract. Upon meeting the requirements of the rebate application, and approval, TEP shall provide the rebate monies to PCC.

01 11 00.02 DEFINITIONS:

A. The term "Contractor" means the person or organization awarded the contract to complete work specified herein, and shall be a General Contractor registered and licensed by the State of Arizona, who has successfully completed a minimum of three comparable remodeling projects and can provide references for those projects. Refer also to Article 7 in the Contract and General Conditions.

B. The term "Owner" as used herein means Pima County Community College (PCC) District of the State of Arizona, the Director of Facilities Operations and Construction or the PCC Facility’s Project Manager assigned to this Project, who shall act on behalf of the Owner. Communication to Pima Community College is not received unless directed to the attention of the PCC Director of Facilities Operations and Construction, or the PCC Facilities Project Manager assigned to this Project.

C. The term "Architect" or "Owner’s Representative" as used herein means the firm of NTD Architecture and its employees.

01 11 00.03 INTENT OF DOCUMENTS:

A. Drawings and Specifications are cooperative and supplementary. Portions of the work which can be best illustrated by drawings may not be included in specifications, and portions best described by specifications may not be depicted on the drawings. The Intent of the Bid Documents is to include labor, materials and services necessary for proper completion of this project.

B. Completeness and correctness of Bid Documents shall be verified before execution by Contractor who shall notify the Architect of any errors, inconsistencies or omissions within ten (10) days from the Notice to Proceed. The Contractor shall be liable to the Owner or the Architect for any damages resulting from any errors, inconsistencies or omissions and knowingly failed to report it to the Architect. If the Contractor performs any construction activity knowing it involves a recognized error, inconsistency or omission in the Contract Documents without such notice to the Architect, the Contractor shall assume appropriate responsibility for such performance and shall bear an appropriate amount of attributable responsibility for such performance and shall bear an appropriate amount of attributable...
costs for correction. Refer also to Article 7.2, “Review of Contract Documents and Examination of Site”.

C. Where drawings and specifications appear to conflict, specifications shall govern. Detail drawings have priority over other drawings and large scale plans have priority over small scale plans. Discrepancy in figures, drawings or specifications shall be promptly submitted to the Architect, who shall promptly make a determination in writing.

01 11 00.04 DETAIL DRAWING INTERPRETATION:

A. Before doing any work or ordering any materials, Contractor shall verify measurements of existing and new work and be responsible for their correctness. Differences which may be found shall be submitted to the Architect for consideration before proceeding with the work. No extra compensation will be allowed because of differences between actual dimensions and those indicated on working drawings. The Contractor will be responsible for the locations and elevations of all the construction indicated by the construction documents. Refer also to Article 7.2, “Review of Contract Documents and Examination of Site”.

01 11 00.05 PROTECTION OF ADJACENT PROPERTY:

A. Contractor is responsible for preservation of public and private property on the surface or underground, along and adjacent to the work, and shall conduct his operations so as to ensure the prevention of injury or damage thereto.

B. Whenever direct or indirect damage or injury is done to public or private property by or on account of acts, omissions, neglect or misconduct in the execution of the work, or in consequence of non-execution thereof on the part of the Contractor, such property shall be restored by Contractor at his expense, to a condition equal to that existing before such damage or injury was done, by repairing, rebuilding or otherwise restoring same, or the contractor shall make good such damage or injury in an acceptable manner to the Owner.

END OF SECTION 01 11 00

SECTION 01 14 00 WORK RESTRICTIONS

01 14 00.01 WORK RESTRICTIONS:

A. Work involving excessive noise which will disrupt classroom instruction shall be scheduled during non-school hours.

B. Work involving shutdown of utilities, and building systems (for example: water service, electric service, heating/cooling, life safety systems) shall be scheduled during non-school hours.

END OF SECTION 01 14 00
SECTION 01 23 00  ALTERNATES

01 23 00.01 RELATED DOCUMENTS:

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

01 23 00.02 DEFINITION:

A. An Alternate is an amount proposed by Bidders and stated on the Bid Form for certain construction activities defined in the Bidding Requirements that may be added to or deducted from the Base Bid amount if the Owner decides to accept a corresponding change in either the amount of construction to be completed, or in the products, materials, equipment, systems or installation methods described in the Contract Documents.

01 23 00.03 COORDINATION:

A. The General Contractor shall coordinate related Work and modify or adjust adjacent work as necessary to ensure that the Work affected by each accepted Alternate is complete and fully integrated into the project. Include as part of each Alternate, miscellaneous devices, accessory objects and similar items incidental to or required for a complete installation which are reasonably inferable from the specifications and drawings describing the Alternate.

01 23 00.04 BID:

A. Indicate the amount of each Alternate separately on the Bid Form. Indicate if the Alternate amount is to be added to the Base Bid or deducted from the Base Bid. The Alternate amount must include all costs related to the Alternate such as, but not limited to, costs to coordinate related Work, Subcontractor costs, taxes, and costs related to the bonds.

01 23 00.05 NOTIFICATION:

A. Immediately following the award of the Contract, prepare and distribute to each party involved, notification of the status of each Alternate. Indicate whether Alternates have been accepted, rejected or deferred for consideration at a later date. Include a complete description of negotiated modification to Alternates.

01 23 00.06 SCHEDULE OF ALTERNATES:

A. A Schedule of Alternates is included at the end of this Section. Specification Sections referenced in the Schedule contain requirements for materials and methods necessary to achieve the Work described under each Alternate.

1. Alternate 1: Removal of existing masonry wall and foundation and site improvements to extend the Auto Shop Lab parking area per drawings and specifications.

END OF SECTION 01 23 00
SECTION 01 25 00  PRODUCT SUBSTITUTION PROCEDURES

01 25 00.01  SUBSTITUTION REQUEST PRIOR TO BID – PRIOR APPROVAL:

A.  Refer to Instructions to Bidders for requirements to submit a substitution request prior to the Bid due date.

01 25 00.02  SUBSTITUTION REQUEST AFTER BID AWARD:

A.  After the bid award, substitution requests will only be considered if the specified product or system has gone out of production, or has been deemed illegal or dangerous subsequent to bidding.

01 25 00.03  SUBSTITUTION SUBMITTAL REQUIREMENTS AFTER BID AWARD:

A.  The General Contractor shall submit substitution requests after the bid has been awarded using separate requests for each substitution. Include, at a minimum, in each request:
   1.  Complete data substantiating compliance of proposed substitution with contract documents, include:
       a.  Product identification, manufacturer's name and address.
       b.  Product specifications and data per 01 33 00.
       c.  Samples per 01 33 00 if applicable.
   2.  Itemized comparison of proposed substitution with specified products, listing all variations, including size and weight, and performance characteristics.
   3.  Data relating to changes in the construction schedule.
   4.  Any effect on in-place construction or other materials and systems to be installed.
   5.  Cost data comparing proposed substitution with specified products.
       a.  Engineering fees and additional agency permit costs required by the Substitution Submittal will be paid for by the General Contractor.
   7.  Advantages to the Owner of accepting the substitutions.

01 25 00.04  SUBSTITUTIONS NOT CONSIDERED:

A.  Substitutions will not be considered when:
   1.  They are indicated or implied on submittals without formal request.
   2.  Acceptance may require revision of Contract documents, unless Contractor agrees to compensate Owner for Architect's additional services.
   3.  The requested substitution is directly from a subcontractor, a manufacturer, a vendor, or supplier's representative. All substitution requests have to be submitted for consideration by the Contractor.

01 25 00.05  SUBSTITUTE PRODUCT:

A.  Substitute products shall not be ordered or installed without written acceptance of Architect and the Owner.
01 25 00.06 SUBSTITUTION DATA:

A. Based on the submitted data, the Architect will determine if the proposed substitution meets the requirements of the contract documents.

END OF SECTION 01 25 00

SECTION 01 26 00 CONTRACT MODIFICATION PROCEDURES

01 26 33 MINOR CHANGES IN THE WORK:

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

01 26 46 CONSTRUCTION CHANGE DIRECTIVE:


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

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

01 26 53 PROPOSAL REQUEST:

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

1. Proposal Requests issued by the Architect are for information only. Do not consider them instructions either to stop work in progress or to execute the proposed change.
2. Within 10 days after receipt of Proposal Request, submit a quotation estimating cost adjustments to the Contract Sum and the Contract Time necessary to execute the change. Contractor to submit the following items:
   a. Include a list of quantities of materials, supplies, and equipment (including cost of transportation, whether incorporated or consumed) required or eliminated and unit costs, with total amount of purchases and credits to be made. If requested, furnish survey data to substantiate quantities.
   b. Include applicable costs of premiums for all bonds and insurance, permit fees, taxes, delivery charges, equipment rental (exclusive of hand tools), and amounts of trade discounts required or eliminated.
   c. Include costs of labor and supervision directly attributable to the change, including social security, old age and unemployment insurance, fringe benefits required by agreement or custom, and workers’ compensation insurance required or eliminated.
   d. Include an updated Contractor’s Construction Schedule that indicates the effect of the change, including, but not limited to, changes in activity
duration, start and finish times, and activity relationship. Use available
total float before requesting an extension of the Contract Time.

e. Comply with requirements in Division 1 Section "Product Requirements" if
the proposed change requires substitution of one product or system for
product or system specified.

f. For deductive change order proposals, Contractor may add appropriate
preparation costs.

B. Contractor-Initiated Proposal Request: Contractor may propose changes by submitting a
request for a change to Architect, properly itemized and supported by sufficient
substantiating data for permit evaluation, plus a fee; such costs shall be itemized by crafts
as defined within the Schedule of Values and limited to the following items directly
attributable to the change in the Work:

1. Comply with requirements in Division 1 Section 01 25 00, “Product Substitution
Procedures” if the proposed change requires substitution of one product or system
for product or system specified.

2. Include a statement outlining reasons for the change and the effect of the change on
the Work. Provide a complete description of the proposed change. Indicate the
effect of the proposed change on the Contract Sum and the Contract Time.

3. Include a list of quantities of materials, supplies, and equipment (including cost of
transportation, whether incorporated or consumed) required or eliminated and unit
costs, with total amount of purchases and credits to be made. If requested, furnish
survey data to substantiate quantities.

4. Include applicable costs of premiums for all bonds and insurance, permit fees,
taxes, delivery charges, equipment rental (exclusive of hand tools), and amounts of
trade discounts required or eliminated.

5. Include costs of labor and supervision directly attributable to the change, including
social security, old age and unemployment insurance, fringe benefits required by
agreement or custom, and workers’ compensation insurance required or eliminated.

6. Include an updated Contractor’s Construction Schedule that indicates the effect of
the change, including, but not limited to, changes in activity duration, start and finish
times, and activity relationship. Use available total float before requesting an
extension of the Contract Time.

7. For deductive change order proposals, Contractor may add appropriate preparation
costs.

01 26 57 CHANGE ORDER REQUESTS:

A. On Owner’s approval of a Proposal Request, Architect will issue a Change Order for
signatures of Owner and Contractor on AIA Document G701. Change Orders may
combine more than one Proposal Request. Refer to Article 15, “Changes in the Work and
Claims”.

END OF SECTION 01 26 57

SECTION 01 29 00 PAYMENT PROCEDURES

01 29 00.01 PAYMENT APPLICATION:

A. Applications for payment must be submitted, in triplicate, to the attention of the Architect for
certification and processing. Applications for payment will normally be processed and a
check ready within 14 days after receipt of the certified pay application by the Owner.
Applications for payment which are not properly submitted will be delayed. Applications for
payment mailed to Pima College Accounts Payable are NOT properly submitted. The
Contractor shall submit a draft pay application for review and approval at the last construction meeting of each month. Refer also to Article 12, “Payments and Completion”.

01 29 00.02 PROGRESS PAYMENT APPLICATION PROCEDURES:

A. Contractor shall provide the items listed below with each payment application. Applications for payment which do not include these items will not be certified. Refer also to Article 12.

1. Updated project schedule per Section 01 32 16, and Article 7 showing the actual progress for each task during the pay application period.
2. A copy of the Schedule of Values completed for the period of time covered by the application, including the percent of each task complete as shown on the updated project schedule. Use AIA document G703 certificate for payment continuation sheet. Provide a breakdown of the Contract Sum in sufficient detail to facilitate continued evaluation of the Applications for Payment and progress reports. Correlate line items in the Schedule of Values with the Construction Schedule and Sub-Contractor list.
3. Invoices for materials stored on-site. Payment will not be made for materials stored off-site.
4. Lien Waivers: after the first pay application, the Contractor shall submit with each pay application a partial lien release for the work and partial lien releases from each subcontractor and/or for each separate line item on the schedule of values, for the work equal to the amount approved on the last application for payment, less retainage.
5. Copies of Superintendent’s daily log upon request by the Owner or Architect.
6. Prior to final payment also refer to Section 01 77 00.06

01 29 00.03 PROGRESS PAYMENT:

A. Payments on account of this Contract will be made monthly as Work progresses. The Contractor shall submit to the Owner through the Architect, in the manner and form prescribed by the Owner, an application for each payment, and, if required, receipts or other vouchers showing its payments for materials suitably stored at the construction site and labor, including applications from and payments to Subcontractors.

01 29 00.04 INVOICE DETAIL:

A. Invoices shall include the following: Contractor’s invoice number; invoice date; official project title; current purchase order number and reference to any change orders for which payment is being requested; number of invoice pages; and dates covered by the invoice. Payment of invoices that do not indicate the correct current purchase order may be delayed. Use AIA G702 and G703. Refer also to Article 12, “Payments and Completion”.

01 29 00.05 RETENTION:

A. Retention: All invoices shall provide a line item indicating retention of 10% of the dollar amount due at the time. Retention will be held per Article 12. Final Payment of retention will not occur until all Punch list items are completed in a manner acceptable to the Owner and per Section 01 77 00.

01 29 00.06 PROMPT PAY:

A. The Contractor shall promptly pay each Subcontractor, upon receipt of payment from the Owner, out of the amount paid to the Contractor on account of such Subcontractor’s portion of the Work, the amount to which said Subcontractor is entitled, reflecting percentages actually retained from payments to the Contractor on account of such Subcontractor’s
portion of the Work. The Contractor shall, by appropriate agreement with each Subcontractor, require each Subcontractor to make payments to Sub-subcontractors in a similar manner.

END OF SECTION 01 29 00

SECTION
01 31 19 PROJECT MEETINGS

01 31 19.01 PRECONSTRUCTION MEETINGS:

A. A pre-construction conference will be called by the Owner's Representative for the purpose of discussing execution of the work. The Contractor and any subcontractors whose presence is necessary or requested must attend.

01 31 19.02 COORDINATION MEETINGS:

A. Job site Coordination Meetings may be called by Owner or Architect as deemed necessary to coordinate, expedite, or schedule the work of this Contract.

01 31 19.03 PROGRESS MEETINGS:

A. When installation begins, weekly Progress Meetings will be held at the job site with the PCC Facilities Project Manager, Architect’s representative, and Contractor's Project Manager and Site Superintendent.

1. Review of schedules and the job progress in relation to the current Project Schedule.
2. Review of the "as-built" drawings for work accomplished since the last meeting.
3. Notification by the contractor of potential delays due to action or inaction by the owner and/or architect.
4. Review of shop drawing status.
5. Critical Work Sequencing: Discuss coordination requirements, working hours and critical path.
6. The Contractor will notify the Architect and/or Owner of any action required on their part prior to the next meeting.

END OF SECTION 01 31 19

SECTION
01 32 00 CONSTRUCTION PROGRESS DOCUMENTATION

01 32 16 CONSTRUCTION PROGRESS SCHEDULE:

A. Work schedule shall be coordinated with the Owner, and Owner’s Representative. Refer also to Article 7.10 and Section 01 11 00.

B. Prepare the construction schedule as follows:

1. The schedule shall be a Gantt (bar chart) with a horizontal time scale and activities listed vertically or a time scaled network diagram (CPM). Note on the schedule any assumptions made, including but not limited to, request for information (RFI) turnaround times.
2. At a minimum, no task on the schedule shall have duration greater than 15 (calendar) days. All activities shall include tasks for shop drawing review or other submittals, approvals, procurement, fabrication, delivery, installation, start-up and

SPECIFICATIONS DIVISION 1 GENERAL REQUIREMENTS
testing as required. The schedule shall clearly indicate the start and completion
date of each activity.
3. The initial construction schedule shall be developed and based on the Contract
Time as indicated in Article 3.2 and Section 01 11 00.

C. The schedule shall anticipate the following number of normal adverse weather days as
indicated in the following Table. No extension of the Contract Time will be granted unless
the actual adverse weather days exceed the cumulated normal adverse weather days for
the duration of the Contract Time and the actual adverse weather days had an effect on the
scheduled construction. The number of adverse weather days was determined by using
the following number of average days with greater than one quarter (1/4) inch of rain in

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TABLE 013216 - NORMAL ADVERSE WEATHER DAYS

D. If the Architect determines that the start or completion of any activity on the schedule
deviates from the schedule by more than seven days, the Contractor shall revise and
reissue the schedule within seven days of the determination that an activity has deviated by
more than seven days.

E. An updated CPM schedule will be required to request as adjustment in the Contract Time.

END OF SECTION 01 32 16

SECTION
01 33 00 SUBMITTAL PROCEDURES

01 33 00.01 START-UP SUBMITTALS:

A. Start-up Submittals: Within 10 days after the Notice to Proceed, submit:
   1. Three (3) copies of Schedule of Values per Division 1, Section 01 29 00.02.
   2. Three (3) copies of the shop drawing review schedule and shop drawing copies per
Division 1, Section 01 33 23.
3. Three (3) copies of the construction schedule for the work per Division 1, Section 01 32 16.
4. A letter stating which individual within the Contractor’s organization is authorized to sign change orders on behalf of the Contractor.
5. No construction work shall be started and no progress payments made until the above are submitted and accepted.

01 33 00.02 OTHER COMMUNICATIONS:

A. Project Communications: Routine written communications between the Contractor and the Architect shall be in letter, field memo or PDF format. Such communication shall not substitute for any other written requirement or submittal.

B. Request for Information (RFI): A request from the Contractor seeking an interpretation or a clarification of some requirement of the contract documents. The contractor shall clearly and concisely set forth the issue for which they seek clarification or interpretation and why a response is needed. The Contractor shall, in the written request, set forth their interpretation or understanding of the contract’s requirements along with the reasons why they have reached such an understanding. Responses to the RFI will not change any requirements of the contract documents unless so noted in the Request for Information response.

C. Drawing/Plan Clarification: An answer from the Architect, in response to an inquiry from the Contractor, intended to make some requirement(s) of the drawings or plans clearly understood. Drawing clarifications/plan clarifications may be sketches, drawings or in narrative form and will not change any requirements of the drawings or plans.

01 33 00.03 MATERIAL SAFETY DATA SHEETS (MSDS):

A. Provide the Owner with MSDS for all material which may affect the Owner's students or staff 10 days prior to delivery of material to the job site.

B. Prior to start of Work, the Contractor must provide an inventory list of chemicals that will be used on this project. A copy of this list shall be provided by the Contractor to the PCC Facility Project Manager. The Contractor is responsible for maintaining Material Safety Data Sheets (MSDS) at the job site. Copies must be readily accessible and available for review by both College employees and regulatory authorities.

C. Contractor shall maintain binder at the job site with MSDS for all materials used in the work.

01 33 23 SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES

A. Review Times: the shop drawing review schedule shall include 10 working days for review of submittals by the Architect. Revise shop drawing review schedule and resubmit when progress deviates from previous schedule by 7 days. The shop drawing review tasks must be included with the Construction Progress Schedule. (See Section 01 32 16)

B. Submit up to four (4) copies of shop drawings (Owner will retain one set). Provide drawing scale large enough to clearly show all elements of the work. Show how adjacent work relates. Reference the shop drawing to the sheet, detail and/or schedule, and specification section. The number of shop drawing copies will be determined at the Preconstruction Meeting. For most shop drawing submittals, the Owner will prefer digital copies.

C. Submit up to four (4) copies of manufacturer's standard product data (Owner will retain one set). Include reference standards and warranty information. Provide references to sheet, detail, schedule, and/or specification section. Show dimensions and clearances specific to the work. The number of copies will be determined at the Preconstruction Meeting. For
most product data submittals, the Owner will prefer digital copies.

D. Submit up to four (4) samples (Owner will retain one set). The number of samples needed for the project will be discussed and determined at the Preconstruction Meeting.

E. Submittals without indication of Contractor's review and approval of conformance with the Contract Documents will be returned without Architect's review, and will have to be resubmitted by the Contractor.

F. Electronic submittals are allowed if all parties, Owner, Contractor, and Architect, agree to their use.

END OF SECTION 01 33 23
SECTION
01 41 00 REGULATORY REQUIREMENTS

01 41 00.01 STANDARDS, CODES, AND LAWS:

A. Project shall be completed in accordance with Federal, State, and local codes, laws, regulations, and rules that govern such operations, including fire codes. Applicable codes are listed on the drawings.

B. Material and products are specified for their appropriateness in the completed work. The Contractor is responsible for: Providing training and education to the Contractor's employees and obtaining and distributing information regarding the potential dangers and appropriate safety measures for material and products during the work as required by the Occupational Safety and Health Administration, Hazard Communication Standard and the State of Arizona.

C. Contractor and his Subcontractors shall follow PCC policies, regulations, and Standard Policy Guidelines related to safety and conduct on site. The PCC policies, regulations and Standard Practice can be found at the following internet site: http://www.pima.edu/about-pima/policies/index.html

01 41 00.02 PERMITS, LICENSES, AND REGULATORY FEES:

A. Required governmental agency permits (for example: Fire Alarm/Sprinklers and Construction Plan permits with the Arizona State Fire Marshal, EPA) shall be paid for by the Owner - Pima Community College (PCC), except for the following circumstances:

1. If the permit and or fee is an additional requirement resulting from a Contractor’s substitution request per Section 01 25 00 “Product Substitution Procedures”

2. If the permit and or fee is an additional requirement resulting from modifications or changes related to a Contractor initiated Proposal Request.

3. As required by Specification Section 01 51 00 “Temporary Utilities”.

4. Refer to General Conditions Article 7, Contract Plans, and Specifications for additional requirements.

B. The following permits and fees will be paid for by the Owner when required by the Local, State and Federal regulations and the pertinent Authority Having Jurisdiction except as indicated in Section 01 41 00.02 A above:

1. Storm Water Pollution Prevention Plan Permit Submittal fee
2. Site Grading, Demolition and Building Permits
3. State of Arizona Fire Marshal Permit Application fees
4. Plumbing, Electrical, Mechanical Permits
5. Permanent Water Meters Installed by Utility Water Company
6. Utility Water Company Service and Plan Review fees
7. Sewer Tap Connection fees
8. Sewer Fees or Assessments
9. Utility Gas Company Service fees
10. Electric Utility Company Service and Design fees
11. Systems Furniture Vendor Design fee
12. Permits required by the local, State and Federal Environmental Protection Agencies
13. Hazardous materials abatement
14. All required governmental agency licenses
15. Deferred shop drawing permit review submittals

C. The General Contractor shall obtain the permits.

01 41 00.03 REGULATORY TESTING AND SPECIAL INSPECTIONS:
A. The Owner will hire a company or companies to perform special inspections, and tests required by the Contract drawings and specifications and per Article 10.

B. If applicable, the Owner will pay for water flow tests to confirm that there is adequate water flow pressure for the sprinkler system.

C. The General Contractor shall make arrangements and schedule the tests and inspections.

D. The General Contractor shall hire an independent testing, adjusting (TAB) agency.

END OF SECTION 01 41 00

SECTION 01 51 00 TEMPORARY UTILITIES

A. Prior to start of ANY trenching or excavation, Contractor shall employ a specialist to locate all utilities, including irrigation lines, in areas not under the jurisdiction of Bluestake, and shall include expense of such work in Bid. Contractor shall call for Bluestake, shall review As-Built drawings and other information supplied by the Owner, as well as information provided by utility location specialist, prior to submitting the initial Construction Schedule. Any down time for utilities that may be required due to the location of utility lines found, shall be shown on the initial Construction Schedule. See Section 01 32 16.

B. Owner will provide temporary water and electricity from the existing points of connection for the Contractor’s use during construction until Substantial Completion. Temporary modifications and extensions to the water and electrical connections shall be the responsibility and paid for by the Contractor. The temporary utility connections shall be made and maintained in a safe and secure condition. The Contractor shall be responsible for any temporary meters, temporary backflow preventers, and maintaining temporary climate control as required by the Contract Documents, and obtaining and paying for temporary use permits.

END OF SECTION 01 51 00

SECTION 01 52 00 CONSTRUCTION FACILITIES

01 52 13 FIELD OFFICES AND SHEDS:

A. For this project, a temporary field office trailer will not be required.

B. The Contractor shall provide at his expense temporary storage container/s, as needed, to secure tools and materials during the construction period. The storage container/s shall be located per the Owner’s direction, and as required by law, ordinances, and permits.

C. Contractor’s Superintendent shall have, as a minimum, a cellular telephone and shall provide the telephone number to the Owner and the Architect.

D. The Contractor will have to make arrangements off-site or use his own resources to make copies, send faxes, make phone calls or other office related functions because the College resources will not be available for use by the Contractor or his subcontractors.

01 52 19 SANITARY FACILITIES:

A. The Contractor shall not use College restrooms for any construction purpose.
Accommodations may be made to use existing toilet facilities for non-construction purposes. Provide portable toilets for use by construction personnel.

END OF SECTION 01 52 19

SECTION 01 55 00 VEHICULAR ACCESS AND PARKING

01 55 00.01 TEMPORARY ACCESS ROADS AND PARKING:

A. General Access to the site shall be from Drachman Street located near the north side of the PCC Downtown campus.

B. Parking arrangement for Contractor's crew to be made during the Pre-Construction conference. Contractor will be responsible for restricting his employees', sub-contractors' and suppliers' vehicles to the designated area.

END OF SECTION 01 55 00

SECTION 01 56 00 TEMPORARY BARRIERS AND ENCLOSURES

01 56 16 TEMPORARY DUST BARRIERS:

A. Controlling construction-related dust and preventing the spread of flying particles is the Contractor's responsibility. HVAC return air paths must be sealed to prevent dust and odors from spreading to occupied parts of the building.

01 56 23 TEMPORARY BARRICADES AND WARNING SIGNS:

A. Contractor shall furnish, erect, and maintain barricades, barriers, construction fencing and warning signs, etc., required for protection of persons and property in compliance with applicable statutes.

01 56 36 TEMPORARY SECURITY ENCLOSURES:

A. Contractor is responsible for: providing appropriate safety and warning signs; securing materials stored on site to prevent theft; and securing the work in-place to prevent vandalism.

B. The Contractor will be issued a set of keys for access to existing Owner facilities if required. The Contractor will be responsible for loss or theft of keys issued and will be liable for the cost of re-keying all or a portion of the Owner's existing facilities.

END OF SECTION 01 56 36

SECTION 01 60 00 PRODUCT REQUIREMENTS

01 60 00.01 PRODUCT OPTIONS:

A. Products are generally specified by reference standard and/or manufacturer's name and model number or trade name. When specified only by referenced standard, the Contractor may select any product meeting this standard by any manufacturer. When several products or manufacturers are specified as being acceptable, the Contractor has the option of using any product and manufacturer combination listed, subject to submittal of specific

SPECIFICATIONS DIVISION 1 GENERAL REQUIREMENTS
A. Deliveries may be made directly to job site, however, it shall be the sole responsibility of the Contractor to receive, handle, and store such items in a safe and secure manner.

B. Materials required for this project shall be stored on-site at locations and in a manner mutually acceptable to Owner and Contractor. Store materials per the manufacturer's written instructions.

01 65 00.02 MAINTENANCE OF IN-PLACE MATERIALS AND CONSTRUCTION:

A. Provide maintenance per manufacturer's written instructions and recommendations, and industry recommendations until Substantial Completion.

B. Maintenance required elsewhere in the contract documents shall continue after Substantial Completion as specified.

01 65 00.03 INSTALLATION INSTRUCTIONS:

A. Materials and equipment incorporated into the work shall be installed or applied per the manufacturer's written instructions, specifications (including guide specifications), and recommendations; unless specifically modified by written instruction from the manufacturer. Submit any modifications to Architect as product data per Section 01 33 00 “Submittal Procedures”

END OF SECTION 01 65 00

SECTION 01 77 00 CLOSEOUT PROCEDURES

01 77 00.01 INITIATE SUBSTANTIAL COMPLETION:

A. Initiate Substantial Completion procedures a minimum of 7 days prior to the date for substantial completion.

01 77 00.02 PRIOR TO SUBSTANTIAL COMPLETION:

A. Prior to substantial completion complete the following:

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DIVISION 1 GENERAL REQUIREMENTS
1. Contractor prepared Punch list of all incomplete items and corrections to be made.

2. Punch list: When the Contractor considers that the Work is Substantially Complete, the Contractor shall prepare and submit to the Architect a comprehensive list of items to be completed or corrected. By submitting a request for substantial completion inspection the Contractor thereby certifies that the Work, or the designated portion, is functionally ready for Occupancy by the Owner and that the remaining incomplete or defective work required by the Contract Documents shall be completed within 30 days. The Contractor shall proceed promptly to complete and correct items on the list. Failure to include an item on the list does not alter the responsibility of the Contractor to complete all work in accordance with the Contract Documents.

3. Schedule Punch list inspection with the Owner's Representative in order to exhibit the completeness of the work. Owner's Representative will not participate in an inspection unless a full Punch list is submitted 5 days prior to inspection.

4. Remove all temporary facilities and controls.

5. Complete final cleanup requirements, including touchup painting.

01 77 00.03 PUNCH LIST:

A. If the Architect's inspection discloses an item, whether or not included on the Contractor's punch list, which is not in accordance with the requirements of the Contract Documents, the Contractor shall, before issuance of the Certificate of Substantial Completion, complete or correct the item upon notification by the Architect to determine Substantial Completion. When the Work or designated portion is substantially complete, the Architect will prepare a Certificate of Substantial Completion which shall establish responsibilities of the Owner and Contractor for maintenance, damage to the Work, insurance, and the Final Punch list and shall fix the time within which the Contractor shall finish all items on the Final Punch list accompanying the Certificate. Satisfactory completion of all items on the Final Punch list shall be final completion of the work. Warranties required by the Contract Documents shall commence on the date of Substantial Completion of the Work or designated portion unless otherwise provided in the Certificate of Substantial Completion. The Project shall not be deemed substantially complete until the Certificate is issued.

B. Neither Final Payment nor any remaining retainage or substituted securities shall become due until the Contractor submits to the Owner:

1. An affidavit that payrolls, bills for materials and equipment, and other indebtedness connected with the Work have been paid or otherwise satisfied,

2. Consent of surety to final payment or release of substituted securities and other data establishing payment or satisfaction of obligations, such as receipts, releases and waivers of liens, claims, security interests or encumbrances arising out of the Contract.

C. Acceptance of final payment by the Contractor, Subcontractor or material supplier shall constitute a waiver of claims by that payee except those previously made in writing and identified by that payee as unsettled at the time of final Invoice.

D. The Contractor shall promptly correct Work rejected by the Architect or failing to conform to the requirements of the contract documents, whether observed before or after Substantial Completion and whether or not fabricated, installed or completed. The contractor shall bear costs of correcting such rejected work, including additional testing and inspections and compensation for the Architect's services and expenses made necessary thereby.

E. If the Contractor fails to correct nonconforming Work within a reasonable Time, the Owner may correct it. If the Contractor does not proceed with correction of such nonconforming Work within a reasonable time fixed by written notice from the Architect, the Owner may remove it and store the salvageable materials at the Contractor's expense.
01 77 00.04 RECORD DRAWINGS AS-BUILTS:

A. Maintain a clean, undamaged set of blue or black line white-prints of Contract Documents and Shop Drawings. Mark the set to show the actual installation where the installation varies substantially from the Work as originally shown. Mark whichever drawing is most capable of showing conditions fully and accurately; where Shop Drawings are used, record a cross reference at the corresponding location on the Contract Drawings. Give particular attention to concealed elements that would be difficult to measure and record at a later date. Tape or paste addenda, architect’s supplemental instructions, proposal requests and other information onto the appropriate sheet to provide a complete record of the work.

B. Mark record sets with red erasable pencil; use other colors to distinguish between variations in separate categories of the Work. The Architect will either approve the as-built submittal or note corrections to be made prior to approval.

C. Mark new information that is important to the Owner, but was not shown on Contract Drawings or Shop Drawings.

D. Note related Change Order numbers where applicable.

E. Organize record Shop Drawing sheets into manageable sets, bind with durable paper cover sheets, and print suitable titles, dates and other identification on the cover of each set. Upon completion of the work, submit complete sets to the Architect. The Architect will either approve the as-built submittal or note corrections to be made prior to approval.

F. Upon completion of the work, the Contractor shall scan the approved as-built documents, shop drawings and other data and provide the Owner and Architect with PDF copies. The Contractor shall deliver to the Architect these record drawings “as-builts”. Unless contracted otherwise between the Architect/Owner, these record drawing “as-builts” shall be transferred to electronic media by the Architect, and delivered to the Owner.

01 77 00.05 OPERATIONS AND MAINTENANCE MANUALS:

A. Provide four (4) copies of the closeout submittals in three ring notebooks with section tabs, organized in CSI format:

1. Updated subcontractor list with names and phone numbers.

2. From each subcontractor and material and equipment supplier, provide the following:
   a. Guarantees and Warranties.
      i. Provide minimum Two Year Warranty
   b. Operation and Maintenance data, including:
      i. Emergency instructions
      ii. Spare parts list
      iii. Wiring diagrams
      iv. Recommended “turn around” cycles
      v. Inspection procedures
      vi. Shop Drawings and Product Data
      vii. Special inspection documentation
   c. Testing Reports.

01 77 00.06 PRIOR TO FINAL PAYMENT:

A. Prior to Final Payment complete the following and items noted below and as noted in Article 12.6:

1. Schedule a time with the Architect and Owner to inspect the work following the
completion of the final punch list by the Contractor.
2. Provide a letter documenting that the project has been completed in accordance with Contract Documents and Warranting materials and work.
3. Provide Operations and Maintenance Manuals per 01 77 00.05.
4. Record Documents
5. Final Cleaning
6. Submit Warranties and Bonds
7. Submit a final Liquidated Damages or Early Completion Bonus settlement statement.

01 77 00.07 CLEANING:

A. Final Cleaning: Thoroughly clean the interior and exterior of the project areas, removing misplaced mastic, paint, and other finishes. Remove dust, dirt, and stains from new and existing materials.

B. Sweep all exterior paving areas, remove debris and stains. Remove debris from landscaping areas. Rake and/or remove debris from all other areas affected by the work.

END OF SECTION 01 77 00

SECTION
01 78 36 WARRANTIES

01 78 36.01 WARRANTY PERIOD:
A. The standard warranty period shall be two (2) years from the date of Substantial Completion. Refer to Article 18 and Specification Manual for additional warranty requirements.

01 78 36.02 EXCLUSIONS:
A. The Contractor warrants to the Owner and Architect that materials and equipment furnished under the Contract will be of good quality and new unless otherwise required or permitted by the Contract Documents, that the work will be free from defects not inherent in the quality required or permitted, and that the Work will conform with the requirements of the Contract Documents. Work not conforming to these requirements, including substitutions not properly approved and authorized, may be considered defective. The Contractor's warranty excludes remedy for damage or defect caused by abuse, modifications not executed by the Contractor, improper or insufficient maintenance, improper operation, or normal wear and tear under normal usage.

01 78 36.03 CONTRACTOR GUARANTEE:
A. Neither the final payment nor any provision in the Contract Documents shall constitute an acceptance of the Work not done in accordance with the Contract Documents or relieve the Contractor or its sureties of liability with respect to any warranties or responsibility for faulty materials and workmanship. The Contractor guarantees that the Work will conform to the Contract Documents.

01 78 36.04 FAILURE TO REMEDY DEFECTS:

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19
A. If the Contractor fails to remedy any defects or damage, the Owner may correct the Work or repair the damages, and the cost and expense incurred in such event shall be paid by or be recoverable from the Contractor or Surety, or offset against any amounts owing the Contractor.

01 78 36.05 TIME OF WARRANTY SUBMISSION:
A. Submittal Time: Submit written warranties on request of Architect for designated portions of the Work where commencement of warranties other than date of Substantial Completion is indicated.

01 78 36.06 WARRANTY SUBMISSION:
A. Organize warranty documents into an orderly sequence based on the table of contents of the Project Manual.
B. Bind warranties and bonds in 3-ring, loose-leaf binders, thickness as necessary to accommodate contents, and sized to receive 8 ½ x 11.
C. Provide dividers with plastic-covered tabs for each separate warranty. Mark tab to identify product or installation. Provide a typed description of the product or installation, including the name of the product and the name, address and telephone number of the installer.
D. Identify each binder on the front and spine with the typed or printed title “WARRANTIES,” Project name, and name of Contractor.

01 78 36.07 ADDITIONAL COPIES:
A. Provide additional copies of each warranty to include in operation and maintenance manuals.

END OF SECTION 01 78 36

END OF DIVISION 1
SECTION 02 41 19
SELECTIVE BUILDING DEMOLITION AND RENOVATION

1. PART 1 - GENERAL

1.1. WORK INCLUDED

1.1.1. Remove designated mechanical equipment and fixtures.

1.1.2. Remove designated masonry, concrete walls and structure.

1.1.3. Remove desiganted paving, base material and landscape material.

1.1.4. Remove electrical systems and components.

1.1.5. Remove mechanical and plumbing systems and components.

1.1.6. Repair and renovate existing surfaces in preparation for final finish, and as necessary to restore to original functional condition.

1.1.7. Disposal of debris and rubbish.

1.2. SUBMITTALS

1.2.1. Demolition Schedule: Provide as part of the project master schedule, a demolition schedule for equipment removal, wall demolition, temporary site fencing and new equipment installation. Articulate utility shut downs and demonstrate coordination with Owner activities.

1.2.1.1. Coordinate schedule with Owner.

1.3. QUALIFICATIONS

1.3.1. Operations shall be done by a firm and personnel experienced in the work.

1.4. ENVIRONMENTAL REQUIREMENTS

1.4.1. Do not remove existing exterior envelope systems when weather conditions threaten the integrity of the building, contents, or intended continued occupany.

1.4.2. Maintain continuous temporary protection during, and prior to, installation of new exterior envelope systems.

1.4.3. Do not perform any demolition activities when building is occupied without Owner approval.

1.5. COORDINATION AND SCHEDULING

1.5.1. Schedule work to coincide with commencement of installation of new exterior envelope systems.

1.5.2. Unless otherwise scheduled, remove only that amount of existing exterior envelope systems that can be protected or replaced prior to completion of each day's work.
1.5.3. Coordinate work with affected mechanical and electrical work associated with exterior penetrations.

1.5.4. Superintendent shall be present on job at all times.

1.6. EXISTING CONDITIONS

1.6.1. Conduct demolition to minimize interference with adjacent buildings. Maintain protected egress and access at all times.

1.6.2. Provide safe pathways, maintaining continuous separation of construction activity from areas occupied by visitors, students and faculty.

1.6.3. Contractor shall comply with all applicable laws and ordinances regarding hazardous materials, including lead-based coatings.

2. PART 2 - PRODUCTS

2.1. PRODUCTS FOR PATCHING AND EXTENDING WORK

2.1.1. General:

2.1.1.1. Unless noted otherwise, provide products matching existing finish, color, dimension, and assembly.

2.1.1.2. All products shall be new, unless specifically noted otherwise.

2.1.1.3. Provide asbestos free materials.

2.1.1.4. Maintain all fire resistance ratings of existing assemblies and materials.

2.1.1.5. Maintain water and weather tight characteristics of assemblies and materials.

2.1.2. Comply with requirements as specified in applicable specification sections for materials used in repairing and extending existing work.

2.2. OWNER’S SALVAGED ITEMS

2.2.1. All removed door hardware, and water treatment equipment deliver to the Owner. Control contractor shall salvage all existing CSI building and unit controllers removed from the ST Building to Pima Community College Facilities Management. The existing parking lot light fixture and pole assembly are to be salvaged and relocated on a new base by the Contractor.

2.3. MINOR DRYWALL AND PLASTER REPAIR MATERIALS

2.3.1. In areas where work requires minor access to or penetration of existing surfaces, provide all materials, including lath and accessories, for repairing and filling voids in existing drywall and plaster interior surfaces.

2.3.1.1. Material shall contain no asbestos.

2.3.1.2. Provide assembly thickness, construction and finish equal to existing finish.
2.4. ROOF PENETRATIONS

2.4.1. In areas where work requires penetration of existing metal roof surface, provide all materials, including flashing, sealant and accessories, for repairing roof system and providing a watertight condition.

2.4.1.1. Provide flashing collar for pipe and conduit penetrations, as recommended for type of roof.

2.4.1.2. Provide flashing assembly for plumbing vent piping.

2.4.1.3. Provide flashing collar with rain hood counterflashing and clamp ring at flue vent assembly.

2.5. PAVEMENT REPAIRS

2.5.1. Sawcut trench width where required for the work.

2.5.2. In the case of backfilled trenches, compact, install base course and new paving to match existing construction and COT standards.

2.6. OTHER MATERIALS

2.6.1. Provide all other materials, not specifically described but required for complete and proper installation of this work, as selected by the contractor and subject to the approval of the Architect.

3. PART 3 - EXECUTION

3.1. SURFACE CONDITIONS

3.1.1. Inspection

3.1.1.1. Prior to work of this Section, carefully inspect previously installed work. Verify all such work is complete to the point where this installation may properly commence.

3.1.1.2. Verify that work of this Section may be installed in strict accordance with the original design, all pertinent codes and regulations, and all pertinent portions of the referenced standards.

3.1.1.3. In the event of discrepancy, immediately notify the Architect.

3.1.1.4. Do not proceed with installation in areas of discrepancy until all such discrepancies have been fully resolved.

3.2. DOCUMENTATION OF EXISTING CONDITIONS

3.2.1. Prior to beginning any alterations, including surface demolition or fixture removal, prepare a record of existing improvements affected by the work of this contract. In regard to existing utilities, refer to and comply with Section 01 51 00 Temporary Utilities.

3.3. PREPARATION

3.3.1. Protect existing items not designated for removal.
3.3.1.1. Protect existing surfaces of adjacent buildings with barriers, protective panels, tarps and other devices as necessary to avoid damage.

3.3.2. Repair all underground utilities and services damaged during construction, including utilities and services documented by Contractor at no additional cost to Owner.

3.4. UTILITY AND BUILDING SERVICES REMOVAL AND RE-INSTALLATION

3.4.1. Where encountered, remove conduit and conductors, piping, drains, and other associated system components within the limits of the work and not covered by other requirements of the contract documents. Include all utilities and services documented by Contractor.

3.4.2. Coordinate the time and duration of all system disconnects with Owner’s Representative.

3.4.3. Remove all conductors from conduit at all abandoned electrical circuits

3.4.4. Where irrigation systems in parking lots are to be demolished, run cap the line where it enters the parking lot. Mark this location by dimension on the as-built drawings and with a mark on the adjacent curb.

3.5. DEMOLITION

3.5.1. Demolish components in an orderly and careful manner. Concrete footings and stem walls shall be removed entirely.

3.5.1.1. Limit heavy equipment used to perform demolition and to transport debris as specified in other contract documents.

3.5.2. Coordinate with Owner’s Representative the time of day and route to remove demolished materials from premises.

3.5.3. Unless designated for re-use, all remaining items to be demolished or removed are designated as scrap and become the property of the Contractor.

3.5.4. Remove demolished materials from site as work progresses. Upon completion of work, leave areas of work in clean condition.

3.5.5. Fixture and Equipment Removal:

3.5.5.1. All existing building system equipment shall be removed as identified and shown on drawings and required by Architect.

3.5.5.2. Prior to beginning any system removal, properly disconnect all water, gas and electrical power supply at appropriate disconnect locations. Obtain all necessary releases and approvals from serving utility companies.

3.5.6. Remove concrete slab and pavement by saw-cutting. At areas where existing curb or wall line prevents saw use, carefully jack-hammer concrete slab as required to provide new concrete. Saw cut all reinforcing bars - Do not torch.

3.5.7. Remove, store, protect and re-install existing materials and equipment as shown on drawings.
3.6. PAINTING

3.6.1. Paint repaired surfaces at locations shown on drawings.

3.6.2. Prepare existing surface as recommended by manufacturer for substrate. Clean of all dirt, dust, and oily films.

3.6.3. Paint existing surface with specified coatings. Unless noted otherwise on drawings, paint entire surface where crack repair occurs. Painting crack repair only is not acceptable.

3.6.4. Provide one coat of specified primer, and two coats of specified finish paint.

3.7. DISPOSAL

3.7.1. Dispose of all demolished material, trash, debris, and other materials not used in the work in accordance with the regulations of jurisdictional authority. Remove demolished materials and debris from site on a daily basis.

3.8. ADJACENT CONSTRUCTION

3.8.1. Take particular care at connection between structures designated to remain. Use hand tools only to remove all portions designated as demolished.

3.8.2. Where foundations occur adjacent to demolished structure, provide all required underpinning or shoring support.

3.8.3. Provide appropriate wall and roof repair detailing to maintain long term water and weather-proof assembly at structures designated to remain.

3.8.3.1. Maintain fire resistance of original assembly. Maintain materials and finishes of original assembly.

3.8.3.2. Provide multiple materials, lapped and counterflashed as required to properly shed water without creating traps.

END OF SECTION
SECTION 03 30 00
CAST-IN-PLACE CONCRETE

1. PART 1 - GENERAL

1.1. SECTION INCLUDES

1.1.1. Formwork and anchorage.
1.1.2. Concrete reinforcement and accessories.
1.1.3. Cast-In-Place concrete.

1.2. REFERENCES

1.2.1. ACI 117 - Specification for Tolerances for Concrete Construction and Materials.
1.2.2. ACI 211.1 – Standard Practice for Selecting Proportions for Normal, Heavyweight, and Mass Concrete.
1.2.3. ACI 301 - Specification for Structural Concrete.
1.2.4. ACI 302.1R - Guide for Concrete Floor and Slab Construction.
1.2.5. ACI 305R - Hot Weather Concreting, and ACI 306.1, Cold Weather Concreting.
1.2.6. ACI 308 - Standard Practice for Curing Concrete.
1.2.7. ACI 318 - Building Code Requirements for Structural Concrete.
1.2.8. ACI 347 – Guide to Formwork for Concrete
1.2.9. ASTM C 31 – Making and Curing Concrete Test Specimens in the Field
1.2.10. ASTM C 33 - Concrete Aggregates.
1.2.11. ASTM C 39 – Compressive Strength of Concrete Specimens
1.2.12. ASTM C 94 - Ready-Mixed Concrete.
1.2.13. ASTM C 109 – Test of Hydraulic Cement Concrete
1.2.14. ASTM C 143 – Slump of Hydraulic Cement Concrete
1.2.15. ASTM C 150 - Portland Cement.
1.2.16. ASTM C 172 – Sampling Freshly Mixed Concrete by the Volumetric Method
1.2.17. ASTM C 309 - Liquid Membrane-Forming Compounds for Curing Concrete.
1.2.18. ASTM C 494 – Chemical Admixtures for Concrete
1.3. SUBMITTALS

1.3.1. Provide submittals under provisions of Section 01 33 00.

1.3.2. Product Data/Certificates: Provide data on admixtures, finishing and curing compounds (including product characteristics, compatibility and limitations), fine and coarse aggregates, and portland cement.

1.3.3. Test Reports: Submit certified copies of mill test report of reinforcing steel analysis to testing laboratory, indicating products meet or exceed specified requirements.

1.3.3.1. Steel Source and Description

1.3.3.2. Ultimate tensile strength, Bend test, Elongation percentage and Yield point.

1.3.3.3. Heat number and Chemical analysis.

1.3.4. Mix designs: Prepare mix designs for Architect's review. Include the following information in mix design data:

1.3.4.1. Project name, address, site location, and location of mix design usage.

1.3.4.2. Contractor, subcontractor, supplier, and plant location.

1.3.4.3. Design Method, mix number.

1.3.4.4. Specified compressive strength, maximum aggregate size, slump, and placement method.

1.3.4.5. Application and location in structure.

1.3.4.6. Water-Cement Ratio.

1.3.4.7. Cement: Type, amount, and compliance with specified criteria statement.

1.3.4.8. Aggregates: Source(s), gradations (individual and combined).

1.4. QUALITY ASSURANCE

1.4.1. Comply with applicable portions of referenced ACI 315 and ACI 347 standards for construction of concrete work specified in this Section.

1.4.2. Comply with Chapters 7 and 12 of ACI 318 for details of reinforcement and laps at bar splices respectively.

1.4.3. Maintain same source for materials throughout the project unless approved by the Architect.

1.5. REGULATORY REQUIREMENTS

1.5.1. Conform to applicable sections of IBC Chapter.
1.6. PRODUCT HANDLING

1.6.1. On delivery to Project Site, place materials in area protected from weather.

1.6.2. Store materials above ground on framework or blocking and cover with protective waterproof covering providing for adequate air circulation and ventilation. Handle materials to prevent damage.

2. PART 2 - PRODUCTS

2.1. FORM MATERIALS

2.1.1. Conform to ACI 347.

2.1.2. Softwood Plywood - Vertical and horizontal surfaces.

2.1.2.1. Grade Certification: APA Grade stamped, complying with PS-1.

2.1.2.2. Type: APA Plyform, Exterior Type.

2.1.2.3. Class/Face Veneer: Class I or II, B-B Veneer.

2.1.2.4. Panel Finish: Where concrete will be exposed to view in final project, with painted and non-painted finish, provide HDO resin fiber overlay.

2.1.3. Lumber Forms: Any grade or species, S4S.

2.1.4. Form Ties:

2.1.4.1. Concealed Condition: Meadow Burke Penta-Tie or equal. Snap-off type, fixed length, cone type, 1 inch back break dimension, free of defects that could leave holes larger than one inch in concrete surface; provide flush plugs for cone holes or grout fill as specified.

2.1.4.2. Exposed Condition: Snap-off type, fixed length, cone type, 1 inch back break dimension, free of defects that could leave holes larger than one inch in concrete surface; provide semi-recessed plugs for cone holes.

2.1.5. Form Release Agent: Cresset or equal, colorless, water based material which will not stain concrete, or absorb moisture, or impair natural bonding or color characteristics of coating intended for use on concrete.

2.1.5.1. Select type suitable and appropriate for achieving CCS 2 surface at exposed concrete applications.

2.1.6. Corners: Chamfered, rigid plastic or wood strip type; 3/4 x 3/4 inch size; maximum possible lengths.

2.1.7. Form Stakes: Steel bar stock, pre-drilled for nails.

2.1.8. Formwork Panel Edge: Provide foam edge stripping at exposed formwork panel edges to minimize mortar leakage.

2.2. REINFORCING STEEL

2.2.1. Reinforcing Steel:
2.2.1.1. Non-Welded Systems: ASTM A615, Grade 60 deformed billet steel bars, uncoated.

2.2.1.2. Provide reinforcing steel complying with ASTM A 706, Grade 60, deformed, uncoated steel, where shown.

2.2.2. Welded Steel Wire Fabric: ASTM A185, Plain Type, flat sheets; plain finish.

2.2.3. Chairs, Bolsters, Bar Supports, and Spacers: Sized and shaped for strength and support of reinforcement during concrete placement conditions including load bearing pad on bottom to prevent vapor retarder/retarder/barrier puncture.

2.2.4. Fabricate concrete reinforcing in accordance with CRSI Manual of Standard Practice, ACI 315, and ACI 318.

2.2.5. Do NOT bend or straighten bars in manner that will weaken or injure bar. Do not re-bend bars #5 and larger.

2.2.6. Do NOT use heat to bend bars.

2.2.7. Remove and replace reinforcement with following fabrication defects:

2.2.7.1. Bar lengths, depths and bends exceeding specified fabrication tolerances.

2.2.7.2. Bends or kinks not shown on drawings or final shop drawings.

2.2.7.3. Bars with reduced cross-section due to excessive rusting or other causes.

2.2.8. Locate reinforcing splices as shown on Drawings. Obtain approval of Structural Engineer for splices not shown on drawings.

2.3. CONCRETE MATERIALS

2.3.1. Cement: Conform to ASTM C150; normal weight - Type II, low alkali, grey color.

2.3.2. Fly Ash: Not Allowed.

2.3.3. Fine and Coarse Aggregates: Conform to ASTM C 33 and the following:

2.3.3.1. Coarse Aggregate: Clean, hard, fine-grained, sound, crushed rock or washed gravel;

2.3.3.1.1. Slabs: Class Designation 4M per ASTM C 33, Table 3.

2.3.3.1.2. Foundations: Class Designation 4M per ASTM C 33, Table 3.

2.3.3.2. Fine Aggregate: Washed natural or manufactured sand, hard, strong, durable particles: not more than 1 percent deleterious materials.

2.3.3.3. Aggregate shall be non-reactive per ASTM C 289.

2.3.4. Water: Clean, potable, and not detrimental to concrete.
2.4. ACCESSORIES.

2.4.1. Membrane Curing Compound and Sealers

2.4.1.1. Curing Compound: Atlas Quantum-Cure, or equal, zero VOC, NSF/ANSI Standard61 certified (www.atlastechproducts.com) when tested in accordance with ASTM C-156, curing compound shall have maximum moisture evaporation of 0.65 kg/ sq M, water-based, clear with fugitive dye.

2.4.1.2. Sealer: Atlas Tech-1315 complying with ASTM C 1315, Type 1 Clear Class A and B.

2.4.2. Vapor Retarder Membrane

2.4.2.1. Manufacturer: Stego Wrap, www.stegoindutries.com, or equal.

2.4.2.2. Type: Polyolefin geomembrane film.

2.4.2.3. Product Characteristics:

2.4.2.3.1. Thickness: Minimum 15 mils.

2.4.2.3.2. Perm Rating: Maximum 0.01 grains/square foot/hour per ASTM F 1249.

2.4.2.3.3. Water Vapor Transmission Rate: Maximum 0.006 grains/square foot/hour per ASTM F 1249.

2.4.2.3.4. Puncture resistance: Minimum puncture resistance of 2200 grams per ASTM D 1709.

2.4.2.3.5. Tensile Strength: Minimum tensile strength of 50 pounds per ASTM D 882. Values shall be based on ASTM E 154 Resistance to Decay test portion.

2.4.2.3.6. Low Temperature Brittleness: Pass per ASTM D 1790.

2.4.2.4. Accessories.

2.4.2.4.1. Provide all required seam tapes and mastics as supplied by manufacturer.

2.4.3. Vapor Retarder Tape

2.4.3.1. Water Vapor Transmission Rate: ASTM E 96, 0.3 perms or lower

2.4.3.2. Minimum 8 mils thick.

2.4.3.3. Minimum 4 inches wide.

2.4.3.4. Manufactured from high density Polyethylene.

2.4.3.5. Pressure Sensitive Adhesive.
2.4.4. Non-Shrink Grout: Premixed compound consisting of non-metallic aggregate, cement, water reducing and plasticizing admixtures, capable of developing a minimum compressive strength of 8,000 psi at 28 days when tested in accordance with CRD-C-621 and ASTM C 1107.

2.4.5. Admixtures: Concrete admixtures shall be subject to prior approval by the Architect. Calcium chloride or admixtures containing chloride shall not be used. Admixture(s) shall not adversely affect concrete strength or color of colored concrete, where occurs.

2.4.6. Water Reducing: ASTM C 494 Type A, or Type D

2.4.7. Air Entraining: Conform to ASTM C 260.

2.4.8. Mid Range Water Reducers: Master Builders “Polyheed” or approved equal.

2.4.9. Bonding Agent: Provide SikaDur 32 Hi-Mod bonding agent/adhesive conforming to manufacturer's criteria, or approved equal.

2.5. SCREED SYSTEMS AND JOINT FORMING MATERIALS

2.5.1. Screed Systems: Provide Grann Adjustable Quick Screed or equal chairs, available through Dayton Richmond (800-745-3700).

2.5.2. Formed Construction Joints: Meadow Burke Keyed Kold or equal, galvanized steel, tongue and groove type.

2.5.3. Isolation Joint at radiused conditions: W.R. Meadows, www.wrmeadows.com, or equal, Ceramar, 3/8 inch thick by full depth of slab.

2.5.4. Isolation Joint at perimeter conditions: W.R. Meadows or equal, Sealtight Fiber, 3/8 inch thick by full depth of slab.

2.5.5. Weakened plane/control joints: Provide Soff-Cut system or sawcutting at all slab areas. Use of cast-in-place concrete joints is not acceptable.

2.6. JOINT SEALERS

2.6.1. Provide sealants: Pecora DynaTred, Temco Vulkem 45SSL or Sonneborn NP2.

2.7. CONCRETE MIX

2.7.1. Prepare concrete mix design in accordance with ACI 211.1 and IBC Section 1905.

2.7.1.1. Provide concrete mixes as necessary to attain strengths and characteristics as noted on the drawings and in the specifications.

2.7.2. Concrete Mix: Foundations, Stem walls and other concrete U.N.O. (Except Post-tension slab on grade).

2.7.2.1. Strength: 3000 psi 28 days.

2.7.2.2. Maximum aggregate size: 1 inch.

2.7.2.3. Cement Content: 480# per cubic yard minimum.

2.7.3. Concrete Mix: Slab on Grade (Post-Tension-Concrete)
2.7.3.1. Strength: 4000 psi 28 days
2.7.3.2. Maximum aggregate size: 1 inch.
2.7.3.3. Cement Content: 570 # per cubic yard minimum.

2.7.4. Mix concrete in accordance with ASTM C94 and IBC Section 1905.

2.8. SOURCE QUALITY CONTROL AND TESTS

2.8.1. Provide for testing under the provisions of Section 01 41 00

2.8.2. Reinforcing

2.8.2.1. Reinforcing Bars: IBC Chapter 19, Section 1903.

2.8.2.2. Cost of testing for unidentified stock shall be reimbursed to the Owner by the Contractor.

2.8.3. Cement and Aggregate

2.8.3.1. Cement: IBC Chapter 19, Section 1903.

2.8.3.2. Aggregate: IBC Chapter 19, Section 1903.

2.9. OTHER MATERIALS

2.9.1. Provide all other materials, not specifically described but required for complete and proper installation of this work, as selected by the contractor and subject to the approval of the Architect.

3. PART 3 - EXECUTION

3.1. SURFACE CONDITIONS

3.1.1. Inspection

3.1.1.1. Prior to work of this section, carefully inspect previously installed work. Verify all such work is complete to the point where this installation may properly commence.

3.1.1.2. Verify that work of this section may be installed in strict accordance with the original design, all pertinent codes and regulations, and all pertinent portions of the referenced standards.

3.1.1.3. Verify all excavations have been inspected and approved by a Geotechnical Engineer. Verify all reinforcement and forms have been inspected and approved.

3.1.1.4. Verify concrete elevations, dimensions, and alignment with work specified in other sections.

3.1.1.5. Verify requirements for concrete cover over reinforcement.

3.1.1.6. Identify, verify, and coordinate placement of piping and conduit sleeves through concrete.
3.1.1.7. Identify, verify, and coordinate the location, dimension, and requirements of all depressions, recesses, block-outs and other provisions.

3.1.1.8. Verify anchors, seats, plates, reinforcement and other items embedded in concrete are accurately placed, positioned securely, and will permit proper concrete placement.

3.1.2. In the event of discrepancy, immediately notify the Architect.

3.1.3. Do not proceed with installation in areas of discrepancy until all such discrepancies have been fully resolved.

3.2. FORMWORK AND REINFORCING

3.2.1. Erect formwork, shoring and bracing to achieve design requirements, in accordance with requirements of ACI 347.

3.2.2. Verify lines, levels, and measurement before proceeding with formwork.

3.2.3. Do not apply form release agent where concrete surfaces receive special finishes or applied coatings which may be affected by agent.

3.2.4. Coordinate work of other Sections in forming and setting openings, slots, recesses, chases, sleeves, bolts, anchors, and other inserts.

3.2.5. Locate and set in place items which will be cast directly into concrete.

3.2.5.1. Set all anchor bolts, hold downs and related embeds with plywood templates, anchored to formwork as required to maintain in alignment and position during concrete placement.

3.2.6. Arrange and assemble formwork to permit dismantling and stripping. Do not damage concrete during stripping. Provide crush plates or other approved guards where stripping operation may damage concrete. Kerf wood inserts to permit easy removal.

3.2.7. Chamfer exposed corners. Seal Joints between chamfer and form panel. Miter chamfer strips at changes in direction.

3.2.8. Openings in structural members which are not indicated on Drawing are not permitted.

3.2.9. Foundation Formwork

3.2.9.1. Hand trim sides and bottom of earth forms; remove loose dirt.

3.2.9.2. Construct wood edge forms, as specified below, to extend not less than 2 inches below soil level. Do not permit stakes to extend into or through footing zone. Form all concrete without penetrating footing concrete.

3.2.9.3. Fill over-excavated footings and foundations with concrete at no additional contract cost.

3.2.9.4. Excavate as necessary to accommodate installation and removal of formwork.
3.2.9.5. Prior to pouring footings or foundations, remove all debris, loose material, and water from excavation. Where water has accumulated in excavation, obtain Architects and Geotechnical Engineers review of the suitability of sub-grade condition.

3.2.9.6. Do not place concrete on mud or saturated soils. Repair sub-grade as required by Geotechnical Engineer at no additional contract cost. Vapor retarder/barrier membrane installation.

3.2.9.7. Proof roll subgrade.

3.2.9.8. Place 4 inch crushed rock base over sub-grade.

3.2.9.9. Place vapor retarder/barrier membrane over rock base, lapping edges 12 inches. Tape and seal edges and penetrations. Extend membrane to footing face and turn down to bottom of footing.

3.2.9.10. Provide pipe “boots” at all pipe and conduit penetrations in accordance with manufactures recommendations.

3.2.9.11. Obtain inspectors approval of membrane installation before placing concrete.

3.2.9.12. Exercise care in placing reinforcing steel and concrete to avoid puncturing vapor retarder/barrier membrane. Do not drive stakes through the membrane. Use flat base screed supports.

3.2.10. Place all concrete reinforcing in accordance with CRSI Placing Reinforcing Bars.

3.2.11. Before placing, clean reinforcing of loose scale, rust, oil, dirt, and any coating adversely affecting concrete bond.

3.2.12. Repair vapor retarder/barrier damaged during placement of concrete reinforcing. Repair with same material; lap over damaged areas minimum 6 inches and seal watertight with manufacturers approved seam tape.

3.2.13. Place, support and secure reinforcement against displacement. Do not deviate from required position. Do not bend or straighten bars after placement.

3.2.14. Do not displace or damage vapor retarder/barrier.

3.2.15. Accommodate placement of formed openings. Maintain concrete cover around reinforcing as indicated.

3.2.16. Provide dowel joints at concrete joints as shown on drawings.

3.2.17. Prepare previously placed concrete by cleaning with steel brush and applying bonding agent in accordance with manufacturer's instructions. Before concrete is deposited upon or against concrete that has taken its initial set or has hardened, mechanically roughen hardened concrete to minimum 1/4" amplitude. Remove all encrustations from forms and reinforcements.

3.2.18. Screed Placement and Leveling:

3.2.18.1. Space screeds at manufacturers recommended spacing.
3.2.18.2. Space screed for strip pours.

3.2.18.3. Level screeds by use of laser level equipment to specified slab elevation.

3.3. PLACING CONCRETE

3.3.1. Place concrete in accordance with ACI 304 and IBC Section 1905.

3.3.2. Ready mix concrete shall be delivered in accordance with ASTM C94. Concrete shall be placed within 90 minutes after start of mixing.

3.3.3. Conform to ACI 305R when concreting during hot weather or when weather conditions may cause rapid evaporation of moisture. Conform to ACI 306R for concrete placement in cold weather conditions.

3.3.4. Ensure reinforcement, inserts, embedded parts, formed joint fillers, and joint devices are not disturbed during concrete placement.

3.3.5. Maintain records of concrete placement. Record date, location, quantity, air temperature, and test samples taken.

3.3.6. Place concrete continuously between predetermined expansion, control, and construction joints.

3.3.6.1. Place construction joints only at locations shown on drawings or as approved by Architect.

3.3.6.2. Once concrete operation has begun, it shall be continued until the specific panel, component, or section is complete. Use of cold joints is not permitted without specific prior approval of the Architect.

3.3.7. Thoroughly consolidate concrete during placement using mechanical vibrators. Do not allow vibrators to contact forms or reinforcing.

3.3.8. Screed floors and slabs on grade level or slope to drain as noted on drawings.

3.4. CONCRETE FINISHING

3.4.1. Slab Finish

3.4.1.1. Produce hard and impervious surfaces, free from defects and blemishes.

3.4.1.2. Provide steel troweled finish, Class 3, per ACI 302.1R. Steel troweling shall consist of three separate operations. Obtain Architect's approval of finish prior to proceeding.

3.4.1.3. At all corridors, utility areas, and similar surfaces not receiving subsequent finish, provide medium swirl texture.

3.4.1.4. Slabs receiving carpet or resilient floor finish: Provide smooth trowel finish, ACI 302.1R Class 3, free of ridges and defects.

3.4.1.5. Slabs receiving thin set ceramic tile, waterproofing membranes or traffic topping: Provide steel trowel and very light broom finish.
3.4.2. Surface Defects

3.4.2.1. Surface defects shall be as defined in ACI 309.2R.

3.4.2.2. Surface irregularities shall be as defined in ACI 347 for Class B surfaces for semi exposed surfaces, and Class A surfaces at all exposed to view conditions.

3.4.2.3. All surface defects shall be repaired per approved methods and as specified.

3.5. EXPANSION AND WEAKENED PLANE JOINT INSTALLATION

3.5.1. Locate and form expansion control and contraction joints. Coordinate location with joint pattern shown for finish flooring.

3.5.2. Place formed construction joints in floor slab. Set top screed to required elevations. Secure to resist movement of wet concrete.

3.5.3. Install isolation joints between slab edges and vertical structural elements.

3.5.4. Install sealants in accordance with Section 07 90 00.

3.5.5. Provide Soff-cut or equal weakened plane joints at locations shown on drawings.

3.5.5.1. Saw cut slab before random shrinkage cracks form, and as soon as slab is firm enough to not be damaged by saw blade. Complete sawcutting within 12 hours of pour.

3.6. CURING AND PROTECTION

3.6.1. Maintain concrete above 50 degrees F and in a thoroughly moist condition for at least the first 7 days after placing concrete.

3.6.2. Floor Surface Curing

3.6.2.1. Cure floor surfaces in accordance with ACI 308. Membrane Curing/sealing Compounds: Apply in accordance with manufacturer's instructions.

3.7. FIELD QUALITY CONTROL

3.7.1. Field inspection and testing per IBC Section 1903 and IBC Chapter 17, will be performed in accordance with provisions of Section 01 41 00.

3.7.2. Provide free access to Work and cooperate with appointed firm.

3.7.3. Comply with requirements of IBC Section 1905, regarding frequency of testing for concrete test specimens.

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

3.7.4.1. Prepare concrete sample(s) for each type of concrete placed each day. A sample shall consist of four cylinders. One sample for a 7 day break, 2 samples for 28 day break and one hold cylinder.

3.7.4.2. Prepare one sample for each 50 cubic yards or fraction thereof.
3.7.4.3. Prepare one sample for each 2,000 square feet of slab or wall surface are placed, or a fraction thereof.

3.8. TOLERANCES

3.8.1. All tolerances shall be as defined in ACI 117 and as specified.

3.8.2. Classification shall be per General Building: Cast-in-Place, ACI 117, Section 4.0, unless noted otherwise.

3.8.3. Unless noted otherwise, depressions in slab floors between high spots shall be a maximum 3/16 inch in ten feet, using a metal straight edge placed at any location on slab, and measured within 72 hours of pour.

3.8.4. For the following applications, depressions in slab floors between high spots shall be a maximum 1/8 inch in ten feet, using a metal straight edge placed at any location on slab, and measured within 72 hours of pour.

3.9. PATCHING

3.9.1. Exposed formed concrete surfaces, both interior and exterior, including surfaces designated to receive painted finish, shall provide surfaces suitable for subsequent finishing, free from imperfect joints, fins, "honeycombing", air pockets or "bug" holes, or other such imperfections.

3.9.2. Remove rough spots, stains and hardened mortar or grout from intended smooth surfaces by rubbing such surfaces lightly with fine Carborundum stone. Use liberal amount of water and rub sufficiently to remove defects without changing texture of concrete.

3.9.3. Filling Snap Tie Cone Holes:

3.9.3.1. Break off tie rods at bottom of cone holes.

3.9.3.2. Concealed Applications: Flush hole with water, and allow to dry. Coat entire inner surface of cone hole with liquid bonding agent, then grout holes solid with approved cement grout and grind smooth.

3.9.3.3. Exposed Applications: Flush hole with water, and allow to dry. Coat entire inner surface of cone hole with liquid bonding agent. Insert semi-recessed plug with approved cement.

3.10. DEFECTIVE CONCRETE

3.10.1. Concrete will be considered defective if strength characteristics indicated by tests of molded cylinders and core tests fall below the minimum 28-day strengths specified or indicated. Replace or adequately strengthen such defective concrete in a manner acceptable to the Architect and Structural Engineer.

3.10.2. Concrete will be considered defective if any one of the following conditions occurs:

3.10.2.1. Any concrete work not formed as indicated or is not in conformance with specified tolerances.

3.10.2.2. Any concrete with voids or honeycomb that has been cut, resurfaced or filled, unless under the direction of the Structural Engineer.
3.10.2.3. Any concrete with sawdust, shavings, wood, or embedded debris.

3.10.2.4. Any concrete placed more than 90 minutes after batching.

3.10.2.5. Replace or repair such defective concrete to the satisfaction of the Architect at no extra cost to the Owner.

3.11. EQUIPMENT BASES

3.11.1. Provide concrete bases and anchorage for mechanical, electrical, and other work as required and shown on the drawings and in accordance with reviewed Shop Drawings of related trades.

3.12. MISCELLANEOUS CONCRETE WORK

3.12.1. Provide areaways, cast-in-place valve boxes, pits, splash blocks, bases, and other miscellaneous concrete as shown and required to complete the Work. Conform to applicable requirements as specified in this section.

END OF SECTION
SECTION 04 05 13
MASTERY MORTAR AND GROUTING

1. PART 1 - GENERAL

1.1. SECTION INCLUDES

1.1.1. Mortar and grout for masonry.

1.2. RELATED WORK

1.2.1. Section 01 41 00 Testing Laboratory Services

1.2.2. Section 04 22 00 Concrete Unit Masonry

1.3. REFERENCES

1.3.1. ASTM C 144: Aggregate for Masonry Mortar

1.3.2. ASTM C 150: Portland Cement

1.3.3. ASTM C 207: Hydrated Lime for Masonry Purposes

1.3.4. ASTM C 270: Mortar for Unit Masonry

1.3.5. ASTM C 404: Aggregates for Masonry Grout

1.3.6. ASTM C 476: Grout for Masonry

1.4. DELIVERY, STORAGE, AND HANDLING

1.4.1. Deliver products to site under provisions of Section 01 65 00.

1.4.2. Store and protect products under provisions of Section 01 65 00.

1.4.3. Maintain packaged materials clean, dry, and protected against dampness, freezing, and foreign matter.

1.5. SUBMITTALS

1.5.1. Submit under provisions of Section 01 33 00.

1.5.2. Product Data: Provide data on admixtures, including product characteristics, compatibility and limitations.

1.5.3. Mix designs: Include the following information in grout and mix design data:

1.5.3.1. Design

1.5.3.1.1. Project name, address, site location, and location of mix design usage.
1.5.3.1.2. Contractor, Sub-Contractor, Supplier and Plant Location.

1.5.3.1.3. Mix Number.

1.5.3.1.4. Specified compressive strength, maximum aggregate size, slump, and placement method.

1.5.3.1.5. Application and location in structure.

1.5.3.2. Materials

1.5.3.2.1. Design Method.

1.5.3.2.2. Slump.

1.5.3.2.3. Cement: Type, amount, and compliance with specified criteria statement.

1.5.3.2.4. Aggregates: Source(s), gradations (individual and combined).

1.5.3.2.5. Admixtures: Not Allowed

1.5.3.2.6. Water source.

1.5.3.2.7. Test Results, Batch Quantities, Yield (calculations).

1.5.3.3. All other considerations relative to placement, curing, finishing and testing.

2. PART 2 - PRODUCTS

2.1. MATERIALS

2.1.1. Mortar Aggregate: ASTM C144 with not less than 3 percent passing #100 sieve.

2.1.2. Grout Aggregate: ASTM C404

2.1.2.1. Coarse Aggregate: 100 percent passing 3/8 inch sieve and not more than 5 percent passing #8 sieve.

2.1.2.2. Fine Aggregate: Washed, natural sand; not more than 2 percent by weight deleterious substances; 5 percent minimum passing #100 sieve.

2.1.3. Portland Cement: ASTM C150 Type II, free alkali content 0.06 percent maximum, gray color.

2.1.4. Hydrated Lime: ASTM C207, Type S.

2.1.5. Water: Clean and potable.

2.1.6. Admixtures: No Admixtures Permitted
2.2. MORTAR MIXES

2.2.1. Mortar for Reinforced Masonry: ASTM C270, Proportion Mix

2.2.1.1. Provide Type S, minimum compressive strength of 1800 psi at 28 days as indicated on the drawings.

2.3. MORTAR MIXING

2.3.1. Thoroughly mix mortar ingredients in quantities needed for immediate use in accordance with ASTM C270.

2.3.2. If water is lost by evaporation, retemper only within one hour of mixing or prior to cement reaching initial set, whichever occurs first.

2.4. GROUT MIXES

2.4.1. Comply with ASTM C476 Proportion Specification only. Delete reference to mix proportion per compressive strength.

2.4.1.1. Type: Coarse or fine grout for concrete masonry units.

2.4.1.2. Slump: 8-10 inches slump at low lift grouting applications.

2.4.1.3. Strength: Minimum compressive strength of 2000 PSI at 28 days

2.4.1.4. Use of fly ash is not permitted.

2.4.2. Mix Designs: Prepare mix design for Architects review. Comply with requirements specified in Section 03 30 10.

2.4.3. Grout proportions:

2.4.3.1. Proportion mixes per Table 1 of ASTM C 476 Proportion Mix by volume. Delete reference to mix proportion per compressive strength.

2.5. GROUT MIXING

2.5.1. Mix grout concrete in accordance with ASTM C 94 and ASTM C 476 Proportion Mix.

2.5.2. Do not use admixtures including pigments, air-entraining agents, accelerators, retarders, water-repellent agents, anti-freeze compounds, or other admixtures, unless otherwise indicated.

2.5.3. Do not use calcium chloride.

2.6. OTHER MATERIALS

2.6.1. Provide all other materials, not specifically described but required for complete and proper installation of this work, as selected by the contractor and subject to the approval of the Architect.

2.7. SOURCE QUALITY CONTROL

2.7.1. Provide for testing under the provisions of Section 01 41 00.
3. **PART 3 - EXECUTION**

3.1. **SURFACE CONDITIONS**

3.1.1. Inspection

3.1.1.1. Prior to work of this section, carefully inspect previously installed work. Verify all such work is complete to the point where this installation may properly commence.

3.1.1.2. Verify that work of this section may be installed in strict accordance with the original design, all pertinent codes and regulations, and all pertinent portions of the referenced standards.

3.1.1.3. In the event of discrepancy, immediately notify the Architect.

3.1.1.4. Do not proceed with installation in areas of discrepancy until all such discrepancies have been fully resolved.

3.2. **INSTALLATION**

3.2.1. Install mortar and grout to requirements of the specific masonry Sections.

3.3. **FIELD QUALITY CONTROL**

3.3.1. Test mortar and grout in accordance with Section 01 41 00

3.3.2. Testing of Mortar Mixes:

3.3.2.1. Mortar Test: For each type of mortar, provide mortar field tests per ASTM C 780.

3.3.3. Testing of Grout Mixes:

3.3.3.1. Grout Test: Provide grout sample field tests per ASTM C 1019.

**END OF SECTION**
SECTION 04 22 00
CONCRETE UNIT MASONRY

1. PART 1 - GENERAL

1.1. SECTION INCLUDES

1.1.1. Concrete Masonry Units.
1.1.2. Reinforcement, anchorage, and accessories.

1.2. RELATED SECTIONS

1.2.1. Section 01 41 00: Testing Laboratory Services
1.2.2. Section 03 20 00: Concrete Reinforcing
1.2.3. Section 04 05 13: Masonry Mortar and Grouting

1.3. REFERENCES

1.3.1. ASTM C90: Hollow Load Bearing Concrete Masonry Units

1.4. QUALIFICATIONS

1.4.1. Installer: Company specializing in performing the work of this Section with minimum 5 years documented experience.

1.5. SUBMITTALS

1.5.1. Submit under provisions of Section 01 33 00.
1.5.2. Samples:

1.5.2.1. Submit two 6-inch square samples indicating surface texture and color of block.
1.5.3. Certification: Submit certification from block manufacturer confirming compliance with criteria established by referenced standard and this section.
1.5.4. Materials List: Submit proposed materials list for all products used.
1.5.5. Shop Drawings

1.5.5.1. Submit steel reinforcement shop drawings in accordance with ACI 315. Include placing drawings and bending charts. Show 1/4" scale elevations indicating length and locations of splices, size and length of reinforcing steel, bar position dimensions, spacing and all openings and penetrations with required reinforcing.

1.5.6. Mock-up

1.5.6.1. Prior to beginning installation, prepare in-place mock-up of approximately 4 foot by 6 foot high, and obtain Architect's approval.
1.6. DELIVERY, STORAGE, AND HANDLING

1.6.1. Deliver products to site under provisions of Section 01 65 00.

1.7. SEQUENCING AND SCHEDULING

1.7.1. Coordinate work under provisions of Section 01 32 00.

1.8. GUARANTEE

1.8.1. Provide the Owner with a guarantee, in Architect approved form, against the following specific defects or failures for a period of three (3) years after Notice of Substantial Completion:

1.8.1.1. Expansion/contraction cracks.

2. PART 2 – PRODUCTS

2.1. MANUFACTURERS

2.1.1. Basis of Design: Characteristics of specific products, where named in this Section, are indicated to establish required level of quality, appearance, and performance. Architect will consider requests for substitutions, under the provisions of Section 01 25 00.

2.2. CONCRETE MASONRY UNITS:

2.2.1. Block: Hollow Load Bearing Block Units per ASTM C90.

2.2.1.1. Minimum compressive strength of 1900 psi as a component of design f'm assembly value of 1500 psi.

2.2.2. Weight Classification All units: Normal Weight

2.2.3. Size and style

2.2.3.1. Block: Nominal 8 x 8 x 16 and 8 x 12 x 16, hollow load bearing units, with bond beam units at horizontal reinforcing. Provide additional sizes as required and as shown on drawings.

2.2.3.2. Provide special shapes for lintels, corners, jambs, sashes, movement joints, headers, bonding and other special conditions.

2.2.3.3. Provide square-edged units for outside corners, unless otherwise indicated.

2.2.3.4. Provide cap block and sill block profiles as shown on drawings.

2.2.4. Finish: As indicated on project drawings.

2.2.5. Color: Color and texture matching the range represented by the Architects sample.

2.2.5.1. Concealed applications: Provide natural gray color.

2.2.6. Fire Rating: Where masonry units are components in fire rated assemblies, provide written certification of compliance with IBC and UL material listing requirements or other approved material certification methods.
2.3. **ACCESSORIES, REINFORCEMENT AND ANCHORAGE**

2.3.1. **CMU Admixture:** No admixtures are allowed without prior written approval from the Architect and Engineer of Record.

2.3.2. **Reinforcing Steel:** ASTM A 615 or ASTM A 706.

2.3.3. Where required or shown on structural drawings, provide prefabricated horizontal joint reinforcement complying with ASTM A 951, hot dipped galvanized.

2.3.4. **Mortar and Grout:** Per Section 04 05 13.

2.3.5. **Weep Joint Tubes:** 1/4 inch diameter clear polyethylene weep tubing.

2.4. **SOURCE QUALITY CONTROL AND TESTING**

2.4.1. Provide for testing under the provisions of Section 01 41 00.

2.4.1.1. **Masonry Units:** ASTM C 140.

2.5. **OTHER MATERIALS**

2.5.1. Provide all other materials, not specifically described but required for complete and proper installation of this work, as selected by the contractor and subject to the approval of the Architect.

3. **PART 3 - EXECUTION**

3.1. **SURFACE CONDITIONS**

3.1.1. **Inspection**

3.1.1.1. Prior to work of this section, carefully inspect previously installed work. Verify all such work is complete to the point where this installation may properly commence.

3.1.1.2. Verify that work of this section may be installed in strict accordance with the original design, all pertinent codes and regulations, and all pertinent portions of the referenced standards.

3.1.1.3. Verify that built-in items are in proper location, and ready for roughing into masonry work.

3.1.1.4. In the event of discrepancy, immediately notify the Architect.

3.1.1.5. Do not proceed with installation in areas of discrepancy until all such discrepancies have been fully resolved.

3.2. **PREPARATION**

3.2.1. Direct and coordinate placement of metal anchors supplied to other Sections.

3.2.2. Provide temporary bracing during installation of masonry work. Maintain in place until building structure provides permanent bracing.

3.2.3. Provide templates for setting anchor bolts, maintaining clearances and embedment in compliance with construction documents.
3.3. COURSING

3.3.1. Establish lines, levels, and coursing indicated. Protect from displacement.

3.3.2. Maintain masonry courses to uniform dimension. Form vertical and horizontal joints of uniform thickness.

3.3.3. Lay masonry units in running bond, unless otherwise noted; joint width 3/8”.

3.3.4. Joint Tooling:

3.3.4.1. Tool exterior wall joints concave.

3.3.4.2. Tool exposed interior wall joints concave.

3.3.4.3. Tool joints tight and flush at locations where waterproofing or tile finish occurs.

3.3.4.4. Where furring or framing assemblies are installed over masonry, tool joints tight and flush.

3.3.5. Surface preparation for waterproofing membranes: Provide smooth mortar parging coat at all block surfaces receiving below grade waterproofing systems, free of ridges, gaps, holes or other surface imperfections.

3.3.6. Preparation for flashing assemblies: Where roof or other flashing assemblies butt against or slope against adjoining masonry wall surface, sawcut reglet joint as required to receive flashing termination and as directed by Architect.

3.4. REINFORCEMENT AND ANCHORAGES - REINforced UNIT MASONRY

3.4.1. Install reinforcement at spacing indicated and to allow a minimum grout coverage of 1/2 inch or 1 bar diameter, whichever is greater.

3.4.2. Support and secure reinforcing bars from displacement. Maintain position within 1/2 inch of dimensioned position.

3.4.3. Retain vertical reinforcement in position at top and bottom of cells and at intervals not exceeding 192 bar diameters with fabricated bar positioners. Splice reinforcement in accordance with Section 03 20 00.

3.4.4. Splice reinforcing bars in accordance with IBC Section 2107.5 and as shown on structural drawings.

3.4.5. Embed anchors for attachment of metal fabrications.

3.5. PLACING AND BONDING

3.5.1. Lay masonry in accordance with IBC Section 2104.1.

3.5.2. Perform jobsite cutting of masonry units with proper tools to provide straight, clean, unchipped edges. Prevent broken masonry unit corners or edges.

3.5.3. Lay hollow masonry units with full face shell bedding on bed joints and full head joints. Lay clay/concrete brick masonry units with full head and bed joints.

3.5.4. Buttering corners of joints or excessive furrowing of mortar joints are not permitted.
3.5.5. Lay masonry units with core cells grout space vertically aligned, clear of mortar, and unobstructed with a minimum cell dimension of 3 inches.

3.5.6. Interlock intersections and external corners.

3.5.7. Where expansion or control joints are shown on structural drawings, provide Type 1 sealant and backer rod as specified in Section 07 90 00 at both sides of joint.

3.5.8. Remove excess mortar as Work progresses. Do not shift or tap masonry units after mortar has achieved initial set. Where adjustment must be made, remove mortar and replace.

3.5.9. Grout may be placed after mortar has achieved initial set.

3.6. GROUTING

3.6.1. Provide coarse or fine grout at hollow unit masonry applications as required.

3.6.2. Grout hollow unit masonry using specified grouting techniques.

3.6.2.1. Maintain weep joints free of grout.

3.6.3. When grouting is stopped for more than one hour, terminate grout 1/2 inch below top of upper masonry unit to form a positive key for subsequent grout placement.

3.6.4. Low Lift Grouting

3.6.4.1. Install masonry units to a maximum height of 60 inches.

3.6.4.2. Remove all overhanging mortar and mortar droppings.

3.6.4.3. Place first lift of grout and mechanically vibrate for grout consolidation. See IBC Section 2104.1.

3.7. BUILT - IN WORK

3.7.1. As work progresses, build in anchor bolts, plates, and other items furnished by other Sections.

3.7.2. Build in items plumb and level.

3.7.3. Do not build in pipes or ducts unless specifically detailed.

3.7.4. Do not build in organic materials subject to deterioration.

3.8. TOLERANCES

3.8.1. Maximum Variation from Unit to Adjacent Unit: 1/16 inch.

3.8.2. Maximum Variation From Plane of Wall: 1/4 inch in 10 feet and 1/2 inch in 20 feet or more.

3.8.3. Maximum Variation From Plumb: 1/4 inch per story non-cumulative.

3.8.4. Maximum Variation From Level Coursing: 1/8 inch in 3 feet and 1/4 inch in 10 feet; 1/2 inch in 30 feet.
3.8.5. Maximum Variation of Joint Thickness: 1/8 inch in 3 feet.

3.9. CUTTING AND FITTING

3.9.1. Cut and fit for chases, pipes, conduit, sleeves, grounds, and other penetrations. Coordinate with other Sections of work to provide correct size, shape, and location.

3.9.2. Obtain Architect approval prior to cutting or fitting masonry work not indicated or where appearance or strength of masonry work may be impaired.

3.10. CLEANING

3.10.1. Clean work under provisions of Section 01 77 009.

3.10.2. Remove excess mortar and mortar smears.

3.10.3. Replace defective mortar. Match adjacent work.

3.10.4. Use non-metallic tools in cleaning operations.

3.10.5. Do not use acid or acid base cleaning agents.

3.11. PROTECTION OF FINISHED WORK

3.11.1. Protect finish installation under provisions of Section 01 56 00.

3.11.2. Without damaging completed work, provide protective boards at exposed external corners which may be damaged by construction activities.

3.11.3. Protection of groundface units:

3.11.3.1. Without damaging completed work, provide protective covers at groundface block external corners to prevent damaged by construction activities.

3.11.3.2. Without damaging completed work, provide protective covers to prevent dirt staining on surfaces.

3.12. FIELD QUALITY ASSURANCE

3.12.1. Perform testing and inspection under the provisions of Section 01 41 00.

3.12.2. Masonry Inspection: Provide inspection per IBC Section 1704.5.

3.12.3. Masonry Testing: Provide one set of tests for each 2000 square feet of wall area or portion thereof.

3.12.4. Concrete Masonry Unit Testing: For each different masonry compressive strength. Provide testing per ASTM C 140.

END OF SECTION
SECTION 05 50 00
METAL FABRICATIONS

1. PART 1 - GENERAL

1.1. SECTION INCLUDE

1.1.1. Miscellaneous fabricated ferrous metal items, galvanized, plated, and prime painted.

1.1.2. Miscellaneous fabricated structural connectors and clips

1.1.3. Handrails and Guardrails

1.1.4. Bollards: Galvanized steel pipe; concrete filled, crowned cap.

1.2. PRODUCTS FURNISHED BUT NOT INSTALLED UNDER THIS SECTION

1.2.1. Section 03 30 10 - Cast-In-Place Concrete.

1.3. REFERENCES

1.3.1. ASTM A36 - Structural Steel.

1.3.2. ASTM A53 - Pipe, Steel, Black and Hot Dipped, Zinc-Coated Welded and Seamless.

1.3.3. ASTM A123 - Zinc (Hot-Galvanized) Coatings on Iron and Steel Products.

1.3.4. ASTM A283 – Low and Intermediate Tensile Strength Carbon Steel Plates.

1.3.5. ASTM A307 - Carbon Steel Bolts and Studs, 60,000 PSI Tensile Strength.

1.3.6. ASTM A500 - Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Round and Shapes.

1.3.7. ASTM A 653, Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron-Alloy Coated (Galvannealed) by the Hot-Dip Process.

1.3.8. AWS A2.0 - Standard Welding Symbols.

1.3.9. AWS D1.1 - Structural Welding Code.

1.3.10. SSPC - Steel Structures Painting Council.

1.4. SUBMITTALS

1.4.1. Submit under provisions of Section 01 33 00.

1.4.2. Product Data: Provide data on material, finishes and attachment.

1.4.3. Manufacturer’s Installation Instructions: Submit criteria for preparation and application.

1.4.4. Shop Drawings: Indicate profiles, sizes, connection attachments, reinforcing, anchorage, size and type of fasteners, and accessories. Include erection drawings, elevations, and details where applicable.
1.4.5. Indicate welded connections using standard AWS A2.0 welding symbols. Indicate net weld lengths.

1.5. QUALITY ASSURANCE

1.5.1. Manufacturer: Manufacturer shall have produced the specified system or products for a period of one (1) year prior to beginning work of this section, and shall have the capability to produce the specified products to the delivery and quantity criteria of the project.

1.5.2. Staff:

1.5.2.1. Use only staff who are completely familiar with the manufacturers' recommended methods of installation as well as the requirements of this work.

1.5.3. Welders’ Certificates: Submit under provisions of Section 01 33 00, certifying welders employed on the Work, verifying AWS qualification within the previous 12 months.

1.6. FIELD MEASUREMENTS

1.6.1. Verify that field measurements are as indicated on shop drawings.

1.7. WARRANTY AND GUARANTEE

1.7.1. Contractors Guarantee:

1.7.1.1. Provide, in Architect approved form, the Owner with a guarantee against the following specific defects or failures for a period of two (2) years after Notice of Substantial Completion:

2. PART 2 – PRODUCTS

2.1. MANUFACTURERS

2.1.1. Basis of Design: Characteristics of specific products, where named in this Section, are indicated to establish required level of quality, appearance, and performance. Architect will consider requests for substitutions, under the provisions of Section 01 25 00.

2.2. MATERIALS

2.2.1. Plates and Bars: ASTM A283, Grade D or approved equal.

2.2.2. Pipe: ASTM A53, Grade B Schedule 40, (pressure test not required), unless noted otherwise.

2.2.3. Tube: ASTM A 500, Grade B.

2.2.4. Sheet Steel: ASTM A 653, gage and profile indicated, galvanized to G90 finish in accordance with ASTM A 653.


2.2.6. Welding Materials: AWS D1.1; type required for materials being welded.

2.2.7. Shop and Touch-Up Primer: VOC approved primer.
2.2.8. Touch-Up Primer for Galvanized Surfaces: Zinc rich Type.

2.2.9. Copper: ASTM B370, temper H00 (cold rolled) or 060 (soft), 16 ounce unless noted otherwise.

2.3. STRUCTURAL SHAPES

2.3.1. Provide structural shapes in accordance with Section 05 12 00.

2.4. STEEL RAILING SYSTEM –WALL MOUNTED OR VERTICALS SET IN CONCRETE

2.4.1. Steel Pipe: ASTM A53, Grade B.

2.4.2. Rails and Posts: Size, shape and spacing as shown on the Drawings, welded joints.

2.4.2.1. Handrail: 1 inch NPS (1.33 inch OD), Schedule 80, welded joints.

2.4.3. Fittings: Elbows, T-shapes, wall brackets; bent or mitered tube steel.

2.4.4. Metal Pipe Support Mounting: Provide solid steel rod, bent as shown on drawings. Fabricate as required to provide 1-1/2 inch clear dimension from face of wall surface to railing inside surface.

2.4.4.1. Wall mounting: expansion anchors appropriate for masonry wall.

2.4.4.2. Post mounts in drilled holes in concrete, leveled and plumbed and set with non-shrink grout.

2.4.5. Grout: Non-shrink, non-metallic as specified.

2.5. PIPE BOLLARDS

2.5.1. Provide galvanized extra strong weight steel pipe as specified in ASTM A 53. Anchor posts in concrete [and fill solidly with concrete with minimum compressive strength of 2500 psi.

2.5.2. Fixed Pipe Bollard: 6 inch diameter galvanized steel pipe, concrete filled as indicated on drawings.

2.5.3. Removable Pipe Bollard: Assembly consisting of a removable 6 inch diameter galvanized steel pipe set in pipe sleeve as indicated on drawings.

2.6. FABRICATION

2.6.1. Fit and shop assemble in each item in largest practical sections, for delivery to site.

2.6.2. Fabricate items with joints tightly fitted and secured.

2.6.3. Continuously seal joined members by continuous welds.

2.6.4. Grind exposed joints flush and smooth with adjacent finish surface. Make exposed joints butt tight, flush, and hairline. Ease exposed edges to small uniform radius.

2.6.5. Exposed Mechanical Fastenings: Flush countersunk screws or bolts; unobtrusively located; consistent with design of component, except where specifically noted otherwise.
2.6.6. Supply components required for anchorage of fabrications. Fabricate anchors and related components of same material and finish as fabrication, except where specifically noted otherwise.

2.6.7. Fabricate radiused components by cold-rolled process, using equipment and techniques resulting in crimp free surfaces. Verify component wall thickness is suitable for rolling without flattening or crimping.

2.6.8. In addition to above criteria, fabricate railing, trellis and fencing components for exposed architectural appearance conditions.

2.6.8.1. Remove all weld splatter, grind and sand all weld joints uniformly smooth, without visible scratches, gouges, or patch marks. Conform to Finish #2 of National Ornamental and Miscellaneous Metals Association “Joint Finish Guidelines.”

2.6.8.2. All visible welds shall be continuous; bead or spot welding not acceptable.

2.6.8.3. Provide tube closures at all tube and pipe components.

2.6.8.4. Grind edges of all bent and fabricated components smooth to a 1/4 inch radius.

2.7. FINISHES

2.7.1. Prime paint with one coat rust inhibitive VOC approved primer compatible with finish specified in Section 09 91 00.

2.7.1.1. Prepare surfaces to be primed as specified.

2.7.1.2. Do not prime surfaces in direct contact with concrete or where field welding is required.

2.8. MISCELLANEOUS METAL FABRICATIONS AND ACCESSORIES

2.8.1. Unistrut: Provide Unistrut assemblies as shown on drawings.

2.9. OTHER MATERIALS

2.9.1. Provide all other materials, not specifically described but required for complete and proper installation of this work, as selected by the Contractor and subject to the approval of the Architect.

3. PART 3 - EXECUTION

3.1. SURFACE CONDITIONS

3.1.1. Inspection

3.1.1.1. Prior to work of this Section, carefully inspect previously installed work. Verify all such work is complete to the point where this installation may properly commence.

3.1.1.2. Verify that work of this Section may be installed in strict accordance with the original design, all pertinent codes and regulations, and all pertinent portions of the referenced standards.
3.1.3. In the event of discrepancy, immediately notify the Architect.

3.1.4. Do not proceed with installation in areas of discrepancy until all such discrepancies have been fully resolved.

3.2. PREPARATION

3.2.1. Clean and strip primed steel items to bare metal where site welding is required.

3.2.2. Supply items required to be cast into concrete or embedded in masonry with setting templates, to appropriate sections.

3.3. INSTALLATION

3.3.1. Install items plumb and level, accurately fitted, free from distortion or defects.

3.3.2. Allow for erection loads, and for sufficient temporary bracing to maintain true alignment until completion of erection and installation of permanent attachments.

3.3.3. Perform field welding in accordance with AWS D1.1.

3.3.4. After erection, prime welds, abrasions, and surfaces not shop primed or galvanized, except surfaces to be in contact with concrete.

3.3.4.1. Use primer as specified for steel fabrications.

3.3.4.2. Use Galvalloy galvanizing coating in accordance with manufacturer's instructions for galvanized fabrications.

3.3.5. Install all railing and guardrail in accordance with applicable codes and regulations. Maintain all required clearances and dimensions, including the following:

3.3.5.1. Maintain continuous 1-1/2 inch clear dimension between handrail and adjacent wall.

3.4. INSTALLATION OF PIPE BOLLARDS

3.4.1. Pipe guards shall be set plumb.

3.5. ERECTION TOLERANCES

3.5.1. Maximum Variation From Plumb: 1/4 inch per story, non-cumulative.

Maximum Offset From True Alignment: 1/4 inch. END OF SECTION
SECTION 08 11 00
HOLLOW METAL DOORS AND FRAMES

1. PART 1 - GENERAL

1.1. SECTION INCLUDES

1.1.1. Hollow metal rolled steel doors, non-rated.

1.1.2. Hollow metal rolled steel door frames, non-rated.

1.1.3. Modifications to existing frames to accommodate new hardware, including field inspection.

1.2. REFERENCES

1.2.1. ASTM A 1008 – Specification for Commercial Steel Sheet, Carbon (0.15 Percent), Cold-Rolled.

1.2.2. ASTM A 653 – Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvanized) by the Hot-Dip Process.

1.2.3. ANSI/SDI-100 - Recommended Specifications for Standard Steel Doors and Frames.

1.2.4. ANSI/SDI-119 - Performance Test Procedures for Steel Door Frames and Anchors.


1.2.6. ANSI-A250.4 - Test Procedure and Acceptance Criteria for Physical Endurance, Steel Doors and Frames.

1.2.7. ANSI-A250.10 - Test Procedure and Acceptance Criteria for Prime Painted Steel Surfaces for Steel Doors and Frames.

1.2.8. ANSI A 250.6 - Hardware on Steel Doors (Reinforcement-Application). Warnock Hersey - Certification Listings for Fire Doors.

1.2.9. Underwriters Laboratories - Building Materials Directory

1.3. SUBMITTALS

1.3.1. Submit shop drawings and product data under provisions of Section 01.

1.3.1.1. Provide shop drawings illustrating system and component dimensions, components within assembly, framed opening requirements and tolerances, anchorage and fasteners; and affected related work.

1.3.1.2. Provide, where required, shown or specified, custom modifications to manufacturers or referenced standard, including material gage, anchorage, dimension and fabrication criteria.
1.3.1.3. Provide manufacturer’s installation instructions and listing requirements.

1.3.2. Samples: Provide one 12 inch square sample of each type of door, cut at corner, showing edge treatment and core material.

1.4. QUALITY ASSURANCE

1.4.1. Hollow metal supplier shall be a qualified direct distributor of specified products.

1.4.1.1. Distributor shall employ a person of equivalent experience who will be available at reasonable times to consult with the architect and owner regarding all matters affecting work of this Section.

1.4.2. Hollow metal supplier shall be a member of the Steel Door Institute or Hollow Metal Manufacturers Association Division of NAAMM.

1.4.3. Perform work in accordance with standards of the Steel Door Institute and as required by this Section.

1.4.3.1. Where more restrictive than referenced standards, comply with requirements of this Section.

1.4.4. Provide written certification all doors conform to Level ‘A’ criteria of ANSI-A-250.4, including testing to 2,000,000 operating cycles.

1.5. DELIVERY, STORAGE AND PROTECTION

1.5.1. Deliver doors and frames cardboard wrapped, crated, palletized or otherwise protected during transit and site storage.

1.5.2. Inspect doors and frames upon delivery for damage. Minor damage may be repaired provided refinished items are equal in all respects to new work and accepted by the Architect; otherwise remove and replace damaged items.

1.5.3. Store doors and frames at the building site in a dry secure place.

1.5.3.1. Place units on minimum 4 inch high wood blocking.

1.5.3.2. Store in vented shelters.

1.5.3.3. If cardboard wrapper on door becomes wet, remove carton immediately.

1.5.3.4. Provide 1/4 inch spaces between stacked doors to promote air circulation.

1.6. SEQUENCING AND SCHEDULING

1.6.1. Order and deliver all doors and frames so as not to delay progress of work of other Sections.

2. PART 2 - PRODUCTS

2.1. STEEL DOORS

2.1.1. Manufacturer: Characteristics of specific products manufactured by Security Metal Products Corporation (SMPC), www.secmet.com, are indicated to establish required level of quality, appearance, and performance. The Architect will consider requests for substitutions, under the provisions of Section 01 25 00.
2.1.2. Type/Series:

2.1.2.1. Type: Flush, Hollow metal, with core material as specified.

2.1.2.2. Style: As shown on drawings.

2.1.3. Construction:

2.1.3.1. Grade:

2.1.3.1.1. Exterior Doors: Grade III per SDI 100.

2.1.3.2. Material: Cold Rolled Steel per ASTM A 653, CS grade, A 60 galvanized, extra smooth.

2.1.3.3. Thickness: 1-3/4 inch.

2.1.3.4. Face Sheet Gauge:

2.1.3.4.1. Exterior Doors: 16 gage.

2.1.3.5. Edge Seams: Continuously welded and ground smooth. Filler not acceptable.

2.1.3.6. Core:

2.1.3.6.1. Exterior Doors: Provide steel channel framework.

2.1.4. Finish:

2.1.4.1. At exterior doors and frames, provide factory primed after assembly.

2.2. STEEL DOOR FRAMES

2.2.1. Manufacturer: Characteristics of specific products manufactured by Security Metal Products Corporation (SMPC), www.secmet.com, are indicated to establish required level of quality, appearance, and performance. The Architect will consider comparable products by alternate manufacturers listed in this Section, and requests for substitutions, under the provisions of Section 01 25 00.

2.2.2. Type: Unless noted otherwise, wrap around, double rabbet, flush frames, welded as specified.

2.2.3. Construction:

2.2.3.1. Material: Provide spray applied primer at all frames per ANSI A224.1

2.2.3.2. Face Dimension: 2 inches, unless otherwise shown on drawings.

2.2.3.3. Gage:

2.2.3.3.1. Exterior: 16 gage.

2.2.4. Anchors:
2.2.4.1. Provide minimum 16 gage masonry T-Anchors at masonry walls. Wire anchors not acceptable.

2.3. FABRICATION

2.3.1. General:

2.3.1.1. Fabricate all doors and frames in accordance with SDI 100 except where more stringent requirements are specified.

2.3.1.2. Supply only doors and frames manufactured by a single manufacturer.

2.3.2. Door Construction:

2.3.2.1. Unless otherwise required by hardware specified in other Sections, bevel vertical lock edges 1/8 inch in 2 inches.

2.3.2.2. Door lock edge reinforcing: one-piece, full height 14 gage channel.

2.3.2.3. Closer Reinforcing: one-piece, minimum 12 gage plate.

2.3.2.4. Door Hinge Edge Reinforcing: one-piece, full height 14 gage channel, formed and tapped for hinges, with additional 7 gage reinforcement at each hinge.

2.3.2.5. Weld both hinge and lock channels to each door face sheet.

2.3.2.6. Provide minimum 16 gage top and bottom channels, flush or inverted, and welded to face sheets.

2.3.2.6.1. Close tops of outswinging exterior doors flush by the addition of steel top channel filler.

2.3.3. Frame Construction:

2.3.3.1. At all exterior openings, provide SMPC Type 2B weld joints. Provide continuous welds at all horizontal to vertical sections, including stop sections and rabbets on exterior side. Weld face trim, tabs, rabbets, and frame soffit with continuous fillet weld.

2.3.3.1.1. Grind all welds smooth. Repair specified finish.

2.3.4. Provide temporary shipping bars for protection from damage during transit and handling.

2.3.4.1. Remove temporary spreaders before setting frames.

2.3.4.2. Reinforce frames wider than 48 inches with roll formed steel channels fitted tightly into frame head, flush with top.

2.3.4.3. Prepare door frame for silencers. Provide three single rubber silencers for single doors on strike side, and two single silencers on frame head at double doors without mullions.

2.3.4.4. Supply welded in mortar guards at all hardware cutouts in frames built into masonry or grouted.

2.3.5. Frame Anchors:
2.3.5.1. Provide frame jamb anchors at 30 inches on center (or fractional portion) on each jamb.

2.3.5.2. Floor Anchors:
2.3.5.2.1. Where access to back of frame is possible, provide angle clip type, 16 gage minimum, welded to the bottom of each jamb.

2.3.6. Hardware Preparation:
2.3.6.1. Reinforcement: Reinforce components for hardware installation in accord with ANSI A 250.8 and A250.6 and the following criteria.

2.3.6.1.1. Provide 'box' type lock reinforcing, minimum 16 gage.
2.3.6.1.2. Provide minimum 7 gage hinge reinforcing, welded to frame.
2.3.6.1.3. Provide minimum 12 gage closer reinforcement.
2.3.6.1.4. Provide minimum 12 gage reinforcement at other hardware locations.

2.3.6.2. Locate factory prepared hardware locations in compliance with "Recommended Locations for Builders' Hardware for Standard Steel Doors and Frames", as adopted by The Steel Door Institute.

2.3.7. Door and Frame Modifications:
2.3.7.1. Modify existing frames as indicated on Door Schedule with specified hardware.

2.3.7.1.1. Carefully remove and store existing hardware.
2.3.7.1.2. Prior to modifying assembly, review modification with Testing service representative to verify modification will not void rating, or that modification will prevent rating from being assigned in field.
2.3.7.1.3. Prepare frames and doors for new hardware, including reinforcing.

2.4. OTHER MATERIALS
2.4.1. Provide all other materials, not specifically described but required for complete and proper installation of this work, as selected by the Contractor and subject to the approval of the Architect.

3. PART 3 - EXECUTION

3.1. SURFACE CONDITIONS
3.1.1. Inspection:
3.1.1.1. Prior to work of this Section, carefully inspect previously installed work. Verify all such work is complete to the point where this installation may properly commence.

3.1.1.2. Verify that work of this Section may be installed in strict accordance with the original design, all pertinent codes and regulations, and all pertinent portions of the referenced standards.

3.1.1.3. In the event of discrepancy, immediately notify the Architect.

3.1.1.4. Do not proceed with installation in areas of discrepancy until all such discrepancies have been fully resolved.

3.2. INSTALLATION

3.2.1. Set all frames in accord with SDI 105 and as specified.

3.2.2. Set anchors for frames as work progresses. Install anchors at hinge and strike levels.

3.2.2.1. Where frame is accessible from back, install sill/floor anchors to slab or floor assembly.

3.2.2.2. Where wall framing is installed on concrete curb, install jamb anchor at approximately 7 inches above floor level.

3.2.2.3. Install two head anchors per frame with width exceeding 3 feet and less than 6 feet wide. Install three anchors, equally spaced, at wider frames.

3.2.3. Use temporary setting spreaders at all locations. Use intermediate spreaders to assure proper door clearances and header braces for grouted frames.

3.2.4. At concrete and masonry walls, install frames as work progresses, setting anchors in masonry and grouting frames in place.

3.2.4.1. At pre-existing concrete and masonry walls, install frames in openings using countersunk bolts and expansion shields. Fill all anchor holes and fastener slots with weld material. Epoxy filler not acceptable. Grind smooth and flush with adjacent finish.

3.3. DOOR INSTALLATION

3.3.1. Install hollow metal doors in frames using specified hardware.

3.3.2. Clearance at edge of doors:

3.3.2.1. Between door and frame at head and jambs: 1/8 inch.

3.3.2.2. Meeting edges of doors and mullions: 1/8 inch.

3.3.2.3. Transom panels, without transom bars: 1/8 inch.

3.3.2.4. Sills without thresholds: 5/8 inch maximum above finish floors.

3.3.2.5. Sills with thresholds: 1/8 inch above threshold.
3.4. ADJUSTMENT AND CLEANING

3.4.1. Remove dirt and excess sealants, mortar from exposed surfaces.

3.4.2. Adjust moving parts for smooth operation. Use shims if necessary to allow for proper closing.

3.4.3. Where approved by Architect, fill all dents, holes, and similar defects with epoxy metal filler. Where required by Architect, fill all dents, holes and similar defects with weld material. After filling, grind smooth and flush with adjacent surface. Provide approved zinc rich primer at all galvanized products.

3.4.4. Touch up abrasions with primer.

END OF SECTION
SECTION 08 71 00
DOOR HARDWARE

1. PART 1 - GENERAL

1.1. WORK INCLUDED

1.1.1. Door hardware.

1.1.2. Weatherstripping and gasketing.

1.1.3. Thresholds, door stops, and related finish hardware.

1.1.4. Scope of Work in this Section: Provide all finish hardware necessary to complete work.

1.2. WORK FURNISHED BUT INSTALLED UNDER OTHER SECTIONS

1.2.1. Furnish templates to:

1.2.1.1. Section 08 11 00 for door and frame preparation.

1.3. REFERENCES

1.3.1. Builders’ Hardware Manufacturers Association (BHMA) standards as specified.

1.3.2. Steel Door Institute (SDI) standards as specified.

1.3.3. Part 2, Title 24, CCR, 2007 edition, including all current amendments.

1.3.4. Americans with Disabilities Act Accessibility Guidelines (ADAAG) criteria as specified.

1.3.5. Underwriters Laboratories Inc. standards as specified.


1.4. QUALITY ASSURANCE

1.4.1. Hardware Supplier: Provide hardware from company specializing in supplying institutional door hardware with 5 years experience and approved by hardware manufacturer. Supplier shall have in its employ a certified Architectural Hardware Consultant (AHC) to prepare submittals required by this Section and who shall be available at reasonable times, during the course of the work, for project hardware consultation to the Owner, Architect, and Contractor. In addition AHC shall certify hardware installation as specified in this Section.

1.4.2. Hardware supplier shall have a maintenance and service facility located within 100 miles of the project site. This facility will stock parts for products supplied and be capable of repairing and replacing hardware items found defective within the warranty period.

1.5. REGULATORY REQUIREMENTS

1.5.1. Hardware shall be tested and listed per UL10C. Furnish letter of compliance from each manufacturer in the submittals for each type of rated opening.
1.5.2. Conform to applicable requirements of the Americans with Disabilities Act Accessibility Guidelines regarding accessibility requirements for door and entrance hardware.

1.6. CERTIFICATIONS

1.6.1. Architectural Hardware Consultant provided by Contractor shall inspect preparation and initial installation of each type of hardware condition.

1.6.2. Architectural Hardware Consultant provided by Contractor shall inspect the completed installation and certify that hardware and installation has been furnished and installed in accordance with manufacturer's instructions and as specified.

1.7. SUBMITTALS

1.7.1. Submit schedule and product data under provisions of Section 01 33 00.

1.7.2. Provide seven (7) copies of hardware schedule showing each application, the quantity required, part numbers and finish of each item.

1.7.2.1. Architects review of such schedule does not relieve the Contractor of providing all hardware required for the Work, whether or not such hardware was inadvertently omitted from Submittal. No extra cost will be allowed for changes or corrections necessary to facilitate the proper installation of hardware.

1.7.3. Accompanying schedules, provide two (2) manufacturer's brochures of each item specified and scheduled, indicating function, finish, dimensions, and related features. No hardware schedules will be accepted for review without submission of such brochure package.

1.7.4. When alternate manufacturers are proposed by contractor, provide two brochures of originally specified item, marked to identify original specified item.

1.7.5. Submit only manufacturers specified as approved alternates.

1.7.6. Provide samples indicating hardware design and finish when required by Architect.

1.7.7. Provide shop drawings showing all boxes, wiring and/or other support components of hardware assemblies enclosed or embedded in construction.

1.8. COORDINATION

1.8.1. Coordinate work of this Section with other directly affected Sections involving manufacturer of any internal reinforcement for door hardware.

1.8.1.1. In particular, coordinate door preparation in accordance with applicable regulatory and trade standards specified.

1.8.2. Review all details and conditions prior to ordering hardware. If door hand is changed during construction, coordinate and change all hardware as necessary at no cost to the Owner.

1.9. OPERATION AND MAINTENANCE DATA

1.9.1. Submit operation and maintenance data under provisions of Section 01.
1.9.2. Include data on operating hardware, lubrication requirements, and inspection procedures related to preventative maintenance.

1.10. DELIVERY, STORAGE, AND HANDLING

1.10.1. Deliver products to site under provisions of Section 01 65 00.
1.10.2. Store and protect products under provisions of Section 01 65 00.
1.10.3. Package hardware items individually; label and identify package with door opening code to match hardware schedule.

1.11. MAINTENANCE MATERIALS

1.11.1. Provide special wrenches and tools applicable to each different or special hardware component.
1.11.2. Provide maintenance tools and accessories supplied by hardware component manufacturer.

1.12. WARRANTY AND GUARANTY

1.12.1. Provide warranty from hardware supplier against all defects on all hardware, including electrical components, as follows:

1.12.1.1. Closers: Ten years, except electronic closers shall be warranted for two years.
1.12.1.2. Exit Devices: Three years.
1.12.1.3. Hinges: Life of the building.
1.12.1.4. All other hardware: Two years.

1.12.2. CONTRACTORS GUARANTEE

1.12.2.1. Provide, in Architect approved form, the Owner with a guarantee against the following specific defects or failures for a period of a minimum of two (2) years after Notice of Substantial Completion:

1.12.2.1.1. Loose or misaligned components, resulting in the inability for the hardware assembly to function as intended or in compliance with applicable regulations.
1.12.2.1.2. Finish failure, including rust, pitting, flaking and other finish appearance defects.

2. PART 2 - PRODUCTS

2.1. MANUFACTURERS

2.1.1. Basis of Design: Characteristics of specific products, where named in this Section and Hardware Schedule, are indicated to establish required level of quality, appearance, and performance. The Architect will consider comparable products by alternate manufacturers where listed, and requests for substitutions, under the provisions of Section 01 25 00.
2.1.2. Obtain each kind of hardware (latch and locksets, exit devices, hinges, and closers) from one manufacturer.

2.2. DOOR HARDWARE CRITERIA

2.2.1. Manufacturers:

2.2.1.1. Hinges: Stanley (STA).

2.2.1.1.1. Approved Alternate: Hager or Lawrence.

2.2.1.2. Locks and Latchsets: Arrow (ARR).

2.2.1.2.1. Approved Alternate: None – Owners Standard.

2.2.1.3. Cylinders: Provide by PCC Lock Shop (non removable core).

2.2.1.4. Exit Devices: Corbin-Russwin (C-R). Approved Alternate: None – Owners Standard

2.2.1.5. Closer: LCN(LCN).

2.2.1.5.1. Approved Alternate: Norton.

2.2.1.6. Miscellaneous hardware, including pulls and kick plates: Trimco (TRM)

2.2.1.6.1. Approved Alternate: None – Owners Standard.

2.2.1.7. Stop, Anchors and Door Bumpers: Trimco (TRM).

2.2.1.7.1. Approved Alternate: None – Owners Standard.

2.2.1.8. Lock Guards: Ives (IVE).

2.2.1.8.1. Approved Alternate: Trimco

2.2.2. Finishes

2.2.2.1. Finishes are identified in Schedule at end of this Section.

2.2.2.2. Where finish not shown, match finish of lockset.

2.2.2.3. Provide black colored seals unless specified otherwise.

2.2.2.4. Provide fasteners matching in finish, base material and color.

2.2.3. Door Closers:

2.2.3.1. Secure closer base or shoe to door with sex bolt fasteners, painted to match closer finish.

2.2.3.2. Provide parallel arm design, mounted on door, push side, unless noted otherwise.

2.2.3.3. Provide all required shoes, drop brackets, extension and long arms as required to install in designated location.
2.2.3.4. Provide fire retardant fluid in closers for rated openings in compliance with UL 10C.

2.2.3.5. Where door is indicated as having fire resistance rating, provide UL Listed and labeled hardware.

2.2.4. Door Butts:

2.2.4.1. Unless noted otherwise, provide steel or stainless steel hinges, sheradized, with finish as shown in schedule. Provide pre-finish equivalent to Stanley "K" at all exterior doors.

2.2.4.2. Unless noted otherwise, provide hinges in accordance with following schedule.

2.2.4.2.1. Doors up to 4 feet 0 inches high: 2 hinges.

2.2.4.2.2. Doors 4 feet 0 inches to 7 feet 5 inches high: 3 hinges minimum.

2.2.4.2.3. Doors greater than 7 feet 5 inches high: 4 hinges minimum.

2.2.4.2.4. Provide extra heavy weight hinges on doors over 3 feet 5 inches wide.

2.2.4.3. Unless otherwise noted or required, provide full mortise hinges, with non-rising loose pins, ball bearing or oilite bearings, and hospital tips.

2.2.4.4. Provide set screw (NRP) type at exterior outswinging doors to prevent pin removal when door is in closed position.

2.2.4.4.1. Provide security stud hinges at exterior outswinging doors.

2.2.4.5. Where necessary to maintain door clearance at jamb trim, frame conditions, door reveals and similar conditions, furnish wide throw hinges as approved by the Architect.

2.2.4.6. Where door is indicated as having fire resistance rating, provide UL Listed and labeled hardware.

2.2.5. Locksets, Latchsets and Strikes

2.2.5.1. Unless noted otherwise in schedule, all locksets, latchsets, cylinders and component parts shall be the products of a single manufacturer.

2.2.5.2. Provide strikes at all locks with curved lip of sufficient length to protect trim and jamb. Each strike shall include wrought strike box. Provide 7/8 inch lip strikes at pairs of doors.

2.2.5.3. Unless noted otherwise, provide lever handles at all locks, latches, and other door hardware. Provide lever design with maximum of 1/2 inch handle return, measured from door face.

2.2.5.4. Unless noted otherwise, provide 2-3/4 inch backset. Provide minimum 3/4 inch throw, two piece latch bolt with dogging assistance, on all latchsets and locksets.
2.2.6. Fasteners

2.2.6.1. Unless noted otherwise, provide countersunk, full thread, flat head Phillips screw fasteners. Provide machine screws at metal substrates and wood screws at wood substrate.

2.2.6.2. Provide lead shields or similar anchor devices for items fastened to concrete or masonry.

2.2.7. Thresholds

2.2.7.1. Unless noted otherwise, provide aluminum finish thresholds, with proper anchor, insert and fastener.

2.2.7.2. Unless shown otherwise, provide thresholds as indicated in Hardware sets.

2.2.7.3. All thresholds shall comply with Section 1008.1.6 and 1133B.2.4.1.

2.2.8. Kickplates and Accessories

2.2.8.1. Unless noted otherwise, provide stainless steel kickplates, 18 gauge, B4E finish. Provide 10 inches high, 2 inches less than door width on single doors, 1 inch less than door width on pair of doors, with beveled/eased edges.

2.2.8.2. Floor mounted door stops are prohibited where located in the path of travel. Where provided, install maximum 4 inches from wall surface parallel to the direction of travel.

2.2.9. Seals

2.2.9.1. Unless noted otherwise, provide seals complete with retainers, fasteners and trim.

2.2.9.2. Provide UL Listed seals at all rated openings.

2.2.9.3. Unless noted otherwise, provide brush, silicone or polyurethane seals at all door jamb and head conditions. Use of vinyl seals prohibited.

2.3. KEYING

2.3.1. Stamp master keys and grand master keys with a registry number. Do not stamp "Master" or letter "M". Provide three of each, GGM Keys, GM Keys, Master Keys, and Control Keys.

2.3.2. Stamp individual room keys with plain identification number. Do not indicate key cut. Provide four keys per cylinder.

2.3.3. Factory cut all keys and stamp "DO NOT DUPLICATE".

2.3.4. All locksets and cylinders shall be construction keyed with brass cores. Provide plug and extractor or construction control keys, ten each, for the system for final keyway. The Contractor, after Owner's approval, shall remove the construction cores and assist the Owner inserting the permanent cores.
2.3.5. Contractor and hardware supplier shall meet with the Owners Representative and Architect to establish the keying schedule and to provide the correct grand, master, pass and change key groups to properly operate all locking devices. Provide a keying submittal for review and acceptance. Provide a bitting list with keying nomenclature and location for each core and cylinder.

2.3.5.1. Owner’s representative: MaryAnne Wilson, 520-206-2722, Mwilson@pima.edu

2.3.6. Provide record and registration system as directed by Architect.

2.3.7. All locksets and cylinders shall be keyed, masterkeyed, and grand masterkeyed at the factory.

2.3.8. Contractor shall be responsible for completion of keying schedule and ordering all construction and permanent keys.

2.3.9. Deliver keys directly to Owner by registered security shipment direct from hardware manufacturer. Hardware supplier shall not cut keys.

2.4. OTHER MATERIALS

2.4.1. Provide all other materials, not specifically described but required for complete and proper installation of this work, as selected by the contractor and subject to the approval of the Architect.

3. PART 3 - EXECUTION

3.1. SURFACE CONDITIONS

3.1.1. Inspection

3.1.1.1. Prior to all work of this section, carefully inspect the installed work of all other trades and verify that all such work is complete to the point where this installation may properly commence.

3.1.1.2. Verify that work of this Section may be installed in strict accordance with the original design, all pertinent codes and regulations, and all pertinent portions of the referenced standards.

3.1.1.2.1. Verify that power supply of proper voltage and type is available to power operated devices.

3.1.1.3. In the event of discrepancy, immediately notify the Architect.

3.1.1.4. Do not proceed with installation in areas of discrepancy until all such discrepancies have been fully resolved.

3.2. INSTALLATION

3.2.1. Install hardware in accordance with manufacturer’s instructions and requirements of SDI, ANSI/NFPA 80, AWS, and BHMA. Select applicable standard based on door function, type and regulatory criteria.

3.2.2. Renovation of existing hardware assembly.

3.2.2.1. Inspect all existing hardware.
3.2.2. Where door is designated as receiving new hardware, remove, package and label hardware type and function, and deliver to Owner.

3.2.3. Renovate hardware designated to remain with new fasteners, adjustment and alignment as necessary.

3.2.3. Install hardware using templates provided by hardware item manufacturer.

3.2.3.1. Prior to finishing door, fit hardware to door, utilizing fasteners and templates as specified.

3.2.3.2. Remove hardware, carefully label and store. Where door is existing and designated to receive new finish, remove all existing hardware.

3.2.3.3. Re-install after door finish is complete.

3.2.4. Unless noted otherwise or shown on drawings, mount hardware in accordance with the following criteria:

3.2.4.1. Hinges:

3.2.4.1.1. Top and Bottom Hinge: 9-5/8 inches to center of hinge.

3.2.4.1.2. Intermediate Hinge(s): Equally spaced between top and bottom hinge center line

3.2.4.2. Latchset and lockset handle: Mount lockset’s operating at 40 5/16” above the finish floor. Verify manufacturers template with door design.

3.2.4.3. Dead Locks: Mount lockset’s operating hardware at 48 inches above the finish floor.

3.2.4.4. Panic Devices: Mount lockset’s operating hardware at 38 inches above the finish floor. Verify manufacturers template with door design.

3.2.4.5. Push Plate: 40 inches, cut for cylinders or turn pieces if necessary.

3.2.4.6. Door Pulls: 40 inches, cut for cylinders or turn pieces if necessary.

3.2.5. Install thresholds in full bed of sealant at front and side edges.

3.3. DOOR HARDWARE SCHEDULE.

HW-1: Exterior Doors 1 and 2

<table>
<thead>
<tr>
<th>Item</th>
<th>Description</th>
<th>Model/Spec</th>
<th>Quantity</th>
<th>Location</th>
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<td>3</td>
<td>Hinges</td>
<td>FBB199 5” x 4-1/2” NRP</td>
<td>630 STA</td>
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<tr>
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<td>Lockset</td>
<td>Q12 SR 2-3/4” BS #306</td>
<td>626 ARR</td>
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<td>Cylinder</td>
<td>(BY PCC LOCK SHOP NON RC</td>
<td>626</td>
<td></td>
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<tr>
<td>1</td>
<td>Closer/ Stop</td>
<td>4040XP CUSH SRI</td>
<td>689 LCN</td>
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<tr>
<td>1</td>
<td>Lock Astragal</td>
<td>5000</td>
<td>630 TRM</td>
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HW-2: Exterior Door 3.

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<tr>
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<td>Hinges</td>
<td>FBB199 5” x 4-1/2” NRP</td>
<td>630 STA</td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>Panic Device</td>
<td>ED5208 X N955 M51 M110</td>
<td>630 C-R</td>
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</table>
1 Mortise Cylinder (BY PCC LOCK SHOP NON RC 626
1 Closer (Pull Side) 4040XPT Special Template #3592 SRI 689 LCN

Note: Door and frame to be installed flush with outside wall. Door closer body/cover to be installed on wall with track arm installed on door 6" down from top of door.

HW-3: Exterior Existing Door 4

1 Mortise Cylinder (BY PCC LOCK SHOP NON RC 626

Balance of Existing Hdwe. to Remain

END OF SECTION
1. **PART 1 - GENERAL**

1.1. **SECTION INCLUDES**

1.1.1. Metal lath. (used at caps and corners.)

1.1.2. Portland cement plaster system, three coat exterior application 1 inch thick.

1.1.3. Plaster accessories.

1.2. **REFERENCES**

1.2.1. ASTM C144 - Aggregate for Masonry Mortars.

1.2.2. ASTM C150 - Portland Cement.

1.2.3. ASTM C 206 - Finishing Hydrated Lime.

1.2.4. ASTM C 926 – Application of Portland Cement Plaster

1.3. **QUALITY ASSURANCE**

1.3.1. Applicator: Company specializing in cement plaster work.

1.4. **SUBMITTALS: NONE REQUIRED**

1.5. **ENVIRONMENTAL REQUIREMENTS**

1.5.1. Apply plaster materials when substrate or ambient air temperature is within manufacturers temperature ranges.

1.5.2. Maintain manufacturers minimum recommended ambient temperature during and after installation of plaster. Provide barriers, heaters and all other temporary facilities as required.

1.5.3. Take all precautions required to protect plaster from drying winds and other environmental impacts.

2. **PART 2 - PRODUCTS**

2.1. **MANUFACTURERS**

2.1.1. Basis of Design: Characteristics of specific products, where named in this Section, are indicated to establish required level of quality, appearance, and performance.

2.2. **FIELD MIX PLASTER MATERIALS**

2.2.1. Cement: ASTM C150, Type II Portland Cement, low alkali.

2.2.1.1. Use of plastic cement is not permitted.
2.2.2. Lime: ANSI/ASTM C206, Type S.

2.2.3. Aggregate: Clean sharp plastering sand, complying with ASTM C144 and ASTM C897.

2.2.3.1. Finish coat: match existing texture for aggregate and finish.

2.2.4. Water: Clean, fresh, potable and free of mineral or organic matter which can affect plaster.

2.2.5. Plaster Bonding Agent: Larsen Weld-Crete or equal, surface application bonding agent.

2.3. LATH

2.3.1. Self Furred Metal Lath: Cemco or equal, Cem-Lath, 3.4 lb/sq. yd, G40 galvanized finish, self-furring.

2.3.1.1. Cover wall caps and exposed corners with metal lath.

2.4. ACCESSORIES

2.4.1. Corner Reinforcing Lath: 2.7 lb/sq yd expanded metal lath, G40 galvanized, or approved equivalent at all openings.

2.4.2. Expansion and edge accessories:

2.4.2.1. Manufacturer: Provide manufacturer as indicated or approved equal.

2.4.2.2. Outside Lath/Corner Bead: Cemco 1-A series.

2.4.2.3. Interior corners (where shown): Cemco #30, galvanized, ground as required for plaster thickness.

2.4.2.4. Control Joint/Reveal - Type 1: Cemco # XJ-15.

2.4.3. Anchorage: Nails, staples, or other metal supports conforming to requirements of referenced standards, galvanized, of type and size to suit application.

2.4.4. CEMENT PLASTER MIXES

2.4.4.1. Field Mix: Mix and proportion cement plaster in accordance with ASTM C 926, Table 3, for type C portland cement plaster. Do not add plasticizers of any kind. Incorporate specified fiber reinforcing in mix design.

2.4.4.2. Mix only as much plaster as can be used in one hour.

2.4.4.3. Protect mixtures from frost, contamination, and evaporation.

2.4.4.4. Do not re-temper mixes after initial set has occurred.

2.5. OTHER MATERIALS

2.5.1. Provide all other materials, not specifically described but required for complete and proper installation of this work, as selected by the contractor and subject to the approval of the Architect.
3. **PART 3 - EXECUTION**

3.1. **SURFACE CONDITIONS**

3.1.1. Inspection

3.1.1.1. Prior to all work of this section, carefully inspect the installed work of all other trades and verify that all such work is complete to the point where this installation may properly commence.

3.1.1.2. Verify that work of this Section may be installed in strict accordance with the original design, all pertinent codes and regulations, and all pertinent portions of the referenced standards.

3.1.1.2.1. Mechanical and Electrical: Verify services within walls have been tested and approved.

3.1.1.3. In the event of discrepancy, immediately notify the Architect.

3.1.1.4. Do not proceed with installation in areas of discrepancy until all such discrepancies have been fully resolved.

3.2. **PREPARATION**

3.2.1. Protect surfaces near the work of this Section from damage or disfiguration.

3.2.2. Provide water-resistant underlayment as specified at plaster accessory installation.

3.2.3. Concrete/Masonry wall applications:

3.2.3.1. Provide surface treatment of masonry and concrete surfaces as required to achieve proper bond and adhesion.

3.2.3.2. Remove all surface coatings, dirt, glossy or smooth finishes limiting plaster adhesion.

3.2.3.3. Where necessary, sandblast concrete surfaces to remove surface paste film.

3.3. **PLASTER ACCESSORIES AND CONTROL JOINTS**

3.3.1. Place specified plaster accessories at terminations of plaster finish per ASTM C 1063.

3.3.1.1. Neatly miter or cope, corners and intersections of accessories to fit exposed edges.

3.3.2. Install accessories to proper lines and levels. Provide 1/8 inch spacing at joints. Align intersections.

3.3.3. Establish control and expansion joints with specified joint devices. Do NOT allow lath to continue behind or through expansion joint.

3.3.4. Provide joints as shown on drawings. Where joints not shown, provide as directed by Architect in compliance with the following criteria:
3.4.  **TOLERANCES**

3.4.1. Exposed finish plaster: Maximum variation from true plane limited to 1/4 inch plus or minus, in 10 feet, non-cumulative.

3.5.  **CLEANING AND PROTECTION**

3.5.1. Protect all frames, accessories, glass and thresholds from plaster application with complete waterproof protective sheeting or tape.

3.5.1.1. Remove all traces of spilled or splashed plaster from surfaces and landscaping. Do not discharge plaster wash-off into planter areas.

3.5.2. Remove all covering and tape within two weeks of plaster completion in any one area.

**END OF SECTION**
SECTION 09 91 00
PAINTING

1. PART 1 - GENERAL

1.1. SECTION INCLUDES

1.1.1. Surface preparation.

1.1.2. Surface paint finishes as scheduled.

1.1.3. Renovation and re-finishing of existing finishes.

1.2. REFERENCES

1.2.1. ASTM D 16 - Definitions of Terms Relating to Paint, Varnish, Lacquer, and Related Products.

1.2.2. ASTM D 3359 – Test Method for Measuring Adhesion by Tape Test.


1.3. REGULATORY REQUIREMENTS

1.3.1. Submit manufacturer's certification of compliance with local criteria regarding VOC limits for all applied paints and coatings.

1.4. APPLICATOR: COMPANY SPECIALIZING IN COMMERCIAL PAINTING AND FINISHING.

1.4. SUBMITTALS

1.4.1. Provide submittals under provisions of Section 01 33 00.

1.4.2. Product Data: Submit product data of all proposed products, identifying product series, material composition, performance characteristics and sheen.

1.4.2.1. Submit manufacturer's certificate that products comply with current safety and environmental regulations, including hazardous materials labeling and air quality/VOC regulations.

1.4.2.2. Submit manufacturer's certificate that products are physically and chemically compatible with each other and meet listed ASTM or Federal Specifications.

1.4.2.3. Where applicable, provide manufacturer's written evaluation of existing paint/coating systems, including directions as to surface preparation and primers compatible with existing systems.

1.4.3. Submit manufacturer's application instructions for each painting system, including surface preparation.
1.5. DELIVERY, STORAGE, AND HANDLING

1.5.1. Deliver products to site under provisions of Section 01 65 00.

1.5.2. Store and protect products under provisions of Section 01 65 00.

1.5.3. Deliver products to site in sealed and labeled containers; inspect to verify acceptance.

1.5.4. Container labeling to include manufacturer's name, type of paint, brand name, brand code, coverage, surface preparation, drying time, cleanup, color designation, and instructions for mixing and reducing.

1.5.5. Store paint materials at minimum ambient temperature of 45 degrees F and a maximum of 90 degrees F, in an enclosed metal storage container located outside of building, unless required otherwise by manufacturer's instructions.

1.5.6. Take precautionary measures to prevent fire hazards and spontaneous combustion.

1.6. ENVIRONMENTAL REQUIREMENTS

1.6.1. Provide continuous ventilation and heating facilities to maintain surface and ambient temperatures above 65 degrees F for 24 hours before, during, and 48 hours after application of finishes, unless required otherwise by manufacturer's instructions.

1.6.2. Prior to beginning preparation and coating application, provide lighting level of 80 foot candles measured on substrate surface. Where natural lighting does not provide such levels, provide temporary lighting.

2. PART 2 - PRODUCTS

2.1. ACCEPTABLE MANUFACTURERS

2.1.1. Basis of Design: Specific products listed on Schedule in Part 3 of this Section, are indicated to establish required level of quality, appearance, and performance. Architect will consider requests for substitutions under the provisions of Section 01 25 00.

2.2. MATERIALS

2.2.1. Coatings: Ready mixed, except field catalyzed coatings.

2.2.2. Accessory Materials: Provide all admixtures, thinners, flow agents and other materials not specifically indicated but required to achieve the finishes specified.

2.3. FINISHES/COLOR

2.3.1. Refer to schedule at end of Section for type of surface finish.

2.3.2. Colors shall match existing colors.

2.3.3. Each coat shall be a perceptibly different tint.
2.4. OTHER MATERIALS

2.4.1. Provide all other materials, not specifically described but required for complete and proper installation of this work, as selected by the Contractor and subject to the approval of the Architect.

3. PART 3 - EXECUTION

3.1. SURFACE CONDITIONS

3.1.1. Inspection

3.1.1.1. Prior to all work of this Section, carefully inspect the installed work of all other trades and verify that all such work is complete to the point where this installation may properly commence.

3.1.1.2. Verify that work of this Section may be installed in strict accordance with the original design, all pertinent codes and regulations, and all pertinent portions of the referenced standards.

3.1.1.2.1. Examine surfaces scheduled to be finished prior to commencement of work. Report any condition that may potentially affect proper application.

3.1.1.2.2. Measure moisture content of surfaces using an electronic moisture meter. Do not apply finishes unless moisture content of surfaces are below the maximum levels recommended by the manufacturer:

3.1.1.3. In the event of discrepancy, immediately notify the Architect.

3.1.1.4. Do not proceed with installation in areas of discrepancy until all such discrepancies have been fully resolved.

3.2. PREPARATION

3.2.1. Remove electrical plates, hardware, light fixture trim, and fittings prior to preparing surfaces or finishing.

3.2.2. Correct minor defects and clean surfaces which affect work of this Section.

3.2.3. Shellac and seal marks which may bleed through surface finishes.

3.2.4. Steel Surfaces: Touch up damaged or spalled primed surfaces.

3.2.4.1. Shop Primed Steel Surfaces: Sand and scrape to remove loose primer and rust. Feather edges to make touch-up patches inconspicuous.

3.2.4.2. Bare Steel: Sand and scrape to remove loose primer and rust. Clean surfaces with solvent.
3.2.4.3. Galvanized steel: Test all galvanized steel surfaces for evidence of chromate conversion treatments or other post-galvanizing applications that are not compatible with paint finishes. Where testing demonstrates presence of such treatment, brush blast or otherwise mechanically abrade the surface as required by coating manufacturer.

3.2.5. Gypsum Board Surfaces: Latex fill minor defects. Spot prime defects after repair. Remove drywall texture nibs and other protrusions.

3.2.6. Cement Plaster Surfaces: Repair minor defects, including cracks, in an approved manner. Remove plaster nibs and other protrusions.

3.2.7. Steel Doors and Door Frames: Repaint existing door and frame. Paint new doors and frames.

3.2.7.1. Provide specified primer at all frames, including frames with fabricators primer system. Comply with criteria specified in this Section.

3.2.7.2. Prepare frame steel surfaces as required for proper adhesion and appearance of specified finish coat system.

3.2.7.3. Paint all surfaces of window frames, including surfaces not visible when operable vent portions are in closed position.

3.3. PROTECTION

3.3.1. Protect elements surrounding the work of this Section from damage or disfiguration.

3.3.2. Repair damage to other surfaces caused by work of this Section.

3.3.3. Furnish drop cloths, shields, and protective methods to prevent spray or droppings from disfiguring other surfaces.

3.3.4. Remove empty paint containers from site.

3.4. APPLICATION

3.4.1. Apply products in accordance with manufacturer's instructions.

3.4.2. Do not apply finishes to surfaces that are not dry.

3.4.3. Apply each coat to uniform finish.

3.4.4. The number of coats specified are minimum. Additional coats shall be applied until finish is uniform in color and sheen.

3.4.5. Sand lightly between coats to achieve required finish.

3.4.6. Obtain Owners Representative approval of each coat prior to applying succeeding coat.

3.4.7. Allow applied coat to dry before next coat is applied.

3.4.8. Do not paint over labels at fire rated doors, door or window frames or other fire rated assemblies.
3.4.9. Paint all structural components and surfaces visible through louvers and vents in wall and soffit surfaces.

3.4.10. Steel Doors: Finish all surfaces of doors, including tops and bottoms.

3.4.10.1. Apply paint to non-factory prefinished doors and frames by spray method only.

3.4.11. Exterior surfaces, including plaster, concrete, metal fabrications, structural components and metal flashings: Unless noted otherwise, apply paints and coatings as specified below:

3.4.11.1. Paint all exposed steel or metal including railings, steel structural components, all roof flashings and accessories, all plaster trim and accessories, and all mechanical and electrical system components.

3.4.11.2. Apply exterior paint to steel structural components, and miscellaneous fabrications visible to the eye from typically occupied locations in the finished project.

3.4.11.3. Apply exterior paint to all plaster trim, reveals and accessories.

3.4.11.4. Apply paint to all other exterior components as specified or shown on drawings.

3.5. FINISHING MECHANICAL AND ELECTRICAL EQUIPMENT/

3.5.1. Scope of work: Paint new work, and work affected by installation only.

3.5.2. Paint shop primed equipment.

3.5.3. Do not paint pre-finished equipment.

3.5.4. Remove unfinished louvers, grilles, covers, and access panels on mechanical and electrical components and paint separately.

3.5.5. At interior and exterior applications, prime and paint insulated and exposed pipes, conduit, boxes, insulated and exposed ducts, mechanical equipment units, hangers, brackets, collars and supports, except where items are prefinished.

3.5.6. Replace identification markings on mechanical or electrical equipment when painted accidentally.

3.5.7. Replace electrical plates, hardware, light fixture trim, and fittings removed prior to finishing.

3.6. CLEANING

3.6.1. As Work proceeds, promptly remove paint where spilled, splashed, or spattered.

3.6.2. During progress of Work maintain premises free of unnecessary accumulation of tools, equipment, surplus materials, and debris.

3.6.3. At end of workday remove from building flammable paint, solvents, and reducing agents.
3.6.4. Collect cotton waste, cloths, and material which may constitute a fire hazard, place in closed metal containers and remove daily from site.

3.7. SCHEDULE

3.7.1. For ease of specifying, unless otherwise noted, product numbers of Frazee have been used. Equivalent products of Vista, Sherwin Williams, GliddenProfessional, Dunn Edwards, and other manufacturers may be used subject to the substitution provisions listed under Section 01 25 00.

3.7.2. Steel Doors and Frames/Miscellaneous metal- Galvanized - Semi-Gloss

3.7.2.1. Solvent clean, etch with PCI 02150 Metal Conditioner solution and rinse with clear water.

3.7.2.2. One coat primer # 561 Acrylic Metal Prime

3.7.2.3. Two Coats Finish #124 Mirroglide

3.7.3. Gypsum Board - Low Sheen/Eggshell Paint Finish

3.7.3.1. One coat Frazee Aqua Seal #061 Vinyl Acrylic Wall Sealer

3.7.3.2. Two coats Frazee Envirokote #029.

3.7.4. Ferrous metal piping, miscellaneous metal fabrications, and related components.

3.7.4.1. Solvent clean and rinse with clear water.

3.7.4.2. One coat primer # 561 Acrylic Metal Prime

3.7.4.3. Two Coats Finish #128 Satinglide

3.7.5. Cement Plaster and Masonry: Eggshell enamel finish

3.7.5.1. One coat Frazee filler #262.

3.7.5.2. Two coats Frazee Envirokote #029.

END OF SECTION
1. **PART 1 - GENERAL**

1.1. **WORK INCLUDED**

1.1.1. Plumbing Fixtures
1.1.2. Plumbing Specialties
1.1.3. Plumbing Equipment

1.2. **RELATED SECTIONS**

1.2.1. Section 23 05 00 - Basic Mechanical Materials and Methods
1.2.2. Section 23 07 00 - Mechanical Insulation
1.2.3. Section 23 20 00 - Building Services Piping
1.2.4. Section 21 11 00 - Fire Protection

1.3. **QUALITY ASSURANCE**

1.3.1. The plumbing equipment schedules are shown on the drawings. The following is a list of additional equipment approved for use on this project:

1.3.1.1. **SANITARY FLOOR DRAIN**: Josam, J.R. Smith, Ancon, Rockford, Wade, Zurn, Watts

1.3.1.2. **TRAP SEALER**: Sure Seal, J.R. Smith

1.4. **SUBMITTALS (Also refer to Section 23 05 00 and Section 01 33 00)**

1.4.1. Before beginning work, provide shop drawings on the following items:

1.4.1.1. Plumbing fixtures
1.4.1.2. Drains
1.4.1.3. Plumbing Specialties
1.4.1.4. Other items as directed by the Owner

2. **PART 2 - PRODUCTS**

2.1. **FIXTURES**

2.1.1. General:
2.1.1. Furnish and install all plumbing fixtures as indicated below. All fixtures shall be white and be of the same manufacturer unless otherwise noted. All fixtures to have accessible stops and all faucets shall have renewable seats, discs, and metal indexed handles. All fixture trim shall be chrome plated and by the same manufacturer unless otherwise noted.

2.1.2. Cleanouts:

2.1.2.1. Floor cleanouts in finished floors shall be Wade W-6000-Z series with nickel bronze cover and frame, adjustable top, and tapered bronze plug. Cleanouts in concrete floors shall be provided with standard tractor type covers. Cleanouts in carpeted areas shall be provided with carpet flange top. Cleanouts in tile floors shall be provided with square or round tops for tile or terrazzo as required.

2.1.2.2. Wall cleanouts shall be Wade W-8560-E series with 8480-R. Cast iron tee with countersunk brass plug drilled for cover screw and round stainless steel access cover.

2.1.2.3. Exterior cleanouts in non-traffic areas or pedestrian light-traffic areas shall be Wade W-6000-Z-179 series with nickel bronze cover and frame, adjustable top, tapered bronze plug, and vandal proof top. Set in an 18" cube of concrete.

2.1.2.4. Exterior cleanouts in traffic areas shall be Wade W-8300-MF with W-8550-B series. Access housing with adjustable anchor flange and extra-heavy secured scoriated ductile iron cover set in an 18" cube of concrete. With cast iron cleanout ferrule with spigot outlet and raised tapered brass plug.

2.1.2.5. Provide membrane clamps for cleanouts installed in surfaces have waterproofing membranes installed.

2.1.3. Fixture Specifications:

P-1: Sanitary Floor Drain:
Wade Model #W-9142, 12" x 12" x 8" cast iron sanitary floor drain with A.R.E. interior, aluminum dome strainer, seepage flange, and nickel bronze hinged top. Provide deep seal trap

HB: Hose Bibb:
Chicago Faucet Co. Model #387 polished chrome plated 3/4" with vandal proof lock shield removable tee handle and Chicago model #E27 vacuum breaker.

2.2. PLUMBING SPECIALTIES

2.2.1. Provide ASSE 1072-07 listed trap sealer (Sure Seal or equivalent) on all floor drains and sanitary floor drains provided on this project.

3. PART 3 - EXECUTION:

3.1. GENERAL

3.1.1. All changes in the plumbing work made after letting of the contract, in order to comply with the applicable codes or requirements of the plumbing inspectors, Health inspectors, Utility Regulatory Agency and similar shall be made without additional cost to the Owner.
3.1.1.1. Should the Plumbing Contractor or any of the Subcontractors 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 Engineer.

3.2. INSTALLATION

3.2.1. Secure each water line where it penetrates partitions to serve fixtures, shower arms, hose bibbs and similar items. Wrap all piping in block walls or penetrating concrete with 10 mil polyethylene tape or covering with polysleeve.

3.2.2. Set hose bibbs 18 inches above finished grade, unless otherwise indicated. Adjust height as required to line-up bottom or top edge of wall hydrants with masonry seams where applicable. Grout water-tight any wall penetrations with non-shrinking grout. Wall hydrants shall be installed level and square with face flush with finished wall face. Thoroughly clean after installation.

3.2.3. Cleanouts shall be installed in accessible locations. Wall cleanout access covers shall be installed above bottom course of tile when installed in tiled walls. Floor and ground cleanouts shall be installed with covers set flush to finished grade or floor.

3.2.4. During construction, floor drains, fixtures, and equipment shall be provided with adequate protection against damage and sealed against entrance of construction debris. Floors shall not be washed into floor drains as part of the construction clean-up process.

END OF SECTION
1. **PART 1 - GENERAL**

1.1. GENERAL

1.1.1. This section covers basic materials and methods which may be common to one or more subsequent sections.

1.2. WORK INCLUDED

1.2.1. Mechanical Sound, Vibration, and Seismic Control
1.2.2. Mechanical Identification
1.2.3. Motors
1.2.4. Access Panels and Doors

1.3. RELATED SECTIONS

1.3.1. Section 01 33 00 – For submittals
1.3.2. Section 01 77 00 – Record drawings and O&M manuals
1.3.3. Section 03 30 00 – For mechanical supports
1.3.4. Section 09 91 00 – For field painting of equipment and piping, other than for identification.
1.3.6. Section 23 09 33 – Adjustable frequency motor control
1.3.7. Section 26 39 13 – For motor starters

1.4. SYSTEM DESCRIPTION

1.4.1. The work under this section of the specification shall include all systems as shown on drawings or specified herein. This shall include all items of a minor nature necessary to complete the installation whether specifically mentioned in the contract documents or not.

1.4.2. Drawings are diagrammatic. Dimensions given in figure on the plans shall take precedence over scaled dimensions and all dimensions, whether given in figures or scaled, shall be verified in the field.

1.4.3. No ductwork or piping shall be shop fabricated before clearances are field verified. Offsets and transitions required because of interferences encountered in the field shall be a part of this contract and shall be shown on record drawings.

1.5. PROJECT/SITE CONDITIONS

1.5.1. Before submitting a bid, carefully study the Civil, Architectural, Electrical and Mechanical drawings. Make a careful examination of the premises and any existing work. Determine, in advance, the methods of installing and connecting the apparatus, the means to be provided.
for getting the equipment into place, and become thoroughly familiar with all of the requirements of the contract.

1.6. REFERENCES

1.6.1. All work shall be performed in accordance with all codes, laws, rules and regulations of all National, County, State and Local authorities having jurisdiction over the premises. This shall include, but not be limited to, the latest editions of the Uniform Plumbing Code, the International Mechanical Code, the International Building Code, State or local Board of Health, Federal and State Environmental protection regulations, International Energy Conservation Code and Utility Regulatory Agencies, Occupational Safety and Health Act, the American Gas Association, National Fire Protection Association, and the International Fire Code. In case of differences, between codes, ordinances, specifications, or plans, the most stringent shall apply. This does not delete requirements of plans and specifications which may be in excess of code requirements.

1.7. QUALITY ASSURANCE

1.7.1. The mechanical systems have been designed around the makes and sizes of equipment named on the drawings or elsewhere in the specifications. Other makes of equipment named in the specifications, shown on the drawings, or approved by the Architect as outlined in Division 01, may be furnished at the contractor’s option. Equipment furnished must have equivalent capacity, the same electrical characteristics, substantially the same physical dimensions, and can be installed in the space available with ample working space around it. Any extra costs resulting from equipment substitution shall be at no cost to the owner.

1.7.2. Where possible, all items of the same type (i.e. pumps, fans, fixtures) shall be by the same manufacturer.

1.7.3. Where instructions on installation are not included in these specifications or on the plans, the manufacturer’s instructions shall be followed.

1.8. SUBMITTALS

1.8.1. See Section 01 33 00 for general submittal requirements. Refer to subsequent sections for other requirements.

1.8.2. Before beginning work and prior to placing orders, submit one electronic copy of shop drawings or literature in PDF format (separating groups of similar items) on fixtures, materials, and equipment to be furnished. Each cut-sheet or shop drawing shall have options and selections highlighted or otherwise clearly identified. Each cut-sheet or shop drawing shall include: mark indicated on drawings, manufacturer with address and phone number, model number, capacities, ratings, dimensions, electrical characteristics, trim, and accessories. Each cut sheet or shop drawing shall be an original from the manufacturer or a clean and clear black and white copy. Each submittals shall include a cover sheet indicating the project title, Architect, General Contractor’s name, and contractor’s name, address, and phone.

1.8.3. Submittals not in the format of paragraph B or illegible will be returned. All submittals shall be complete, shall be submitted at one time and shall not be submitted in batches. Separate complete submittals for Plumbing, HVAC, and Fire Protection may be submitted. HVAC control drawings may be submitted separate from the rest of the HVAC submittals. Reference Spec Section 01 33 00.

1.8.4. Resubmittals shall be issued per the requirements outlined above, except resubmittals shall be marked as “resubmittal” on each page.

1.8.5. Before submitting any equipment for review, determine that such equipment will fit satisfactorily into the space allotted to it.
1.8.6. When equipment or materials submitted differ from that specified or when local conditions
necessitate an arrangement of equipment or materials different from that indicated on the
drawings, submit for review shop drawings showing proposed rearrangement before
installation. Any deviations from plans and specifications shall be called to the attention of
the Architect in writing.

1.8.7. Voltage and phase of motors furnished under this section shall be as indicated on the
electrical drawings. Verify electrical characteristics with electrical drawings before final
ordering of equipment.

1.8.8. Submittals will be checked for general compliance only and should not be relied on for
review of quantities, fabrication methods, safety precautions, or electrical or physical
coordination. Requirements of contract documents are not limited, waived, or superseded by
submittal review.

1.9. FEES, PERMITS & INSPECTIONS (also refer to Section 01 41 00)

1.9.1. The Architect-Owner shall secure and pay for all permits and fees including, but not limited
to: water meters, fire line connection charges, sewer connection fees, and other mechanical
connection charges required for the installation of the mechanical systems. The Contractor
shall arrange for all inspections and secure all approvals required for work.

1.10. COOPERATION AND WORK PROGRESS:

1.10.1. Perform work so that progress of project, including work of other Trades is not delayed.

1.10.2. Coordinate work of this Section with work of other Sections to complete work as soon as
conditions permit and to minimize interruptions of building functions. Assume additional
costs incurred due to lack of or improper coordination with work of other Sections.

1.10.3. Coordinate exact mounting arrangement and location of equipment shown on Drawings.
Allow for proper space requirements for equipment access, operation and maintenance.
Particular attention shall be given to group installations. If insufficient space or conflict with
work of other Sections will prevent proper installation, access, operation, or maintenance of
shown equipment, immediately notify Architect and do not proceed with this part of Contract
work until directed by Architect.

2. PART 2 - PRODUCTS

2.1. MECHANICAL SOUND, VIBRATION, AND SEISMIC CONTROL

2.1.1. All equipment, piping, registers and grilles, etc., shall be installed to meet local seismic code
requirements including but not limited to the following:

2.1.1.1. Isolators under equipment shall have seismic restraint.

2.2. MECHANICAL IDENTIFICATION

2.2.1. Provide coiled plastic pipe markers for pipe identification of all exposed piping or piping
above accessible ceilings. Markers used on outdoor piping shall be approved for outdoor
use.

2.2.2. Provide 2" x 3" or larger laminated black plastic nameplates with one-half inch engraved
white numbers and letters for each piece of equipment. Nameplate materials mounted
outside shall be resistant to UV degradation.

2.2.3. Approved pipe identification and engraved plastic tag manufacturers: Seton, Brimar
2.2.4. Valves shall be provided with brass valve tags stamped with valve number and identification for service.

2.2.5. Piping Painting:

2.2.5.1. All exposed steel piping and all equipment room piping indicated below shall be painted. Coordinate with Section 09 90 00 for painting. The color code scheme shall be as indicated in the table below. The color code is per Federal Standard No. 595A.

<table>
<thead>
<tr>
<th>PIPING CONTENTS</th>
<th>COLOR</th>
<th>COLOR CODE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fire Protection</td>
<td>Red</td>
<td>11105</td>
</tr>
<tr>
<td>Domestic Cold Water</td>
<td>White</td>
<td>17875</td>
</tr>
<tr>
<td>Domestic Hot Water</td>
<td>Gray</td>
<td>16473</td>
</tr>
<tr>
<td>Chilled Water Supply</td>
<td>Light Blue</td>
<td>15200</td>
</tr>
<tr>
<td>Chiller Water Return</td>
<td>Dark Blue</td>
<td>15102</td>
</tr>
<tr>
<td>Heating Water Supply</td>
<td>Yellow</td>
<td>13618</td>
</tr>
<tr>
<td>Heating Water Return</td>
<td>Orange</td>
<td>12473</td>
</tr>
<tr>
<td>Condenser Water Supply</td>
<td>Light Green</td>
<td>14491</td>
</tr>
<tr>
<td>Condenser Water Return</td>
<td>Dark Green</td>
<td>14110</td>
</tr>
<tr>
<td>Steam Piping Supply</td>
<td>Yellow</td>
<td>23793</td>
</tr>
<tr>
<td>Steam Condensate Return</td>
<td>Yellow</td>
<td>23814</td>
</tr>
<tr>
<td>Gas Piping</td>
<td>Yellow</td>
<td>13538</td>
</tr>
<tr>
<td>Make-up Water</td>
<td>Brown</td>
<td>10371</td>
</tr>
<tr>
<td>Condensate</td>
<td>Gray</td>
<td>16357</td>
</tr>
<tr>
<td>Oxygen</td>
<td>Green</td>
<td>14090</td>
</tr>
<tr>
<td>Air</td>
<td>Yellow</td>
<td>13655</td>
</tr>
<tr>
<td>Vacuum</td>
<td>White</td>
<td>17875</td>
</tr>
</tbody>
</table>

2.2.5.2. Primer on exposed steel piping shall be iron oxide Fed Spec TT-P-664D. Second and third coats for exterior piping shall be alkyd-enamel resin Fed Spec TTP-37D and TT-E-489H Class A. The second and third coat for exposed interior steel pipe shall be semi-gloss enamel Fed Spec TT-E-508C. Installation to be per manufacturer recommendations. Note: Products specified in Section 09 90 00 shall take precedence.

2.3. MOTORS

2.3.1. Motors shall be NEMA Premium efficiency as tabulated below and in accordance with NEMA MG 1-1998, "Motors and Generators," and IEEE 112 Test Method B. Provide motor starters and coordinate with Electrical. Motor efficiencies shall be part of each submittal for equipment with a motor.

<table>
<thead>
<tr>
<th>Minimum Motor Efficiency %</th>
<th>Open Drip-Proof</th>
<th>Totally Enclosed Fan-Cooled</th>
</tr>
</thead>
<tbody>
<tr>
<td>HP 1200 RPM</td>
<td>91.7</td>
<td>91.7</td>
</tr>
<tr>
<td>1800 RPM</td>
<td>93.0</td>
<td>92.4</td>
</tr>
<tr>
<td>3600 RPM</td>
<td>90.2</td>
<td>91.0</td>
</tr>
</tbody>
</table>

2.3.2. Motors used with adjustable frequency motor controllers shall be squirrel-cage induction type manufactured and rated for inverter duty. Efficiencies shall be as shown in paragraph A above.

2.4. ACCESS PANELS AND DOORS

2.4.1. Provide access panel for any concealed equipment or valve requiring access. This includes...
2.4.2. Access doors for lined duct shall be insulated access door type. Access doors for wrapped duct shall have insulation trimmed back and insulation glued to the outside of the access door. Access doors for fire rated construction shall maintain rating of construction after installation. All access doors shall have screwdriver-operated latches.

2.4.3. Approved access panel and door manufacturers: Cesco, Karp, and Ductmate Industries

3. PART 3 - EXECUTION

3.1. GENERAL

3.1.1. All work shall be performed by personnel and company with a minimum of three years experience in this type of work. All work shall be under the direct supervision of a competent foreman. Verification of similar work experience may be required prior to beginning work. All work shall be planned and carried out so as not to interfere with the progress of the work by other sections on the job.

3.1.2. Locations indicated on the drawings show the arrangement desired for the principal apparatus and shall be followed as closely as possible. The work shall be laid out on the job to secure a neat arrangement, to secure the best conditions throughout, and to overcome local difficulties and interferences where encountered. Equipment shall be installed to permit access for service. All installations shall be made as recommended by the equipment manufacturers.

3.1.3. Erect equipment and accessories in neat and workmanlike manner. All piping, ductwork, etc. shall be run parallel and at right angles to building. Align, level and adjust for satisfactory operation, install so that connecting and disconnecting of piping and accessories can be made readily and so that all parts are easily accessible for inspection, operation and maintenance.

3.1.4. Be fully responsible for any and all damages to fixtures and equipment that results from improper handling or installation.

3.1.5. Provide safety guards for any equipment that may present a hazard to personal safety.

3.2. TEMPORARY FACILITIES

3.2.1. Staging and Scaffolding:

3.2.1.1. All staging and scaffolding, exterior and interior, required to be over eight feet in height, shall be furnished, erected and maintained in safe condition for proper execution of the work.

3.2.1.2. Staging, Scaffolding and other temporary construction shall be rigidly built in accordance with local and state requirements. Remove from premises upon completion of work.

3.2.2. Provide temporary construction required for work as directed by Architect.

3.2.3. Hoisting Equipment and Machinery:

3.2.3.1. All hoisting equipment and machinery required for the placement of equipment shall be furnished, installed, operated, and maintained in safe condition.
3.3.1. Protect all equipment, materials, and plumbing fixtures on the job site until project has been finished.

3.3.2. All equipment shall be tightly covered and protected against dirt, water, chemical or mechanical injury, and theft. Insulation damaged by rain or water shall be replaced at no cost to owner. Plumbing fixtures shall be covered with heavy paper coverings after installation and shall be thoroughly cleaned after completion of the project.

3.3.3. Any mechanical items damaged by exposure to the weather shall be replaced or refinished. Any damage or defect of work developed before final acceptance of work shall be replaced or repaired at no cost to the owner.

3.3.4. All materials such as valves, fittings, piping, equipment, pumps, coils, etc., shall be properly protected. All duct and piping openings shall be temporarily closed at the end of each working day to prevent obstruction and damage. Open ended ducts or plenums shall not be used for storage of materials or for temporary staging during construction.

3.3.5. At the completion of the work, equipment and materials shall be cleaned, polished thoroughly and turned over to the Owner in a condition satisfactory to the Architect.

3.4. MECHANICAL IDENTIFICATION

3.4.1. Screw tags to equipment with pan head sheet metal screws or strap to equipment in obvious locations. Attachment methods shall be in accordance with manufacturer’s recommendations. Engrave equipment designation and numbers as shown on plans and drawings on upper half of tag, leaving lower half of tag for future engraving. Tags for valves shall be attached using solid brass jack chain.

3.4.2. Access points for fire and/or smoke dampers shall be permanently identified on the exterior by a label with letters not less than “one-half inch” (13mm) in height reading: SMOKE DAMPER or FIRE DAMPER.

3.4.3. Pipe markers on exposed piping shall be maximum 25'-0" on center. Pipe markers on piping above accessible ceilings shall be maximum 6'-0" on center. Pipe markers shall indicate flow direction at every marker location (with arrows pointing away from text). Markers shall be installed per latest standards for markers. Markers shall not be required on painted piping.

3.5. PAINTING

3.5.1. Touch-up damaged factory finishes with factory approved products in accordance with manufacturer’s instructions.

3.5.2. All surfaces to be painted shall be thoroughly cleaned of grease, dirt and oil before paint is applied. Painting materials, the application thereof, and protection of other work shall conform to the requirements of Section 09 90 00.

3.5.3. Paint all plastic pipe exposed to sunlight with two coats of white latex paint.

3.5.4. All uninsulated steel piping either exposed to weather or visible in equipment rooms shall be painted white.

3.6. CUTTING & PATCHING

3.6.1. Provide all openings through walls, floors and the roof necessary for the installation of the work under this Section. Openings shall be neatly cut with any damage to the building repaired and repainted.

3.6.2. Layout all chases and openings required, and furnish and set all sleeves, concrete inserts
and anchor bolts required for the installation of work under this Division.

3.7. MECHANICAL PROVISIONS

3.7.1. Extend all inaccessible oil or grease fittings by copper tubing to readily accessible locations.

3.8. TESTS AND ADJUSTMENTS

3.8.1. Notify the Architect of readiness to perform a test 24 hours in advance and all tests shall be performed in the presence of the Architect's representative and Pima Community College Facilities Management. Any defective material and/or equipment shall be repaired, adjusted and/or replaced by like new materials and/or equipment before acceptance. Pima Community College retains the right to request retesting if the original testing was performed without presence by the Architect representative and Pima Community College Facilities Management.

3.8.2. All items such as valves, gauges, traps, strainers, etc., which may be damaged by the test pressure shall be removed before the tests are made and shall not be replaced until the tests have been approved.

3.8.3. Furnish all pumping equipment tools, instruments, equipment, and temporary connections required for tests.

3.8.4. All defects which develop under tests shall be repaired promptly and the tests repeated. No caulking of screwed joints, cracks or holes will be permitted. Leaks in screwed joints shall be repaired by replacing the pipe or the fittings or both with new material. Leaks in copper fittings shall be repaired by melting out the joint, thoroughly cleaning both parts and resoldering.

3.8.5. Lubricate, start up, and operate all equipment and demonstrate its operation and compliance with the specifications. Any undue noise, vibration and/or other objectionable features shall be promptly repaired and/or the device replaced and the system retested.

3.8.6. All systems shall be placed in service and be operating properly for a period of not less than seven consecutive 24-hour days before acceptance.

3.8.7. A written report of all test results shall be submitted to the Architect for approval.

3.9. CLEANING-UP

3.9.1. At all times keep the building and premises in a neat manner. All instructions issued by the Architect and indicated elsewhere in these specifications in regard to storage of materials, protective measures, cleaning of debris etc., shall be followed. Upon completion of the work, thoroughly clean all machinery, piping, etc., and leave areas directly affected by work broom clean.

3.10. SYSTEM CLEANING AND START UP

3.10.1. The piping systems shall first be flushed with city water before the boiler, chiller or air handling units are connected to the system. The boiler, chiller, and/or air handling units shall then be connected and the system cleaned thoroughly with a solution of tri-sodium phosphate with circulating pumps in operation. The systems then shall be flushed, filled with fresh water and vented or purged of air. The system water should test slightly alkaline (above 7 and below 9 pH). Circulate the systems in a cold condition for several hours and re-vent at all high points. The heating system water shall then be heated to 200 degrees F. and again purged of air. The system water shall then be allowed to cool to operating temperature and a final check of the pH made. A final solution of boron nitrate (600 ppm chilled water, 900 ppm heating water) shall be added to the closed loop. The pressure at the
expansion tank shall be set at 12 psig.

3.10.2. Provide temporary connections and arrange piping in such a way to facilitate flushing and cleaning.

3.10.3. The system flushing, cleaning, and testing shall be supervised by a water treatment company and three copies of a report of start up procedure, chemicals added, and a final pH submitted to the Architect.

3.11. RECORD DRAWINGS

3.11.1. Maintain a clean, undamaged set of blueline or blackline contract drawings on site. Record all changes from contract drawings including “found” conditions, addenda, change orders, or other instructions issued by the Architect and submit to Architect as “record drawings” at close of project. Changes to contract documents shall be clouded and dated. Include dimensioned locations of underground piping from a clearly visible point on the building. Refer to Section 01 77 00.

3.12. CERTIFICATES

3.12.1. Perform sterilization of the domestic water systems with a 50 ppm chlorine at each valved outlet to be held for twenty-four hours with tests every eight hours or 200 ppm and allowed to stand for 3 hours. Then flush all outlets to 0.2 ppm. Testing shall be provided by locally based, full time, full service water treatment company with a minimum of three years experience in the water treatment business. Furnish all equipment and chemicals required. Provide appropriate tags on all outlets during testing to prevent accidental consumption or draining of the system. Give 24-hours notice to Owner's representative for start and finish inspections.

3.12.2. Certify in writing, by the testing company, that the water lines have been sterilized and that approval of the installation was obtained from the authorities having jurisdiction over the work. Sterilization to be in accordance with requirements of local authorities. Give original to owner and include one copy with each O&M submittal.

3.13. OPERATION AND MAINTENANCE MANUAL

3.13.1. Furnish a complete package of operating and maintenance manuals to the Architect for review by the Engineer of Record and Pima Community College Facilities Management – coordinate the number of O&M manuals required with Division 1. Manuals shall be loose-leaf 8-1/2”x11” format, bound in three-ring binders with identifying tabs separating sections. Each shall contain manufacturer's spare parts list, care, operation, and installation instructions. Provide a sequence of operation and a preventative maintenance schedule identifying daily, weekly, monthly and seasonal maintenance procedures as required. Contractor shall provide this sequence of operation and schedule if not given by the manufacturer. Provide a list of suggested suppliers with names, addresses, and phone numbers for each product or product group. Information may be printed on both sides of each page. Each binder shall include a cover sheet indicating the project title, architect, general contractor's name, and contractor's name, address, and phone.

3.13.2. Instruct the maintenance personnel in the operation of the system and submit copies of a letter signed by the owner's representative attesting to such instructions listing names of Owner personnel who received these instructions. Include a copy with each operation and maintenance manual (O&M).

3.13.3. Coordinate with “guarantees” and “certificates” for other inclusions.

3.14. GUARANTEES

3.14.1. Guarantee work to be free from defects in workmanship and material for a period of two years.
years from the date of final acceptance as determined by the Architect. Any material, equipment, or workmanship which proves defective within the guarantee period shall be promptly repaired or replaced at no cost to the Owner. Repair any damage done to areas, materials, and other systems resulting from failure or defect at no cost to owner. Extend guarantee of replaced item a period of **two** years from date of replacement. Replace materials or equipment that requires excessive maintenance during the guarantee period. Service calls, repairs, adjustments, and replacements during the guarantee period shall be made at no cost to the owner.

3.14.2. Provide notarized copies of the guarantee with the O&M manuals.

3.14.3. Furnish a letter stating that the system has been installed in accordance with the contract documents and with any deviations detailed in full.

3.14.4. Connections made to owner provided equipment shall be the responsibility of the contractor and shall be included in the guarantee.

3.14.5. Service or replacement required as a result of faulty operation or neglect on the part of the Owner shall be paid for by the Owner at prevailing rates.

3.14.5.1. However, if written instructions of the care and maintenance of equipment were not given to the Owner the neglect shall be on the Contractor’s part and the cost of the service or replacements shall be at no cost to the owner.

3.14.6. General Contractor, as part of their services, shall submit energy rebate application on PCC’s behalf through TEP’s Commercial Energy Solutions program. Rebates will be provided directly to PCC.

**END OF SECTION**
SECTION 23 05 93

TESTING, ADJUSTING, AND BALANCING (TAB)

1. PART 1 - GENERAL

1.1. GENERAL

1.1.1. An independent testing, adjusting, and balancing (TAB) agency shall test, adjust, and balance the mechanical systems.

1.1.2. The work included in this section consists of furnishing labor, instruments, and tools required in testing, adjusting and balancing the HVAC systems, as described in these specifications or shown on accompanying drawings. Services shall include checking equipment performance, taking the specified measurements, and recording and reporting the results.

1.2. WORK INCLUDED

1.2.1. Air Systems

1.2.2. Hydronic Systems

1.2.3. Vibration Testing

1.2.4. Special Systems

1.3. RELATED SECTIONS

1.3.1. Section 23 05 00: Basic Mechanical Materials and Methods

1.4. DEFINITIONS, REFERENCES, STANDARDS

1.4.1. All work shall be in accordance with the latest edition of the AABC National Standards. If these contract documents set forth more stringent requirements than the AABC National Standards, these contract documents shall prevail.

1.5. QUALIFICATIONS

1.5.1. The TAB Agency shall be a current member of the Associated Air Balance Council (AABC).

1.5.2. The following TAB Agencies are approved to provide TAB services on this project. No exceptions or prior approvals are allowed:

1.5.2.1. Arizona Air Balance Company, 624 South Perry Lane, Tempe, AZ 85281, contact Byron Seed at (480) 966-2001.

1.5.2.2. General Air Control, Inc., 1751 West Dairy Place, Tucson, AZ 85705, contact Jon Ziegler at (520) 887-8850.

1.5.2.3. Precisionaire of Arizona, Inc., 1720 East Deer Valley Road, Suite 205, Phoenix, AZ 85024, contact Dean Steffen at (623) 580-1644.

1.5.2.4. Tab Technology, Inc., 1912 North Rosemont, Mesa, AZ 85205, contact Phil Hoyt at (480) 964-0187.

1.5.2.5. Technical Air Balance, SW, Inc., 16055 N. Dial Blvd., Scottsdale, AZ 85260, contact Wade Handley at (623) 492-0831.
1.6. SUBMITTALS (also refer to Section 23 05 00 and Section 01 33 00)

1.6.1. The TAB agency shall submit a company resume listing personnel and project experience in air and hydronic system balancing and a copy of the agency’s test and balance engineer (TBE) certificate.

1.6.2. Procedures and Agenda: The TAB agency shall submit the TAB procedures and agenda proposed to be used.

1.6.3. The TAB agency shall submit sample forms, which shall include the minimum data required by the AABC National Standards.

1.7. TAB PREPARATION AND COORDINATION

1.7.1. TAB agency shall obtain shop drawings, submittal data, up-to-date revisions, change orders, and other data required for planning, preparation, and execution of the TAB work no later than 30 days prior to the start of TAB work.

1.7.2. System installation and equipment startup shall be complete prior to start of TAB agency’s work.

1.7.3. The building control system shall be complete and operational. The Building Control System contractor shall install all necessary computers and computer programs, and make these operational. Assistance shall be provided by TAB agency as required for reprogramming, coordination, and problem resolution.

1.7.4. All test points, balancing devices, identification tags, etc. shall be accessible and clear of insulation and other obstructions that would impede TAB procedures.

1.7.5. Qualified installation or startup personnel shall be readily available for the operation and adjustment of the systems. Assistance shall be provided as required for coordination and problem resolution.

1.8. REPORTS

1.8.1. The TAB agency shall submit three copies of the final TAB report for review by the engineer. All outlets, devices, HVAC equipment, etc., shall be identified, along with a numbering system corresponding to report unit identification. The TAB agency shall submit an AABC “National Project Performance Guaranty” assuring that the project systems were tested, adjusted and balanced in accordance with the project specifications and AABC National Standards.

1.9. DEFICIENCIES

1.9.1. Any deficiencies in the installation or performance of a system or component observed by the TAB agency shall be brought to the attention of the appropriate responsible person.

1.9.2. The work necessary to correct items on the deficiency listing shall be performed and verified by the affected contractor before the TAB agency returns to retest. Unresolved deficiencies shall be noted in the final report.
2. PART 2 - PRODUCTS

2.1. INSTRUMENTS

2.1.1. All instruments used for measurements shall be accurate and calibrated. Calibration and maintenance of all instruments shall be in accordance with the requirements of AABC National Standards.

3. PART 3 - EXECUTION

3.1. GENERAL

3.1.1. The specified systems shall be reviewed and inspected for conformance to design documents. Testing, adjusting and balancing on each identified system shall be performed. The accuracy of measurements shall be in accordance with AABC National Standards. Adjustment tolerances shall be + 15% or - 5% unless otherwise stated.

3.1.2. Equipment settings, including manual damper quadrant positions, manual valve indicators, fan speed control levers, and similar controls and devices shall be marked to show final settings.

3.1.3. All information necessary to complete a proper TAB project and report shall be per AABC standards unless otherwise noted. The description for work required, as listed in this section, are a guide to the minimum information needed.

3.1.4. Changes to pulleys, drives, etc. shall be part of the balance responsibility.

3.2. AIR SYSTEMS

3.2.1. The TAB agency shall verify that all ductwork, dampers, grilles, registers, and diffusers have been installed per design and set in the full open position. Systems where VFD’s or 2 speed motors are used, all balancing of air system will be conducted at the maximum and minimum rated speeds of unit. The TAB agency shall perform all TAB procedures in accordance with the AABC National Standards.

3.2.2. Supply Fans:

3.2.2.1. Fan speeds - Test and adjust fan RPM to achieve maximum or design CFM.

3.2.2.2. Current and Voltage - Test and record motor voltage and amperage, and compare data with the nameplate limits to ensure fan motor is not in or above the service factor.

3.2.2.3. Pitot-Tube Traverse - Perform a Pitot-tube traverse of main supply and return ducts, as applicable to obtain total CFM.

3.2.2.4. Outside Air - Test and adjust the outside air on applicable equipment using a Pitot-tube traverse. If a traverse is not practical use the mixed-air temperature method if the inside and outside temperature differences is at least 20 degrees Fahrenheit or use the difference between Pitot-tube traverses of the supply and return air ducts.

3.2.2.5. Static Pressure - Test and record system static profile of each supply fan. Variable frequency drive shall be tested in bypass mode to determine maximum static pressure capabilities.
3.2.3. Zone, Branch and Main Ducts:

3.2.3.1. Adjust ducts to within design CFM requirements. As applicable, at least one zone balancing damper shall be completely open. Multi-diffuser branch ducts shall have at least one outlet or inlet volume damper completely open.

3.2.4. Diffusers, Registers and Grilles:

3.2.4.1. Tolerances - Test, adjust, and balance each diffuser, grille, and register to within 10% of design requirements. Minimize drafts.

3.2.4.2. Identification - Identify the type, location, and size of each grille, diffuser, and register. This information shall be recorded on air outlet data sheets.

3.2.4.3. Adjust the louvers in all supply outlets to produce air distribution satisfactory to the occupants.

3.2.4.4. All measurements of air quantities delivered by grilles shall be made in a manner approved by the manufacturer of the grille.

3.2.5. Coils:

3.2.5.1. Air Temperature - Once air flows are set to acceptable limits, take wet bulb and dry bulb air temperatures on the entering and leaving side of each cooling coil. Dry-bulb temperature shall be taken on the entering and leaving side of each heating coil.

3.3. HYDRONIC SYSTEMS

3.3.1. The TAB agency shall, as applicable, confirm that all hydronic equipment, piping, and coils have been filled and purged; that strainers have been cleaned; and that all balancing valves (except bypass valves) are set full open. The TAB agency shall perform all testing and balancing functions in accordance with the AABC National Standards.

3.3.2. Pumps:

3.3.2.1. Test and adjust chilled water, hot water, and condenser water pumps or applicable to achieve maximum or design GPM. Check pumps for proper operation. Pumps shall be free of vibration and cavitation. Record appropriate gauge readings for final TDH and Block-Off/Dead head calculations.

3.3.2.2. Current and Voltage - Test and record motor voltage and amperage, and compare data with the nameplate limits to ensure pump motor is not in or above the service factor.

3.3.3. System Mains and Branches:

3.3.3.1. Adjust water flow in pipes to achieve maximum or design GPM.

3.3.4. Chillers:

3.3.4.1. Test and adjust condenser water flows to achieve design GPM.

3.3.5. Cooling Towers:

3.3.5.1. Verify that cooling towers have been filled and started by others, and are operational.
3.3.5.2. Test and adjust water flows to balance tower cells and flows between towers.

3.3.5.3. Test and record temperature profiles for water and air side operation.

3.3.6. Heat Exchangers:

3.3.6.1. Test and adjust the condenser water flow through heat exchangers.

3.3.7. Coils:

3.3.7.1. Tolerances - Test, adjust, and balance AHU-4 condenser-water and hot-water coils within 10% of design requirements.

3.3.7.2. Verification - Verify the type, location, final pressure drop and GPM of each coil. This information shall be recorded on coil data sheets.

3.3.7.3. Spot check 10% of the existing VAV terminal unit reheat coils to confirm the existing flows within the system meet the original design documents.

3.4. VIBRATION TESTING

3.4.1. The TAB agency shall conduct vibration testing on the following equipment per AABC National Standards. Test deflection in mils and velocity in inches per second shall be measured and the results compared to requirements in equipment specification sections.

EQUIPMENT:
Fans over 3.0 horsepower or over 3000 CFM (whichever is less)
Pumps over 3.0 horsepower

3.5. SPECIAL SYSTEMS

3.5.1. Verification of HVAC Controls:

3.5.1.1. The TAB agency shall be assisted by the building control systems contractor in verifying the operation and calibration of all HVAC and temperature control systems. The following tests shall be conducted:

3.5.1.1.1. Verify that all control components are installed in accordance with project requirements and are functional, including all electrical interlocks, damper sequences, air and water resets, fire and freeze stats, and other safety devices.

3.5.1.1.2. Verify that all controlling instruments are calibrated and set for design operating conditions.

3.5.2. Duct Leakage Testing:

3.5.2.1. The mechanical contractor shall isolate and seal existing sections of AHU-4 supply ductwork for testing. The test pressures required and the amount of duct to be tested is described in the appropriate duct classification section. All testing shall be based on one test per section only unless otherwise noted.

3.6. GUARANTEE

3.6.1. All work shall be guaranteed for a period of ninety days. TAB contractor shall make adjustments during this period for comfort level adjustment, at direction of Engineer. TAB contractor shall meet with Engineer during this period as may be required to verify any readings. Coordinate with Section 01 30 00.
1. **PART 1 – GENERAL**

1.1. **WORK INCLUDED**

1.1.1. Piping insulation

1.1.2. Equipment insulation and covering

1.1.3. Ductwork Insulation

1.1.4. Pre-Insulated Piping

1.1.5. Duct Wrap for Grease Exhaust Ducts

1.2. **RELATED SECTIONS**

1.2.1. Section 22 40 00 – Plumbing

1.2.2. Section 23 05 00 – Basic Mechanical Materials and Methods

1.2.3. Section 23 20 00 – Building Services Piping

1.2.4. Section 23 30 00 – Air Distribution

1.3. **QUALITY ASSURANCE**

1.3.1. The following is a list of additional manufacturers approved for use on this project:

1.3.1.1. **Insulation Products:** Owens Corning, Johns Manville, CertainTeed, Schuller, Manson

1.3.1.2. **Closed Cell:** Armstrong, Nomaco

1.3.1.3. **Pre-Insulated Piping:** Insulpipe, PermaPipe/Ricwil, Urecon Systems, Inc.

1.4. **SUBMITTALS**

1.4.1. **Product Data:** Provide product description, list of materials and thickness for each service or equipment scheduled, locations, and manufacturer's installation instructions.

1.4.2. See Section 23 05 00 for general submittal requirements.

1.5. **ENVIRONMENTAL REQUIREMENTS**

1.5.1. Maintain ambient temperatures and conditions required by manufacturers of adhesives, mastics, and insulation cements.
2. **PART 2 – PRODUCTS**

2.1. **GENERAL**

2.1.1. Coverings and linings, including adhesives when used, 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.

2.1.2. Duct coverings and linings shall not flame, glow, smolder, or smoke when tested in accordance with ASTM C 411 at the temperature to which they are exposed in service. The test temperature shall not fall below 250°F (121°C).

2.2. **PIPE INSULATIONS**

2.2.1. Glass Fiber insulation shall meet ASTM C547. Insulation shall be rigid, molded, and noncombustible.

2.2.1.1. 'K' ('ksi') Value: 0.23 at 75°F (0.033 at 24°C).

2.2.1.2. Maximum Service Temperature: 850°F (454°C).

2.2.1.3. Vapor Retarder Jacket: AP-T PLUS White kraft paper reinforced with glass fiber yarn and bonded to aluminum foil, secured with self sealing longitudinal laps and butt strips or AP Jacket with outward clinch expanding staples or vapor barrier mastic as needed.

2.2.2. Field Applied Jackets (for fiberglass insulation):

2.2.2.1. Aluminum Jacket: 0.016 inch (0.045 mm) thick sheet, embossed finish, with longitudinal slip joints and 2 inch (50mm) laps, die shaped fitting covers with factory attached protective liner.

2.2.3. Pre-Insulated Underground Piping:

2.2.3.1. Underground condenser water supply and return shall be a pre-insulated piping system composed of integral sealed units of PVC plastic outer jacket, carrier pipe as specified and insulated with polyurethane foam that completely fills the annular space between the pipe and the jacket. Jacket ends shall be protected with factory applied moisture barrier and plastic end caps.

3. **PART 3 – EXECUTION**

3.1. **EXAMINATION AND PREPARATION**

3.1.1. Verify that all surfaces are clean, dry and free of foreign material.

3.2. **INSTALLATION**

3.2.1. Install materials in accordance with manufacturer's recommendations, building codes and industry standards.

3.2.2. Continue insulation vapor barrier through penetrations except where prohibited by code.

3.2.3. Piping Insulation

3.2.3.1. Locate insulation and cover seams in least visible locations.

3.2.3.2. Neatly finish insulation at supports, protrusions, and interruptions.
3.2.3.3. Provide form fitted insulation for elbows and tees.

3.2.3.4. Provide fitted insulation which can be removed and reused around equipment, valves and flanges, etc.

3.2.3.5. Provide insert between support shield and piping on piping 1-1/2" inches (38 mm) diameter or larger. Fabricate of heavy density insulating material suitable for temperature. Insulation inserts shall not be less than the following lengths:

- 1-1/2" to 2-1/2" pipe size: 10" long
- 3" to 6" pipe size: 12" long
- 8" to 10" pipe size: 16" long
- 12" and over: 22" long

3.2.3.6. For exterior applications, provide weather protection jacket. Insulated pipe, fittings, joints, and valves shall be covered with aluminum jacket. Jacket seams shall be located on bottom side of horizontal piping.

3.3. PIPING INSULATION SCHEDULE

<table>
<thead>
<tr>
<th>Pipe Size</th>
<th>Insulation Thickness</th>
</tr>
</thead>
<tbody>
<tr>
<td>A. Fiber Glass Insulation</td>
<td></td>
</tr>
<tr>
<td>Condenser Water Supply and Return piping to AHU-4.</td>
<td>All Sizes 1&quot;</td>
</tr>
<tr>
<td>Piping Subject to freezing</td>
<td>All Sizes 1&quot;</td>
</tr>
</tbody>
</table>

END OF SECTION
SECTION 23 09 00

ENERGY MONITORING AND CONTROL SYSTEM (EMCS)

1. PART 1 - GENERAL

1.1. WORK INCLUDED

1.1.1. EMCS

1.1.2. Control Valves

1.1.3. Valve Actuator Electric/Electronic

1.1.4. Butterfly Valve Actuators

1.1.5. Airflow Measuring Station

1.1.6. Control Dampers

1.1.7. Integration Engine

1.2. RELATED SECTIONS

1.2.1. Section 23 05 00 - Basic Mechanical Materials and Methods

1.2.2. Section 23 20 00 - Building Services Piping

1.2.3. Section 23 30 00 - Air Distribution

1.2.4. Section 23 05 93 - Testing, Adjusting, and Balancing (TAB)

1.3. SUBMITTALS (Also Refer to Section 23 05 00)

1.3.1. Prior to commencement of work, provide complete system drawings, control air compressor calculation, panel drawings, schematic diagrams, point to point wiring diagrams, written operational sequences, and description and engineering data on each control system component.

1.4. ENVIRONMENT

1.4.1. The EMCS shall be capable of operating in an environment of 32-120 degrees F and 10-95% relative humidity. Sensors and control elements shall operate under the temperature, pressure, humidity, and vibration conditions normally encountered in the installed location. EMCS system shall maintain accuracy as follows:

1.4.1.1. +/- .5°F for the space temperatures in the 40 - 120°F range.

1.4.1.2. +/- 1.0°F for outside air temperatures in the 30 - 130°F range.

1.4.1.3. +/- 1.0°F for water temperature in the 30 - 230°F range.

1.4.1.4. +/- .5°F for duct temperatures in the 40 - 130°F range.

1.4.1.5. +/- 3% for relative humidity in the 20 - 70% range.

2. PART 2 - PRODUCTS

2.1. EMCS

2.1.1. General
2.1.1.1. The Electronic Microprocessor Based Energy Monitoring & Control System (EMCS) shall monitor the Data Environment and perform control functions in relation to a programmed strategy and the status of the Data Environment.

2.1.1.2. The system shall use solid state computer-based digital and analog technology. The system shall be standard with the manufacturer to insure ongoing parts availability and trained technical support.

2.1.1.3. The EMCS shall be of the fully user programmable type requiring no special computer education for operation. All necessary instruction manuals and user orientation training shall be supplied by the manufacturer or agent thereof.

2.1.1.4. Communication protocol between Application Specific and Programmable controllers shall adhere to BACnet protocol as described in paragraph 2.01B below. Communication protocol shall be considered “native” BACnet at all levels. Proprietary protocols are not acceptable at any level.

2.1.1.5. The intent of this division specification is to establish a level of control system required for this project. All functions described herein are required but it is understood that some degree of flexibility may be required. Any major deviation requires the written approval of the Architect/Engineer prior to bid date.

2.1.2. Open Protocol Communications

2.1.2.1. Read (Initiate) and Write (Execute) Services as defined in Clauses 15.5 and 15.8 respectively of ASHRAE Standard 135-95, shall be used to communicate with BACnet objects in the network.

2.1.3. Acceptable Manufacturers:

2.1.3.1. Alerton

2.1.3.2. Prior approved equal as indicated via addendum

2.1.3.2.1. Requests for prior approval consideration shall be submitted by a General Contractor to the architect a minimum of (15) working days prior to the published bid date. Prior approval requests shall include complete submittal data demonstrating physical compatibility and equal redundancy and performance.

2.1.4. Modular Design/Expandability

2.1.4.1. The EMCS shall be of a modular design providing distributed processing capability, and allowing future expansion of both input/output points and processing/control functions.

2.1.5. Battery Backup

2.1.5.1. The system shall be tolerant of power failure and hold memory a minimum of 24 hours using battery backup. On power restoration, the system shall automatically execute the following restart procedures.

2.1.5.1.1. Come on line

2.1.5.1.2. Update all monitored functions.

2.1.5.1.3. Resume operation based on current time and status.

2.1.5.1.4. Implement special building start up strategies as required.
2.1.5.1.5. Log time of power outages and start ups.

2.1.5.2. The system shall monitor the battery backup and provide a low battery alarm.

2.1.6. Program Storage

2.1.6.1. The system shall be capable of interfacing with a mass storage (DVD and CD) device, for use in up loading and down loading programs to the EMCS.

2.1.7. EMCS Inputs

2.1.7.1. The input section of the EMCS shall connect the EMCS to the building environment. The EMCS shall be capable of accepting information in the form of 3k and 10k thermistors, 0-5 VDC, 0-10 VDC, 4-20 mA, dry contacts, and pulse inputs.

2.1.7.2. The Analog Input (AI) function shall monitor each analog input, perform analog-to-digital (A/D) conversion, and hold the digital value in a buffer for interrogation. The A/D conversion shall have a minimum resolution of 10 bits. Analog inputs shall withstand continuous direct shorting to 120 VAC, 60 Hz power without failure.

2.1.7.3. The Digital Input (DI) function shall accept dry contact closures and voltage level transitions. Digital inputs shall withstand continuous direct shorting to 120 VAC, 60 Hz power without failure.

2.1.7.4. Temperature inputs originating from a thermistor or resistance temperature detector (RTD) shall be monitored and buffered as an AI, except that automatic conversion to degrees F shall occur without any additional signal conditioning. Temperature inputs shall withstand continuous direct shorting to 120 VAC, 60 Hz, power without failure.

2.1.7.5. The pulse or watt accumulator function shall have the same characteristics as the DI, except that, in addition, a buffer shall be included to totalize pulses between interrogations. The pulse accumulator shall accept rates up to 10 pulses/second. Pulse inputs shall withstand continuous direct shorting to 120 VAC, 60 Hz, power without failure.

2.1.8. EMCS Outputs

2.1.8.1. The Digital Output (DO) function shall provide contact closure for momentary (Pulse Width Modulation) and maintained operation of field devices. Output pulse width shall have a minimum resolution of 0.1 seconds. Isolation and protection against voltage surges up to 180 VAC peak shall be provided. Contact rating shall be a minimum of 2 amps at 24 VAC. Each digital output shall be equipped with an On/Off/Auto switch to manually obtain either output state. Manual overrides shall be reported to the Master at each update. An LED shall be provided to indicate the state of each digital output.

2.1.8.2. The EMCS shall have an Analog Output (AO) function which shall accept digital data, perform digital-to-analog (D/A) conversion, and modify the signal of a current loop within the range of 4-20mA. D/A conversion shall have a minimum resolution of 8 bits. 4-20mA signal shall be regulated with a minimum resolution of .16mA.

2.1.9. Surge Protection

2.1.9.1. Lighting arrestors shall be provided on communication lines that run between buildings.
2.1.9.2. Controllers shall be rated to withstand voltage spikes of 1500 volts.

2.1.9.3. Input wiring shall be shielded; output wiring and power circuits shall use metal oxide varistors.

2.1.9.4. Noise, surge, and spike protection shall be Kele Model No. HSP-121-B or equivalent.

2.1.10. Software Features

2.1.10.1. Mathematical Capabilities:

2.1.10.1.1. The EMCS shall have a math package capable of +, -, *, <, >, functions and up to five levels of parentheses for computation of variables. Control commands may be executed based on these calculated variables which are available to the program on a global basis. Math expressions may be used in action and exit commands of control program.

2.1.10.1.2. The mathematical software shall be capable of mixed mode arithmetic, utilizing Boolean Logic statements in combination with basic arithmetic to provide conditional mathematical computations.

2.1.10.1.3. Final field programs shall be stored in battery backed up memory.

2.1.10.1.4. The software shall include fixed formulas for psychrometric calculations.

2.1.10.2. Passwords:

2.1.10.2.1. The EMCS shall have a minimum of six levels of user programmable passwords in addition to a master password, for programming security. Up to eight character passwords may be programmed. Access to first level password shall allow interrogation of system status only.

2.1.10.3. History Logging (Trend Logs):

2.1.10.3.1. System server shall periodically gather historically recorded data stored in the building controllers and archive the information. Archived files shall be appended with new sample data, allowing samples to be accumulated. Systems that write over archived data shall not be allowed, unless limited file size is specified. Samples shall be viewed at the operator's workstation. Operator shall be able to scroll through all trended data. All trend log information shall be displayed in standard engineering units.

2.1.10.3.2. Software shall be included that is capable of graphing the trend logged object data. Software shall be capable of creating two-axis (x, y) graphs that display up to ten object types at the same time in different colors. Graphs shall show object values relative to time.

2.1.10.3.3. Operator shall be able to change trend log setup information. This includes the information to be logged as well as the interval at which it is to be logged. All input, output, and value
object types in the system may be logged.

2.1.10.3.4. Contractor shall provide history logging software as an add-on if it is not already included with the operator’s workstation software package.

2.1.10.3.5. Trend data shall be downloadable to Microsoft Excel format.

2.1.10.4. Messages:

2.1.10.4.1. The EMCS shall have the capability of storing and displaying up to 99 user programmed messages of up to 128 characters each for alarming, preventative maintenance, and status reporting.

2.1.10.5. Look Up Tables:

2.1.10.5.1. The EMCS shall have preprogrammed "LOOK UP" tables for the conversion of voltage inputs into temperature and water vapor pressure values for the computation of relative humidity and enthalpy.

2.1.10.6. Output Documentation Format for Operator’s Use:

2.1.10.6.1. The programming language of the EMCS shall be English based such that a printout of the control program may serve as the primary documentation for the system. The same programming language shall be used for all levels of system equipment.

2.1.10.7. Micro Processor Integrity Checking:

2.1.10.7.1. The EMCS microprocessor shall continuously monitor and check itself and produce error messages in the event of a malfunction.

2.1.10.8. Software Manual:

2.1.10.8.1. The software manual shall describe programming and testing, starting with a system overview and proceeding to a detailed description of each software feature. The manual shall instruct the user on programming or re-programming any portion of the system. This shall include all control programs, variables, set points, time periods, messages, passwords, and other information necessary to load, alter, test, and execute the system. The manual shall include:

2.1.10.8.1.1. Complete description of the programming language, including commands, editing and writing control programs, printouts and logs, and mathematical calculations.

2.1.10.8.1.2. Instructions on modifying any control point, verifying error status, changing passwords, and initiating or disabling control programs.
2.1.10.9. User Interface

2.1.10.9.1. Local Display and Adjustment:

2.1.10.9.1.1. The master DDC controller shall be provided with a digital display or a portable hand held module which can display such information as time, date, analog variable, binary conditions, or other analog or binary information required for proper analysis and adjustment of the system being controlled.

2.1.10.9.1.2. Adjustments of control variables shall be conveniently available at the master controller or hand held module through the keyboard and display, and must be programmable on-site.

2.1.10.9.1.3. Access to various levels of local control shall be password "secured" at each panel.

2.1.10.9.4. Web Browser:

2.1.10.9.4.1. Install all onsite hardware and software necessary to allow the system operator to access the system via the Internet.

2.1.10.9.4.2. The system shall have a user editable "remote access password" in the onsite computer for protection against unauthorized dial-in to the system. During a dial-in attempt, if the remote access password in an offsite computer does not match the remote access password in the onsite computer, then the onsite computer shall not permit a connection to the system. This remote access password shall be different from passwords used by individual system operators for access to the system.

2.1.10.9.4.3. The data port for remote communications shall be provided by the Owner.

2.1.10.10. Approval

2.1.10.10.1. The complete EMCS shall be UL 916 approved as an Energy Management System.

2.2. CONTROL VALVES (Also Refer to Section 23 20 00)

2.2.1. General:

2.2.1.1. Control valves shall be 2 or 3-way type for two-position or modulating service as scheduled, shown on drawings, or as specified in Sequence of Operation.

2.2.2. Close-off (differential) pressure rating:

2.2.2.1. Valve actuator and trim shall be furnished to provide the following minimum close-off pressure ratings:
2.2.2.1.1. Water Valves:

- **2.2.2.1.1.** Two-way - 150% of total system (pump) head.
- **2.2.2.1.2.** Three-way - 300% of pressure differential between ports A and B at design flow or 100% of total system (pump) head.

2.3. VALVE ACTUATORS - ELECTRIC/ELECTRONIC

2.3.1. Valve actuators shall be compatible with the input signal provided. They must also have sufficient torque to provide the characteristics required for the valve body to meet the requirements specified for the intended service. Valve actuators shall be Delta, Johnson Controls, Inc., Belimo, ABZ.

- **2.3.1.1.** Actuator shall be fully modulating, two position or spring return as required for each application.
- **2.3.1.2.** Actuator shall fail - open - closed - or last position as required for each application.
- **2.3.1.3.** Enclosure and components shall meet all fire rating and smoke generation requirements for location of valve including plenum applications.
- **2.3.1.4.** Enclosure shall be NEMA-3 rated when used for exterior applications.

2.4. AIRFLOW/TEMPERATURE MEASUREMENT STATION

2.4.1. General:

- **2.4.1.1.** The airflow/temperature measurement station (AFTMS) indicated on the plans shall be capable of monitoring airflow and temperature rates at each measurement location.

2.4.2. Description:

- **2.4.2.1.** The system shall be factory tested prior to shipment and shall not require calibration or adjustment over the life of the equipment, when installed in accordance to manufacturer’s guidelines. Each sensor probe shall be provided with a UL plenum-rated connecting cable. Connecting cable shall be a minimum of 10 feet in length for each probe. No additional devices or transducers shall be required to interface with the host controls.
- **2.4.2.2.** Sensors shall be calibrated to NIST-traceable standards for both airflow and temperature. Each sensing point shall independently measure airflow and temperature prior to averaging. Installed accuracy shall be percent of reading and demonstrated at both maximum and minimum airflow rates for each measurement location.

2.4.3. Acceptable Manufacturers:

- **2.4.3.1.** Ebtron GTA116-PC: Gold Series probes, combination airflow/temperature sensors plus associated transmitter.

2.4.4. Transmitter and Electronics Enclosure

- **2.4.4.1.** The transmitter shall operate on 24 VAC. The transmitter shall have a minimum 16 character alphanumeric LCD display for airflow, temperature, and system diagnostics. Analog output signals shall be user selectable (0-10 VDC or 4-20 mA). When required on the plans, a serial RS-485 interface will be made available with network protocols of either N2 or ModBus RTU, as required by
the DDC control equipment. All inputs and outputs shall be fused, protected, and internally isolated from the 24 VAC power supply. The transmitter shall have a non-drifting adjustment for output signal offset/gain. The transmitter display shall be capable of being configured in either I.P. or S.I. units. The transmitter shall accept a user-defined area to display volumetric flow rates in CFM or LPS. An infrared output to transmit instantaneous airflow and temperature data for traverse information of the airflow profile shall be provided. This output shall be available to a PDA device (supplied by others) and transferable to Microsoft® Excel® using Ebtron provided free software.

2.4.4.2. The enclosure shall be aluminum alloy for indoor use and capable of operating over a temperature range of +30° F to +120° F. The electronics shall be installed inside and protected from the weather in a NEMA4 enclosure.

2.4.5. Duct and Plenum Mounted Sensor Probes

2.4.5.1. Sensor probes shall be constructed of anodized aluminum alloy tube with stainless steel mounting brackets. Probes shall be constructed to provide insertion, internal, or standoff mounting, depending on the applications and field installation requirements.

2.4.5.2. The sensor accuracy for airflow shall be at least ±2% of Reading over the sensor probe operating ranges. The installed total accuracy for airflow shall be better than ±3% of Reading over the sensor probe operating ranges when installed in accordance with manufacturers’ guidelines. The sensor accuracy for temperature shall be better than ±0.15° F over the entire operating range. Each sensing point shall independently measure airflow and temperature prior to averaging.

2.4.5.3. The number of independent sensing points shall be distributed per duct face area, at a minimum quantity as indicated below.

<table>
<thead>
<tr>
<th>Area (ft²)</th>
<th>Area (m²)</th>
<th>Sensors</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt;= 1</td>
<td>&lt;= 0.093</td>
<td>2</td>
</tr>
<tr>
<td>&gt;1 to &lt;4</td>
<td>&gt;0.093 to &lt; 0.372</td>
<td>4</td>
</tr>
<tr>
<td>4 to &lt;8</td>
<td>0.372 to &lt; 0.743</td>
<td>6</td>
</tr>
<tr>
<td>8 to &lt;12</td>
<td>0.743 to &lt; 1.115</td>
<td>8</td>
</tr>
<tr>
<td>12 to &lt;16</td>
<td>1.115 to &lt; 1.486</td>
<td>12</td>
</tr>
<tr>
<td>&gt;=16</td>
<td>&gt;= 1.486</td>
<td>16</td>
</tr>
</tbody>
</table>

2.4.5.4. Airflow: 0 to 5,000 FPM Temperature: -20° F to +160° F Relative Humidity: 0 to 99% (non-condensing)

2.4.6. Warranty

2.4.6.1. Provide 36 month manufacturer warranty from date of shipment.

2.5. CONTROL DAMPERS

2.5.1. The dampers for the outside air shall be furnished by the air handling unit supplier. The damper motor and linkage shall be furnished and installed by Division 15900. The damper motor shall have a 120/24V transformer.

2.6. INTEGRATION ENGINE

2.6.1. The integration engine shall be capable of integrating the existing CSI proprietary communication protocol to BACnet open protocol that meets the requirements of section 2.1.2.1 above. Coordinate required drivers for integration with unit manufacturer.
2.6.2. Integration engine shall be provided with PowerPC 440 524 MHz processor, 256 MB DDR RAM and 128 MB Serial Flash, battery backup and real-time clock.

2.6.3 Integration engine shall include universal voltage input power supply module, DIN rail or panel mounted.

2.6.4 Acceptable Manufacturers

2.6.4.1. Tridium

2.6.4.2. Tridium products repackaged with control manufacturer’s labels will be accepted as an alternate approved manufacturer.

3. PART 3 - EXECUTION

3.1. QUALIFICATIONS

3.1.1. Control contractor shall have been in business a minimum of three years with a full time office and staff located in the Tucson area. Control contractor shall be an authorized distributor and have a full time locally based service staff that can respond to service calls within four hours. Local office shall have an inventory of spare parts for support of all systems provided under this contract.

3.2. INSTALLATION

3.2.1. Salvage all existing CSI building and unit controllers removed from the ST building to Pima Community College Facilities Management.

3.2.2. Check and verify location of all equipment with plans before installation.

3.2.3. Interlock EMCS alarms with starter switching to bypass alarm when equipment is manually disconnected to avoid false alarms.

3.2.4. Provide engineering, installation, supervision, labor, calibrations, software programming, and commissioning necessary for a complete and fully operational system.

3.3. STARTUP AND CHECKOUT

3.3.1. Provide startup of system and program user supplied operating hours and holiday scheduling.

3.3.2. A system demonstration procedure shall be developed, submitted to Architect for approval, and performed in presence of Architect’s representative for final checkout of system. Minor program modifications requested by the owner at that time shall be made at no charge to the owner.

3.4. WIRING

3.4.1. All 24 volt and lower control wiring including conductors, control relays, switches, sensors, transformer interconnections, etc., for control functions shall be provided as part of Section 23 09 00 work.

3.4.2. Control wiring for start/stop signals to motor starters and contactors shall be provided as part of Section 23 09 00 work.

3.4.3. Electrically operated PE and EP switches, furnished under this section, shall be wired by Division 15900 unless specifically indicated otherwise. Control wiring shall be run to terminal strips in panels located adjacent to equipment except where EP and PE switches are installed directly in starter control circuits. Extension of power wiring from terminal strips and
starters will be provided and installed under Section 16.

3.4.4. Control switches and cover plates as applicable shall utilize same color and material as specified in Division 26 for electrical wiring devices.

3.4.5. EMCS bus wiring must be wired using shielded cable approved for return air plenums. Use 22-gauge for runs up to 250 ft. For runs from 250 ft. to 500 ft. use 18-gauge.

3.4.6. EMCS bus wiring must not be run in the same conduit as line voltage wiring (30 VAC or above) or wiring that switches power to highly inductive loads (contactors, coils, motors, generators, etc.)

3.5. OPERATOR INSTRUCTIONS

3.5.1. Provide competent instructors who will give full instruction to designated personnel in the adjustment, operation, and maintenance of the equipment and system specified, including pertinent safety requirements. A minimum of twelve (12) hours of instruction, in three four-hour sessions spaced a minimum of one week apart, shall be provided.

3.5.2. A written statement that training has been completed, signed by owner's designated personnel, shall be submitted with warranty to Architect.

3.5.3. Provide tuition for four (4) individuals from Pima Community College Facilities Management to attend the two (2) day training course at the factory headquarters. Travel and lodging costs shall not be included and will be provided by Pima Community College.

3.7. WARRANTY AND INSPECTIONS

3.7.1. Section 23 09 00 shall guarantee work to be free from defects in workmanship and material for a minimum period of two years from the date of final acceptance. Any material or equipment furnished that proves defective within the warranty period shall be promptly repaired or replaced without cost to the owner.

3.7.2. Make minimum of three complete inspections of approximately one hour duration, in addition to normal service calls to adjust controls, with reports written and submitted to the Architect/Engineer during first year. Inspections shall be spaced three months apart.

END OF SECTION
SECTION 23 09 33

ADJUSTABLE FREQUENCY DRIVES

1. PART 1 – GENERAL

1.1. DESCRIPTION

1.1.1. This specification covers a complete Adjustable Frequency motor Drive (AFD) consisting of a pulse width modulated (PWM) inverter output waveform (VVI, six-step, and current source drives are not acceptable) designed for use on a standard NEMA Design B induction motor. The AFD shall employ a 1600 volt full wave bridge rectifier, 5% impedance AC or DC Line Reactor, EMI / RFI filters, capacitors, and Insulated Gate Bipolar Transistors (IGBT’s) as the output switching device.

1.1.2. The drive manufacturer shall have a representative exclusively for HVAC products, both sales and service will be the same organization for sole source responsibility.

1.1.3. The manufacturer shall have been engaged in the production of this type of equipment for a minimum of ten years.

1.1.4. Controlled motors shall be inverter duty meeting NEMA MG 1, Part 31.

1.2. QUALITY ASSURANCE

1.2.1. Referenced Standards:

1.2.1.1. Institute of Electrical and Electronic Engineers (IEEE) Standard 519-1992, IEEE Guide for Harmonic Content and Control.

1.2.1.2. Underwriters Laboratories: UL508C

1.2.1.3. National Electrical Manufacturer’s Association (NEMA) ICS 7.0, AC Adjustable Speed Drives

1.2.1.4. IEC 16800 Parts 1 and 2

1.2.2. Qualifications:

1.2.2.1. AFD’s and options shall be UL listed as a complete assembly. AFD’s that require the customer to supply external fuses for the AFD to be UL listed are not acceptable. The base AFD shall be UL listed for 100 KAIC without the need for input fuses.

1.2.2.2. CE Mark – European Union Electro Magnetic Compatibility directive, a requirement for CE marking. The AFD shall meet product standard EN 61800-3 for the First Environment restricted level.

1.2.2.3. Acceptable Manufacturers:

1.2.2.3.1. ABB ACH 550 Series

1.2.2.3.2. Prior approved equal as indicated via addendum

1.2.2.4. Requests for prior approval consideration shall be submitted by a General Contractor to the architect a minimum of (15) working days prior to the published bid date. Prior approval requests shall include complete submittal
data demonstrating physical compatibility and equal redundancy and performance.

1.2.2.5. All AFD’s shall be provided by the authorized local Rep / Distributor and be of one manufacturer. All HVAC OEM units shall be designed to interface / accommodate field mounting of AFD’s.

1.3. SUBMITTALS

1.3.1. Submittals shall include the following information:

1.3.1.1. Outline dimensions, conduit entry locations and weight, customer connection and power wiring diagrams, and technical product description including a complete list of options provided.

1.3.1.2. Compliance to IEEE 519 – harmonic analysis for particular jobsite including total harmonic distortion (BOTH VOLTAGE and TDD). Using job specific electrical information, the AFD manufacturer shall provide calculations showing total harmonic voltage distortion is less than 5% at point of common coupling. Input line filters shall be sized and provided as required by the AFD manufacturer to ensure compliance with IEEE standard 519. All AFD’s shall include a minimum of 5% impedance AC or DC line reactors.

1.3.1.3. Protocol for serial communications link (DDC / BAS / EMCS interface).

2. PART 2 – PRODUCTS

2.1. ADJUSTABLE FREQUENCY DRIVES

2.1.1. The AFD shall be listed ISO9001 and the package as specified herein shall be enclosed in a UL Listed Type 3R (outdoor enclosure) as applicable/specified.

2.1.1.1. The AFD tolerated voltage window shall allow the AFD to operate from a line of +10% nominal, and -10% nominal voltage as a minimum.

2.1.1.2. Environmental operating conditions:

2.1.1.2.1. AFD’s shall be rated from 15 to 50°C (5 to 122°F) continuous. There shall be no current de-rate from 15 to 40°C to (5 to 104°F) ambient temperature continuous. From 40°C (104°F) to 50°C (122°F) ambient temperature range, AFD current de-rate shall not be greater than 10% and not exceed a rate of 1% current de-rate per 1°C or AFD must be oversized. AFD’s that can operate at 50°C intermittently (during a 24 hour period) are not acceptable and must be oversized.

2.1.1.2.2. Altitude 0 to 3300 feet above sea level

2.1.1.2.3. Less than 95% humidity, non-condensing.

2.1.1.2.4. Enclosure shall be UL listed as a plenum rated AFD.

2.1.2. All AFDs shall have the following standard features:

2.1.2.1. All AFDs shall have the same digital keypad, shall be removable, capable of remote mounting and uploading and downloading of parameter settings for start-up of multiple AFDs.
2.1.2.2. The keypad shall include Hand-Off-Auto selections and manual speed control. The drive shall incorporate “bumpless transfer” of speed reference when switching between “Hand” and “Auto” modes.

2.1.2.3. There shall be a built-in time clock in the AFD keypad. The clock shall have a battery back up with 10 years minimum life span. The clock shall be used to date and time stamp faults and record operating parameters at the time of fault. The clock shall also be programmable to control start/stop functions; constant speeds; PID parameter sets and output relays; and four (4) separate, independent timer functions that have both weekday and weekend settings.

2.1.2.4. The AFD’s shall utilize pre-programmed HVAC application macro’s specifically designed to facilitate start-up.

2.1.2.5. The AFD shall have cooling fans designed for replacement without removing the AFD from the wall or removal of circuit boards.

2.1.2.6. The AFD shall be capable of starting into a coasting load (forward or reverse) up to full speed and accelerate or decelerate to setpoint without safety tripping or component damage (flying start).

2.1.2.7. The AFD shall automatically restart after an over-current, over-voltage, under-voltage, or loss of input signal.

2.1.2.8. The overload rating of the drive shall be 110% of its normal duty current rating for 1 minute every 10 minutes. The minimum FLA rating shall meet or exceed the values in the NEC/UL Table 430-150 for 4-pole motors.

2.1.2.9. The AFD shall have integral 5% impedance line reactors to reduce the harmonics to the power line and to add protection from AC line transients. The 5% impedance may be from dual (positive and negative DC bus) reactors, or 5% impedance AC line reactors. AFD’s with only one 5 % DC reactor shall add AC line reactors.

2.1.2.10. The AFD shall include a coordinated AC transient protection system consisting of 4-120 joule rated MOV’s (phase to phase and phase to ground), a capacitor clamp, and 5% impedance reactors.

2.1.2.11. The AFD shall be capable of sensing a loss of load (broken belt / broken coupling) and signal a warning or fault as required.

2.1.2.12. If there is a loss of the input reference the AFD shall give the user the option of either (1) stopping and displaying a fault, (2) running at a programmable preset speed, (3) hold the AFD speed based on the last good reference received, or (4) cause a warning to be issued, as selected by the user.

2.1.3. All AFDs to have the following adjustments:

2.1.3.1. Three (3) programmable critical frequency lockout ranges to prevent the AFD from operating the load continuously at an unstable speed.

2.1.3.2. Two (2) PID Setpoint controllers shall be standard in the drive, using the microprocessor for the closed loop control. The AFD shall have 250 ma of 24 VDC auxiliary power and be capable of loop powering a transmitter supplied by others. The PID setpoint shall be adjustable from the AFD keypad, analog inputs, or over the communications bus. The PID parameter values may be changed with a digital input, serial communications or from the keypad. There shall be an independent, second PID loop that can utilize...
the second analog input and modulate one of the analog outputs to maintain
setpoint of an independent process (i.e. valves, dampers, cooling tower
bypass valve control, chilled water valve control, etc.) and be accessible
from the serial communication network. The setpoints shall be available in
Engineering units.

2.1.3.3. Two (2) programmable analog inputs shall accept current or voltage signals.

2.1.3.4. Two (2) programmable analog outputs (0-20ma or 4-20ma)

2.1.3.5. Six (6) programmable digital inputs allowing multiple safeties, run
permissive circuits for damper and valve control, etc.

2.1.3.6. The AFD shall include a run permissive contact for hard-wired safety
interlocks. The normally open contact shall close whenever a run command
is provided (local or remote start command in AFD or bypass mode). The
dry contact closure shall signal a device (usually a smoke damper) to open.
The AFD system (AFD or bypass) shall not operate the motor until it
receives a dry contact closure from the device’s (smoke damper’s) end-
switch. When the AFD system safety interlock (fire detector, freezestat,
high static pressure switch, etc) opens, the motor shall coast to a stop and
the run permissive contact shall open, closing the device being controlled
(smoke damper).

2.1.3.7. Three (3) programmable digital Form-C relay outputs standard, expandable
to (6). The relays shall include programmable on and off delay times and
adjustable hysteresis. The relays shall be rated for maximum switching
current of 8 amps at 24 VDC or 250 VAC with maximum voltage of 30 VDC
and 250 VAC and maximum continuous current rating of 2 amps RMS.
Outputs shall be true Form-C type contacts; open collector outputs are not
acceptable.

2.1.3.8. Seven (7) programmable preset speeds.

2.1.3.9. The AFD shall include a motor flux optimization circuit that will automatically
reduce applied motor voltage to the motor to optimize energy consumption
and audible motor noise.

2.1.3.10. The AFD shall reduce the carrier frequency based on actual AFD
temperature that allows the highest carrier frequency without derating the
AFD.

2.1.3.11. The AFD shall include password protection against parameter changes.

2.1.4. The Keypad shall include a backlit LCD display in complete English words for
programming and fault diagnostics (alpha-numeric codes are not acceptable).

2.1.5. All applicable operating values shall be capable of being displayed in Engineering (user)
units. A minimum of three selectable values will be displayed in real time, in complete
English words.

2.1.6. The AFD shall include a fireman’s override input. Upon receipt of a contact closure from
the fireman’s control station, the AFD shall override all other inputs (analog/digital, serial
communication, and all keypad commands) and force the motor to run at the adjustable,
preset speed.

2.1.7. Serial Communications Link (DDC / BAS / EMCS Interface)

2.1.7.1. The AFD shall have an RS-485 port. The available protocols shall be
BACnet. All protocols shall be “certified” by the governing authority. If
additional gateway, hardware, etc. is required to communicate with the EMCS, the AFD manufacturer shall supply one gateway, hardware device, etc. per AFD. Multiple AFD’s sharing one gateway, hardware, etc. shall not be acceptable.

2.1.7.1.1. It shall be the AFD manufacturer's responsibility to coordinate the appropriate EMCS protocol with the controls contractor before submitting a bid.

2.1.7.2. The BACnet connection shall be an RS-485, MSTP interface operating at 9.6, 19.2, 38.4, or 76.8 Kbps. The connection shall be tested by the BACnet Testing Labs (BTL) and be BTL Listed. The BACnet interface shall conform to the BACnet standard device type of an Applications Specific Controller (B-ASC). The interface shall support all BIBBs (BACnet Interoperability Building Blocks) defined by the BACnet standard profile for a B-ASC.

2.1.7.3. The drive shall have the capability of allowing the DDC / BAS / EMCS (Direct Digital Control / Building Automation System / Energy Management Control System) to monitor feedback, such as process variable feedback, output speed / frequency, etc. monitoring the AFD relay output status, digital input status, and all analog input and analog output values. All diagnostic warning and fault information, remote AFD fault reset, "Hand" or "Auto" selection, bypass selection (if bypass is specified), and PID setpoint adjustment shall be transmitted over the serial communications bus. The DDC system shall also be able to monitor feedback and start/stop the motor if it is running in bypass mode (if bypass is specified). The AFD shall allow the DDC to control the drive’s digital and analog inputs and outputs. For example, the analog outputs may be used for modulating chilled water valves or cooling tower bypass valves while digital (relay) outputs may be used to actuate a damper, open a valve or control any other device that requires a maintained contact for operation.

2.1.8. EMI / RFI filters. All AFD’s shall include EMI/RFI filters. The onboard filters shall allow the AFD assembly to be CE Marked. The AFD shall meet product standard EN 61800-3 for the First Environment restricted level.

2.1.9. Bypass - All features shall be UL Listed by the drive manufacturer as a complete assembly and carry a UL508 label. The bypass shall have the following features:

2.1.9.1. Door inter-locked, pad-lockable circuit breaker that will disconnect all input power from the drive and all internally mounted equipment.

2.1.9.2. Fused AFD only disconnect (service switch) and/or fast acting fuses exclusive to the AFD to allow the AFD to disconnect from the line prior to clearing upstream branch circuit protection while maintaining bypass capability. Bypass designs that incorporate fuses common to both the AFD and the bypass will not be accepted. Three contactor bypass schemes are not acceptable, as an AFD input contactor is not a NEC recognized, lockable, physical disconnect and is an unacceptable means of safely disconnecting power to the AFD.

2.1.9.3. The drive / bypass shall provide single-phase motor protection and undervoltage protection in both the AFD and bypass modes.

2.1.9.4. The following operators shall be provided:

2.1.9.4.1. Bypass Hand-Off-Auto

2.1.9.4.2. Drive mode selector
2.1.9.4.3. Bypass mode selector
2.1.9.4.4. Bypass fault reset

2.1.9.5. The following indicating lights (LED type/pilot light) with a test mode or push to test feature shall be provided for the following:

2.1.9.5.1. Power-on (Ready)
2.1.9.5.2. Run enable (safeties) open
2.1.9.5.3. Drive mode select damper opening
2.1.9.5.4. Bypass mode selected
2.1.9.5.5. Drive running
2.1.9.5.6. Bypass running
2.1.9.5.7. Drive fault
2.1.9.5.8. Bypass fault
2.1.9.5.9. Bypass H-O-A mode
2.1.9.5.10. Automatic transfer to bypass selected
2.1.9.5.11. Safety open
2.1.9.5.12. Damper open
2.1.9.5.13. Damper end-switch made

2.1.9.6. The following relay (Form-C) outputs from the bypass shall be provided:

2.1.9.6.1. System started
2.1.9.6.2. System running
2.1.9.6.3. Bypass override enabled
2.1.9.6.4. Drive fault
2.1.9.6.5. Bypass fault motor overload or underload (broken belt)
2.1.9.6.6. Bypass H-O-A position

2.1.9.7. Customer Interlock Terminal Strip for connection of freeze, fire, smoke contacts, and external start command. The remote start/stop contact shall operate in AFD and bypass modes.

2.1.9.8. Dedicated digital input that will transfer motor from AFD mode to bypass mode upon dry contact closure for fireman’s override. Two modes of operation are required.

2.1.9.8.1. One mode forces the motor to bypass operation.
2.1.9.8.2. The second fireman’s override mode remains as above but will also defeat all safeties and inputs (run until destruction).
2.1.9.9. Class 20 or 30 (selectable) electronic motor overload protection shall be included.

2.1.9.10. Provide capability to select manual or automatic bypass.

3. PART 3 – EXECUTION

3.1. INSTALLATION

3.1.1. Install equipment to provide sufficient cooling air and maintenance access.

3.2. FIELD QUALITY CONTROL

3.2.1. Field Tests

3.2.1.1. Provide testing checkout and startup of the adjustable-speed motor controller.

3.2.1.2. Conduct field test under the direction of the manufacturer’s service engineer or other authorized representative.

3.2.1.3. Demonstrate that the adjustable-speed motor controller performs over the speed range, acceleration/deceleration rates, and other variables as specified.

3.2.1.4. Tune the drive acceleration and deceleration rates to the system as installed and coordinate with system automatic controls.

3.2.2. Installation shall be the responsibility of the mechanical contractor as outlined in the installation manual.

3.2.3. Power wiring shall be completed by the electrical contractor as outlined in the installation manual.

3.3. ADJUSTING

3.3.1. Adjust the controller to obtain the operating parameters as specified for each application.

3.4. MANUFACTURER’S FIELD SERVICE

3.4.1. Require the manufacturer to provide a qualified service engineer’s time in the amount of one normal work day per adjustable frequency motor control unit. This time will be used to ensure proper connection and functioning of the equipment prior to start-up and to train owner personnel in the use of the equipment.

3.4.2. Require the Service Engineer to tune each adjustable frequency motor control unit to a coordinated maximum continuous amperage setting with corresponding calibration of the volts to hertz ratio to reflect the actual site voltage and motor requirements. All drives shall be set up and tuned in conjunction with the system balancing and shall be coordinated with final test and balance and control system set-up.

3.4.3. Require the manufacturer to provide one spare for each type of plug-in PC card, color-coded or otherwise keyed to their original counterpart. In addition to the cards, require the manufacturer to provide two spares per drive of all expendable items such as fuses and pilot lamps.

END OF SECTION
SECTION 23 20 00
BUILDING SERVICES PIPING

1. PART 1 - GENERAL

1.1. GENERAL

1.1.1. This section covers basic materials and methods which may be common to one or more subsequent sections.

1.2. WORK INCLUDED

1.2.1. Valves
1.2.2. Backflow Preventers
1.2.3. Sanitary Waste and Vent Piping
1.2.4. Domestic Water Piping
1.2.5. Heating and Cooling Piping
1.2.6. Piping Joints
1.2.7. Hangers and Supports
1.2.8. General Piping Specialties
1.2.9. Heating and Cooling Piping Specialties
1.2.10. Heating and Cooling Pumps
1.2.11. Chemical Water Treatment

1.3. RELATED SECTIONS

1.3.1. Section 33 00 00 for Site Water Storm Drainage, and Sanitary Sewerage Distribution
1.3.2. Section 23 05 00 for Basic Mechanical Materials and Methods
1.3.3. Section 23 07 00 for Mechanical Insulation and Pre-Insulated piping
1.3.4. Section 23 09 00 for Automatic Valve Operators

1.4. SUBMITTALS (Also refer to 23 05 00)

1.4.1. Prior to commencement of work, provide submittals on the following:

1.4.1.1. Valves
1.4.1.2. Backflow Preventers
1.4.1.3. Piping Specialties (Heating and Cooling and General)
1.4.1.4. Hydronic Pumps
1.4.1.5. Chemical Water Treatment
1.4.1.6. Underground Pre-insulated Piping

1.4.1.7. Pipe Hangers

2. PART 2 – PRODUCTS

2.1. GENERAL

2.1.1. Piping and piping specialties exposed within air plenums 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.

2.2. VALVES

2.2.1. Provide isolation valves and either unions or flanges to isolate and to allow removal of all mechanical equipment.

2.2.2. All isolation valves (SOVs) 2" and smaller shall be 1/4 turn ball valves. SOVs 2-1/2" and larger shall be butterfly valves.

2.2.3. Valves shall be of an approved make, equivalent to Stockham company numbers listed as follows:

2.2.3.1. Bronze Ball Valves - 2" and under 600 psi CWP, 150 psi SWP, two piece construction, full port, blowout proof stem, 1/4 turn, PTFE packing and seats, adjustable packing nut, bronze ball, threaded ends: Stockham S206BR-R-T, solder ends with extended solder cops: Stockham S206BR-R-S.

2.2.3.2. Bronze Check Valves - 2" and under Class 125#, 200# WOG, swing check, bronze disc, threaded ends: Stockham B-319; Solder ends: Stockham B-309.

2.2.3.3. Iron Butterfly Valves - 2-1/2" and larger 200 psi wog, full lug style, iron body, field replaceable EPDM seat, 410 stainless steel stem, aluminum bronze disc, no painting of disc to stem connections 12" and under, 2" through 6" - lever lock operated: Stockham LG-712-BS3-E; 8" and larger-gear operated: Stockham LG-722-BS3-E.

2.2.3.4. Iron Check Valves - 2-1/2" and larger Class 125#, IBBM, renewable seat and disc, bolted cap, swing, flanged ends: Stockham G-931; threaded ends: Stockham G-927.

2.2.4. Valves in Insulated Piping: Valves shall have 2-inch stem extensions and the following features:

2.2.4.1. Ball Valves: Shall have extended operating handle of non-thermal-conductive material, protective sleeve that allows operation of valve without breaking the vapor seal or disturbing insulation, and memory stops that are fully adjustable after insulation is applied.

2.2.4.2. Butterfly Valves: Shall have extended necks.

2.2.5. All valves shall be of the same manufacturer equivalent of Stockham, Red and White, Nibco, Hammond, Henry, and SSI Equipment.

2.3. BACKFLOW PREVENTERS

2.3.1. The backflow preventer shall be a Reduced Pressure Principle and shall include a tightly
closing resilient-seated shut-off valve on each end of the body. The assembly shall be fitted
with four properly located resilient-seated test cocks.

2.3.2. The assembly shall have two independent and internally loaded check valves and a pressure
differential relief valve located between the check valves.

2.3.3. The backflow preventer shall be suitable for supply pressure up to 175 psi and water
temperature from 33 to 180°F.

2.3.4. The backflow preventer shall meet the requirements of the following standards: USC's FCCC
and HR Manual, Sec. 10, ASSE 1013, AWWA C-5111, IAPMO, and CSA B65.5.

2.3.5. Approved manufacturers are: Conbraco, Watts, Febco, Flomatic Valves

2.4. SANITARY WASTE AND VENT PIPING

2.4.1. The sanitary waste and underground sanitary vent piping shall be solid wall Schedule 40 PVC
DWV (ASTM D2665). If contractor willingly accepts all responsibility for any associated future
failure problems with all underslab waste pipe installation, ABS DWV (ASTM D2661-11)
plastic pipe will be accepted, as an approved alternate. All piping shall bear the seal of a
nationally-recognized listing or certifying agency and shall be installed per manufacturer's
recommendations. Sanitary vent piping exposed within the equipment yard shall be standard
weight hubless cast iron soil pipe conforming to the requirements of CISPI standard 301-97
and ASTM A-888 with fittings conforming to ANSI B-16.4. Pipe and fittings shall be marked
with a collective trademark of the Cast Iron Soil Pipe Institute and shall receive prior approval.

2.4.2. Sanitary vent pipes 2” and smaller may be Schedule 40 galvanized steel pipe with threaded
cast iron galvanized malleable iron fittings.

2.5. DOMESTIC WATER PIPING

2.5.1. Above ground domestic water piping shall be Type L seamless hard drawn copper tubing with
cast brass or wrought copper fittings for piping up to 2” and wrought copper fittings for 2-1/2”
and larger.

2.5.2. Underground domestic water piping shall be Type K copper, soft annealed, without joints
when possible.

2.6. COOLER DRAIN PIPING

2.6.1. Cooler drain piping shall be type ‘DWV’ copper with type ‘DWV’ fittings and cleanouts at
changes in direction. Provide appropriate reducer fittings and couplings at each cooler
connection.

2.7. HEATING AND COOLING PIPING

2.7.1. Hydronic Piping:

2.7.1.1. Heating water piping shall be Type "L" hard drawn copper with wrought copper
fittings.

2.7.1.2. Above ground Condenser water piping 2 ½” and larger shall be Schedule 40
black steel with forged carbon steel fittings.

2.7.2. Underground Condenser Water Piping:

2.7.2.1. Underground condenser water supply and return piping shall be Ricwil/Perma-
Pipe Econo-Gard system composed of a PVC plastic outer jacket (minimum wall
thickness of 0.060 inches), schedule 40 black steel carrier pipe and insulated with
polyurethane foam (k factor of 0.14 Btu-in/hr-sq. ft.-degree F and closed cell
content of minimum 90%) that completely fills the annular space between the pipe and jacket. Pipe system shall have a one year factory warranty. Approved manufacturers: Ricwil/Perma-Pipe, Insul-Pipe Systems, Urecon Systems, Inc.

2.8. PIPING JOINTS

2.8.1. Cast Iron:

2.8.1.1. Joints in cast iron soil pipe below grade and joints in storm drainage pipe above and below grade shall be Husky SD 2000 white shield couplings as manufactured by Husky Technologies. Shield and clamp assembly shall include white colored type 304 corrugated, 0.010” minimum thick shield with multiple bands and neoprene gaskets complying with ASTM C-564. Approved manufacturers: Husky, A.B. & I.

2.8.1.2. Joints in cast iron soil pipe above ground, within the building shall also be of the shield and clamp type, with corrugated stainless steel shield conforming to CISPI 310-97 and ASTM C-564 standards. Approved manufacturers: Husky, Mission, A.B. & I, Tyler, Clamp-All.

2.8.2. Plastic Pipe:

2.8.2.1. Joints in plastic pipe shall be made using solvent cement per manufacturer’s recommendations.

2.8.2.1.1. Solvent cement for PVC welding shall have maximum volatile organic compound (VOC) emissions of 510 g/L less water.

2.8.2.1.2. Solvent cement for CPVC welding shall have maximum volatile organic compound (VOC) concentration emissions of 490 g/L less water.

2.8.2.1.3. Solvent cement for ABS welding shall have maximum volatile organic compound (VOC) emissions of 325 g/L less water.

2.8.3. Copper Water Piping:

2.8.3.1. Joints in copper water piping 2” and smaller above grade shall be soldered with ENGELHARD “SILVABRITE 100”, 100% LEAD FREE or other non-lead solder, minimum 4,000 psi tensile strength using nokorode solder paste applied with a brush to both the pipe and the inside of the fitting socket. No acid core solder nor flux containing acid shall be used. Pipe shall be cut square and reamed. The parts of the pipe and fittings to be soldered shall be thoroughly cleaned with sand cloth before applying flux.

2.8.3.2. Joints in copper piping 2 ½” and larger and all sizes below grade shall be brazed using a brazing compound with a minimum of 15% silver.

2.8.4. Hydronic Piping:

2.8.4.1. Joints in steel piping shall be welded. Joints in chilled, heating and condenser water piping above grade may be made with Victaulic couplings at contractor’s option.
2.8.5. Underground Chilled Water Piping:

2.8.5.1. Joints and fittings in pre-insulated underground chilled water piping shall be welded per section 2.8.4.1 and field insulated with Ricwil/Perma-Pipe elbow insulation field kit #EG-1110-AA. Service elbow shall be provided by the mechanical contractor. Fittings shall be provided as required to render a complete installation. Concrete thrust blocks shall be provided in accordance with manufacturer’s recommendations.

2.9. HANGERS AND SUPPORTS

2.9.1. Pipe Hangers:

2.9.1.1. Approved manufacturers: Elcen, Unistrut, B-Line.

2.9.1.2. All piping within the confines of the building shall be supported by means of adjustable steel clevis hangers spaced per ASHRAE recommendations and suspended from the building construction by all thread rods sized per ASHRAE. Strap, wire, or chair hangers are not permitted. Where suspended from steel structural members, appropriate clamps shall be used. Provide a sheet metal saddle, minimum 12” long by two times the diameter of the outside of the insulated pipe at all hangers for insulated pipe.

2.9.1.3. Trapeze hangers may be used in lieu of individual clevis hangers at contractor’s option. Where trapeze length exceeds 42”, an additional hanger rod shall be installed at mid-span. Trapeze hangers shall be spaced no further apart than the smallest pipe on the trapeze requires. Provide hold down clamps for each insulated pipe and a sheet metal cover full diameter of pipe insulation at each hold down clamp.

2.9.1.4. Where piping is supported from concrete or masonry construction, approved concrete inserts shall be used. Anchors shall be equivalent to HILTI “HDI” drop-in anchors or HILTI “HVA” adhesive anchors as required to accommodate applicable loads. Coordinate selection with structural. Power driven anchors/studs shall not be used.

2.9.1.5. Clevis hangers shall be sized large enough to pass insulation on insulated pipe. Provide sheet metal saddle for piping 1” and larger. Refer to 23 07 00 for inserts on larger piping.

2.9.1.6. Pipe Rollers: All pipe rollers shall be of single piece cast iron construction. Reference, Elcen #17. Provide chain; carrier; clevice as required per each roller application. Individual rollers on each side of pipe are not acceptable.

2.9.1.7. All sizes of non-insulated copper piping shall be supported using “Trisolator #500” isolators at all support locations.

2.9.1.8. Insulated piping up to 1-1/2” shall continue insulation through support clamp or hanger.

2.9.1.9. Plastic piping shall be supported a minimum of 4’ on center or as required to avoid sagging.
2.9.1.10. Except where governed by local codes, maximum hanger spacing for metal piping and minimum hanger rod sizes shall conform to the following table:

<table>
<thead>
<tr>
<th>Pipe Size</th>
<th>Spacing</th>
<th>Hanger Rod</th>
</tr>
</thead>
<tbody>
<tr>
<td>Steel Pipe</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1/2&quot;</td>
<td>6'-0&quot;</td>
<td>3/8&quot;</td>
</tr>
<tr>
<td>3/4&quot;-1-1/4&quot;</td>
<td>8'-0&quot;</td>
<td>3/8&quot;</td>
</tr>
<tr>
<td>1-1/2, 2&quot;</td>
<td>10'-0&quot;</td>
<td>3/8&quot;</td>
</tr>
<tr>
<td>2-1/2&quot;</td>
<td>10'-0&quot;</td>
<td>1/2&quot;</td>
</tr>
<tr>
<td>3&quot;</td>
<td>12'-0&quot;</td>
<td>1/2&quot;</td>
</tr>
<tr>
<td>4&quot;</td>
<td>12'-0&quot;</td>
<td>5/8&quot;</td>
</tr>
<tr>
<td>5&quot;</td>
<td>12'-0&quot;</td>
<td>5/8&quot;</td>
</tr>
<tr>
<td>6&quot;</td>
<td>12'-0&quot;</td>
<td>3/4&quot;</td>
</tr>
<tr>
<td>8-12&quot;</td>
<td>12'-0&quot;</td>
<td>7/8&quot;</td>
</tr>
<tr>
<td>Copper Pipe</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1/2&quot;</td>
<td>6'-0&quot;</td>
<td>3/8&quot;</td>
</tr>
<tr>
<td>3/4&quot;, 1&quot;</td>
<td>8'-0&quot;</td>
<td>3/8&quot;</td>
</tr>
<tr>
<td>1-1/4&quot;, 2&quot;</td>
<td>10'-0&quot;</td>
<td>3/8&quot;</td>
</tr>
<tr>
<td>2-1/2&quot;, 5&quot;</td>
<td>12'-0&quot;</td>
<td>1/2&quot;</td>
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<tr>
<td>6&quot; and above</td>
<td>12'-0&quot;</td>
<td>3/4&quot;</td>
</tr>
<tr>
<td>Cast Iron</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2&quot;</td>
<td>1 ea. Joint</td>
<td>3/8&quot;</td>
</tr>
<tr>
<td>3&quot;</td>
<td>1 ea. Joint</td>
<td>1/2&quot;</td>
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<tr>
<td>4&quot; &amp; 5&quot;</td>
<td>1 ea. Joint</td>
<td>5/8&quot;</td>
</tr>
<tr>
<td>6&quot;</td>
<td>1 ea. Joint</td>
<td>3/4&quot;</td>
</tr>
</tbody>
</table>

2.9.2. Piping Supports:

2.9.2.1. All piping shall be supported as shown on plans.

2.10. GENERAL PIPING SPECIALTIES

2.10.1. Unions:

2.10.1.1. Unions in screwed steel pipe 2" and smaller and all unions in gas pipe shall be ground joint malleable iron with brass to iron seats.

2.10.1.2. Unions in welded pipe shall be a slip-on weld flange.

2.10.1.3. Unions in copper pipe 2" and smaller shall be ground joint copper unions equivalent to Mueller C-107. Unions for 2-1/2" and larger pipe shall be bronze flanges.

2.10.1.4. Provide nuts, bolts, and gaskets for flanges. Materials shall be compatible with the piping and fluid conveyed.

2.10.2. Sleeves:

2.10.2.1. Pipe sleeves shall be schedule 40 steel pipe for all pipes passing through fire rated floors or walls. Sleeves for non-rated walls shall be PVC schedule 40 pipe or 18-gauge sheet metal. Sleeves for uncovered pipe shall be two pipe sizes larger than the main. Sleeves for insulated mains shall be of sufficient size to pass the covering with a minimum 1/4" clearance.

2.10.3. Pressure Reducing Valve:

2.10.3.1. Approved Manufacturers: Watts, Conbraco, and Wilkins.

2.10.3.2. Valve shall be suitable for water supply pressures up to 300 psi and a maximum temperature of 180°F. Bronze body construction with inlet and outlet NPT unions and gauge tapping with pressure gauge. Coordinate pressure range and setpoint with equipment prior to ordering. Provide a pressure reducing valve in
accordance with manufacturer’s instructions for each dishwasher, glasswasher, and similar items and where indicated on drawings. Pressure range shall be 10-35 psi for dishwashers as indicated by the manufacturer. Equivalent to Watts series N35BDU-LP-GG.

2.10.4. Balancing Valves:

2.10.4.1. Approved Manufacturers: Armstrong, Bell & Gossett, Watts, Taco.

2.10.4.2. Multi-turn (1/2" to 12"): Each valve shall have two 1/4" NPT brass metering ports with Nordel check valves and gasketed caps located on both sides of valve seat. Two additional 1/4" NPT connections with brass plugs are to be provided on the opposite side of the metering ports for use as drain connections. Drain connections and metering ports are to be interchangeable to allow for measurement flexibility when valves are installed in tight locations. Valve shall provide multi-turn, 360° adjustment with a micrometer type indicator located on valve handwheel. Valve handwheel shall have hidden memory feature which will provide a means for locking the valve position after the system is balanced. 90° turn adjustable valves are not acceptable. Valves are to be of the “Y” pattern, modified, equal percentage globe style and shall provide three functions: 1) Precise flow measurement, 2) Precision flow balancing, 3) Positive drip tight shut-off.

2.11. HEATING AND COOLING PIPING SPECIALTIES

2.11.1. Air and Dirt Separators

2.11.1.1. Manufacturers:

1. Taco, Inc; 4900 (size and capacity as called for on plans)
2. Spirotherm.

2.11.1.2. Air and dirt removal device shall be constructed of steel. It shall be designed, fabricated and stamped per ASME Section VIII Division 1 with a maximum working pressure of 125 psi at 270°F. Manufacturer shall be holder of ASME U stamp. Manufacturer to have optional 250 psi and 150 psi ASME units available.

2.11.1.3. Units up to three 3-inch in size shall be provided with threaded connections as standard. Units four 4-inch and larger shall be provided with flanged system connections as standard. Inlet and outlet connections to be inline with piping system. Both inlet and outlet to be in the same horizontal and vertical planes.

2.11.1.4. Each air and dirt removal device shall be equipped with a brass conical shaped air venting chamber designed to minimize system fluid from fouling the venting assembly. The air vent shall be able to be closed to allow flushing and purging of dirt via side port without dirt passing through vent on initial system fill.

2.11.1.5. A brass flushing cock shall be located on the side of each separator to facilitate system fast-fill and removal of the floating impurities from the air system interface within the separator.

2.11.1.6. A blow down valve shall be provided by the unit manufacturer on the bottom of each unit to allow blow down and cleaning. On units 2 ½" and smaller the valve and all of its fittings shall be 1". On units three 3" and larger the valve and all openings shall be 2".

2.11.1.7. The air and dirt removal device shall remove air down to 18 microns and shall remove dirt/debris down to 35 microns. The unit shall be 100% efficient at
removing dirt down to 90 microns in 100 passes or less.

2.11.1.8 The unit manufacturer shall provide the owner and design engineer third party independent test data certifying that their unit performs to the above standards. Suppliers not providing these independent performance test results will not be acceptable.

2.11.1.9 The air and dirt separator shall employ the use of high surface area pall rings to achieve optimal separation of air and dirt with minimal pressure drop. The pall rings shall be made of stainless steel. Stainless steel will be the only acceptable material used for suppressing turbulence and increasing surface area for high efficiency air and dirt removal. Inferior materials of construction such as copper for the straining medium will not be acceptable.

2.11.1.10 The unit shall be manufactured with a removable cover to facilitate removal, inspection, and cleaning of the pall ring basket. The entire pall ring basket shall be constructed of stainless steel. For safety and ease of service the unit shall be accessed from the top and the pall ring basket shall be accessed as one complete assembly housed in a stainless steel cage.

2.11.2 Flexible Stainless Steel Hoses:

2.11.2.1. Approved Manufacturers: Mason, C-Flex, Metraflex, Twin City Hose, or approved equivalent.

2.11.2.2. Flexible stainless steel hoses shall be manufactured using type 304 stainless steel hose and braid. Sizes 2-1/2" and larger shall have one fixed and one floating raised face carbon steel plate flange.

2.11.2.3. Minimum lengths and minimum number of corrugations per foot to assure flexibility are as tabulated:

<table>
<thead>
<tr>
<th>Pipe Size</th>
<th>Flanged Face to Face</th>
<th>Copper or Threaded Ends End to End</th>
<th>Minimum Corrugations per Foot</th>
</tr>
</thead>
<tbody>
<tr>
<td>3&quot;</td>
<td>12&quot;</td>
<td>-</td>
<td>54</td>
</tr>
</tbody>
</table>

2.11.1.4. Hoses shall be installed on the equipment side of the shut off valves horizontal and parallel to the equipment shafts wherever possible.

2.11.1.5. Submittals shall include type of stainless steel and fittings, lengths, and number of corrugations per foot, as well as temperature and pressure ratings.

2.11.2. Strainers:

2.11.2.1. Approved Manufacturers: Armstrong, Yarway, Watts, SSI Equipment

2.11.2.2. Chilled and heating water strainers to be full size, bronze body "Y" pattern, 1/8" perforation mesh monel metal screens. 2" and smaller shall be screwed, 2-1/2" and larger shall be flanged. Strainers to have 3/8" drain valve and cap.

2.11.2.3. Chilled and heating water strainers 2-1/2" and larger to be full size, cast iron body "Y" pattern, 1/8" perforation stainless steel mesh metal screens for strainers 2-1/2" to 8" in size. 3/16" perforations on strainers 10" to 12" in size. Strainers to have 3/8" drain valve and cap. Strainers 2-1/2" and larger shall be flanged. Armstrong, Yarway, Watts, or equivalent.

2.11.3. Stick-Type Thermometers:
2.11.3.1. Approved manufacturers: Powers, Weiss, Weksler, Trerice, Miljoco, Winters Instruments

2.11.3.2. Thermometer to have Red reading mercury, adjustable angle with 9" scale constructed of GE Valox 735 polyester or cast aluminum and heavy glass lens securely mounted to prevent rattling. Scale shall be white coated aluminum with permanently baked bold black markings locked in place and adjusted through a device at top of scale. There shall be no mounting screws to cover up the scale markings. Accuracy shall be 1% of scale range. Provide range of 0-120 degrees for chilled water and range of 30-240 degrees for heating hot water applications.

2.11.3.3. Thermometer shall be supplied with a brass well of 3-1/2" in length for systems up to 6" in pipe diameter. 6" stem lengths shall be provided for larger diameter pipe applications. Wells to be of the extended neck type when used on applications requiring more than 1" insulation.

2.11.3.4. Locate all thermometers as close as possible to equipment being monitored. Thermometer shall be mounted no higher than 7' from floor and shall be easily accessible by the operator.

2.11.4. Pressure Gauges:

2.11.4.1. Approved manufacturers: Powers, Weiss, Weksler, Trerice, Miljoco, Winters Instruments

2.11.4.2. Pressure gauge shall have 4-1/2" diameter dial, stainless steel case with 1/4" NPT lower connection, copper alloy bourdon tube, brass socket with silver soldered connection and 1% mid-range accuracy with recalibrating pointer. Provide with snubber and gauge cock. When used on a steam line, supply with a steel syphon tube. Provide scales suitable for specific systems, including compound gauges, so gauge will read within the middle 1/3 of the overall scale. Note: Cooling tower pump requires compound gauge.

2.11.5. P-T Plugs:

2.11.5.1. Approved Manufacturers: Cflex, Sisco, Watts.

2.11.5.2. Test plug of solid brass into appropriately sized welded socket, threaded boss, valve or vessel. Plugs shall be located per project drawings. Test plug shall have a dual seal core or Nordel, good up to 350°F for water, (or neoprene to 200°F for natural gas) and shall be rated zero leakage for vacuum to 1000 psig. Plug shall be capable of receiving a pressure or temperature probe.

2.11.5.3. For insulated pipe, provide extended test plugs.

2.11.5.4. Owner shall be provided with one master test kit. Kit shall contain one or two 2-1/2" or 3-1/2" pressure gauges of suitable range, one or two gauge adapter(s) 1/8" o.d. probe(s) and two 5" stem pocket testing thermometers consisting of one 0-220°F, and one 50-550°F in a sturdy custom carrying case.

2.12. HEATING AND COOLING PUMPS

2.12.1. General:

2.12.1.1. Approved Manufacturers: Armstrong, Bell & Gossett, Taco, Paco.
2.12.1.2. Pumps shall be either single stage vertical split case, base mounted, flexible coupled, or in-line close coupled, single stage style as noted on the drawings. Pumps shall be cast iron construction, bronze fitted. The pumps shall be capable of being serviced without disturbing piping connections.

2.12.1.3. The impeller shall be of the enclosed type, hydraulically and dynamically balanced and keyed to the shaft and secured with a suitable lock nut or locking cap screw.

2.12.1.4. The motor shall meet NEMA specifications and be of standard industrial style with re-greaseable ball bearings. The pump shall not overload the motor at any point on the curve. Bearings shall be rated at a minimum L50 life of 200,000 hours at maximum speed.

2.12.1.5. Each pump shall be factory tested. It shall then be thoroughly cleaned and painted with one coat of high grade machinery enamel prior to shipment. A set of installation instructions shall be included with each pump at the time of shipment.

2.12.2. Pumps: (Base Mounted)

2.12.2.1. Pumps shall be base mounted, single stage, end suction design. The pump internals shall be capable of being serviced without disturbing the motor.

2.12.2.2. Pump seal shall be a standard single mechanical seal with carbon seal ring and ceramic (or Tungsten Carbide) seat.

2.12.2.3. A replaceable shaft sleeve shall be furnished to cover the wetted area of the shaft under the seal or packing.

2.12.2.4. The pump and motor shall be mounted on a common baseplate of heavy structural steel design with securely welded cross members and open grouting area. A flexible coupler, capable of absorbing torsional vibration, shall be employed between the pump and motor, and it shall be equipped with a suitable coupling guard as required.

2.13. CHEMICAL WATER TREATMENT

2.13.1. Systems and chemicals shall be provided by Tucson based full time, full service water treatment company with a minimum of three years experience in the water treatment business. The water treatment system shall be designed to control total dissolved solids, corrosion, scale, algae and fungus. This includes automatic feed and bleed control equipment, chemical treatment, and a service program as applicable. Control system shall have a built in flow switch or be interlocked with condenser water pump to shut down system in case of no water flow. This package shall be provided complete by a single water treatment firm for individual responsibility.

2.13.2. The water treatment company shall provide:

2.13.2.1. Initial water analysis and recommendations.

2.13.2.2. System start-up assistance.

2.13.2.3. Initial water treatment of the condenser water system.

2.13.2.4. Two year supply of chemicals.

2.13.2.5. Two year service program with minimum monthly inspections of all equipment.
2.13.2.6. Logs and written test instructions to be provided.

2.13.3. Water treatment company to provide water test kit to owner and give a minimum of four hours instruction in the use of the water test kit and instructions of required preventive maintenance. Verification of this instruction signed by owner's representative to be submitted with final operating and maintenance manuals. Test kit to include inhibitor kit and TDS meter.

3.  PART 3 - EXECUTION

3.1. VALVES

3.1.1. Valves shall be installed with valve stem in upright (vertical) orientation.

3.1.2. Provide access panels for any valves located above solid ceilings at valve location.

3.1.3. Provide a shut-off valve or angle stop with cast brass stem and nuts to isolate all plumbing equipment.

3.1.4. Provide isolation valves where shown on drawings and at branch lines to multiple (more than two) fixture groups.

3.1.5. All flexible piping connectors (expansion joints) shall be installed on the equipment side of the shut off valves.

3.2. BACKFLOW PREVENTERS

3.2.1. Reduced pressure backflow preventers shall be installed at connections between potable and non-potable water systems. Reduced pressure backflow assemblies shall have drains extended to the nearest floor drain.

3.2.2. Anti-siphon, pressure type vacuum breakers shall be installed at connection to irrigation systems.

3.2.3. Reduced pressure backflow preventers shall be provided with an air gap drain funnel for each unit connected to a full-size rigid drain line. Terminate over appropriately sized (for full flow) drain with air gap.

3.3. CAST IRON JOINTS

3.3.1. Husky Couplings with at least 4 sealing bands shall have each bolt per band torqued to 80 inch-pounds and retorqued no sooner than four hours later. Husky Couplings with only 2 sealing bands shall have each bolt per band torqued to 125 inch-pounds and retorqued no sooner than four hours later.

3.3.2. Standard couplings shall have each bolt of the clamp assembly torqued to 60 inch-pounds and retorqued no sooner than four hours later.

3.4. PLASTIC PIPE

3.4.1. Joints in plastic pipe shall be made with solvent and cement per manufacturer's recommendations.

3.4.2. Plastic piping exposed to sunlight shall be painted with two coats of latex paint. Color shall be white unless otherwise specified by Architect.
3.5. COPPER PIPING JOINTS

3.5.1. No acid core solder or flux containing acid shall be used.

3.5.2. Pipe shall be cut square and reamed.

3.5.3. The parts of the pipe and fittings to be soldered shall be thoroughly cleaned with sand cloth before applying flux.

3.5.4. Maintain a minimum of 50% penetration of brazed joints.

3.6. HANGERS AND SUPPORTS

3.6.1. Support piping to adequately prevent sagging, pocketing, swaying, and displacement.

3.6.2. Vertical piping shall be secured to structure.

3.6.3. Piping shall not be racked to the floor in kitchen or areas other than mechanical rooms.

3.7. ESCUTCHEONS

3.7.1. All pipes passing through walls, floors, or ceiling in finished rooms shall be fitted with polished chrome plated escutcheons.

3.8. UNIONS

3.8.1. A dielectric union shall be used to join any dissimilar metals.

3.8.2. Unions shall be installed in piping on the equipment side of each service valve and in all connections to fixtures or equipment where the trimmings do not permit convenient removal.

3.9. SLEEVES

3.9.1. Where pipes pass through floors (except slab on grade) or interior masonry or concrete walls, pipe sleeves shall be installed. Sleeves through concrete walls or floors shall be installed with minimum 1" clearance to be packed and sealed. Sleeves through floors shall extend a minimum of two inches above the finished floor. Sleeves through walls shall be one continuous piece and shall extend from finished surface to finished surface.

3.9.2. The outer surface of the sleeve shall be fixed to the partition it penetrates with pour rock, mortar, or etc. for fire-resistance-rated assemblies, the internal surface shall be sealed with a UL 2079 approved firestopping material. Sealant shall be tested per ASTM E 1399. Equivalent to Bio Fireshield Biostop 500+.

3.9.2.1. Firestopping material shall have maximum volatile organic compound (VOC) emissions of 50 g/L less water.

3.9.3. Sleeve shall not support pipes as it will transmit vibration and sound to structure.

3.9.4. Copper pipe passing through a steel sleeve shall be protected with polyethylene tape or other approved dielectric materials.
3.10. BALANCING VALVES

3.10.1. Balance valves shall be installed with flow in the direction of the arrow on the valve body. Install valves at least five pipe diameters downstream from any fitting, at least ten pipe diameters downstream from any pump, and with no fittings at least two pipe diameters downstream of the valve. Install to allow for easy and unobstructed access to the valve handwheel and metering ports for adjustment and measurement. Locate to prevent sediment build-up in metering ports.

3.11. INSTALLATION

3.11.1. No service lines shall be laid on the backfill over other service lines or conduits except at crossings. All piping shall be accurately cut and installed in place without forcing. Changes in direction shall be made with fittings. Bending of pipe is not permitted. Reducing fittings shall be used where pipe sizes change, rather than bushings.

3.11.2. Pipe and fittings located within return air plenums shall have a flame spread index of not more than 25 and a smoke developed rating of not more than 50 when tested in accordance with the test for Surface Burning Characteristics of Building Materials, U.B.C. Standard Number 42.1.

3.11.3. Route piping to allow sufficient access to all equipment, valves, controls, etc., for maintenance.

3.11.4. In general, piping shall be installed below electrical conduits not requiring maintenance access.

3.11.5. Provide isolation valves on each side of strainer.

3.11.6. Install piping sufficiently below structure to allow top air vents.

3.11.7. Cap all pipe openings during construction until final connections are made. Also caps or plugs for end of line valves until final connections are made.

3.11.8. Provide approved, listed fire-stopping materials for any piping which pass through fire partitions, rated walls, or floors. Coordinate with Architectural specifications.

3.11.9. Install piping parallel or at right angles to the building, straight, plumb, and level (or at slope as required). Piping shall be pitched for drainage at a uniform slope to drainage points.

3.11.10. Provide a pressure reducing valve on water lines which are subject to pressures above 80 psi and for any lines to fixtures which require less pressure than the building pressure.

3.12. EXCAVATION, TRENCHING AND BACKFILLING

3.12.1. Do all excavating and backfilling necessary for the installation of this work. This shall include the cutting of sidewalks and pavings if required.

3.12.2. All work under this heading shall be in accordance with Section 31 (earthwork section) of these specifications.

3.12.3. Where trenches cross roads, walks, or public thoroughfares, provide suitable barricades and bridges adequately protected by signs or red flags during the day and lights at night.

3.12.4. No piping shall be concealed or buried before inspection by authorized person.

3.12.5. All trenches shall be dug to exact grade and depth with only sufficient dirt removed to
provide working space. Trenches shall be dug 6" below the required depth and shall be refilled to proper depth with sand. Accurately grade sand in bottom of trenches to provide uniform bearing and support for each section of pipe at every point along its length. Trenches shall not be more than 18" wider than the external diameter of the pipe or duct and the sides shall be as perpendicular as possible. Trenches shall be shored or sheet piled if necessary to prevent caving and to protect the work of other contractors of existing structure.

3.12.6. All excavations shall be refilled with sand to 6" above piping and the rest with loosen granular, moist earth thoroughly tamped. Compact backfill to 95% of maximum density within limits of building, under sidewalks, under slabs on grade, and under asphalt or concrete paving.

3.12.7. After the trench is backfilled per specifications to within 12" of the finished grade, install a detectable pipe locating tape over the entire piping runs. The backfill shall be sufficiently leveled so that the tape will be installed on a flat surface. The tape shall be centered in the trench and laid flat with printed side up. Caution shall be exercised to avoid displacement of tape and to ensure its integrity. The tape shall consist of a minimum 4.0 mil thickness, inert polyethylene plastic which is impervious to all known alkalis, acids, chemicals, reagents and solvents likely to be encountered in the soil, with a minimum 1/3 mil metallic foil. The tape shall be at least three inches in width and shall be yellow in color with identifying print in black letters. The tape shall have printed thereon the following:

CAUTION - BURIED PIPELINES BELOW

The identifying lettering shall be 1" high and repeated continuously the full length of the tape. In no instance shall the spacing of the individual segment of the identifying message be greater than eight inches. Approved detection tape manufactures are Reef Industries, Alaramatape, and Linetec, Inc. The remainder of the trench shall be backfilled and compacted in accordance with these specifications.

3.12.8. Coordinate all trenching with operation "Blue stake", as applicable.

3.12.9. Underground private sewer lines outside the building structure shall have a green #18 tracer wire securely attached to it at 8’ O.C. and shall have 12” of tracer wire accessible above grade at the cleanout and be securely attached at that point.

3.12.10. Underground water lines outside the building structure shall have a blue #18 tracer wire securely attached to it at 8’ O.C. and shall have 12” of tracer wire accessible above grade at the termination and be securely attached at that point.

3.13. TESTS AND ADJUSTMENTS

3.13.1. All waste, vent, rainwater, gas, and water piping shall be tested per International Plumbing Code (IPC) before being concealed in any way. All joints shall be made driptight before being concealed. Domestic water piping shall be tested at 1-1/2 times working pressure or 100 psig, whichever is greater, for at least 15 minutes. Gas piping shall be tested with an inert gas at 1-1/2 times the working pressure or 3 psig, whichever is greater, for at least 1/2 hour per 500 cuft of piping, but no longer than 24 hours. Test on building drain, vent and rainwater piping shall be made with hydrostatic pressure to minimum 10'-0" head for at least 15 minutes.

3.13.2. Piping shall not be insulated or covered until tested and approved.

3.13.3. Heating and condenser water piping shall be pressure tested to 100 psig.
3.17. ACTIVE SERVICES

3.17.1. When encountered in work, active electric, steam, water, gas and sewer services shall be protected against damage due to construction work. If active services are encountered which require relocation, make request to proper authorities for determinations of procedure. Do not prevent or disturb operation of active services that are to remain.

END OF SECTION
1. PART 1 – GENERAL

1.1. WORK INCLUDED

1.1.1. Ducts

1.1.2. Duct Accessories

1.1.3. Air Cleaning Devices

1.2. RELATED SECTIONS

1.2.1. Section 15050 - Basic Mechanical Materials and Methods

1.2.2. Section 15080 - Mechanical Insulation

1.2.3. Section 15900 – Controls

1.2.4. Section 15950 - Testing, Adjusting, and Balancing.

1.3. QUALITY ASSURANCE

1.3.1. The following is a list of additional equipment approved for use on this project.

1.3.1.1. SPIRAL DUCT: General Metals, Metal Manufacturing, Graco, Spiro FAB Inc., Spiral Pipe of Texas, CA Systems Inc.

1.3.1.2. DUCT FITTINGS: Flexmaster, Air Tight, Inc., Metal Masters

1.3.1.3. AIR FILTERS: Farr, Flanders

1.4. SUBMITTALS (also refer to Section 15050)

1.4.1. Before beginning work, submit shop drawings or literature bound on the following items:

1.4.1.1. Ductwork

1.4.1.2. Other equipment as directed by the Architect.

2. PART 2 - PRODUCTS

2.1. DUCTS

2.1.1. Metal Ducts:

2.1.1.1. All metal ductwork shall be constructed of new galvanized steel ASTM A 527, G90 of lock-forming quality.
2.1.1.2. Ductwork gauges shall be according to latest SMACNA "HVAC Duct Construction Standards" for the 2" W.G. pressure class unless otherwise specified.

2.1.1.2.1. All duct joints shall be sealed with Hardcast FG1402-181BFX foil-grip tape or Hardcast VG-181 duct sealant. Material used for joining ducts shall be UL181 listed.

2.1.1.2.2. Branch duct connections manufactured by "Air-Tite Inc." (1-501-935-8483) may be used in lieu of spin-in collars but must still be sealed with hardcast.

2.2. DUCT ACCESSORIES

2.2.1. Volume Control Dampers:

2.2.1.1. Fabricate in accordance with SMACNA HVAC Duct Construction Standards - Metal and Flexible, and as indicated.

2.2.1.1.1. Fabricate single blade dampers for duct sizes to 9-1/2 x 30 inch (240 x 760 mm).

2.2.1.1.2. Fabricate multi-blade damper of opposed blade pattern with maximum blade sizes 12 x 72 inch (300 x 1825 mm). Assemble center and edge crimped blades in prime coated or galvanized channel frame with suitable hardware.

2.2.1.1.3. Except in round ductwork 12 inches (300 mm) in diameter and smaller, provide end bearings.

2.2.1.1.4. Provide locking, indicating quadrant regulators on single and multi-blade dampers. Where width exceeds 30 inches (750 mm), provide regulator at both ends.

2.2.2. Flexible Connections:

2.2.2.1. Provide Duro Dyne UL approved neoprene-coated fiberglass flexible connection at inlet and outlet of all air moving devices.

2.2.2.2. Equivalent manufacturer: Ductmate Industries

2.2.3. Weatherproofing:

2.2.3.1. Caulk watertight all ductwork exposed to the weather with DAP "CMC" exterior duct sealant, Hardcast Versa Grip "VG-102", or Design Polymerics DP 1010.

2.3. AIR CLEANING DEVICES

2.3.1. Filters:

2.3.1.1. Disposable, Extended Area Panel Filters: Pleated, reinforced cotton fabric; supported and bonded to welded wire grid; enclosed in cardboard frame; nominal size as indicated on drawings 2 inches thick; rated 25-30 percent average dust spot efficiency.
3. PART 3 - EXECUTION

3.1. INSTALLATION

3.1.1. Install flexible connections between fan or motorized equipment and ductwork. Flexible connectors shall not be in tension while running.

3.1.2. Prevent passage of unfiltered air around filters with felt, rubber, or neoprene gaskets.

3.1.3. Provide balancing dampers on duct take-off to diffusers, grilles and registers, regardless of whether dampers are specified as part of the diffuser, grille or register assembly.

3.1.4. Install a new set of filters after final inspection.

3.2. DUCTS

3.2.1. Furnish and install all sheet metal ducts together with necessary dampers, supports and other items required for a complete installation.

END OF SECTION
SECTION 23 60 00
REFRIGERATION EQUIPMENT

1. PART 1 - GENERAL:

1.1 WORK INCLUDED

1.1.1. Packaged Cooling Towers

1.2. RELATED DOCUMENTS

1.2.1. Section 23 05 00 – Basic Mechanical Materials and Methods
1.2.2. Section 23 07 00 – Mechanical Insulation
1.2.3. Section 23 09 00 – Energy Monitoring and Control System
1.2.4. Section 23 20 00 – Building Services Piping

1.3. QUALITY ASSURANCE

1.3.1. The mechanical equipment schedules are shown on the drawings. The following is a list of additional equipment approved for use on this project.

1.3.1.1. COOLING TOWERS: BAC, Marley, Evapco

1.4. SUBMITTALS

1.4.1. Before beginning work, submit shop drawings or literature bound on the following items:

1.4.1.1. Cooling Towers

1.5. REGULATORY REQUIREMENTS

1.5.1. AFBMA 9—Load Ratings and Fatigue Life for Ball Bearings.
1.5.2. AMCA 99—Standards Handbook.
1.5.3. CTI Certification Program
1.5.4. ASHRAE Standard 90.1
1.5.5. OSHA Safety Guidelines
1.5.6. NEMA MG1—Motors and Generators.
1.5.7. UL/CUL 508
1.5.8. ANSI B16.1
1.5.9. CTI ATC-128 Test code

1.6. STORAGE AND HANDLING
1.6.1. Comply with manufacturer’s installation instructions for rigging, unloading, and transporting units.

1.6.2. Protect units from physical damage. Leave factory shipping covers in place until installation.

1.7. WARRANTY

1.7.1. Provide a full parts warranty for one year from start-up.

2. PART 2 - PRODUCTS:

2.1. COOLING TOWERS

2.1.1. MANUFACTURERS

2.1.1.1. The following manufacturers will be considered provided they comply with contract documents. No substitutions will be permitted.

2.1.1.1.1. Marley/SPX

2.1.1.1.2. Baltimore Air Coil

2.1.1.1.3. Evapco

2.2. CONSTRUCTION

2.2.1. Except where otherwise specified, all components of the cooling tower shall be fabricated of heavy gauge steel protected by G-235 galvanizing.

2.2.2. The tower structure, anchorage and all its components shall be designed by licensed professional engineers, employed by the manufacturer, per the International Building Code to withstand a wind load of 30 psf, as well as a 0.3g seismic load. The fan deck, hot-water basin covers and maintenance platforms shall be designed for 60 psf live load or a 200 lb. concentrated load. Guardrails shall be capable of withstanding a 200 lb. concentrated live load in any direction, and shall be designed in accordance with OSHA guidelines.

2.2.3. The tower shall be structurally capable of being supported at the four outer corners of the tower cell.

2.2.4. The top of the fan shall be equipped with a conical, non-sagging, removable fan guard, fabricated of welded 5/16" and 7 gauge rods, and hot dip galvanized after fabrication.

2.2.5. The collection (cold water) basin shall be welded 300 series low-carbon stainless steel construction. The basin shall include the number and type of suction connections required to accommodate the outflow piping system shown on the plans. Suction connections shall be equipped with stainless steel debris screens. A factory-installed, float-operated, mechanical make-up valve shall be included. An overflow and drain connection shall be provided in each cell of the cooling tower. The basin floor shall slope toward the drain to allow complete flush out of debris and silt that may accumulate. The basin shall be accessible and maintainable while water is circulating.

2.2.6. Tower shall include (2) 300 series low-carbon stainless steel hot water basins (one above each bank of fill. These basin components shall be installed and sealed at the factory and assembled with bolted connections. The basins shall be equipped with removable, stainless steel covers capable of withstanding the loads described in
paragraph 2.01.B.2. The water distribution system shall be accessible and maintainable during tower fan and water operation.

2.2.7. Access doors shall be located on both cased faces for entry into the cold-water basin for access to the fan plenum area. Doors shall be at least 30” wide by 33” high and fabricated of the same material as the tower casing.

2.2.8. The top of the tower shall be equipped with a guardrail, complete with kneerail and toeboard, designed according to OSHA guidelines and factory welded into subassemblies for field installation. Fabricated from tubular steel, the guardrail assembly shall be hot dipped galvanized after welding and capable of withstanding a 200 pound concentrated live load in any direction. An 18” wide aluminum ladder with 3” I-beam side rails and 1.25” diameter rungs shall be permanently attached to the endwall casing of the tower, rising from the base of the tower to the top of the guardrail. Provide a ladder extension for connection to the foot of the ladder attached to the tower casing. This extension shall be long enough to rise from the grade level to the base of the tower.

2.2.9. On elevated towers, there shall be an access platform with perforated non-slip surface at the base of the tower extending from the vertical ladder to the endwall access door. The platform shall be surrounded by an OSHA compliant guardrail system welded into subassemblies.

2.2.10. Provide a factory-installed galvanized steel walkway above the cold-water basin overflow level extending from one cased-face access door to the other.

2.2.11. On towers with an overall height above 11 feet, provide a factory-installed, OSHA compliant, elevated grating platform for maintenance of the tower's mechanical equipment.

2.3. FILL, LOUVERS, AND DRIFT ELIMINATORS

2.3.1. Fill shall be film type, thermoformed PVC, with louvers and eliminators formed as part of each fill sheet. Fill shall be suspended from stainless steel structural tubing supported from the tower structure, and shall be elevated above the floor of the cold-water basin to facilitate cleaning. Air inlet faces of the tower shall be free of water splash out.

2.3.2. Drift eliminators shall be PVC, triple-pass, and shall limit drift losses to 0.005% or less of the design water flow rate.

2.4. MECHANICAL EQUIPMENT

2.4.1. Fan(s) shall be propeller-type, incorporating aluminum alloy blades attached to galvanized hubs with U-bolts. Blades shall be individually adjustable. Fan(s) shall be driven through a right angle, industrial duty, oil lubricated, geared speed reducer that requires no oil changes for the first five (5) years of operation. All gearbox bearings shall be rated at an L10A service life of 100,000 hours or greater and the gear sets shall have AGMA Quality Class of 9 or greater. The gearbox shall include any modifications to enable operation down to 10% of full speed.

2.4.2. Manufacturer’s proposing alternative belt-drive assemblies shall include annual belt inspect/adjustment and belt replacements as may be necessary for a period of (5) years.

2.4.3. Single-speed motors shall be NEMA Premium Efficiency, TEFC, 1.15 service factor, inverter duty, variable torque, and specially insulated for cooling tower duty (Class F) with electrical characteristics as scheduled. Motor shall operate in the shaft-horizontal position for geardrive towers and shaft-down position for alternate belt drive towers. Nameplate horsepower shall not be exceeded at design operation.
2.4.4. The motor to gearbox coupling shall be a flexible element design to accommodate frequent speed changes.

2.4.5. The complete mechanical equipment assembly for each cell shall be supported by two horizontal steel beams to resist misalignment of the drive system.

2.5. VIBRATION LIMIT SWITCH

2.5.1. A vibration limit switch in a NEMA 4 housing shall be installed on the mechanical equipment support and wired to the shutdown circuit of the fan motor starter or VFD. Switch shall interrupt control power voltage to a safety circuit in the event of excessive vibration causing the starter or VFD equipment to de-energize the motor. It shall be adjustable for sensitivity, and include a manual reset.

2.6. OPTIONAL EQUIPMENT

2.6.1. Provide an electronic water level control system including a NEMA 4X control panel, water level probes and probe stilling chamber. The control system shall monitor the water level in the cold-water basin to determine level events used for cold-water make-up, high and low alarms or pump shut down. The control panel shall use electromechanical relays providing power for the make-up solenoid and electrical contacts for alarm and pump shutdown control circuits. Probes shall be contained in a vertical stilling chamber to stabilize the water in the cold-water basin. Probes shall have replaceable stainless steel tips and level height shall be field adjustable.

2.6.2. Where each tower cell is indicated as having separately field-piped connections to each hot water basin, provide heavy-duty disc-type flow regulating valves with cast iron bodies and stainless steel operating stems. There shall be a locking handle to maintain the valve setting in any position. Valves shall be right-angle configuration, precluding the need for inlet elbows.

2.7. PERFORMANCE

2.7.1. The cooling tower manufacturer shall guarantee that the tower supplied will meet the specified performance conditions when the tower is installed according to plan. If, because of a suspected thermal performance deficiency, the owner chooses to conduct an on-site thermal performance test under the supervision of a qualified, disinterested third party in accordance with CTI or ASME standards during the first year of operation; and if the tower fails to perform within the limits of test tolerance; then the cooling tower manufacturer will pay for the cost of the test and will make such corrections as are appropriate and agreeable to the owner to compensate for the performance deficiency.

2.7.2. The cooling tower shall be designed to meet the scheduled sound performance. Sound levels shall be measured with a Type 1 (precision) system and in full conformance with ATC-128 test code published by the Cooling Technology Institute (CTI). The measurement system shall have a real-time frequency analyzer and separate microphones with an overall tolerance +/- 3 dB. All low sound options shall be CTI Certified for thermal performance.

3. PART 3 - EXECUTION:

3.1. MANNER OF PERFORMING WORK

3.1.1. Coordinate location of piping, ductwork, sleeves, inserts, hangers and equipment for this work with other trades.
3.1.2. All materials and equipment shall be installed in accordance with the approved recommendations and guidelines as issued by the respective manufacturers to conform with contract documents. The installation shall be accomplished by workmen skilled in the trades involved.

3.2. MANUFACTURER'S FIELD SERVICES

3.2.1. Provide Neoprene Isolation Pads to reduce vibration transmission.

END OF SECTION
SECTION 23 70 00
HEATING, VENTILATING, AND AIR CONDITIONING EQUIPMENT

1. PART 1 - GENERAL

1.1. WORK INCLUDED

1.1.1. Air Handling Units (Custom)

1.2. RELATED DOCUMENTS

1.2.1. Section 23 05 00 – Basic Mechanical Materials and Methods
1.2.2. Section 23 05 93 – Testing, Adjusting, and Balancing
1.2.3. Section 23 09 00 – Energy Monitoring and Control System

1.3. QUALITY ASSURANCE

1.3.1. Performance: Manufacturer shall guarantee performance when operating under the specified or indicated conditions. Manufacturer shall repair or replace equipment found deficient in field testing.

1.3.2. Unit shall be constructed in accordance with UL 1995 standards, comply with NEMA standards and shall carry an ETL or UL label. Installation of ancillary electrical components shall comply with applicable NEC standards.

1.3.3. Unit sound performance data shall be derived from testing performed in accordance with AMCA Standard 300.

1.3.4. Filter Media: ANSI/U.L. 900 listed, Class II, as approved by local authorities.

1.3.5. Air Coils: Certify capacities, pressure drops, and selection procedures in accordance with ARI 410.

1.3.6. Air-handling units shall be designed, fabricated, and installed in compliance with NFPA 90A, “Installation of Air Conditioning and Ventilating Systems”.

1.4. SUBMITTALS

1.4.1. Submit shop drawings that indicate performance, unit dimensions, weight loading, required clearances, construction details, and field connection details.

1.4.2. Product data shall include the following:

1.4.2.1. Dimensions and weights of all components, capacities, ratings, fan performance, motor electrical characteristics, and gages and finishes of materials.

1.4.2.2. Detailed fan selections including curves showing the performance of multiple fan arrays. Fan curves and tabular performance data shall indicate the ability of the fan array system to meet the specified operating point with all fans operating and with (1) fan failure. Fan array performance based on a single fan scaled to indicate performance for the number of fans in the array will not be accepted.

1.4.2.3. Sound power levels for unit inlet, outlet, and casing radiated at scheduled operating conditions.
1.4.2.4. Product data for motors, coils, filter media, and dampers.

1.4.2.5. Electrical requirements for power supply wiring including wiring diagrams for interlock and control wiring, clearly indicating factory-installed and field-installed wiring.

1.4.3. At the conclusion of the project, provide Operations & Maintenance Manuals (O&M's).

2. PART 2 - PRODUCTS

2.1. ACCEPTABLE MANUFACTURERS

2.1.1. Products meeting this specification as manufactured by the following companies are acceptable.

2.1.1.1. Huntair
2.1.1.2. Temtrol
2.1.1.3. Governair
2.1.1.4. Mammoth
2.1.1.5. Prior-approved equal as indicated via addendum

2.1.2. Requests for prior approval consideration shall be submitted by a General Contractor to the architect a minimum of (15) working days prior to the published bid date. Prior approval requests shall include complete submittal data demonstrating physical compatibility and equal redundancy and performance.

2.2. CONSTRUCTION REQUIREMENTS

2.2.1. Fabricate units in accordance with these specifications and with components and arrangement as shown on drawings.

2.2.2. Fabricate and ship units in multiple sections as indicated on the drawings or as required by shipping limitations to facilitate rigging and installation.

2.3. CASING

2.3.1. Double wall construction (2" minimum) consisting of A60 galvanized steel with minimum 16-gage exterior and 20 gage interior. Panels to be bolted standing seam construction with seams turned inward or individually secured to a steel support frame. Casing shall be suitably reinforced or braced to preclude noticeable or damaging deflection of any component at the required operating conditions. Casing exterior shall be factory painted with a UL listed industrial grade paint that meets or exceeds a 1000-hr salt spray test in accordance with ASTM117.

2.3.2. Casing design and construction methods shall preclude any exterior sweating at ASHRAE design WB conditions and the scheduled coil leaving air temperature. Units found to produce sweating within the warranty period shall be modified in the field as required to mitigate the situation solely at the contractor’s expense.

2.3.3. Insulate roof, walls, and floor with minimum 3-lbs/ft3 density glass fiber or closed cell foam insulation (minimum 2" thick). Panel construction shall result in a minimum "R" value of 8.4. Casing construction shall preclude any insulation exposed to the conditioned airstream. Utilize mat-faced insulation where perforated liners are indicated or specified.
2.3.4. Roof panels on outdoor units shall be constructed with raised seams. The top of each roof panel seam is to receive a final bead of caulking and be sealed with a 16-gauge roof cleat mechanically formed to enclose the standing seam at the roof panel to panel joint. Roof to slope from center axis of roof a minimum 1/8” per foot to allow complete water drainage and preclude standing water. Roof panels to overlap the side panels a minimum 1” all around the unit creating an overhang to reduce direct runoff from the roof down over the side panels. All doors and louvers shall have a formed rain shield extending a minimum of 1” from the wall to direct water away from the door and louver openings.

2.3.5. Access shall be provided to all components of the unit that require periodic maintenance. Access shall be via hinged double-wall access doors with construction to match the unit casing. Where unit casing height allows, provide 72” high doors. Otherwise, provide maximum door height as allowed by casing dimensions. Latches shall be operable from both the interior and exterior of the unit. Provide minimum 12”x 12” dual pane thermal glass inspection windows on access doors into fan sections. Doors shall be provided with closed cell gasket seal around the entire perimeter of the door and frame. Doors shall be “in-swing” or “out-swing” as required to open against pressure. Doors used to access rotating equipment shall be provided with an OSHA approved safety latching mechanism requiring a tool to open, and shall also have highly visible, permanently fixed, caution sign on the exterior of the door.

2.3.6. Provide a fully welded, 304 stainless steel double wall insulated drain pan in cooling coil sections. The drain pan shall extend completely under the coil rack and a minimum of 18 inches beyond the leaving face of the cooling coil. Drain pans shall be double-sloped for positive drainage. All cooling coils shall be removable without cutting or removing any portion of the drain pan.

2.3.7. Unit base shall be fully welded structural steel around the entire perimeter of the unit and shall include intermediate structural steel supports as required for all internal components. Provide a 3/16” A60 steel tread-plate floor with continuously welded or mechanically fastened and caulked seams. The unit base shall include a 20 gage galvanized steel liner under floor insulation. Unit base shall be provided with fully welded brackets that receive removable steel plate lifting lugs.

2.3.8. On curb mounted units, the structural steel base shall include sealing angles welded to the inside of the base so that the curb is recessed into the base by a minimum of 2” (vertically). Provide a minimum 1-1/2” wide by 1/4” thick continuous foam rubber seal strip around the perimeter of the curb.

2.3.9. Unit shall be designed to fit onto the roof curb of the existing air handling unit. No additional roofing for the installation of the air handling unit shall be required by the general contractor.

2.3.10. Where unit must be provided in sections to facilitate shipment and/or rigging, each section shall include a full-perimeter structural steel frame with all required hardware for re-assembly. All seams shall be gasketed and caulked.

2.3.11. Unit casing leakage rate shall not exceed 0.5% of the design flow rate at the scheduled total static pressure after field assembly. If leakage is found during the warranty period, the Owner may (at his option) hire a test and balance contractor to field test the unit for leakage. If the leakage rate exceeds the specified requirements, the installing contractor shall be responsible for all field modifications necessary to comply with the specifications as well as all costs associated with the initial leakage test and subsequent testing to demonstrate compliance.

2.3.12. All floor penetrations larger than one square foot, including damper openings, shall be covered with removable heavy gauge walk on service grating bolted in place. The service grating shall be capable of supporting a minimum dead load of 300 pounds.
2.4. FAN SYSTEMS

2.4.1. Each fan system array shall consist of multiple fan/motor assemblies ("cubes") consisting of an intake wall, inlet funnel, fan wheel, motor, and motor support structure. Each fan/motor cube shall be dynamically balanced to meet AMCA standard 204-96, category BV-5, to meet or exceed Grade 1.0.

2.4.2. Each fan shall be a direct driven, arrangement 4 plenum fan rated and certified in accordance with AMCA publication 211 and comply with the requirements of the AMCA Certified Ratings Program. Fans shall be constructed per the AMCA requirements for the duty specified, (Class I, II, or III) and shall be selected to operate at a system Total Static Pressure that does not exceed 90% of the peak static pressure producing capability at the design fan/motor speed.

2.4.3. The fan system shall produce a uniform velocity profile within the airway tunnel so as not to exceed the specified cooling coil and/or filter bank face velocity when measured at a point 12” upstream or 48” downstream of the intake plenum bulkhead.

2.4.4. Each fan system shall include an integral electrical control panel. Panels shall be NEMA rated, UL listed surface mounted or recessed enclosure as indicated on the drawings. Each enclosure shall include a single point electrical connection for the multiple fan system with one disconnect and overload protection for each fan motor in the array. The system panel shall be provided with internal ground fault protection such that a ground fault in any motor circuit does not cause a system shutdown.

2.4.5. Each fan system control panel shall include a system optimization controller that automatically configures the number of active fans in the array to achieve peak operating efficiency of the system at all operating points. Optimization shall be achieved by enabling and disabling fans automatically and varying the operating speed of the enabled fans based on the concurrent system flow and pressure demands of the system. The controller shall include a local touch screen interface and allow for remote monitoring and control of the Fanwall System using an industry standard protocol such as LonWorks, BACnet, or Modbus as defined elsewhere in the contract documents.

2.4.6. Each fan system and its associated panel shall provide complete “N+1” redundancy such that the system will provide design flow and pressure in the event of a motor or VFD failure automatically without interruption.

2.4.7. All fans in a fan system shall be provided with a back flow prevention means that produces less than .05” of static pressure drop and/or system effect when that fan is enabled. Any system effects and/or pressure drop shall be included as a component in determining fan system total static pressure as submitted. Back draft dampers that are rated for pressure drop and performance in straight runs of ductwork per AMCA standards will not be accepted.

2.4.8. Each fan/motor cube shall be provided with an acoustical silencer that reduces the bare fan, discharge sound power levels by a minimum of 15 db re 10^-12 watts throughout the eight octave bands with center frequencies of 125, 250, 500, 1000, 2000, 4000, and 8000 HZ. The silencers shall not increase the fan total static pressure, nor shall they increase the airway tunnel length.

2.4.9. Each fan/motor assembly shall be removable through a 24” wide access door located on the discharge side of the Fan array.

2.4.10. All motors shall be pedestal mounted premium efficiency inverter-duty TEFC T-Frame per IEEE standards meeting the requirements of NEMA MG1-2006, Part 31. All motors shall include isolated bearings or shaft grounding system.

2.4.11. The maximum motor size shall be as indicated on the schedules. If not specifically scheduled, in no case shall a fan system require greater than 10-HP motors.
2.5. HEAT TRANSFER COILS

2.5.1. All coil assemblies shall be leak tested under water at 315 PSIG and performance is to be certified under ARI Standard 410. Coils exceeding the range of ARI standard rating conditions shall be noted.

2.5.2. Cooling coils shall be mounted on stainless steel support rack to permit coils to slide out individually from the unit. Provide intermediate drain pans on all stacked cooling coils. The intermediate pan shall drain to the main drain pan through a copper downspout.

2.5.3. Water coils shall be constructed of seamless copper tubing mechanically expanded into fin collars. Connections shall be male pipe thread (MPT) Schedule 40 Red Brass with 1/8" vent and drain provided on coil header for coil drainage. All coil connections shall be extended to the exterior of the unit casing by the manufacturer.

2.5.4. Intermediate tube supports shall be supplied on coils over 44" fin length with an additional support every 42" multiple thereafter.

2.5.5. Water coils shall be 5/8" O.D., 020" wall thickness copper tubes with .028 return bends. Fins shall be 0.008" aluminum.

2.5.6. Coils shall include a 16 gauge galvanized steel casing except for chilled water coils with a scheduled supply water temperatures below 50oF, which shall be 16 gauge 304 SS.

2.6. FILTERS

2.6.1. Provide face-loading type-8 gasketed frames and associated clips for upstream face loading filter media as scheduled and detailed. Provide (2) complete sets of all filter media.

2.6.2. Provide factory installed Magnehelic gage to read pressure drop across the filter bank. Gauge shall be recessed into unit cabinetry. On outdoor units, provide a hinged metal flap cover to protect the gage from UV rays. Cover assembly shall be finished to match the unit casing.

2.7. DAMPERS

2.7.1. Provide AMCA licensed Class 1 low leakage control dampers. Maximum Leakage rate, according to AMCA 500, "Laboratory Methods for Testing Dampers for Rating," shall not exceed 3-cfm/sq. ft at 1-inch wg (1000-Pa) pressure differential.

2.8. LOUVERS

2.8.1. Furnish and install, were shown on the plans, or in accordance with the schedules, a louver of the stationary Drainable Blade type with a drain gutter in each blade and downspouts in the frame jambs and mullions. Louvers shall have a minimum 57% free area based on a 48" wide x 48" high size. The stationary blades shall be contained within a 6" frame. Frame and blade material to be aluminum alloy. Frame shall contain integral caulking slots. A 3/4" x 051" expanded, flattened aluminum birdscreen shall be included and contained within a removable frame.

2.8.2. Louver design shall limit span between visible mullions to 10 feet and shall incorporate structural supports to withstand a wind load of 20 lbs. per square foot (equivalent to a 90-mph wind).

2.8.3. Published louver performance data must be submitted for approval demonstrating pressure drop and water penetration. Louver to be AMCA Standard 500 certified and licensed to bear the AMCA Seal.

2.8.4. Louver Sizing:
2.9. LIGHTS/RECEPTACLES

2.9.1. Provide a 100W vapor proof marine-type light fixture in each accessible section; factory wired to a common switch located adjacent to the supply fan access door or as indicated on the unit drawings. Provide duplex GFI service receptacle adjacent to electrical control center. Lights and service receptacle shall be factory-wired to an external J-box for separate 120V service provided by others. For units split for shipment, all wiring shall be terminated at j-boxes located at the unit shipping splits for field re-connection.

2.10. EVAPORATIVE COOLING

2.10.1. Direct evaporative cooling shall be provided using Munters GLASdek® media as the evaporative cooling media. The media surface shall be sized not to exceed 600 FPM face velocity. Minimum efficiency is to be 88%. The evaporative water circulating pump shall be pre-piped and pre-wired to main electrical panel through a Honeywell adjustable set point, remote bulb controller designed to start the pump when the air temperature, 24” downstream of the evaporative media rises above the set point. A 4” deep water pan and all other sump components shall be constructed with 16 gauge, welded 304 stainless steel. The overflow drain and float valve shall be factory installed and preset to provide proper sump water level. A water distribution system shall be provided to give uniform water flow over the entire top surface of cooling media/distribution pad. The line from the water pump to the distribution shall comply with the requirements for the 94-SV flammability test.

3. PART 3 - EXECUTION

3.1. MANNER OF PERFORMING WORK

3.1.1. Coordinate location of piping, ductwork, sleeves, inserts, hangers and equipment for this work with other trades.

3.1.2. All materials and equipment shall be installed in accordance with the approved recommendations and guidelines as issued by the respective manufacturers to conform with contract documents. Workmen skilled in the trades involved shall accomplish the installation.

3.2. SERVICE CONNECTIONS

3.2.1. Air handling units and coils shall be equipped with required valves, vents, drain valves and safety devices and connected to piping systems and electrical services in a neat and workmanlike manner.

3.3. INSTALLATION

3.3.1. Install in accordance with manufacturer’s instructions.

3.3.2. The custom air handling unit shall be installed on the existing air handling unit roof curb. The mechanical contractor shall include any labor or materials to repair the existing roof curb damaged during the removal and replacement of the existing air handing unit.

3.4. DELIVERY, STORAGE, AND HANDLING

3.4.1. Deliver products to site under provisions of Division 1 and Section 15010 with factory-installed shipping skids and lifting lugs.

3.4.2. Store and protect products under provisions of Division 1 and Section 15010.

3.4.3. Store in clean dry place and protect from weather and construction traffic. Handle carefully to
avoid damage to components, enclosures, and finish.

3.4.4. Do not operate units for any purpose, temporary or permanent, until ductwork is clean, filters are in place, bearings lubricated, and fan has been test run under observation.

3.5. START-UP

3.5.1. Provide the services of a factory authorized service technician to assist the installing contractor with startup services and instruct the contractor and owner’s personnel in the maintenance and use of the equipment.

END OF SECTION
SECTION 26 05 00
GENERAL ELECTRICAL PROVISIONS

1. PART 1 - GENERAL

1.1 SECTION INCLUDES

1.1.1 Basic requirements of a common or administrative nature that pertains to all electrical work.

1.2.1 RELATED SECTIONS

1.2.1 The requirements set out in the contract documents, contract forms, general conditions, supplementary general conditions and general requirements apply to all work specified herein.

1.3.1 WORK INCLUDED

1.3.1. The Contractor shall furnish all materials, labor, transportation, tools, permits, fees and incidentals necessary for the installation of a complete electrical system. It is the intent of the contract documents to provide an installation complete in every respect. In the event that additional details or special construction are required for work indicated or specified, it shall be the responsibility of the Contractor to provide all materials and equipment which are usually furnished with such systems in order to complete the installation, whether mentioned in the contract documents or not.

2.3.1. CODES AND STANDARDS

1.4.1 All work shall be in compliance with all applicable portions of the latest edition of the National Electrical Code (NEC), the National Electrical Safety Code (NESC), all city and county codes and ordinances, and other codes which may or may not be specifically referenced in these contract documents. None of the terms or provisions of these contract documents shall be construed as waiving any of the rules, regulations or requirements of these authorities.

1.4.2 In any instance where these contract documents call for construction materials of a better quality or larger size than required by the codes, the provisions of the contract documents shall take precedence. The codes shall govern in case violations are indicated in the construction documents.

1.1.1 DRAWINGS

1.5.1 The drawings are intended to show the general arrangement and the extent of the work. The exact location and arrangement of all parts shall be determined as the work progresses to conform in the best possible manner with the surroundings and as directed by the Contracting Officer.
1.5.2 If any departures from the drawings are deemed necessary by the Contractor, details of such departures and the reasons therefor shall be submitted to the Contracting Officer for review. No departures shall be made without prior written acceptance of the Contracting Officer.

1.6.2 SUBMITTALS

1.6.3 The Contractor shall furnish eight copies of the manufacturer’s literature and drawings describing all proposed equipment and materials indicated in the specifications. The front sheet or brochure shall have job name, architect, engineer, contractor and suppliers identified.

1.6.2 All sheets of the submittal shall have the job name stamped or permanently written on them, and shall be assembled in an indexed brochure. The descriptive materials shall be arranged in the brochure in the same order as found in the specifications. Each brochure shall be submitted in a three-ring binder. Binders shall be hardback unless the Engineer, at his discretion, allows heavy-paper-type binders on a smaller project. The leading sheet of the descriptive material for each item shall be full size of heavy paper, with a numbered outside tab. An index sheet showing the location in the brochure of all equipment and material submitted shall be placed in the front of the brochure. The index sheet shall be made to conform to the following example.

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1.6.3 Submittals shall include detailed specifications and construction data. Manufacturer’s regular catalog sheets will not be acceptable unless they indicate completely all of the specification requirements. Where submittal sheets cover several sizes or types of equipment, they shall clearly indicate, by the use of a different color ink, the type or size to be used on the project and the use intended. Products submitted as substitutions shall be identified in the index as a substitution.

1.6.4 Approval of the submittals, or any part of the contents therein, shall not eliminate the responsibility for compliance with the drawings and specifications, nor shall it eliminate the requirements or the responsibility for freedom from errors of any sort in the data submitted.

1.7.4 RECORD DRAWINGS

1.7.1 The Contractor shall maintain a set of electrical drawings at the job site neatly marked with all changes from the original contract drawings. This set of drawings shall not be used for construction purposes and shall be available to the Contracting Officer at all times. Drawings shall be kept up to date as the job progresses and shall be delivered to the Contracting Officer at the completion of the contract.

1.7.2 A fresh, clean set of drawings on which variations to the original construction documents are legibly recorded and designated "as-built" shall be furnished to the Contracting Officer upon completion and acceptance of work and before final payment is made.
1.8 OPERATION AND MAINTENANCE MANUALS

1.1.1 The Contractor shall furnish four sets of operation and maintenance manuals to the Contracting Officer. These manuals shall include all items designated in the specifications, shall be assembled in an indexed three-ring binder as described in the paragraph titled "SUBMITTALS" and shall include all warranties. Separate equipment brochures will not be acceptable. A pictorial parts list, operation and maintenance instructions, system descriptions, schematic wiring diagrams and equipment cut sheets shall be included for each item with source information. NOTE: These manuals shall be delivered to the Contracting Officer prior to final acceptance of the installation by the Government.

1.9 SITE EXAMINATION

1.1.1 The Contractor shall be responsible for the coordination and proper relation of his work to the building structure and to the work of all trades. The Contractor shall visit the premises and thoroughly familiarize himself with all details of the work and working conditions, and verify all dimensions in the field. The Contractor shall advise the Contracting Officer of any discrepancy at least seven days prior to bidding. The submission of bids shall be deemed evidence of the Contractor's site visit, the coordination of all existing conditions and the inclusion of all considerations for existing conditions.

1.10 UTILITIES

1.10.1 The contract documents reflect the general location, voltage, capacity, size and manner of routing for all utilities known to be required on this project. It shall be the responsibility of the Contractor to visit the site and to meet with base maintenance personnel responsible for the electric utilities in order to coordinate and confirm the exact requirements for all electrical utilities, including, but not limited to, all facilities required to provide complete and operative electrical power service. The bid submitted by the Contractor shall include costs for all such coordinative work.

1.11 TEMPORARY POWER

1.11.1 The Electrical Contractor shall provide the necessary wiring, connections, service switches, poles, wiring protective devices, lighting fixtures, lamps, outlet devices, disconnect switches, etc., as required for temporary lighting. In addition, a similar system shall be provided for the distribution of single- and three-phase power of voltage levels and adequate ampacity as required to facilitate the construction of the project. These services shall be installed in accordance with requirements of the NEC and OSHA.

1.11.2 The Electrical Contractor shall coordinate with the General Contractor and other trades involved to determine requirements for temporary power on this project. No additional charges shall be made to the Owner for wiring, connections, pole, fixtures or devices required to facilitate construction.

1.12 STORAGE AT SITE

1.12.1 Store major electrical equipment (switchboards, panelboards, lighting fixtures, dry type transformers, etc.) sealed in original factory wrapping in a clean, dry and
conditioned environment protected from the weather. Storage outdoors is not acceptable.

1.13 GUARANTEE

1.13.1. The Contractor shall guarantee all labor and materials furnished by him in accordance with state law or the general conditions of the contract, but in no case for a period of less than one year. Certain work and materials shall be guaranteed for a longer period when so specified. Guarantee period shall extend form the time of final acceptance of the installation. The Guarantee shall cover the repair or replacement, without additional cost to the Government, of any defective material or faulty workmanship. All necessary service to each item and other work requiring specialized training shall be furnished by the Contractor, at no cost to the Government, for a period of one year, concurrent with the warranty period specified above. The above items pertaining to routine servicing of the equipment and motors, replacing fuses or replacing lamps are the responsibility of the Owner unless a service agreement is made between the Contractor and the Government.

2 PART 2 - PRODUCTS

1.2.1 EQUIPMENT AND MATERIALS

2.1.1 All materials shall be new and of quality grade. All materials of a type for which the Underwriters’ Laboratories, Inc. (UL) has established a standard shall be listed by UL and shall bear the UL label.

2.2.1 SUBSTITUTIONS

2.2.1 References in the specifications or on the drawings to any article, device, product, material, fixture, form or type of construction by naming more than one acceptable manufacturer shall be interpreted as establishing a standard of quality and shall not be construed as limiting competition; however, the Contractor, in such cases, shall obtain written prior approval for substitution of unnamed manufacturers. Requests for substitution must be received in writing, in accordance with the contract documents, at least ten working days before bid date. The request shall include a detailed listing of all products and/or devices for which acceptance is being requested. Engineering specification sheets and/or construction details shall be included for comparative purposes. If the product is acceptable to the satisfaction of the Contracting Officer and the Engineer, an addendum item will be issued stating acceptability.

3 PART 3- EXECUTION

3.1 WORKMANSHIP AND COMPLETION OF INSTALLATION
3.1.1 All work shall be performed by competent mechanics, skilled in their trade, and shall be executed in a thorough and substantial manner.

3.1.2 The Contractor shall be held responsible for transportation of his materials to and on the job, and for their storage and protection until the final acceptance of the job.

3.1.3 The Contractor shall be held responsible for timely placing of all conduit and outlet boxes, cabinets and other wiring devices in the walls, ceilings, slabs, beams, etc., as construction progresses.

3.1.4 Contractor shall furnish all necessary scaffolding, tackle, tools and appurtenances of all kinds, and all labor required for the safe and expeditious execution of his contract.

3.1.5 All equipment shall be installed in a manner to permit access to parts requiring service. All electrical equipment shall be installed in such a manner as to allow removal for service without disassembly of other equipment, and shall have working clearances as required by NEC. Any large piece of apparatus which is to be installed in any space in the building, and which is too large to fit through finished openings, shall be placed before enclosing structure is completed. Following placement, such apparatus shall be completely protected from damage.

3.1.6 The Contractor shall, at all times, keep the premises free from accumulations of waste material and packaging debris. This debris shall be removed daily from the construction site.

3.2 CUTTING AND PATCHING

3.2.1 Where it becomes necessary to drill or cut through any floors, walls or ceilings to permit the installation of any work under this contract, such cutting shall be done under the supervision of the Contracting Officer by the Contractor. After the necessary work has been completed, the damage shall be repaired by the Contractor.

3.2.2 No joists, beams, girders or columns shall be cut by the Contractor without first obtaining written permission from the Contracting Officer.

3.2.3 All drilling for expansion bolts, hangers and other supports shall be done by the Contractor, subject to the approval of the Contracting Officer. Labor and materials required to replace or rebuild parts cut or injured shall be furnished at the Contractor's expense, subject to the satisfaction of the Contracting Officer.

3.2.4 All openings made in fire-rated walls, floors and ceilings shall be patched by the electrical contractor in a manner maintaining the original fire rating.

3.3 COORDINATION

3.3.1 The Contractor shall coordinate the work of the different trades so that interferences between piping, equipment, structural and architectural work shall be avoided.

3.3.2 The Contractor is responsible for ensuring that all conduit sleeves are timely installed and are sealed, flashed or caulked to the satisfaction of the Contracting Officer.

3.4 HVAC EQUIPMENT WIRING AND CONTROL

In general, the Mechanical Contractor shall provide the low-voltage (less than 120 volts) control wiring from the heating, ventilation and air conditioning equipment (HVAC) to the mechanical furnished device
3.5 IDENTIFICATION AND LABELING

3.5.1 The Contractor shall provide and install a presentation grade one-line diagram of the electrical system in a framed plexiglass enclosure near the service entrance switchgear at a location as directed by the Contracting Officer.

3.5.2 All equipment shall have the manufacturer's nameplate permanently affixed in an obvious location.

3.5.3 Branch circuit panelboards shall contain a typed index card identifying all circuits.

3.5.4 Major pieces of equipment shall be labeled, as required by the NEC and directed by Contracting Officer, with engraved nameplates constructed of laminated phenolic. Letters shall be condensed gothic, 1/4 inch high. Nameplates shall be at least 1/16 inch thick, 3 ply, white surfaces, black core. Labels shall include equipment name, voltage and phases.

Example: Panel L1
277/480V, 3φ

3.5.5 All junction boxes and pull boxes shall be labeled with a permanent felt tip marker, 1/4 inch wide, indicating the circuits contained within.

Example: L1 7, 9, 11

3.5.6 All device plates shall be labeled on the back of the plate, with a permanent felt tip marker, indicating the circuits contained within the device box.

3.6 MISCELLANEOUS

3.6.1 Each piece of floor-mounted equipment, such as switchboards, transformers, etc., shall be set on a concrete base. Bases shall not be less than 4 inches high and shall be pinned to the floor.

3.6.2 The Contractor shall furnish and install vibration isolation means for all equipment and materials furnished under this contract which may transmit perceptible noise or vibration, structure borne or air borne, to occupied areas.

3.6.3 All transformers and other equipment indicated shall be mounted on 1-inch-thick cork rib pads and/or rubber or steel spring isolator units properly sized, spaced and loaded, as specified herein, which in turn shall rest on a 4-inch minimum concrete base.

3.6.4 Electrical conduit shall be isolated from all dry type transformers and rotating or reciprocating machinery with a minimum of 12 inches of liquidtight flexible metal conduit.

END OF SECTION
1. PART 1 - GENERAL

1.1 SECTION INCLUDES

1.1.1 Conduit
1.1.2 Junction, pull and device boxes
1.1.3 Conductors
1.1.4 Disconnect switches
1.1.5 Overcurrent devices
1.1.6 Wiring devices
1.1.7 Lighting and branch circuit panelboards
1.1.8 Grounding
1.1.9 Testing

1.2 RELATED SECTIONS

Section 260500 - GENERAL ELECTRICAL PROVISIONS

1.3 REFERENCES

1.3.1 National Electrical Manufacturers Association (NEMA).
1.3.2 Underwriters' Laboratories (UL).
1.3.3 American National Standards Institute (ANSI).
1.3.4 ANSI/NFPA 70-National Electrical Code (NEC).
1.3.5 Institute of Electrical and Electronics Engineers (IEEE).

1.4 SUBMITTALS

1.4.1 Submit under provisions of Section 260500.

1.4.2 Product Data: Provide manufacturer's literature and product data on all equipment listed in Paragraph 1.01.
2. PART 2 - PRODUCTS

2.1 CONDUIT

2.1.1 Electrical metallic tubing (EMT) shall be galvanized on the outside and coated on the inside with a smooth hard finish of lacquer, varnish or enamel. EMT shall comply with Underwriters Laboratories (UL) Standard UL 797 and ANSI C80-3. EMT coupling and box connectors for EMT shall be of the steel compression gland type.

2.1.2 Rigid galvanized steel (RGS) conduit shall be hot-dipped, galvanized steel with zinc coating or corrosion-resistant lacquer on the inside. RGS shall comply with UL Standard UL 6 and ANSI C80-1. Fittings shall be threaded, water and concrete-tight.

2.1.3 Flexible metal conduit (FMC) shall be of hot-dipped, galvanized, interlocked, spirally wound steel strip and shall comply with ANSI/UL 1. Connectors shall be galvanized and shall be suitable for connection to the associated boxes and conduits.

2.1.4 Liquidtight flexible metal conduit (LTFMC) shall be similar to flexible metal conduit and shall also have an outer PVC jacket and shall comply with ANSI/UL 360. Connectors shall be equal to Appleton type "ST" connectors.

2.1.5 Plastic conduit for installation in concrete duct banks shall be thinwall conforming to NEMA Standard TC6 and shall be UL listed.

2.1.6 Minimum conduit size shall be 3/4 inch.

2.2 JUNCTION, PULL AND DEVICE BOXES

2.2.1 Junction and pull boxes shall be of code galvanized steel. Boxes mounted vertically on a wall shall be provided with hinged covers and catchlocks. Boxes mounted horizontally in or on the ceiling shall be furnished with screw covers. All such boxes shall conform to NEC for size and gauge of material. Junction and pull boxes shall be provided as required even if not shown on the drawings.

2.2.2 Device boxes and general purpose junction boxes shall be one-piece galvanized pressed steel knockout type with similar cover, and not less than 4 inches square. No sectional boxes will be permitted, except at single-pole switch locations with only two conductors.

2.2.3 All gang boxes for devices shall be designed specifically for the number of devices indicated.

2.2.4 Boxes for exterior devices shall be cast iron, Crouse Hinds FD, or approved equal, with gasketed covers.

2.3 CONDUCTORS

2.3.1 Conductors shall be of soft-drawn annealed copper. Conductors shall conform to federal specifications for the type of wire designated, and shall have a conductivity of not less than 98 percent of that of pure copper.
2.3.2 Minimum conductor size for power and lighting circuits shall be No. 12 AWG, unless shown otherwise on the drawings. Minimum conductor size for control and signal circuits shall be No. 14 AWG, unless shown otherwise on the drawings.

2.3.3 All conductors No. 10 AWG and larger shall be stranded. All conductors No. 12 AWG and smaller shall be solid.

2.3.4 All conductors located in dry locations shall be type THHN/THWN unless specifically designated otherwise. All conductors located in outdoor or wet locations shall be type XHHW-2.

2.3.5 All branch circuit conductors used for wiring in high temperature locations (such as boiler controls, range hoods, heating equipment, etc.) shall be type RHH heat-resistant grade.

2.3.6 Conductors shall be color coded as follows:

- 277/480V, 3 phase, 4 wire: Brown, Orange, Yellow and Gray
- 120/240V, 3 phase, 4 wire: Black, Red, and White
- Control Circuits: Other than above

2.3.7 For phase conductors larger than No. 4 AWG, or neutral conductors No. 4 AWG or larger, colored plastic tape may be used in lieu of continuously colored conductor insulation. Each conductor shall have at least three 1-inch bands (4-inch separation) at every termination and splice.

2.3.8 Wire connectors shall be as follows:

2.3.8.1 Connectors for No. 8 AWG and smaller (dry locations) shall be self-insulated spiral spring screw-on connector with resilient or unbreakable plastic insulating cap. No ceramic or brittle plastic shell connectors will be approved.

2.3.8.2 Connectors for No. 8 AWG and smaller (damp locations) shall be compression sleeve type.

2.3.8.3 Connectors for No. 6 AWG and larger wires (damp or dry locations) shall be compression sleeve type.

2.4 OVERCURRENT DEVICES

2.4.1 Fuses

2.4.1.1 All fuses, 600 volts and less, shall be Bussmann "Low-Peak" or approved equal, and shall meet the following:

2.4.1.1.1 All fuses shall be manufactured by the same manufacturer.
2.4.1.2. Fuses rated 1/10 to 600 amperes shall be UL Class R dual element current limiting. All dual-element fuses shall have separate overload and short-circuit elements, and shall be Bussmann type LPS-RK (600V), LPN-RK (250V) or approved equal.

2.4.2 Circuit breakers

2.4.2.1 All circuit breakers shall be thermal magnetic, molded case, and shall have the following characteristics:

2.4.2.1.1 Quick-make, quick-break type.

2.4.2.1.2 "Bolt-on" type.

2.4.2.1.3 Fully rated for the available fault current as shown on the drawings. Series ratings are unacceptable.

2.4.2.1.3 Common trip type for all multipole breakers.

2.4.2.1.4 Operating handle shall visually indicate ON, OFF or TRIPPED conditions.

2.4.2.1.5 Indicate the ampacity and frame size on the breaker.

2.4.2.1.6 When used for switching light circuits, shall be marked "SWD," indicating "switch duty rated."

2.4.2.1.7 When required by equipment manufacturer, circuit breaker shall be "HACR" rated.

2.4.2.2 Where enclosed circuit breaker disconnects are shown on the drawings, provide an enclosure suitable for the environmental conditions where the breaker is installed.

2.5 GROUNDING

2.5.1 Grounding conductors shall be copper, stranded, soft drawn or soft annealed.

2.5.2 Ground clamps for connecting grounding electrode conductors to copper, brass or lead pipes shall be made of copper, and if pipes are of steel or iron, the ground clamps shall be made of galvanized iron. These clamps shall be designed to provide permanent and positive pressure and to avoid mechanical injury to the pipes.

2.5.3 Grounding conductors and jumpers shall be connected to each other and to items to be grounded by means of pressure connectors, clamps and/or other suitable methods approved by the Engineer.
2.5.4 All grounding conductor connections made below grade shall be made using an exothermic welded connection. All below-grade connections shall be "Cadweld," "Thermoweld" or approved equal.

2.5.5 Ground rods shall be a minimum of 3/4-inch diameter by 10 feet long, copper-clad steel-core.

2.5.6 All concrete-encased or direct-buried underground electrode conductors shall be of stranded copper.

2.5.7 All equipment grounding conductors installed in conduits shall be insulated.

3 PART 3 - EXECUTION

3.1 GENERAL

The Contractor shall study all construction documents and shall carefully lay out all work in advance of fabrication and erection in order to meet requirements of limited spaces. Where conflicts occur, the Contractor shall meet with all involved trades and resolve the conflict prior to erection of any work in the area involved.

3.2 CONDUIT

3.2.1 Above-grade conduit

3.2.1.1 Conduits located indoors and not subject to physical damage shall be electrical metallic tubing (EMT).

3.2.1.2 Conduits located outdoors, or subject to physical damage, shall be rigid galvanized steel (RGS).

3.2.1.3 Flexible metallic conduit (FMC) shall be used in dry locations and liquid tight flexible metal conduit (LTFMC) shall be used in wet locations to extend conduit connections to motors, lighting fixtures, transformers, etc. The length of flexible conduit shall not exceed 24 inches. The length shall not exceed 72 inches for recessed lighting fixtures only.

3.2.1.4 Where to Conceal: Conduits shall be concealed in all finished parts of the building. Conduits shall be concealed in pipe chases, walls, furred spaces, topping or above ceilings unless otherwise shown. All conduits shall be routed parallel or perpendicular to the building lines. No diagonal runs will be permitted.

3.2.1.5 Where to Expose: Conduits may be exposed in mechanical/electrical rooms, duct and piping chases, under-floor crawl spaces, and locations shown on the drawings. All exposed conduit shall be run in the neatest, most inconspicuous manner, and parallel or perpendicular to the building lines. No exposed diagonal runs will be permitted. The Contractor shall run all conduit in a manner satisfactory to the Contracting Officer.
3.2.1.6 Conduits shall be securely supported to building structure at intervals of not more than 8 feet. Conduits shall be fastened in place with galvanized steel clamps or pipe straps, hangers, 3/8-inch-diameter-minimum rods or trapeze. No perforated steel tape is permitted. Supports of structural steel or manufactured framing members shall be provided with all necessary rods, anchors, clamps, spacers and bolts. Conduits above removable ceiling panels shall allow sufficient clearance for panel removal or insertion. Conduits of any size shall not be supported from ceiling hangers or light fixture hangers. Conduit shall not be supported from piping or mechanical equipment unless specifically shown on plans. Allow 7 feet of headroom clearance.

3.2.1.7 Fasteners for conduit supports shall be self-drilling self-tapping screws in metal; wood screws in wood; or threaded expansion anchors or inserts in masonry or concrete. Wooden, plastic or lead inserts, or power-actuated anchors, will not be acceptable.

3.2.1.8 Rigid galvanized steel conduit shall be made up to boxes and equipment with double locknuts and shall have insulated bushings installed. Grounding continuity shall be maintained.

3.2.1.9 All roof penetrations shall be properly sleeved, sealed and flashed for complete waterproofing. In lieu of the above, approved factory-fabricated watertight entrance glands shall be used.

3.2.1.10 In no case shall a raceway be run within 6 inches of steam or hot water pipes, breechings, flues or other high-temperature surfaces.

3.2.1.11 Provide sleeves in new concrete or masonry walls for passage of conduits. Waterproof all sleeves where required.

3.2.2 Below-grade conduit

3.2.2.1 Nonencased, direct-buried conduits in or below slabs-on-grade, in earth, or in gravel shall be rigid, Schedule 40, polyvinyl chloride (PVC).

3.2.2.2 Conduit encased in concrete shall be PVC thinwall.

3.2.2.3 All offsets and ells shall be rigid galvanized steel, wrapped with tape as specified below.

3.2.2.4 All conduit risers shall be rigid galvanized steel.

3.2.2.5 All underground conduits shall be installed a minimum of 24 inches below grade unless shown otherwise on the drawings.

3.2.2.6 Metal conduits and fittings buried underground shall be carefully wrapped with half-lapped 3M No. 51 "Scotchrap," or approved equal, vinyl tape, with wrapping extending at least 3 inches beyond the edge of any exposed metal.

3.2.2.7 Where conduits are installed in slabs, conduits shall be set in position as soon as the forms are in place and in such manner as not to impair the strength of the slab. For exact locations, see architectural sections and locate as directed by Contracting Officer with respect to the reinforcing steel.
3.2.2.8 Where concrete encasement is shown on the drawings, provide a minimum of 3 inches concrete envelope above, below and at sides of ductbank. Provide 3 inches of concrete between conduits. Concrete shall be 2,500 psi class concrete. For multiple rows of conduit, provide plastic spacers on maximum 10-foot centers to maintain horizontal and vertical spacing of conduits.

3.2.3 General

3.2.3.1 To prevent the accumulation of water, dirt or concrete in conduit during work, conduit ends shall be sealed by use of metallic "pennies" or resilient plastic sealing caps during construction until wire is pulled. Properly cap spare and empty conduit systems, stubbed up from below grade or from below floor level, with permanent caps.

3.2.3.2 Horizontal runs of conduit shall be installed to provide a natural drain for condensation without pockets or traps where moisture may collect. All conduits shall be blown out and swabbed out before pulling in wire.

3.2.3.3 Furnish and install a polypropylene pull cord in every empty raceway. Identify each end of pull wire with tags with complete information as to location of the other end of the wire.

3.2.3.4 Provide expansion couplings where conduits cross expansion joints, and where required by the NEC.

3.3 JUNCTION, PULL AND DEVICE BOXES

3.3.1 Provide a standard access panel having a hinged metal door neatly fitted into a flush metal trim, where a junction box is located above hard ceilings or in finished walls. Coordinate the location and type with the Contracting Officer.

3.3.2 Verify final location of all boxes with Contracting Officer prior to rough-in.

3.3.3 Where more than one switch or device is located at the same location, multi-gang boxes and covers shall be provided.

3.3.4 Back-to-back device boxes in a wall are not permitted. Provide a minimum 12-inch-long nipple to offset boxes on opposite sides of a common wall to minimize sound transmission.

3.3.5 Provide proper throats and extension rings to ensure that device boxes are within 1/4 inch of finished wall surfaces.

3.3.6 Identify all circuits located in junction, pull and device boxes per Section 16010.

3.4 CONDUCTORS

3.4.1 All conductors shall be installed in conduit unless noted or specified otherwise.

3.4.2 Maximum branch circuit homerun lengths shall be as follows:

<table>
<thead>
<tr>
<th>CIRCUIT TYPE</th>
<th>No. 12 AWG</th>
<th>No. 10 AWG</th>
<th>No. 8 AWG</th>
<th>No. 6 AWG</th>
</tr>
</thead>
<tbody>
<tr>
<td>Multiple 120V receptacle or lighting homerun</td>
<td>50 feet</td>
<td>100 feet</td>
<td>150 feet</td>
<td>225 feet</td>
</tr>
</tbody>
</table>

PCC DTC
NTD Architecture
NTD # 2011-0230-01

ST West Mechanical Upgrades
BASIC MATERIALS AND METHODS
26 27 00-7
### Dedicated 120V receptacle homerun

<table>
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<tr>
<th>Distance</th>
<th>75 feet</th>
<th>150 feet</th>
<th>225 feet</th>
<th>350 feet</th>
</tr>
</thead>
</table>

### Multiple 277V lighting homerun

<table>
<thead>
<tr>
<th>Distance</th>
<th>100 feet</th>
<th>200 feet</th>
<th>300 feet</th>
<th>500 feet</th>
</tr>
</thead>
</table>

#### 3.4.3 A UL-approved cable pulling compound shall be used as a lubricant where necessary. No materials which may be injurious to the wire covering or insulation shall be used.

#### 3.4.4 Conductors pulled into a wrong raceway or cut too short for termination shall be replaced. Conductors shall not be reinstalled after removal from a raceway.

#### 3.4.5 Mains and feeders shall run their entire length in continuous pieces without joints or splices unless otherwise shown.

#### 3.4.6 Joints in branch circuits shall occur only where such circuits divide as shown on the plans. No splices shall be made in submersible locations.

#### 3.4.7 Splices and taps shall not be made in any conductor except at outlet boxes, pull boxes or junction boxes. Splices shall not be made in conduit bodies.

#### 3.4.8 All electrical conductor terminations shall be torque wrench or torque screwdriver tightened per UL and NEMA standards.

#### 3.4.9 Where the bodies of fluorescent lighting fixtures are used as raceways for lighting branch circuits, conductors shall be securely clamped within the fixture body to positively prevent contact of the wires with the ballast case.

#### 3.4.10 Wire connectors located in damp locations shall be wrapped with rubber and vinyl tape equal to Scotch No. 130 and Scotch No. 33 tape, followed by a coating of ScotchKote, or approved equal.

#### 3.5 OVERCURRENT DEVICES

##### 3.5.1 Verify proper fuse or circuit breaker size prior to installing.

##### 3.5.2 Where circuit breakers are installed in existing panelboards, verify that breaker type and AIC ratings match the existing circuit breakers installed in the panel.

#### 3.6 GROUNDING

##### 3.6.1 The electrical system shall be grounded in accordance with Article 250 of the NEC. All electrical equipment including conduit systems, boxes, disconnect switches, receptacles, panelboards, motors, etc. shall be grounded.

##### 3.6.2 The service entrance groundbus shall be bonded to the building water service, building steel, ufer ground and ground rods with conductors sized per NEC Table 250-94.

##### 3.6.3 Resistance between any point on the grounding electrode system and any object in the vicinity, including earth and floors, shall not exceed 25 ohms. Ground resistance measurements of all ground rods shall be made in normally dry weather, not less than 24 hours after rainfall. The Contractor shall submit measured ground resistance readings to the Engineer.
3.6.4 If the ground resistance exceeds 25 ohms, additional ground rods shall be installed to lower the ground resistance to below 25 ohms.

3.6.5 The ground terminal on all convenience receptacles shall be bonded to the box and to the branch circuit grounding conductor with a bonding jumper to provide good continuity back to the source.

3.6.6 Conduits which connect to boxes, cabinets or enclosures having concentric or eccentric knockouts shall be provided with bonding jumpers sized in accordance with NEC Table 250-95 connected between a grounding type bushing/locknut on the conduit and a groundbus or stud inside the enclosure.

3.6.7 Where grounding connections are made to conduits, cabinets, etc., metal surface contacts shall be cleaned so that there is a good ground connection.

3.6.8 All raceways shall contain a green insulated equipment grounding conductor sized per NEC 250-95, even if not shown on the drawings.

3.7 TESTING

3.7.1 All tests shall be satisfactorily completed and accepted before final inspection or acceptance. Provide test reports for all tests. Test reports shall be bound with O & M manuals.

3.7.2 Insulation of feeder conductors shall be tested with a 1,000-volt megger. Test each feeder conductor for a minimum acceptable ground resistance reading of 100 MEG ohms. Replace feeder conductors which do not meet the minimum reading or which differ appreciably from other feeder ground resistance readings.

3.7.3 Panelboard busbars shall be meggered prior to energizing to ensure that shorts or grounds do not exist.

3.7.4 Measure and record ground resistances in accordance with Paragraph 3.09.

3.7.5 Test each receptacle for proper phase, neutral and ground connections.

END OF SECTION
1. **PART 1 – GENERAL**

1.1 **SECTION INCLUDES**

1.1.1 Manual motor starters.

1.1.2 Combination magnetic motor starters.

1.2 **RELATED SECTIONS**

1.2.1 Section 260500, GENERAL ELECTRICAL PROVISIONS.

1.2.2 Section 262700, BASIC MATERIALS AND METHODS.

1.3 **REFERENCES**

1.3.1 ANSI/NFPA 70 National Electrical Code.

1.3.2 Underwriters Laboratories (UL).

1.3.3 National Electrical Manufacturers Association (NEMA).

1.4 **SUBMITTALS**

1.4.1 Submit under provisions of Section 260500.

1.4.2 Product Data: Provide dimensions, mounting, weight, electrical ratings, control schematics, wiring diagrams and recommended overload heater sizes.

1.4.3 Manufacturer's installation instructions.

2. **PART 2 – PRODUCTS**

2.1 **ACCEPTABLE MANUFACTURERS**

2.1.1 Cutler Hammer

2.1.2 General Electric

2.1.3 Square D

2.1.4 ITE
2.2 COMBINATION MAGNETIC MOTOR STARTERS

2.2.1 Starters shall be combination, full voltage, nonreversing unless shown otherwise, and shall utilize motor circuit protectors or fusible switches as shown on the drawings.

2.2.2 Starters shall be equipped with a fused control power transformer, operating coil shall match EMCS system, ambient compensated overload relays and one NO and one NC spare auxiliary contacts wired to the external terminal strip.

2.2.3 Each starter shall be provided with the control devices as shown on the drawings. If control schematics are not shown on the drawings, provide the following:

2.2.4 'HAND-OFF-AUTO' selector switch mounted on the cover.

2.2.5 Provide a red 'RUN' light and green 'STOP' light.

2.2.6 The 'AUTO' side of switch shall be wired to the external terminal strip for connection to the field-mounted control device.

2.2.7 Control power transformers shall be sized for the operating coil and other loads shown on the drawings. One side of the control power transformer shall be grounded. Primary fusing shall be provided in accordance with the NEC.

2.2.8 Fuses used in fused switches shall be in accordance with Section 262700. Fuse clips shall be rejection type accepting only current limiting fuses.

2.2.9 Overload heaters shall be sized per motor nameplate and manufacturer's recommendations. A manual reset button shall be provided on the cover of the door.

2.2.10 Control accessories shall be heavy-duty oil tight type. Indicating lights shall be transformer type with 6.3-volt lamps and push-to-test feature.

2.2.11 Terminal strips shall be provided for connection to external devices.

2.2.12 Enclosures shall be NEMA type as shown on the drawings. Where NEMA type enclosures are not shown on the drawings, provide NEMA type most suitable for the environmental conditions where the motor starter is being installed.

2.2.13 Enclosures shall be thoroughly cleaned, given a rust-inhibiting primer coat, and painted with manufacturer's standard colors.

2.2.14 Provide nameplates for each control device on door in accordance with Section 260500.

3. PART 3 - EXECUTION
3.1 INSTALLATION

3.1.1 Install per manufacturer's and NEC requirements.

3.1.2 Ensure National Electrical Code clearances.

3.1.3 Verify proper overload heater and fuse sizes and replace/adjust if required.

3.1.4 Adjust all motor circuit protectors per manufacturer's recommendations.

3.1.5 Test all control and safety devices to ensure proper operation.

END OF SECTION
SECTION 31 20 00
EARTH MOVING

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. Remove topsoil and subsoil; stockpile for later use.
2. Preparing sub-grades for slabs-on-grade.
3. Excavating and backfilling for buildings and structures.
4. Drainage course for concrete slabs-on-grade.
5. Excavating and backfilling trenches for utilities and pits for buried utility structures.
6. Consolidation and Compaction.
7. Site Contouring.

B. Related Sections:

1. Division 01 Section "Temporary Facilities and Controls" for temporary controls, utilities, and support facilities; also for temporary site fencing if not in another Section.
2. Division 03 Section "Cast-in-Place Concrete" for granular course if placed over vapor retarder and beneath the slab-on-grade.
3. Divisions 21, 22, 23, 26, 27, 28, and 33 Sections for installing underground mechanical and electrical utilities and buried mechanical and electrical structures.
4. Division 31 Section "Site Clearing" for site stripping, grubbing, stripping, topsoil, and removal of above- and below-grade improvements and utilities.
5. Division 32 Section "Plants" for finish grading in planting areas and tree and shrub pit excavation and planting.
6. Division 33 Section "Sub-drainage" for drainage of foundations, slabs-on-grade, walls and, landscaped areas.

1.3 ABBREVIATIONS

A. ASTM: ASTM International, formerly the American Society for Testing and Materials
B. MAG: Maricopa Association of Governments
C. IBC: International Building Code

1.4 DEFINITIONS

A. Backfill: Soil material or controlled low-strength material used to fill an excavation.

1. Initial Backfill: Backfill placed beside and over pipe in a trench, including haunches to support sides of pipe.
2. Final Backfill: Backfill placed over initial backfill to fill a trench.

B. Bedding Course: Aggregate layer placed over the excavated sub-grade in a trench before laying pipe.

C. Borrow Soil: Satisfactory soil imported from off-site for use as fill or backfill.

D. Concrete: Lean concrete, with a compressive strength of 1000 psi.

E. Drainage Course: Aggregate layer supporting the slab-on-grade that also minimizes upward capillary flow of pore water.

F. Excavation: Removal of material encountered above sub-grade elevations and to lines and dimensions indicated.
   1. Authorized Additional Excavation: Excavation below sub-grade elevations or beyond indicated lines and dimensions as directed by Architect. Authorized additional excavation and replacement material will be paid for according to Contract provisions for changes in the Work.
   2. Unauthorized Excavation: Excavation below sub-grade elevations or beyond indicated lines and dimensions without direction by Architect. Unauthorized excavation, as well as remedial work directed by Architect, shall be without additional compensation.

G. Scarify: To mechanically loosen soil or break down existing soil structure.

H. Fill: Soil materials used to raise existing grades.

I. 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.

J. Sub-grade: Uppermost surface of an excavation or the top surface of a fill or backfill immediately below sub-base, drainage fill, drainage course, or topsoil materials.

K. Utilities: On-site underground pipes, conduits, ducts, and cables, as well as underground services within buildings.

1.5 SUBMITTALS

A. Product Data: For each type of the following manufactured products required:
   1. Warning tapes.

B. Samples for Verification: For the following products, in sizes indicated below:
   1. Warning Tape: 12 inches long; of each color.

C. Material Test Reports: For each on-site and borrow soil material proposed for fill and backfill as follows:
   1. Classification according to ASTM D 2487.
   2. Laboratory compaction curve according to ASTM D 1557.
D. Pre-excavation Photographs or Videotape: Show existing conditions of adjoining construction and site improvements, including finish surfaces that might be misconstrued as damage caused by earth moving operations. Submit before earth moving begins.

E. Accurately record location of utilities remaining, re-routed utilities, new utilities by horizontal dimensions, elevations or inverts, and slope gradients.

1.6 QUALITY ASSURANCE

A. Pre-excavation Conference: Conduct conference at Project site.

B. Perform all earthwork and related structures and devices in accordance with MAG Uniform Standard Specification for Public Works.

C. Where earthwork is constructed in public streets or rights of way, construct in accordance with the standard plans and specifications of the City of Tucson, Arizona and in the presence of a representative of that agency.

1.7 PROJECT CONDITIONS

A. Traffic: Minimize interference with adjoining roads, streets, walks, and other adjacent occupied or used facilities during earth moving operations.

1. Do not close or obstruct streets, walks, or other adjacent occupied or used facilities without permission from Owner and authorities having jurisdiction.

2. Provide alternate routes around closed or obstructed traffic ways if required by Owner or authorities having jurisdiction.

B. Utility Locator Service: Notify utility locator service for area where Project is located before beginning earth moving operations.

C. Do not commence earth moving operations until temporary erosion- and sedimentation-control measures, specified in Division 01 Section "Temporary Facilities and Controls," Division 31 Section "Site Clearing," 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.

B. Soil Material: Clean on-site soils with low expansive potentials and maximum dimension of six inches or imported materials may be used as fill material for the following:

1. Foundation areas.

2. Interior slab areas. (On-site clayey soils are not recommended for use within 30 inches of the bottom of slabs-on-grade or as structural backfill behind retaining walls).

3. Backfill. (On-site clayey soils are not recommended for use within 30 inches of the bottom of slabs-on-grade or as structural backfill behind retaining walls).
C. Imported Soils should conform to the following:

- Gradation (ASTM C136) percent finer by weight
  - 6" 100
  - 4" 85-100
  - 3/4" 70-100
  - No. 4 Sieve 50-100
  - No. 200 Sieve 50 (max.)
- Maximum expansive potential (%)* 1.5
- Maximum soluble sulfates (%) 0.10

* Measured on a sample compacted to approximately 95% of the ASTM D698 maximum dry density at about 3 percent below optimum water content. The sample is confined under a 100 psf surcharge and submerged.

Base course should conform to the Maricopa Association of Governments Uniform Standard Specifications for Public Works Construction (MAG) or other local government specifications.

2.2 ACCESSORIES

A. Detectable Warning Tape: Acid- and alkali-resistant, polyethylene film warning tape manufactured for marking and identifying underground utilities, a minimum of 6 inches (150 mm) wide and 4 mils (0.1 mm) thick, continuously inscribed with a description of the utility, with metallic core encased in a protective jacket for corrosion protection, detectable by metal detector when tape is buried up to 30 inches deep; colored as follows:

2. Yellow: Gas, oil, steam, and dangerous materials.
3. Orange: Telephone and other communications.
4. Blue: Water systems.
5. Green: Sewer systems.

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 sub-grades and foundation soils from freezing temperatures and frost. Remove temporary protection before placing subsequent materials.

D. Verify that work of this section may be installed in strict accordance with the original design, all pertinent codes and regulations, and all pertinent portions of the referenced standards.
1. Verify that the survey benchmark and intended elevations for the work are as indicated.
2. Identify required lines, levels, contours, and datum.
3. Identify known utilities. Stake and flag locations.
4. Maintain and protect existing utilities remaining which pass through work area.
5. Verify fill materials to be reused are acceptable.
6. Prior to placement of fill material, verify scarification and compaction of excavated surface is complete.

E. Protect trees, shrubs, lawns, rock outcropping, and other features remaining as portion of final landscaping.

3.2 DEWATERING
A. Prevent surface water and ground water from entering excavations, from ponding on prepared sub-grades, and from flooding Project site and surrounding area.
B. Protect sub-grades from softening, undermining, washout, and damage by rain or water accumulation.
   1. Reroute surface water runoff away from excavated areas. Do not allow water to accumulate in excavations. Do not use excavated trenches as temporary drainage ditches.

3.3 EXPLOSIVES
A. Explosives: Do not use explosives.

3.4 EXCAVATION, GENERAL
A. Unclassified Excavation: Excavate to sub-grade elevations regardless of the character of surface and subsurface conditions encountered. Unclassified 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.
   1. If excavated materials intended for fill and backfill include unsatisfactory soil materials and rock, replace with satisfactory soil materials.

3.5 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 Footings and Foundations: Footings shall bear on existing native or existing compacted fill soils. In general, the existing soils may be used in its current state without removal and re-compaction; however, footing excavations shall be reviewed by the geotechnical engineer or his qualified representative prior to the placement of reinforcing steel or concrete. If any loose or unstable areas of the existing fill are identified by the geotechnical engineer, it may be recommended that the fill be removed and replaced with engineered fill or lean concrete.
   2. Floor slabs shall be supported on a 4" thick aggregate base course. Remove existing soils to the required subgrade elevation. Following removal of existing soil, scarify, moisten or dry as recommended and re-compact all sub-grade soils to a minimum depth of 8 inches. A minimum of 4 inch layer of base course shall be provided beneath all slabs.
3. Excavation for Underground Tanks, Basins, and Mechanical or Electrical Utility Structures: Excavate to elevations and dimensions indicated within a tolerance of plus or minus 1 inch. Do not disturb bottom of excavations intended as bearing surfaces.

3.6 EXCAVATION FOR UTILITY TRENCHES

A. Excavate trenches to indicated gradients, lines, depths, and elevations.
   1. Beyond building perimeter, excavate trenches to allow installation of top of pipe below frost line.

B. Excavate trenches to uniform widths to provide the following clearance on each side of pipe or conduit. Excavate trench walls vertically from trench bottom to 12 inches higher than top of pipe or conduit unless otherwise indicated.
   1. Clearance: 12 inches each side of pipe or conduit.

C. Trench Bottoms: Excavate and shape trench bottoms to provide uniform bearing and support of pipes and conduit. Shape sub-grade to provide continuous support for bells, joints, and barrels of pipes and for joints, fittings, and bodies of conduits. Remove projecting stones and sharp objects along trench sub-grade.
   1. For pipes and conduit less than 6 inches (150 mm) in nominal diameter, hand-excavate trench bottoms and support pipe and conduit on an undisturbed sub-grade.
   2. For pipes and conduit 6 inches (150 mm) or larger in nominal diameter, shape bottom of trench to support bottom 90 degrees of pipe or conduit circumference. Fill depressions with tamped sand backfill.
   3. For flat-bottomed, multiple-duct conduit units, hand-excavate trench bottoms and support conduit on an undisturbed sub-grade.
   4. Excavate trenches 6 inches (150 mm) deeper than elevation required in rock or other unyielding bearing material to allow for bedding course.

D. Trenches in Tree and Plant Protection Zones:
   1. Hand-excavate to indicated lines, cross sections, elevations, and sub-grades. Use narrow-tine spading forks to comb soil and expose roots. Do not break, tear, or chop exposed roots. Do not use mechanical equipment that rips, tears, or pulls roots.
   2. Do not cut main lateral roots or taproots; cut only smaller roots that interfere with installation of utilities.
   3. Cut and protect roots according to requirements in Division 01 Section "Temporary Tree and Plant Protection."

3.7 SUBGRADE INSPECTION

A. Notify Architect when excavations have reached required sub-grade.

B. If Architect determines that unsatisfactory soil is present, continue excavation and replace with compacted backfill or fill material as directed.

C. Proof-roll sub-grade below the building slabs with a pneumatic-tired and loaded 10-wheel, tandem-axle dump truck weighing not less than 10 tons to identify soft pockets and areas of excess yielding. Do not proof-roll wet or saturated sub-grades.
1. Completely proof-roll sub-grade in one direction, repeating proof-rolling in direction perpendicular to first direction. Limit vehicle speed to 3 mph.

2. Excavate soft spots, unsatisfactory soils, and areas of excessive pumping or rutting, as determined by Architect, and replace with compacted backfill or fill as directed.

D. Authorized additional excavation and replacement material will be paid for according to Contract provisions for changes in the Work.

E. Reconstruct sub-grades damaged by freezing temperatures, frost, rain, accumulated water, or construction activities, as directed by Architect, without additional compensation.

3.8 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, pipe, or conduit as directed by Architect.

3.9 STORAGE OF SOIL MATERIALS

A. 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 remaining trees.

3.10 BACKFILL

A. Place and compact backfill in excavations promptly, but not before completing the following:

1. Construction below finish grade including, where applicable, sub-drainage, damp-proofing, waterproofing, and perimeter insulation.
2. Surveying locations of underground utilities for Record Documents.
3. Testing and inspecting underground utilities.
4. Removing concrete formwork.
5. Removing trash and debris.
6. Removing temporary shoring and bracing, and sheeting.
7. Installing permanent or temporary horizontal bracing on horizontally supported walls.

B. Place backfill on sub-grades free of mud, frost, snow, or ice.

3.11 UTILITY TRENCH BACKFILL

A. Place backfill on sub-grades free of mud, frost, snow, or ice.

B. Place and compact bedding course on trench bottoms and where indicated. Shape bedding course to provide continuous support for bells, joints, and barrels of pipes and for joints, fittings, and bodies of conduits.

C. Trenches under Footings: Backfill trenches excavated under footings and within 36 inches of bottom of footings with satisfactory soil; fill with concrete to elevation of bottom of footings. Concrete is specified in Division 03 Section “Cast-in-Place Concrete”.
D. Backfill voids with satisfactory soil while removing shoring and bracing.

E. Place and compact initial backfill of satisfactory soil, free of particles larger than 1 inch in any dimension, to a height of 12 inches over the pipe or conduit.
   
   1. Carefully compact initial backfill under pipe haunches and compact evenly up on both sides and along the full length of piping or conduit to avoid damage or displacement of piping or conduit. Coordinate backfilling with utilities testing.

F. Place and compact final backfill of satisfactory soil to final sub-grade elevation.

G. Install warning tape directly above utilities, 12 inches below finished grade, except 6 inches below sub-grade under pavements and slabs.

3.12 SOIL FILL

A. On-site fill material shall comply with Section 211, and related sections of the MAG Uniform standard Specifications.

B. Plow, scarify, bench, or break up sloped surfaces steeper than 1 vertical to 4 horizontal so fill material will bond with existing material.

C. Place and compact fill material in layers to required elevations as follows:
   
   1. Under grass and planted areas, use satisfactory soil material.
   2. Under walks and pavements, use satisfactory soil material.
   3. Under steps and ramps, use engineered fill.
   4. Under building slabs, use engineered fill.
   5. Under footings and foundations, use engineered fill.

D. Place soil fill on sub-grades free of mud, frost, snow, or ice.

3.13 SOIL MOISTURE CONTROL

A. Uniformly moisten or aerate sub-grade and each subsequent fill or backfill soil layer before compaction to within 2 percent of optimum moisture content.
   
   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 by 2 percent and is too wet to compact to specified dry unit weight.

3.14 COMPACTION OF SOIL BACKFILLS AND FILLS

A. Place backfill and fill soil materials in layers not more than 12 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 according to ASTM D 698:
D. Materials shall be compacted to the following:

<table>
<thead>
<tr>
<th>Material Type</th>
<th>Minimum Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>On-Site soil, reworked and fill:</td>
<td></td>
</tr>
<tr>
<td>a. Below footings</td>
<td>95</td>
</tr>
<tr>
<td>b. Below conventional slabs-on-grade</td>
<td>95</td>
</tr>
<tr>
<td>Imported Soil:</td>
<td></td>
</tr>
<tr>
<td>a. Below footings</td>
<td>95</td>
</tr>
<tr>
<td>b. Below conventional slabs-on-grade</td>
<td>95</td>
</tr>
<tr>
<td>Base course below slabs-on-grade</td>
<td>95</td>
</tr>
<tr>
<td>Non-structural backfill</td>
<td>90</td>
</tr>
</tbody>
</table>

Fill at depths greater than five feet below finished grade should be compacted to at least 100 percent of the ASTM D 698 dry-density value to within five feet of finished grade. Fill at depths less than five feet below finished grade should be compacted to the minimum values provided above.

On-site and clayey soils should be compacted within a water range of 1 percent below to 3 percent above optimum. Imported and on site soils with low expansion potential should be compacted within a water content range of 3 percent below to 3 percent above optimum.

3.15 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.

1. Provide a smooth transition between adjacent existing grades and new grades.
2. Cut out soft spots, fill low spots, and trim high spots to comply with required surface tolerances.

B. Site Rough Grading: Slope grades to direct water away from buildings and to prevent ponding. Finish sub-grades to required elevations within the following tolerances:

1. Turf or Unpaved Areas: Plus or minus 1 inch.
2. Walks: Plus or minus 1 inch.

C. Grading inside Building Lines: Finish sub-grade to a tolerance of 1/2 inch when tested with a 10-foot straightedge.

3.16 DRAINAGE COURSE UNDER CONCRETE SLABS-ON-GRADE

A. Place drainage course on sub-grades free of mud, frost, snow, or ice.

B. On prepared sub-grade, place and compact drainage course under cast-in-place concrete slabs-on-grade as follows:
1. Place drainage course that exceeds 6 inches in compacted thickness in layers of equal thickness, with no compacted layer more than 6 inches thick or less than 3 inches thick.

2. Compact each layer of drainage course to required cross sections and thicknesses to not less than 90 percent of maximum dry unit weight according to ASTM D 698.

### 3.17 FIELD QUALITY CONTROL

**A. Special Inspections:** Owner will engage a qualified special inspector to perform the following special inspections:

1. Determine prior to placement of fill that site has been prepared in compliance with requirements.
2. Determine that fill material and maximum lift thickness comply with requirements.
3. Determine, at the required frequency, that in-place density of compacted fill complies with requirements.

**B. Testing Agency:** Owner will engage a qualified geotechnical engineering testing agency to perform tests and inspections.

**C. Allow testing agency to inspect and test sub-grades and each fill or backfill layer. Proceed with subsequent earth moving only after test results for previously completed work comply with requirements.**

**D. Footing Sub-grade:** At footing sub-grades, at least one test of each soil stratum will be performed to verify design bearing capacities. Subsequent verification and approval of other footing sub-grades may be based on a visual comparison of sub-grade with tested sub-grade when approved by Architect.

**E. Testing agency will test compaction of soils in place according to ASTM D 1556, ASTM D 2167, ASTM D 2922, and ASTM D 2937, as applicable. Tests will be performed at the following locations and frequencies:**

1. **Paved and Building Slab Areas:** At sub-grade and at each compacted fill and backfill layer, at least one test for every 2000 sq. ft. or less of paved area or building slab, but in no case fewer than three tests.
2. **Foundation Wall Backfill:** At each compacted backfill layer, at least one test for every 100 feet or less of wall length, but no fewer than two tests.
3. **Trench Backfill:** At each compacted initial and final backfill layer, at least one test for every 150 feet or less of trench length, but no fewer than two tests.

**F. When testing agency reports that sub-grades, fills, or backfills have not achieved degree of compaction specified, scarify and moisten or aerate, or remove and replace soil materials to depth required; re-compact and retest until specified compaction is obtained.**

### 3.18 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.**

1. Scarify or remove and replace soil material to depth as directed by Architect; reshape and re-compact.
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.

3.19 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.

B. Transport surplus satisfactory soil to designated storage areas on Owner's property. Stockpile or spread soil as directed by Architect.

1. Remove waste materials, including unsatisfactory soil, trash, and debris, and legally dispose of them off Owner's property.

END OF SECTION
SECTION 32 12 16
ASPHALT PAVING

1. **PART 1 - GENERAL**

1.1. **SECTION INCLUDES**

1.1.1. Asphalt concrete pavement.

1.1.2. Aggregate base course.

1.1.3. Paving accessories as specified.

1.2. **REFERENCES**


1.2.2. Geotechnical Report – TERRACON; Project #11036655, dated April 29, 2011.

1.3. **SUBMITTALS**

1.3.1. Mix Design: Submit asphalt mix design prepared by a certified laboratory, selected by Owner and acceptable to Owner. Certifying that the mix meets or exceeds the specification.

1.3.2. Accompanying mix design, submit materials certificates signed by material producer and Contractor, certifying that each material item complies with, or exceeds, specified requirements.

2. **PART 2 - PRODUCTS**

2.1. **AGGREGATE BASE COURSE MATERIAL**

2.1.1. Provide Aggregate Base per PAG 4 inches thick.

2.2. **ASPHALTIC CONCRETE PAVEMENT MATERIALS**

2.2.1. Provide Asphaltic Concrete Pavement materials conforming to PAG and the Geotechnical Report, 2 inches thick.

2.2.2. Herbicide: Provide approved herbicide, tinted for visual identification, non-flammable formulation, and complying with all current Arizona and EPA environmental regulations.

2.3. **DESIGN CRITERIA**

2.3.1. General:

2.3.1.1. All improvements shall be constructed per the referenced standards, the contract documents, and as specified in this section.

2.3.1.2. Where criteria shown on drawings or specified in this specification exceed that of the referenced standards, the more stringent criteria shall apply.
3. **PART 3 - EXECUTION**

3.1. **SURFACE CONDITIONS AND PREPARATION**

3.1.1. Inspection:

3.1.1.1. Prior to work of this section, carefully inspect previously installed work. Verify all such work is complete to the point where this installation may properly commence.

3.1.1.2. Verify that work of this section may be installed in strict accordance with the original design, all pertinent codes and regulations, and all pertinent portions of the referenced standards.

3.1.1.3. In the event of discrepancy, immediately notify the Architect.

3.1.1.4. Do not proceed with installation in areas of discrepancy until all such discrepancies have been fully resolved.

3.1.2. Preparation:

3.1.2.1. Provide all staking and field engineering required to implement the work as shown on the drawings.

3.1.2.2. Protect all stakes and benchmarks. Replace all stakes and benchmarks damaged during the course of construction at no cost to Owner.

3.1.2.3. Set grade stakes using instrument technology, at 10 foot grid interval.

3.1.2.4. Provide all equipment of such type, function and design as required to achieve specified values.

3.2. **APPLICATION OF SOIL TREATMENTS**

3.2.1. Herbicide Treatment:

3.2.1.1. Apply in strict accordance with Manufacturer's recommendations.

3.2.1.2. Conform to all applicable and current regulations.

3.2.1.3. Do not apply herbicide within a minimum distance of two feet from planted areas.

3.2.1.4. If requested by Architect, provide written certification of purchase and application of herbicide.

3.3. **PLACEMENT OF AGGREGATE BASE COURSE**

3.3.1. Deliver base course to site as uniform mixtures.

3.3.2. Place aggregate base in conformance with PAG standards.

3.3.2.1. Where asphalt paving is installed to replace existing on-site locations, match existing base thickness.
3.4. BASE COURSE COMPACTION AND PROTECTION

3.4.1. Compact base course material per Geotechnical Report requirements.

3.4.2. Where completed base course areas are disturbed by subsequent construction operations or adverse weather, remove base course in damaged areas to subgrade, and place and compact new base course to required density prior to further construction.

3.5. PREPARATION FOR PAVING

3.5.1. Apply tack coat to vertical faces of existing or previously constructed bituminous pavement, curbs, gutters, slab edges, and all structures to be in actual contact with the bituminous pavement.

3.5.2. Asphalt Pavement Crack Preparation:

3.5.2.1. All asphalt cracks shall be cleaned, prepared and filled prior to application of tack coat.

3.5.2.2. All vegetation shall be removed from cracks and blown clean with compressed air.

3.5.2.3. Cracks shall be treated with specified soil sterilizer prior to placement of filler material.

3.6. PLACEMENT OF ASPHALTIC CONCRETE PAVEMENT


3.7. ROLLING

3.7.1. Monitor temperatures of the asphalt concrete mixture as delivered to the site and during laydown to insure conformance with PAG Standard Specifications.

3.7.2. Perform hand tamping in areas not accessible to rolling equipment.

3.8. FIELD QUALITY CONTROL

3.8.1. Testing and inspection of asphaltic concrete mix and asphalt pavement will be performed at Contractors cost by a testing laboratory retained by the Contractor and acceptable to the Owner. The testing laboratory, except for the contract relationship required for this project, shall have no financial or fiduciary relationship with Contractor or paving installer.

3.8.2. Thickness Cores:

3.8.2.1. Provide 1 core test per each 5,000 square feet [or each repair area] to verify compacted thickness.

3.8.3. Density Tests:

3.8.3.1. Provide field density tests indicating compliance with MAG Standard Specifications.

3.8.4. Surface smoothness, thickness and level.
3.8.1. Maintain surface free of gouges, ridges and ruts, with a uniform and consistent finish.

3.8.2. Maintain line and profile shown to tolerance of 1/4 inch plus/minus, in any 10 feet, non-cumulative.

3.8.3. Maintain asphalt pavement free from depressions exceeding 1/8 inch when measured with a 10 foot straight-edge.

3.8.5. Flood Test:

3.8.5.1. Flood test paving prior to application of seal coat.

3.8.5.2. Where water ponds in excess of 1/8 inch in an area greater than 2 feet in any direction, repair or replace as directed by Architect to provide proper drainage.

3.9. PAINT STRIPING AND MARKING

3.9.1. Match existing for width and layout.

3.10. PROTECTION

3.10.1. After final rolling, do not permit vehicular traffic on pavement until it has cooled to atmospheric temperature and hardened, but in no case less than 8 hours.

3.10.2. Erect barricades in accordance with requirements of Division 1 to protect paving from traffic until mixture has cooled in accordance with the specifications.

3.10.3. Do not use completed paving surface for storage of construction vehicles or construction materials.

END OF SECTION
SECTION 32 13 13

CONCRETE PAVING

1. PART 1 - GENERAL

1.1. SECTION INCLUDES

1.1.1. Concrete paving and walkways.
1.1.2. Curbing/gutters, and related concrete improvements.

1.2. REFERENCES

1.2.1. Organization and Trade Standards
1.2.2. City of Tucson jurisdictional and agency engineering and public works regulations and standards.

1.3. SUBMITTALS

1.3.1. Mix Design/Materials List:

1.3.1.1. Submit concrete mix design prepared by a certified batch plant or laboratory, selected by Contractor and acceptable to Owner, for review and approval.

1.3.1.2. Accompanying mix design, submit materials certificates signed by material producer and Contractor, certifying that each material item complies with, or exceeds, specified requirements.

1.4. PUBLIC AGENCY STANDARDS

1.4.1. Perform all paving and related structures and devices indicated as public agency standards in accordance with the standard plans and specifications of that agency.

2. PART 2 - PRODUCTS

2.1. DESIGN CRITERIA

2.1.1. General:

2.1.1.1. All improvements shall be constructed per the referenced standards, the contract documents, and as specified in this section.

2.1.1.2. Where criteria shown on drawings or specified in this specification exceed that of the referenced standards, the more stringent criteria shall apply.

2.2. CAST-IN-PLACE CONCRETE

2.2.1. General:
2.2.1.1. All concrete shall be transit mixed, complying with ATSM C94.

2.2.1.2. All concrete shall be supplied from a single source, using a single cement supplier.

2.2.1.3. All cement shall be portland cement, Type II, low alkali per ASTM C150, and produced within the United States.

2.2.2. Product Characteristics: Paving/Flatwork/Ramps/Stairs:

2.2.2.1. Compressive Strength: 3000 psi. Strength selected for durability. Concrete is non-structural, and does not require special inspection.

2.2.2.2. Combined Aggregate Grading:

2.2.2.2.1. Aggregate shall be non-reactive per ASTM C 289, and shall comply with ASTM C33, Table 3, Class 4M.

2.2.2.3. Cement Content: 560 pounds per cubic yard concrete

2.2.2.4. Slump: 4 inch maximum

2.2.2.5. Water-Cement Ratio: 0.55 maximum.

2.2.2.6. Flatwork Finish:

2.2.2.6.1. Match existing finishes.

2.2.2.6.2. Color: Natural cement gray.

2.2.3. Product Characteristics: Curbing, gutters, related drainage components.

2.2.3.1. Compressive Strength: 2500 psi

2.2.3.2. Combined Aggregate Grading:

2.2.3.3. Cement Content: 520 pounds per cubic yard concrete

2.2.3.4. Slump: 4 inch maximum

2.2.3.5. Finish: Per Section 303-5.5.2 of "Standard Specifications,"

2.2.3.6. Water-Cement Ratio: 0.55 maximum.

2.3. PAVING BASE

2.3.1. Provide crushed aggregate base per Section 200-2.2.1 of the "Standard Specification"

2.4. EXPANSION JOINT MATERIAL

2.4.1. Expansion Joint Material: W. R. Meadows or equal, Sealtight Fiber filler, full depth of slab, matching profile, 1/2 inch thickness or as shown on drawings.
2.5. WEAKENED PLANE JOINTS AND SCORELINES

2.5.1. Tooled joint technique, with maximum tooled radius edge of 1/8”.

2.6. CURING AND SEALING COMPOUNDS

2.6.1. Curing Compound:

2.6.2. Cure and Sealing Compound:

2.6.2.1. Provide Burke Spartan-Cote WB, complying with ASTM C309, Type 1-A and B, at natural color exterior concrete paving.

2.7. OTHER MATERIALS

2.7.1. Provide all other materials, not specifically described but required for complete and proper installation of this work, as selected by the contractor and subject to the approval of the Architect.

3. PART 3 - EXECUTION

3.1. SURFACE CONDITIONS

3.1.1. Inspection:

3.1.1.1. Prior to all work of this section, carefully inspect the installed work of all other trades and verify that all such work is complete to the point where this installation may properly commence.

3.1.1.2. Verify that concrete pavement may be installed in strict accordance with the original design, all pertinent codes and regulations, and all pertinent portions of the referenced standards.

3.1.1.3. In the event of discrepancy, immediately notify the Architect.

3.1.1.4. Do not proceed with installation in areas of discrepancy until all such discrepancies have been fully resolved.

3.2. CONCRETE PAVING INSTALLATION

3.2.1. Preparation:

3.2.1.1. Verify sub-grade, base material, conduit, and all other embedded items are properly located in relation to concrete paving. Secure all embedded items against displacement during pour.

3.2.1.2. Verify all grades for pitch and fall prior to pouring pavements.

3.2.1.3. Verify compaction of existing subgrade complies with criteria specified in Section 31 20 00.

3.2.2. Forming:

3.2.2.1. Install forms in accordance with specified tolerances.
3.2.2.2. Stake rigidly in place at maximum intervals of 4 feet on center. Secure so as to prevent displacement during pouring and finishing process.

3.2.2.3. Install stretched wires or other device to provide form displacement indication.

3.2.2.4. Thoroughly clean forms, removing debris, coatings and foreign matter. Coat forms with approved bond breaker, suitable for use on integral colored concrete without staining or discoloration. Place sand bed over existing paving receiving new concrete paving.

3.2.3. Placement:

3.2.3.1. Prepare subgrade as specified.

3.2.3.1.1. Scarify subgrade to a depth of 12 inches.

3.2.3.1.2. Water, mix and aerate as necessary to moisture condition within range of 1 percent below to 3 percent above optimum moisture content.

3.2.3.1.3. Compact upper 12 inches to a minimum relative compaction of 95 percent based on ASTM D 1557.

3.2.3.1.4. Dampen sub-grade 24 hours prior to placing concrete.

3.2.3.1.5. Dampen forms as required to tighten joints and cracks in forming material.

3.2.3.2. Install concrete paving per Section 303-5 of the "Standard Specifications",

3.2.3.2.1. Provide minimum slab thickness of 5 inches, unless noted otherwise.

3.2.3.3. Install all curbing, cross gutters, and related improvements per Section 303-5 of the "Standard Specifications", and as shown on drawings. form

3.2.3.4. Broom Finish

3.2.3.4.1. Float and steel trowel surface to required slopes and planes.

3.2.3.4.2. Apply broom texture, transverse to direction of pedestrian travel, and using a stiff wire or nylon bristle broom.

3.2.3.4.3. Unless specified otherwise, provide medium broom texture at locations shown on drawings. At ramp surfaces (surfaces exceeding 5 percent slope in direction of travel), provide heavy broom texture.

3.2.3.4.4. Obtain approval of finish texture by Architect for various applications.
3.3. JOINT TREATMENT

3.3.1. Provide expansion joints at locations shown on drawings, and as follows:

3.3.1.1. Beginning and end of curves in curbs and curbs and gutter assemblies, and at center.

3.3.1.2. Where paving is adjacent to walls, bollard or column penetrations, or footings.

3.3.1.3. At 25 feet on center in linear walkways.

3.3.1.4. Tool all edges adjacent to expansion material with maximum 1/8 inch radius tool.

3.3.1.5. Remove joint cap. Provide bondbreaker tape at surface of joint material cover cap.

3.3.1.6. Provide construction joints only at expansion joints.

3.4. CONCRETE CURING AND SEALING

3.4.1. General:


3.5. FIELD QUALITY CONTROL

3.5.1. Flood Test:

3.5.1.1. Provide flood test of all gutters and paving as directed by Architect.

3.5.1.2. Where ponding occurs, or where drainage rate is less than that established by original design, replace all defective concrete. Remove concrete to the nearest joint line.

3.5.2. Tolerances:

3.5.2.1. Level: 3/16 inch plus or minus, at any point, measured along a 10 foot straight edge.

3.5.2.2. Adjacent surfaces: 1/8 inch maximum difference at any point between adjacent concrete pours or between paving and adjacent paving materials.

3.5.2.3. Joint Alignment: 1/16 inch deviation from adjacent joint.

3.5.2.4. Line: 1/4 inch, plus or minus, deviation from a straight line in any 10 foot length, non-cumulative.

3.5.2.5. Final elevations shall comply with grades as shown on drawings, to a tolerance of plus or minus 0.25 inch.
3.5.2.6. Tolerances do not permit violation of dimensions or grade and slopes relationships required by code or jurisdictional authority. Adjust work as required to comply with such requirements.

END OF SECTION
3.5.3. Appearance:

3.5.3.1. Remove and replace concrete not complying with specified tolerances, and concrete with the following defects.

3.5.3.1.1. Inconsistent texture.

3.5.3.1.2. Irregular or misaligned direction of texture.

3.5.3.1.3. Concrete with spalled or raveled control or expansion joints.

3.5.3.1.4. Concrete exhibiting splotching or discoloration in surface including discoloration due to "carbonation".

3.5.3.1.5. Concrete exhibiting cracking, including shrinkage cracking, where cracks are located between joint pattern.

3.5.3.2. Use of patching mortar for repair of edge defects is subject to acceptance of final color and texture by Architect.

END OF SECTION
Downtown Campus
ST WEST - MECHANICAL UPGRADES
Pima Community College

June 7, 2013

PROJECT DIRECTORY

PROJECT:
ST WEST - MECHANICAL UPGRADES
1255 NORTH STONE AVENUE
TUCSON, ARIZONA  85709

OWNER:
PIMA COMMUNITY COLLEGE
DISTRICT OFFICE
1000 NORTH STONE AVENUE
TUCSON, ARIZONA  85705

ARCHITECT:
NTD ARCHITECTURE
2940 NORTH SWAN ROAD, SUITE 214
TUCSON, ARIZONA  85712
TEL: 520/784-0975
WWW.NTD.COM

ENGINEERING:
ELECTRICAL:
ADAMS & ASSOCIATES
4067 E. GRANT ROAD, SUITE 200
TUCSON, ARIZONA  85712
TEL: (520) 323-3858

MECHANICAL AND PLUMBING:
ADAMS & ASSOCIATES
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STRUCTURAL:
HOLDIN, MARTIN & WHITE
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CONTACT: MICHAEL HARRIS

MECHANICAL AND PLUMBING:
ADAMS & ASSOCIATES
4067 E. GRANT ROAD, SUITE 200
TUCSON, ARIZONA  85712
TEL: (520) 323-3858

APPLICABLE CODES

CITY OF TUCSON BUILDING CODES:
- 2012 INTERNATIONAL BUILDING CODE, AND LOCAL AMENDMENTS
- 2012 INTERNATIONAL FIRE CODE, AND LOCAL AMENDMENTS
- 2012 INTERNATIONAL PLUMBING CODE, AND LOCAL AMENDMENTS
- 2012 INTERNATIONAL ELECTRICAL CODE, AND LOCAL AMENDMENTS
- 2012 INTERNATIONAL MECHANICAL CODE, AND LOCAL AMENDMENTS

NATIONAL BOARD OF FIRE UNDERWRITERS:
- 2011 NATIONAL FIRE PROTECTION CODE
- 2011 NATIONAL BOARD OF FIRE UNDERWRITERS CODE
- 2011 NATIONAL BOARD OF FIRE UNDERWRITERS SAFETY CODE
- 2011 NATIONAL BOARD OF FIRE UNDERWRITERS COMPLIANCE CODE
- 2011 NATIONAL BOARD OF FIRE UNDERWRITERS SECURITY CODE
- 2011 NATIONAL BOARD OF FIRE UNDERWRITERS WORKPLACE CODE

EXPIRES 03-31-2014
LATEST EDITION

FROM THE UL LISTING, nATIONAL USE REFERENCED IN DRAWINGS OR OTHER DOCUMENTS.

GENERAL:
SHEET INDEX

01.01 COVER SHEET, SHEET INDEX, PROJECT LOCATION

MECHANICAL:
A1.00 DRAINAGE PLAN
A2.00 SITE PLAN
A3.00 BLMENTS AND DETAILS
A4.00 DRAWING SCHEDULE AND DETAILS

01.01 SYMBOLS & ABBREVIATIONS, PARTIAL SINGLE LINE DIAGRAM
02.01 STRUCTURAL DETAILS
02.02 ELECTRICAL DETAILS
02.03 ELECTRICAL PLANS

CONTACT:
PAUL BOWDEN
TEL: (520) 293-1488

CONTACT:
DAVE TYRELL
TEL: (520) 293-1488

CONTACT:
MICHAEL HARRIS
TEL: (520) 784-0975

CONTACT:
WARREN WHITE
TEL: (520) 327-9491

CONTACT:
GABRIEL THORNLIEF
TEL: (520) 293-1488

CONTACT:
ROBERT W. WARD
TEL: (520) 293-1488

PROJECT LOCATION

AREA OF WORK

NOT TO SCALE

SCALE: 2' = 1/128"
ALTERNATE 1: EXPANDED AUTO SHOP YARD

30'-8" 5'-0"

M.O. M.O.

ALIGN

ST WEST BUILDING AUTOMOTIVE YARD

EXISTING STORAGE & EQUIPMENT

SEE MECHANICAL AND ELECTRICAL DRAWINGS
# SOUTH ELEVATION - ALTERNATE 1

**NOTE:** ALL STEEL ELEMENTS PAINTED FINISH.

**NOTE:** ALL STEEL ELEMENTS PAINTED FINISH.

---

## DOOR SCHEDULE

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<th>WIDTH</th>
<th>HEIGHT</th>
<th>THICK</th>
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<td>P-1</td>
<td>S-1</td>
<td>S-1</td>
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<td>S-1</td>
<td>HW-1</td>
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<td>1'-0&quot;</td>
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<td>S-1</td>
<td>P-1</td>
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<td>HW-3</td>
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**NOTE:** HANDRAIL ASSEMBLY NOT INCLUDED AT GUARDRAIL.
**GENERAL STRUCTURAL NOTES:**

1. All construction shall comply with the International Building Code, 2020 Edition.
2. Concrete columns shall be identified with the location of the reinforcing steel.
3. The concrete shall be cured for a minimum of 7 days.
4. The use of steel reinforcing shall be in accordance with the approved shop drawings.
5. Special inspection shall be performed for the project.
6. The use of concrete in the construction shall be in accordance with the approved shop drawings.
7. The use of steel reinforcing shall be in accordance with the approved shop drawings.
8. Special inspection shall be performed for the project.

**CONCRETE:**

All panels of masonry shall be identified with the location of the reinforcing steel.

**SPECIAL INSPECTION PROGRAM**

1. The construction shall be reviewed by the Structural Engineer of Record in accordance with the approved shop drawings.
2. The use of steel reinforcing shall be in accordance with the approved shop drawings.
3. Special inspection shall be performed for the project.
4. The use of concrete in the construction shall be in accordance with the approved shop drawings.

**SPECIAL INSPECTION REQUIREMENTS**

<table>
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<tr>
<th>Construction</th>
<th>Special Inspection</th>
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<tr>
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<td>Steel Reinforcement</td>
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<tr>
<td>Concrete</td>
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</tr>
</tbody>
</table>

**MASONRY:**

1. All panels of masonry shall be identified with the location of the reinforcing steel.
2. The use of concrete in the construction shall be in accordance with the approved shop drawings.
3. Special inspection shall be performed for the project.
4. The use of steel reinforcing shall be in accordance with the approved shop drawings.

**FOUNDATION NOTES:**

1. All panels of concrete shall be identified with the location of the reinforcing steel.
2. The use of concrete in the construction shall be in accordance with the approved shop drawings.
3. Special inspection shall be performed for the project.
4. The use of steel reinforcing shall be in accordance with the approved shop drawings.

**ANCHOR SYSTEMS:**

1. All anchor bolts shall be identified with the location of the reinforcing steel.
2. The use of concrete in the construction shall be in accordance with the approved shop drawings.
3. Special inspection shall be performed for the project.
4. The use of steel reinforcing shall be in accordance with the approved shop drawings.

**REINFORCING STEEL:**

1. All panels of masonry shall be identified with the location of the reinforcing steel.
2. The use of concrete in the construction shall be in accordance with the approved shop drawings.
3. Special inspection shall be performed for the project.
4. The use of steel reinforcing shall be in accordance with the approved shop drawings.

**STRUCURAL STEEL:**

1. All panels of structural steel shall be identified with the location of the reinforcing steel.
2. The use of concrete in the construction shall be in accordance with the approved shop drawings.
3. Special inspection shall be performed for the project.
4. The use of steel reinforcing shall be in accordance with the approved shop drawings.
Bid No. B13/9823

SECTION THREE
BID FORM

Date __________________________________

Bid of ________________________________________________________________,
(Name)
a corporation organized and existing under the laws of the State of _______________________; a
partnership consisting of ________________________________________; an individual trading as
_______________________________________________________________.
(Name)

PROJECT: DT ST-180 Lab Mechanical Upgrades

TO: Pima County Community College District, hereinafter called the “Owner”

1. In compliance with your Notice Inviting Sealed Bids and Instructions to Bidders, the
undersigned hereby offers to furnish the materials and perform the work for the Owner's Project
designated above, in strict accordance with the Specifications, Schedules, Drawings, and all other
pertinent Contract Documents, and agrees, upon written notice of acceptance of this Bid at any time
within forty-five (45) days after the date of opening of the bids, that he will execute the Contract in
accordance with the Bid as accepted, and give bond, as sufficient surety, in the amount of one hundred
percent (100%) of the Contract Amount, within five (5) days after the Contract Documents are presented
for signature, for the following sums:

Base Bid – Mechanical Upgrades
_____________________________________________________________ ($__________).

Alternate No. 1 (Add)(Deduct) - Relocate and Expansion of Mechanical Yard and
Parking Lot reconfiguration
_____________________________________________________________ ($__________).

Alternate No. 2 (Add)(Deduct) - ___________________________________________
_____________________________________________________________ ($__________).

Alternate No. 3 (Add)(Deduct) - ___________________________________________
_____________________________________________________________ ($__________).

Alternate No. 4 (Add)(Deduct) - ___________________________________________
_____________________________________________________________ ($__________).

Alternate No. 5 (Add)(Deduct) - ___________________________________________
_____________________________________________________________ ($__________).
2. Enclosed is bid security as required consisting of ____________________ in the amount of _________________________________________________ ($_____________). (Not less than ten percent (10%) of the proposed Contract Amount, including all additive alternates.)

3. It is understood and agreed that the work under the Contract Documents shall be commenced by the undersigned Bidder, if awarded the Contract for the Project, on the date specified as the Start Date in the Notice to Proceed issued by the Owner in the manner specified in the Contract and General Conditions, and shall be completed by the Contractor within One Hundred Twenty One (121) consecutive calendar days. If the work is not completed by that date, then the undersigned Bidder shall pay Owner the amount of ____________N/A__________________________ ($__________) as liquidated damages for each calendar day after expiration of the Contract Time that the work remains incomplete. An Early Completion Bonus shall be paid to the Contractor at the rate of ____________N/A__________________________ Dollars.

4. The undersigned Bidder hereby acknowledges receipt of the following Addenda, if any:

Addendum No. Date
________________________________________
________________________________________
________________________________________
________________________________________

5. The undersigned Bidder understands that the Owner reserves the right to reject any or all Bids or to waive any formality or technicality, and to accept Alternates in any order or combination, and to determine the low bidder on the basis of the sum of the Base Bid and the Alternates selected, as determined by the Owner in its sole discretion, in any Bid in the interest of the Owner.

6. The undersigned Bidder hereby certifies and affirms that this Bid is genuine and not a sham or collusive, nor made in the interest or behalf of any person not herein named, and that the undersigned Bidder has not directly or indirectly induced or solicited any other Bidder to put in a sham bid, or any other person, firm, or corporation to refrain from bidding, and that the Bidder has not in any manner sought by collusion to secure for itself an advantage over any other Bidder.

7. The undersigned Bidder hereby discloses the name of any officer, director or agent who is also an employee of the College or any of its agencies. Further, that it has disclosed the name of any College employee who owns, directly or indirectly, an interest in the vendor or any of its branches. (Attach List)

8. Contractor's Arizona Contractor's License No(s). ________________________. 

_______________________________________
(Official Name of Firm)

SEAL - If Bidder is a Corporation

By ________________________________________
Title ________________________________________

(Complete Business Address)
SECTION FOUR
LIST OF SUBCONTRACTORS
(To be filled out and submitted in separate sealed envelopes as a part of the Bid.)

OWNER'S PROJECT: DT ST-180 Lab Mechanical Upgrades

In compliance with Paragraph 2 of the Instructions to Bidders, the undersigned submits the following names of Subcontractors to be used in performing the work for the Project.

Contractor must indicate any changes in the subcontractor list that would result from acceptance by the Owner of any combination of alternates by identifying the substitute Subcontractor to be used, along with the number of the alternate that would result in such substitution. No substitutions or deviations from this list shall be permitted without written consent of the Owner. If required, the Contractor shall supply each subcontractor’s License Type and Number to the owner within 24 hours of such request.

<table>
<thead>
<tr>
<th>SUBCONTRACTORS OR MATERIAL VENDOR'S WORK</th>
<th>SUBCONTRACTOR'S NAME</th>
<th>LICENCE NUMBER AND TYPE (TO BE SUPPLIED WITHIN 24 HOURS IF REQUESTED)</th>
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**SUBMITTED BY:**

______________________________

Contractor

By __________________________

Title _______________________

Date ________________________
SECTION FIVE

FORMS ATTACHED

- BID BOND
- PAYMENT BOND
- PERFORMANCE BOND
- BIDDERS INFORMATION
- CONTRACTOR’S AFFIDAVIT OF RELEASE OF LIENS
- FEDERAL DEBARRED LIST CERTIFICATION

ATTMENTS

- SOILS REPORT
- ASBESTOS REPORT
BID BOND

PURSUANT TO NOTICE INVITING SEALED BIDS
(Value of this bond
must be not less than 10% of the bid amount)

KNOW ALL PERSONS BY THESE PRESENTS:

THAT, ____________________________________________ (hereinafter called the "Principal"), as Principal, and ____________________________________________, a corporation organized and existing under the laws of the State of ____________________________, with its principal office in the City of ______________________ (hereinafter called the "Surety"), as Surety, are held and firmly bound unto Pima County Community College District (hereinafter called the "Obligee") in the amount of _________________________ Dollars ($_____________), for the payment whereof, the said Principal and Surety bind themselves, and their heirs, administrators, executors, successors and assigns, jointly and severally, firmly by these presents.

WHEREAS, the Principal has submitted a bid for _________________________.

NOW, THEREFORE, if the Obligee shall accept the bid of the Principal and the Principal shall enter into a contract with the Obligee in accordance with the terms of the bid and give the bonds and certificates of insurance as specified in the standard specifications with good and sufficient surety for the faithful performance of the contract and for the prompt payment of labor and materials furnished in the prosecution of the contract, or in the event of the failure of the Principal to enter into the contract and give the bonds and certificates of insurance, if the Principal pays the Obligee the difference not to exceed the penalty of the bond between the amount specified in the bid and such larger amount for which the Obligee may in good faith contract with another party to perform the work covered by the bid, then this obligation is void. Otherwise, it remains in full force and effect; provided, however, that this bond is executed pursuant to the provisions of Ariz. Admin. Code Rule R7-2-1111, and all liabilities on this bond shall be determined in accordance with the provisions of the section to the extent as if it were copied at length herein.

The prevailing party in a suit on this bond shall recover as a part of his judgment such reasonable attorneys’ fees as may be fixed by a judge of the Court.

Witness our hands this ____ day of ________________, 201__.

PRINCIPAL

______________

AGENCY OF RECORD

______________

SURETY

______________

By__________________________

Title_________________________

Agency Address

SURETY

______________

By__________________________

Title_________________________
PAYMENT BOND

(Value of this bond must be 100% of the Contract Amount)

KNOW ALL PERSONS BY THESE PRESENTS:

That, ____________________________________________________________________________ (hereinafter called the "Principal"), as Principal, and ____________________________________________________________________________, a corporation organized and existing under the laws of the State of ________________, with its principal office in the City of ________________ (hereinafter called the "Surety"), as Surety, are held and firmly bound unto Pima County Community College District, Pima County, Arizona (hereinafter called the "Obligee"), for the amount of ____________________ Dollars ($____________________) for the payment whereof, the said Principal and Surety bind themselves, and their heirs, administrators, executors, successors, and assigns, jointly and severally, firmly by these presents.

WHEREAS, the Principal has entered into a certain written contract with the Obligee, entitled Contract and General Conditions Between Owner and Contractor, dated the ____ day of ________________, 201__ ("Contract"), to construct and complete certain work described as ____________________________________________________________________________, which Contract is hereby referred to and made a part hereof as fully and to the same extent as if copied at length herein.

NOW, THEREFORE, the condition of this obligation is such that if the Principal promptly pays all monies due to all persons supplying labor or materials to the Principal or the Principal's subcontractors in the prosecution of the work provided for in the Contract, this obligation is void. Otherwise it remains in full force and effect.

Provided, however, that this bond is executed pursuant to the provisions of Arizona Administrative Code Rule R7-2-1112, and all liabilities on this bond shall be determined in accordance with the provisions, conditions and limitations of said Rule, to the extent as if it were copied at length in this agreement.

The prevailing party in a suit on this bond shall recover as part of the judgment reasonable attorney fees that may be fixed by a judge of the Court.

Witness our hands this ____ day of ________________, 201__.

PRINCIPAL Seal

By ____________________________________________________________________________
Title ____________________________________________________________________________

AGENCY OF RECORD

SURETY Seal

By ____________________________________________________________________________
Title ____________________________________________________________________________

Agency Address
PERFORMANCE BOND

(Value of this bond must be 100% of the Contract Amount)

KNOW ALL PERSONS BY THESE PRESENTS:

That, ___________________________________________________________ (hereinafter called the "Principal"), as Principal, and ______________________________, a corporation organized and existing under the laws of the State of ____________, with its principal office in the City of ________________ (hereinafter called the "Surety"), as Surety, are held and firmly bound unto Pima County Community College District, Pima County, Arizona (hereinafter called the "Obligee"), for the amount of ____________________________ Dollars ($____________________) for the payment whereof, the said Principal and Surety bind themselves, and their heirs, administrators, executors, successors, and assigns, jointly and severally, firmly by these presents.

WHEREAS, the Principal has entered into a certain written contract with the Obligee, entitled Contract and General Conditions Between Owner and Contractor, dated the ____ day of ________________, 201___ ("Contract"), to construct and complete certain work described as __________________________________________, which Contract is hereby referred to and made a part hereof as fully and to the same extent as if copied at length herein.

NOW, THEREFORE, the condition of this obligation is such that if the Principal faithfully performs and fulfills all of the undertakings, covenants, terms, conditions and agreements of the Contract during the original term of the Contract and any extension of the Contract, with or without notice to the Surety, and during the life of any guaranty required under the Contract, and also performs and fulfills all of the undertakings, covenants, terms, conditions and agreements of all duly authorized modifications of the Contract that may hereafter be made, notice of which modifications to the Surety being hereby waived, the above obligation is void. Otherwise, it remains in full force and effect.

The prevailing party in a suit on this bond shall recover as part of the judgment reasonable attorney fees that may be fixed by a judge of the Court.

Witness our hands this ____ day of ________________, 201__.

__________________________  ______________________________
PRINCIPAL         Seal

__________________________  By_________________________________
AGENCY OF RECORD     Title____________________________

__________________________  ______________________________________
Agency Address    SURETY      Seal

By_________________________________
Title____________________________
BIDDER’S INFORMATION

Bidder shall state if this Proposal is submitted by an Individual, Partnership, or Corporation.

________________________________________________________________

1. IF PARTNERSHIP, list names of all partners:

________________________________________________________________

________________________________________________________________

________________________________________________________________

2. IF CORPORATION, give name of State in which corporation is registered:

________________________________________________________________

Provide the names of the following Corporation officers:

President ________________________________

Secretary ________________________________

Treasurer ________________________________

3. If LICENSED CONTRACTOR, provide all contractor's license number(s) applicable to this Proposal:

_______________________________  __________________________

_______________________________  __________________________

_______________________________  __________________________

_______________________________  __________________________

4. Provide name of bonding company: ________________________________

Total bonding capacity: $_______________________

5. Name of Firm ________________________________

6. Telephone: __________________ Fax: __________________
CONTRACTOR’S CONTRACT NUMBER ____________
AFFIDAVIT OF CONTRACT DATE ____________
RELEASE OF LIENS

TO
Pima County Community College District
District Purchasing Services
4905D East Broadway, Room 113
Tucson, Arizona 85709-1420

PROJECT:
(Name, Address)

State of:
County of:

The undersigned, pursuant to Article _______ of the General Conditions of the Contract for Construction, hereby certifies that to the best of his knowledge, information and belief, except as listed below, the Releases or Waivers of Lien attached hereto include the Contractor, all Subcontractors, all suppliers of materials and equipment, and all performers of Work, labor or services who have or may have liens against any property of the Owner arising in any manner out of the performance of the Contract referenced above.

EXCEPTIONS: (If none, write "None")

CONTRACTOR:

Attachments
1. Contractor’s Release or Waiver of Liens, conditional upon receipt of final payment.

By:

Subscribed and Sworn to before me on this ______ day of _________ 201__.

Notary Public:

My Commission expires: / / 

(Signature)

If by a Corporation:
(Seal)
FEDERAL DEBARRED LIST CERTIFICATION

Certification Regarding Debarment, Suspension, Proposed Debarment, and Other Responsibility Matters
(Dec 2001)

___________________
(Date)

District Finance Office – Purchasing
Pima Community College
4905 E Broadway Blvd.
Tucson, AZ 85709

In accordance with the Federal Acquisition Regulation, 52-209-5:

(a) (1) The Offeror certifies, to the best of its knowledge and belief, that-

(i) The Offeror and/or any of its Principals-

(A) (check one) Are ( ) or are not ( ) presently debarred, suspended, proposed for debarment, or declared ineligible for the award of contracts by any Federal agency; (The debarred list (List of Parties Excluded from Federal Procurement and Nonprocurement Programs) is at http://epls.arnet.gov on the Web)

(B) (check one) Have ( ) or have not ( ), within a three-year period preceding this offer, been convicted of or had a civil judgment rendered against them for: commission of fraud or a criminal offense in connection with obtaining, attempting to obtain, or performing a public (Federal, state, or local) contract or subcontract, violation of Federal or state antitrust statutes relating to the submission of offers; or commission of embezzlement, theft, forgery, bribery, falsification or destruction of records, making false statements, tax evasion; or receiving stolen property; and

(C) (check one) Are ( ) or are not ( ) presently indicted for, or otherwise criminally or civilly charged by a governmental entity with, commission of any of the offenses enumerated in paragraph (a)(1)(i)(B) of this provision.

(ii) The Offeror (check one) has ( ) or has not ( ), within a three-year period preceding this offer, had one or more contracts terminated for default by any Federal agency.

(2) “Principals”, for the purposes of this certification, means officers; directors’ owners’ partners’ and, persons having primary management or supervisory responsibilities within a business entity (e.g., general manager; plant manager, head of a subsidiary, division, or business segment, and similar positions).

This Certification Concerns a Matter Within the Jurisdiction of an Agency of the United States and the Making of a False, Fictitious, or Fraudulent Certification May Render the Maker Subject to Prosecution Under Section 1001, Title 18, United States Code.
(a) The Offeror shall provide immediate written notice to the Contracting Officer, if, at any time prior to contract award, the Offeror learns that its certification was erroneous when submitted or has become erroneous by reason of changed circumstances.

(b) A certification that any of the items in paragraph (a) of this provision exists will not necessarily result in withholding of an award under this solicitation. However, the certification will be considered in connection with a determination of the Offeror's responsibility. Failure of the Offeror to furnish a certification or provide such additional information as requested by the Contracting Officer may render the Offeror nonresponsible.

(c) Nothing contained in the foregoing shall be construed to require establishment of a system of records in order to render, in good faith, the certification required by paragraph (a) of this provision. The knowledge and information of an Offeror is not required to exceed that which is normally possessed by a prudent person in the ordinary course of business dealings.

(d) The certification in paragraph (a) of this provision is a material representation of fact upon which reliance was placed when making award. If it is later determined that the Offeror knowingly rendered an erroneous certification, in addition to other remedies available to the Government, the Contracting Officer may terminate the contract resulting from this solicitation for default.
AFFIDAVIT BY CONTRACTOR
CERTIFYING THAT THERE WAS NO COLLUSION IN BIDDING FOR CONTRACT

STATE OF:  )
COUNTY OF: ) ss

(Name of Individual)
being first duly sworn upon oath deposes and says:
That he is ____________________________
(Title)
of ____________________________
(Name of Company, Firm, or Corporation)
that, pursuant to Subsection 112(c) of Title 23, United States Code and Title 44, Chapter 10, Article 1, and Title 34, Chapter 2, Article 4 of the Arizona Revised Statutes, he certifies that neither he nor anyone associated with the company, firm, or corporation mentioned above has, either directly or indirectly, entered into any agreement, participated in any collusion, or otherwise taken any action in restraint of full competitive bidding in connection with the associated project:

Subscribed and sworn to before me __________________________
this _______ day of __________ 201___. (Signature)

My commission expires: _________
(Seal)

Notary Public
GEOTECHNICAL ENGINEERING REPORT

PROPOSED PIMA COMMUNITY COLLEGE EXPANSION
DOWNTOWN CAMPUS
TUCSON, ARIZONA

TERRACON PROJECT NO. 63995050
APRIL 28, 1999

Prepared for:

HHPA
811 WEST 7TH STREET
LOS ANGELES, CALIFORNIA 90017

Attn: Mr. Edward Levin

Prepared by:

Terracon
355 South Euclid Avenue, Suite 107
Tucson, Arizona 85719-6654
Phone: 520-770-1789
Fax: 520-792-2539
March 21, 2000

HHPA
811 West 7th Street
Los Angeles, California 90017

Attn: Mr. Edward Levin

Re: Supplemental Recommendations
Proposed Pima Community College Expansion
Downtown Campus
Tucson, Arizona
Terracon Project No. 63995050

Dear Mr. Levin:

As requested, by Holben, Martin, and White, we are providing supplemental recommendations for the CL and RV building renovations and expansions of the referenced project. Terracon prepared a geotechnical report for the new free-standing structures for this project. This report was dated April 28, 1999.

We understand the RV and CL building renovations will include interior renovations and new exterior enclosures. Design foundation loads have been reported to be on the order of 3 to 8 kips for columns and 2.5 kips per foot for continuous wall loads. Holben, Martin, and White has inquired as to the applicability of our previously referenced report for the RV and CL building renovations. In general, it appears reasonable to apply the recommendations and qualifications of our report, dated April 28, 1999, to the planned renovations. However, particular attention should be given to the following:

- new footings constructed near or within the existing building should not bear on poorly compacted existing fill soils
- new footing construction should not disturb the bearing soils below existing footings or superimpose additional loading on the existing footings.
- all footing excavations should be observed by qualified geotechnical personal to evaluate if the bearing soils are consistent with the design parameters.

Our referenced geotechnical report for this project recommended that engineered fill be placed below new footings. This is still recommended for new exterior footings for the enclosures. However, for the interior footings, where the risk of wetting of the bearing soils is presumably less, reduction or possibly elimination of the engineered fill may be possible, depending upon the native soils encountered at bearing depth. This should be further evaluated during construction, as the geotechnical conditions are further exposed.
Proposed Pima Community College Expansion
Terracon Project No. 63995050
Supplement

We appreciate being of service to you in the geotechnical engineering phase of this project, and are prepared to assist you during the construction phases as well. If you have any questions concerning this report or any of our testing, inspection, design and consulting services, please contact us.

Sincerely,
TERRACON

Robert W. Pavlicek, P.E. Reviewed by: Stanley E. Turney, P.E.
Geotechnical Services Manager Manager – Tucson Office

Copies to: Addressee (3)
HMW (1) Attn: Jeff Quinette

n:\public\pavlicek\99geom\63995050.sup
April 28, 1999

HHPA
811 West 7th Street
Los Angeles, California 90017

Attn: Mr. Edward Levin

Re: Geotechnical Engineering Report
   Proposed Pima Community College Expansion
   Downtown Campus
   Tucson, Arizona
   Terracon Project No. 63995050

Dear Mr. Levin:

Terracon has completed geotechnical engineering exploration for the referenced project. This study was performed in general accordance with our proposal number D6399028, dated March 2, 1999.

The results of our engineering study, including the boring location diagram, laboratory test results, test boring records, and the recommendations needed to aid in the design and construction of foundations and other geotechnical related phases of this project are attached.

The subsurface soils at the site generally consisted of clayey sands, overlying sands with clay and varying amounts of gravel. Moderately calcite cemented soils were encountered in two borings. The near surface soils exhibit variable density and low to moderate compressibility at in-situ moisture content and a variable tendency for hydro-compaction or “collapse” when elevated in moisture content. The fines in the sand soils have low to moderate plasticity characteristics and the soils exhibit negligible to low expansion potential when recompacted and wetted under light loading conditions in the laboratory.

Based on the geotechnical engineering analyses, subsurface exploration and laboratory test results, we recommend the proposed structures be supported on spread footing foundation systems. Due to the variable density of the near surface soils and their potential for hydro-compaction, engineered fill is recommended below all footings. If sufficiently cemented soils are encountered at foundation depths, engineered fill below foundations may not be required.
Proposed Pima Community College Expansion
Downtown Campus
Terracon Project No. 63995050

Other design and construction details, based upon geotechnical conditions, are presented in the report.

We appreciate being of service to you in the geotechnical engineering phase of this project, and are prepared to assist you during the construction phases as well. If you have any questions concerning this report or any of our testing, inspection, design and consulting services, please contact us.

Sincerely,

TERRACON

Robert W. Pavlicek, P.E. Reviewed by: Stanley E. Turney, P.E.
Geotechnical Services Manager Manager – Tucson Office

Copies to: Addressee (3)

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INTRODUCTION

This report contains the results of our geotechnical engineering exploration for the proposed Pima Community College Additions in Tucson, Arizona.

The purpose of these services is to provide information and geotechnical engineering recommendations relative to:

- subsurface soil conditions
- groundwater condition
- foundation design and construction
- lateral earth pressures
- floor slab design and construction
- pavement design and construction
- earthwork
- drainage

The recommendations contained in this report are based upon the results of field and laboratory testing, engineering analyses, and experience with similar soil conditions, structures and our understanding of the proposed project.

PROPOSED CONSTRUCTION

We understand the proposed project consists of four new structures along with renovations to existing structures. The focus of our exploration was limited to the new structures. The four new structures will range from about 1800 to 22500 square feet in plan area. All the structures will be slab-on-grade (no basement levels). All the structures will be single-story, except the classroom building which will be two stories in height. It is anticipated the
structures will be of steel and masonry construction. Paved parking areas are also planned as part of this project.

It is anticipated the proposed structures will have maximum column loads of 100 to 150 kips and continuous wall loads of 4 to 6 kips per linear foot. Grading consisting of cuts and fill of 1 to 3 feet is anticipated to develop final site grades.

SITE EXPLORATION

The scope of the services performed for this project included site reconnaissance by a field engineer, a subsurface exploration program, laboratory testing and engineering analyses.

Field Exploration: Fourteen test borings were drilled on the site on April 7, 9, and 27, 1999, to depths of 5 to 31 feet below existing grade. Two borings, originally planned, could not be drilled due to drill rig access and/or utility conflicts. The borings were performed at the approximate locations shown on the Site Plan, Figure 1. All borings were advanced with a truck-mounted drilling rig, utilizing 3-1/4-inch i.d. hollow stem augers.

The borings were located in the field by measuring from existing site features. The accuracy of boring locations should only be assumed to the level implied by the means and methods used to determine them.

Continuous lithologic logs of each boring were recorded by the field engineer during the drilling operations. At selected intervals, samples of the subsurface materials were taken by driving split-spoon or ring barrel samplers. Bulk samples were obtained from the auger flights.

Penetration resistance measurements were obtained by driving the split-spoon and ring samplers into the subsurface materials with a 140-pound hammer falling 30 inches. The penetration resistance value is a useful index to the consistency of cohesive soils or relative density of granular soils.

Groundwater conditions were evaluated in each test boring at the time of the field exploration and upon completion of the drilling operations.
Laboratory Testing: All samples retrieved during the field exploration were returned to the laboratory for observation by the project geotechnical engineer and were classified in accordance with the Unified Soil Classification System described in Appendix C. At that time, the field descriptions were confirmed or modified as necessary and an applicable laboratory testing program was formulated to determine engineering properties of the subsurface materials. Boring logs were prepared and are presented in Appendix A.

Selected soil samples were tested for the following engineering properties:

- Water Content
- Dry Density
- Consolidation
- Expansion
- Percent Fines
- Atterberg Limits

Laboratory test results are presented in Appendix B, and were used for the geotechnical engineering analyses, and the development of foundation and earthwork recommendations. All laboratory tests were performed in general accordance with the applicable ASTM, local or other accepted standards.

SITE CONDITIONS

The project site is located at the Pima Community College Downtown Campus. The site is bounded by Drachman Street on the north, Speedway Boulevard on the south, eleventh Avenue on the west and Stone Avenue on the east. The site is relatively flat and is covered with existing paving, structures and landscape areas. It appears that an existing structure, located along Stone Avenue, will be demolished to accommodate proposed parking.

SUBSURFACE CONDITIONS

Geology: The project area is located in the Basin and Range physiographic province (1Cooley, 1967) of the North American Cordillera (2Stern, et al, 1979) of the southwestern


United States. The southern portion of the Basin and Range province is situated along the southwestern flank of the Colorado Plateau and is bounded by the Sierra Nevada Mountains to the west. Formed during middle and late Tertiary time (100 to 15 m.y. ago), the Basin and Range province is dominated by fault controlled topography. The topography consists of mountain ranges and relatively flat alluviated valleys. These mountain ranges and valleys have evolved from generally complex movements and associated erosional and depositional processes. Structurally, the site lies within the Santa Cruz River Basin. Drainage flows to the Santa Cruz River during late Tertiary time, coupled with structural activity discussed above, are generally responsible for the present day topography within the basin.

Typically, the ranges in this area are of small areal extent, but protrude significantly above adjacent wide alluviated plains and valleys. The basin rims are formed by the mountain ranges which consist of sedimentary, igneous and metamorphic materials which have been subjected to recurrent faulting and tilting and in some places, volcanic and intrusive events. As a result of erosion, the valleys have experienced partial infilling with sedimentary material which has been deposited as alluvial fans. Occasionally, the valleys may become interlocking as a result of coalescing alluvial fans which are referred to as bajadas.

Surficial geologic conditions mapped at the site (Wilson, et al, 1960) consist of alluvium of Quaternary age (10,000 to 1 m.y. ago). The alluvial materials have been described as deposits consisting of sand, silt and gravel. Locally, the alluvium can include clay deposits commonly referred to as playas. Playas are typically formed in shallow temporary lake beds on the valley floor.

**Soil Conditions:** As presented on the Logs of Boring, the near surface soils consist primarily of clayey sands with varying amounts of gravel. Two borings encountered silty sands at the ground surface. Sands with clay and gravel were encountered at depths below 7.5 to 10 feet in several borings. Moderately cemented soils were encountered in Borings B-9 and B-10, from the ground surface to depths of 10 to 15 feet. Bedrock was not encountered at the locations and depths drilled.

---

Field and Laboratory Test Results: Field penetration test results indicate the sand soils range from loose to extremely dense in relative density. The relative density of the soils generally increases with depth.

Laboratory test results indicate the subsoils exhibit low to moderate compression at in-situ moisture contents and variable tendency for hydro-compaction, or additional settlement, when elevated in moisture content. When water is added to samples of laboratory compacted on-site near-surface soils, the material exhibits negligible to low expansion potential under light loading conditions such as those imposed by floor slabs.

Groundwater Conditions: Groundwater was not observed in any test boring at the time of field exploration. These observations represent only current groundwater conditions, and may not be indicative of other times, or at other locations. Groundwater conditions can change with varying seasonal and weather conditions, and other factors.

Based upon review of State of Arizona Department of Water Resources maps (Tucson Water, 1998), regional groundwater predominates in water bearing valley fill deposits on the site. When checked in 1997, regional groundwater was encountered at an estimated depth of 200 to 250 feet below the existing ground surface at the project site.

ANALYSIS AND RECOMMENDATIONS

Geotechnical Considerations: The site appears suitable for the proposed construction based upon geotechnical conditions encountered in the test borings. The soils exhibited variable in-place densities and some of the soil samples tested show significant tendency for hydro-compaction. Laboratory swell tests indicate negligible to low swell potential of remolded and wetted samples of the near surface soils.

Based on the geotechnical engineering analyses, subsurface exploration and laboratory test results, we recommend the proposed structures be supported on spread footing foundation systems. Due to the potential for hydro-compaction, in the near surface soils, spread footings

Proposed Pima Community College Expansion  
Downtown Campus  
Terracon Project No. 63995050

Bearing on engineered fill are recommended for support of the proposed OCED and Classroom structure foundations. At the link building and the small structure to be located west of the existing RV building, engineered fill may not be necessary below footings, if adequately cemented soils are encountered at bearing depths. Based upon the expansion testing, the on-site soils appear suitable for use as fill.

Design and construction recommendations for foundation systems and other earth connected phases of the project are outlined below.

**Foundation Systems:** Spread footing foundations are recommended for the support of the proposed structures on the site. Spread footings bearing on engineered fill are recommended where loose native soils are present at bearing depths. Footings bearing on subgrades prepared as outlined in the Earthwork section of this report may be designed using a maximum allowable bearing pressure of 2000 psf.

Recommended minimum widths of column and wall footings are 24 inches and 16 inches, respectively. Exterior footings should be placed a minimum of 18 inches below finished grade to provide confinement of the bearing soils. Interior footings should bear a minimum of 12 inches below finished grade. Finished grade is the lowest adjacent grade for perimeter footings and floor level for interior footings. Any new footings bearing adjacent to existing footings should bear at the same elevation. Additionally, a clear space equivalent to two new footing widths should be present between new and existing footings. If these guidelines cannot be met, supplemental recommendations will be required.

Footings should be proportioned to reduce differential foundation movement. Proportioning on the basis of equal total settlement is recommended; however, proportioning to relative constant dead-load pressure will also reduce differential settlement between adjacent footings. Total settlement resulting from the outlined structural loads is estimated to be on the order of 1 inch or less. Differential settlement across a building should be less than 1/2 to 2/3 the total settlement. Differential settlement between existing footings could approach the total settlement of new footings. Accordingly, any connections between new and existing structures should be designed to accommodate some movement. Additional foundation movements could occur if water from any source infiltrates the foundation soils; therefore, proper drainage should be provided in the final design and during construction.
Footing, foundations, and masonry walls should be reinforced as necessary to reduce the potential for distress caused by differential foundation movement. The use of joints at openings or other discontinuities in walls is recommended.

Foundation excavations should be observed by the geotechnical engineer. If the soil conditions encountered differ from those presented in this report, supplemental recommendations will be required.

**Lateral Earth Pressures:** For backfill consisting of on-site soils above any free water surface, recommended equivalent fluid pressures for unrestrained foundation elements are:

- Active ................................................................. 40 psf/ft
- Passive ................................................................. 350 psf/ft
- Coefficient of base friction ............................................. 0.45*

*The coefficient of base friction should be reduced to 0.30 when used in conjunction with passive pressure.

Where the design includes restrained elements, the following equivalent fluid pressures are recommended:

- At Rest ................................................................. 60 psf/ft

The lateral earth pressures provided above do not include a factor of safety. Nor do they account for submerged conditions, sloping backfills, or surcharge loads on the backfill. Additional recommendations may be necessary if such conditions are to be included in the design.

**Seismic Considerations:** The project site is located in Seismic Risk Zone 2A of the Seismic Zone Map of the United States as indicated by the 1997 Uniform Building Code. Based upon the nature of the subsurface materials, a soil profile type “S0” should be used for the design of structures for the proposed project (1997 Uniform Building Code, Table No. 16-J).
Floor Slab Design and Construction: Only non to low expansive materials should be used as fill below floor slabs. Based upon our testing, it appears the on-site soils would be suitable for use as fill below floor slabs provided the materials are properly moisture conditioned and compacted. To reduce potential slab movements, the subgrade soils should be prepared as outlined in the Earthwork section of this report.

Additional floor slab design and construction recommendations are as follows:

- Positive separations and/or isolation joints should be provided between slabs and all foundations, columns or utility lines to allow independent movement.
- Control joints should be provided in slabs to control the location and extent of cracking.
- Interior trench backfill placed beneath slabs should be compacted in accordance with recommended specifications outlined below.
- For the anticipated design loading, a minimum 6-inch layer of sand, clean-graded gravel or aggregate base course should be placed beneath interior slabs. For heavy loading, vehicular traffic or concentrated loads on floor slabs, reevaluation of slab and/or base course thickness may be required.
- If moisture sensitive floor coverings are used on interior slabs, consideration should be given to the use of barriers to minimize potential vapor rise through the slab.
- Other design and construction considerations, as outlined in the ACI Design Manual, Section 302.1R are recommended.

Pavement Design and Construction: Recommended pavement sections for the project have been based on the procedures outlined in the 1993 Guideline for Design of Pavement Structures by the American Association of State Highway and Transportation Officials (AASHTO) as modified by the Arizona Department of Transportation. No traffic data was available for pavement design. Traffic loading was assumed. Assumed traffic criteria used for pavement thickness design includes single 18-kip equivalent axle loads (EAL’s) of 25,000 for passenger vehicle parking areas and 75,000 for the main traffic corridors and truck areas. Actual design traffic loading should be verified. Re-evaluation of the recommended pavement sections may be necessary if the actual traffic varies from the assumed criteria outlined above.
Recommended alternatives for flexible and rigid pavements are summarized as follows:

<table>
<thead>
<tr>
<th>Traffic Area</th>
<th>Alternative</th>
<th>Recommended Pavement Section Thickness (Inches)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Asphalt Concrete Surface</td>
</tr>
<tr>
<td>Passenger Vehicle Parking</td>
<td>A</td>
<td>4.0</td>
</tr>
<tr>
<td></td>
<td>B</td>
<td>2.0</td>
</tr>
<tr>
<td></td>
<td>C</td>
<td>--</td>
</tr>
<tr>
<td>Main Traffic Corridors and Truck Areas</td>
<td>A</td>
<td>5.0</td>
</tr>
<tr>
<td></td>
<td>B</td>
<td>3.0</td>
</tr>
<tr>
<td></td>
<td>C</td>
<td>--</td>
</tr>
</tbody>
</table>

Each alternative should be investigated with respect to current material availability and economic conditions. Concrete pavement, a minimum of 6 inches in thickness, is recommended at the location of any dumpsters areas or other areas of high loading conditions.

Materials and construction of pavement for the project should be in accordance with the requirements and specifications of the Pima County/City of Tucson\(^5\).

Earthwork

**General Considerations:** The following presents recommendations for site preparation, excavation, subgrade preparation and placement of engineered fills on the project. The recommendations presented for design and construction of earth supported elements including foundations, slabs and pavements are contingent upon following the recommendations outlined in this section.

All earthwork on the project should be observed and evaluated by Terracon. The evaluation of earthwork should include observation and testing of engineered fill, subgrade preparation, construction.

foundation bearing soils, and other geotechnical conditions exposed during the construction of the project.

**Site Preparation:** Strip and remove existing vegetation, pavements, debris, loose materials, and other deleterious materials from proposed construction areas. All exposed surfaces should be free of mounds and depressions which could prevent uniform compaction. Stripped materials consisting of vegetation and organic materials should be wasted from the site, or used to revegetate landscaped areas or exposed slopes after completion of grading operations. If it is necessary to dispose of organic materials on-site they should be placed in non-structural areas and in fill sections not exceeding 5 feet in height.

Site preparation in the parking areas occupied by the existing structure to be demolished, should consist of removing all above and below-grade portions of the existing structure. This should include removal of footings, slabs, and any loose backfill associated with the structure. Consideration could be given to leaving portions of the footings and slabs in-place provided that slabs are thoroughly broken and seated and at least 2 feet of engineered fill is placed over the abandoned in-place components of the existing structure.

Care should be taken when excavations are performed adjacent to existing structures to remain in-place. The use of temporary shoring, bracing or sloped excavations may be required to prevent undermining or disturbance of the existing bearing soils.

Moderately cemented soils were encountered in Borings B-9 and B-10. These soils are anticipated to be excavatable with conventional heavy duty earthmoving equipment. However, these materials may take additional effort to excavate and a unit rate for difficult excavation should be secured in the contract documents.

The individual contractor(s) are responsible for the design and construction of stable, temporary excavations as required to maintain stability of both the excavation sides and bottom. All excavations should be sloped or shored in the interest of safety following local, and federal regulations, including current OSHA excavation and trench safety standards.

**Subgrade Preparation:** For conventional footings bearing at shallow depths, engineered fill should extend below proposed footings a depth equal to the width of continuous wall footings, and a depth equal to one-half the width of column footings. A minimum fill thickness of two (2) feet is recommended, regardless of footing size. The engineered fill
should extend laterally at least two (2) feet or eight (8) inches for each foot of engineered fill placed below footing base elevation, whichever is greater. Engineered fill could be placed below individual footings as necessary, or below the entire building area, whichever is more economical. If engineered fill is placed beneath an entire building, it should extend horizontally a minimum distance of 5 feet beyond the outside edge of perimeter footings. If sufficiently cemented soils are encountered at bearing depths, the overexcavation can be omitted. All footing excavations should be observed and evaluated prior to placing concrete.

After stripping, excavating to design grade, or prior to placing additional fill, subgrade soils beneath interior and exterior slabs, and pavements should be scarified, moisture conditioned and compacted to a minimum depth of 10 inches. The moisture content and compaction of subgrade soils should be maintained until slab or pavement construction.

The clayey sand soils may become unstable if wetted or subjected to repetitive construction traffic. If unstable conditions develop, it may be necessary to undercut and replace these soils with suitable granular materials or stabilize these materials with lime, flyash, portland cement or geotextile materials.

**Fill Materials and Compaction:** Testing performed on samples of the on-site soils indicated low expansion potential (0 to 0.9%). This implies the on-site soils will be suitable for use as engineered fill. We recommend that further observation and testing be performed during construction by qualified geotechnical personnel to confirm the suitability of the on-site materials or any off-site fill soils used. Imported fill, if required, should consist of materials meeting the following requirements:

<table>
<thead>
<tr>
<th>Gradation</th>
<th>Percent finer by weight (ASTM C136)</th>
</tr>
</thead>
<tbody>
<tr>
<td>6&quot;</td>
<td>100</td>
</tr>
<tr>
<td>3&quot;</td>
<td>70-100</td>
</tr>
<tr>
<td>No. 4 Sieve</td>
<td>50-100</td>
</tr>
<tr>
<td>No. 200 Sieve</td>
<td>50 (max)</td>
</tr>
</tbody>
</table>

- Liquid Limit
  - 30 (max)
- Plasticity Index
  - 15 (max)
- Maximum expansive potential (%)
  - 1.5
Proposed Pima Community College Expansion
Downtown Campus
Terracon Project No. 63995050

*Measured on a sample compacted to approximately 95 percent of the ASTM D698 maximum dry density at about 3 percent below optimum water content. The sample is confined under a 100 psf surcharge and submerged.

Engineered fill should be placed and compacted in horizontal lifts, using equipment and procedures that will produce recommended moisture contents and densities throughout the lift. Fill lifts should not exceed ten (10) inches loose thickness.

Recommended compaction criteria for engineered fill materials are as follows:

<table>
<thead>
<tr>
<th>Material</th>
<th>Minimum Percent (ASTM D698)</th>
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</thead>
<tbody>
<tr>
<td>Scarified subgrade soils</td>
<td>95</td>
</tr>
<tr>
<td>On-site and imported fill soils:</td>
<td></td>
</tr>
<tr>
<td>Beneath foundations</td>
<td>95</td>
</tr>
<tr>
<td>Beneath slabs</td>
<td>95</td>
</tr>
<tr>
<td>Beneath pavements</td>
<td>95</td>
</tr>
<tr>
<td>Aggregate base (beneath slabs)</td>
<td>95</td>
</tr>
<tr>
<td>Miscellaneous backfill in non-structural areas</td>
<td>90</td>
</tr>
</tbody>
</table>

Scarified in-place or on-site fill soils should be compacted within a moisture content range of about -1 percent below, to +3 percent above optimum. Imported soils should be compacted within a moisture range of 3 percent below to 3 percent above optimum.

Additional Design and Construction Considerations:

- **Exterior Slab Design and Construction**: Exterior slab-on-grade, exterior architectural features, and utilities founded on, or in backfill could experience some movement due to the volume change of the backfill. Potential movement could be reduced by:

  - using only non to low expansive backfill materials;
  - reducing moisture increases in the backfill;
  - controlling moisture-density during placement of backfill;
  - using designs which allow vertical movement between the exterior features
and adjoining structural elements;
  • placement of effective control joints on relatively close centers and isolation joints between slabs and other structural elements.

• **Underground Utility Systems:** All underground piping within or near the proposed structures should be designed with flexible couplings, so minor deviations in alignment do not result in breakage or distress. Utility knockouts in foundation walls should be oversized to accommodate differential movements.

• **Surface Drainage:** Positive drainage should be provided during construction and maintained throughout the life of the proposed project. Infiltration of water into utility or foundation excavations must be prevented during construction. Planters and other surface features which could retain water in areas adjacent to the buildings or pavements should be sealed or eliminated. In areas where sidewalks or paving do not immediately adjoin the structures, we recommend that protective slopes be provided with a minimum grade of approximately 5 percent for at least 10 feet from perimeter walls. Backfill against footings, exterior walls, and in utility and sprinkler line trenches should be well compacted and free of all construction debris to reduce the possibility of moisture infiltration.

  Downspouts, roof drains or scuppers should discharge into splash blocks or extensions when the ground surface beneath such features is not protected by exterior slabs or paving. Sprinkler systems should not be installed within 5 feet of foundation walls. Landscaped irrigation adjacent to the foundation system should be minimized or eliminated.

  A trench drain should be installed in pavement areas that slope below surrounding grades, such as loading docks or truck wells. This will help prevent ponding of water in pavement areas adjacent to the structure.
GENERAL COMMMENTS

Terracon should be retained to review the final design plans and specifications so comments can be made regarding interpretation and implementation of our geotechnical recommendations in the design and specifications. Terracon also should be retained to provide testing and observation during excavation, grading, foundation and construction phases of the project.

The analysis and recommendations presented in this report are based upon the data obtained from the borings performed at the indicated locations and from other information discussed in this report. This report does not reflect variations which may occur between borings or across the site. The nature and extent of such variations may not become evident until construction. If variations appear, it will be necessary to reevaluate the recommendations of this report.

The scope of services for this project does not include either specifically or by implication any environmental assessment of the site or identification of contaminated or hazardous materials or conditions. If the owner is concerned about the potential for such contamination, other studies should be undertaken.

This report has been prepared for the exclusive use of our client for specific application to the project discussed and has been prepared in accordance with generally accepted geotechnical engineering practices. No warranties, either express or implied, are intended or made. In the event that changes in the nature, design, or location of the project as outlined in this report, are planned, the conclusions and recommendations contained in this report shall not be considered valid unless Terracon reviews the changes, and either verifies or modifies the conclusions of this report in writing.
**LOG OF BORING NO. B-1**

CLIENT: HHPA

SITE: Tucson, Arizona

PROJECT: Pima Community College Expansion

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</tr>
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<td>SC 5</td>
<td>SS</td>
</tr>
<tr>
<td>SC 6</td>
<td>SS</td>
</tr>
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**DESCRIPTION**

Clayey Sand, trace Gravel; brown, medium dense to extremely dense, non to medium plasticity fines, dry

**Bottom of Boring**

---

The stratification lines represent the approximate boundary lines between soil and rock types; in-situ, the transition may be gradual.

**WATER LEVEL OBSERVATIONS**

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**BORING STARTED** 4-7-99

**BORING COMPLETED** 4-7-99

**RIG** CME-75

**FOREMAN**

**APPROVED** B.P. JOB # 63995050
**LOG OF BORING NO. B-2**

**CLIENT**
HHPA

**SITE**
Tucson, Arizona

**PROJECT**
Pima Community College Expansion

### GRAPHIC LOG

**DESCRIPTION**

Clayey Sand, trace Gravel: brown, loose to extremely dense, low to medium plasticity fines, dry to moist

with gravel below 7’

Bottom of Boring

<table>
<thead>
<tr>
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The stratification lines represent the approximate boundary lines between soil and rock types: in-situ, the transition may be gradual.

**WATER LEVEL OBSERVATIONS**

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**Terracon**

**BORING STARTED** 4-7-99

**BORING COMPLETED** 4-7-99

**RIG** CME-75

**FOREMAN**

**APPROVED** B.P.  JOB # 63995050
Clayey Sand, trace Gravel: brown, loose to dense, low to medium plasticity fines, dry

Sand, with Clay and Gravel: brown, extremely dense, low plasticity fines, dry

Clayey Sand, trace Gravel: brown, extremely dense, low to medium plasticity fines, dry

Bottom of Boring

The stratification lines represent the approximate boundary lines between soil and rock types: in-situ, the transition may be gradual.
**LOG OF BORING NO. B-4**

**CLIENT**
HHPA

**SITE**
Tucson, Arizona

**PROJECT**
Pima Community College Expansion

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<td>extremely dense to very dense,</td>
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<td>Bottom of Boring</td>
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The stratification lines represent the approximate boundary lines between soil and rock types: in-situ, the transition may be gradual.

**WATER LEVEL OBSERVATIONS**

| WL | N | W | D | N | A | B | E | R | V | A | L | O | B | S | E | R | V | A | N | I | S | Y |
| TL |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |
| TL |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |

**BORING STARTED** 4-7-99

**BORING COMPLETED** 4-7-99

**RIG**
CME-75

**FOREMAN**

**APPROVED**
B.P. 63995050
**LOG OF BORING NO. B-5**

**CLIENT**  
HHPA

**SITE**  
Tucson, Arizona

**PROJECT**  
Pima Community College Expansion

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with gravel below 25'

Bottom of Boring

The stratification lines represent the approximate boundary lines between soil and rock types: in situ, the transition may be gradual.

**WATER LEVEL OBSERVATIONS**

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**BORING STARTED**  4-27-99

**BORING COMPLETED**  4-27-99

**RIG**  CME-75

**FOREMAN**

**APPROVED**  B.P.  JOB # 63995050
## LOG OF BORING NO. B-6

**CLIENT**
HHPA

**SITE**
Tucson, Arizona

**PROJECT**
Pima Community College Expansion

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**DESCRIPTION**
Clayey Sand, with Gravel; brown, loose to extremely dense, low to medium plasticity fines, dry to moist

**Bottom of Boring**
21.5

---

The stratification lines represent the approximate boundary lines between soil and rock types: in-situ, the transition may be gradual.

**WATER LEVEL OBSERVATIONS**

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<tbody>
<tr>
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</tr>
<tr>
<td>y</td>
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</tr>
</tbody>
</table>

**BOARING STARTED**
4-7-99

**BOARING COMPLETED**
4-7-99

**RIG**
CME-75

**FOREMAN**

**APPROVED**
B.P. JOB # 63995050
# Log of Boring No. B-7

**Client:** HHPA  
**Site:** Tucson, Arizona  
**Project:** Pima Community College Expansion

<table>
<thead>
<tr>
<th>SAMPLES</th>
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</tr>
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<tbody>
<tr>
<td>USCS</td>
<td>NUMBER</td>
</tr>
<tr>
<td>SC 1</td>
<td>BAC</td>
</tr>
<tr>
<td>SC 2</td>
<td>RS</td>
</tr>
<tr>
<td>SC 3</td>
<td>SS</td>
</tr>
<tr>
<td>SP-SC 4</td>
<td>SS</td>
</tr>
<tr>
<td>SC 5</td>
<td>SS</td>
</tr>
<tr>
<td>SC 6</td>
<td>SS</td>
</tr>
</tbody>
</table>

**Graphic Log Description:**

- **Clayey Sand, trace Gravel:** brown, medium dense to extremely dense, low plasticity fines, dry
- with gravel below 5'
- **Sand, with Gravel and Clay:** brown, extremely dense, low plasticity fines, dry
- **Clayey Sand, trace Gravel:** brown, extremely dense, low plasticity fines, dry
- **Bottom of Boring**

The stratification lines represent the approximate boundary lines between soil and rock types: in-situ, the transition may be gradual.

**Water Level Observations:**

<table>
<thead>
<tr>
<th>WL</th>
<th>NONE WD</th>
<th>NONE AB</th>
</tr>
</thead>
</table>

**Boring Started:** 4-7-99  
**Boring Completed:** 4-7-99  
**Rig:** CME-75  
**Foreman:**

**Approved:** B.P. JOB # 63995050
LOG OF BORING NO. B-9

CLIENT: HHPA

SITE: Tucson, Arizona

PROJECT: Pima Community College Expansion

<table>
<thead>
<tr>
<th>SAMPLES</th>
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</tr>
</thead>
<tbody>
<tr>
<td>DEPTH (FT.)</td>
<td>USCS</td>
</tr>
<tr>
<td>0.0</td>
<td>SM</td>
</tr>
<tr>
<td>5.0</td>
<td>SM</td>
</tr>
<tr>
<td>10.0</td>
<td>SM</td>
</tr>
<tr>
<td>15.0</td>
<td>SM</td>
</tr>
<tr>
<td>15.0</td>
<td>SP-SC</td>
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<tr>
<td>20.0</td>
<td>SC</td>
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The stratification lines represent the approximate boundary lines between soil and rock types: in-situ, the transition may be gradual.

WATER LEVEL OBSERVATIONS

<table>
<thead>
<tr>
<th>WL</th>
<th>NONE W/D</th>
<th>NONE AB</th>
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</thead>
<tbody>
<tr>
<td>WL</td>
<td>V</td>
<td>V</td>
</tr>
</tbody>
</table>

BORING STARTED 4-9-99
BORING COMPLETED 4-9-99
RIG CME-75
FOREMAN

APPROVED B.P. JOB # 63995050
Silty Sand, trace Gravel; light brown, extremely dense, low plasticity fines, dry, moderate calcite cementation

10.0

Sand, with Clay and Gravel; light brown, extremely dense to very dense, low plasticity fines, dry

trace gravel

16.5

Bottom of Boring
LOG OF BORING NO. P-1

CLIENT
HHPA

SITE
Tucson, Arizona

PROJECT
Pima Community College Expansion

<table>
<thead>
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<td>DEPTH (FT.)</td>
<td>USCS</td>
</tr>
<tr>
<td>0.2</td>
<td>SC</td>
</tr>
</tbody>
</table>

DESCRIPTION

1.5" Asphalt
Clayey Sand, trace Gravel; brown, medium plasticity fines, dry

5.0
Bottom of Boring

The stratification lines represent the approximate boundary lines between soil and rock types: in-situ, the transition may be gradual.

WATER LEVEL OBSERVATIONS

<table>
<thead>
<tr>
<th>WL</th>
<th>NONE WD</th>
<th>NONE AB</th>
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</thead>
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BORING Started 4-7-99
BORING Completed 4-7-99
RIG CME-75
FOREMAN

APPROVED B.P. JOB # 63995050
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<th>GRAPHIC LOG</th>
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<tr>
<td>0.2</td>
<td>0.5&quot; Asphalt</td>
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<tr>
<td></td>
<td>Clayey Sand, with Gravel; brown, medium plasticity fines, dry</td>
</tr>
<tr>
<td>5.0</td>
<td>Bottom of Boring</td>
</tr>
</tbody>
</table>

The stratification lines represent the approximate boundary lines between soil and rock types; in situ, the transition may be gradual.

**WATER LEVEL OBSERVATIONS**

- WL: V
- NONE WD: V
- NONE AB

**Terracon**

**BORING STARTED:** 4-7-99
**BORING COMPLETED:** 4-7-99
**RIG:** CME-75
**FOREMAN**
**APPROVED:** B.P. JO# 63995050
**LOG OF BORING NO. P-3**

<table>
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<tr>
<td>PROJECT</td>
<td>Pima Community College Expansion</td>
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</table>

<table>
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<th>GRAPHIC LOG</th>
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<th>DEPTH [FT.]</th>
<th>USCS</th>
<th>NUMBER</th>
<th>TYPE</th>
<th>RECOVERY, IN.</th>
<th>PENETRATION BLOWS/FOOT</th>
<th>MOISTURE, %</th>
<th>DRY DENSITY,pcf</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.2</td>
<td>0.5&quot; Asphalt <em>Clayey Sand, trace Gravel</em>; brown, medium plasticity fines, dry</td>
<td>5</td>
<td>SC</td>
<td>1</td>
<td>BAC</td>
<td></td>
<td></td>
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<td></td>
</tr>
<tr>
<td>6.0</td>
<td>Bottom of Boring</td>
<td>5</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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</table>

The stratification lines represent the approximate boundary lines between soil and rock types; in-situ, the transition may be gradual.

**WATER LEVEL OBSERVATIONS**

<table>
<thead>
<tr>
<th>WL</th>
<th>None WD</th>
<th>None AB</th>
</tr>
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<tbody>
<tr>
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</tbody>
</table>

**BORING STARTED** 4-7-99

**BORING COMPLETED** 4-7-99

**RIG** CME-75

**FOREMAN**

**APPROVED B.P. JOB # 63995050**

---

*Image contains a table with columns for depth, USCS number, recovery, penetration blows, moisture, and dry density.*

*Text within the table describes the soil and rock types found at various depths.*

*Water level observations indicate no observation for WD and AB.*

*The boring started and completed on 4-7-99.*

*The rig is identified as CME-75.*

*The work is approved by B.P. with job number 63995050.*
LOG OF BORING NO. P-4

CLIENT
HHPA

SITE
Tucson, Arizona

PROJECT
Pima Community College Expansion

<table>
<thead>
<tr>
<th>GRAPHIC LOG</th>
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</thead>
<tbody>
<tr>
<td>6.0</td>
<td>Clayey Sand, trace Gravel: brown, medium plasticity fines, moist</td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>DEPTH (FT.)</th>
<th>SC</th>
<th>NUMBER</th>
<th>TYPE</th>
<th>RECOVERY, IN.</th>
<th>PENETRATION BLOWS/FOOT</th>
<th>MOISTURE, %</th>
<th>DRY DENSITY, pcf</th>
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<tr>
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<td>1</td>
<td>BAC</td>
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</table>

Bottom of Boring

The stratification lines represent the approximate boundary lines between soil and rock types: in-situ, the transition may be gradual.

WATER LEVEL OBSERVATIONS

<table>
<thead>
<tr>
<th>WL</th>
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<th>NONE AB</th>
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<tr>
<td>WL</td>
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</tbody>
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BORING STARTED 4-7-99
BORING COMPLETED 4-7-99
RIG CME-75
FOREMAN

APPROVED B.P. JOB # 63995050

Terracon
**LOG OF BORING NO. P-5**

<table>
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<td>PROJECT</td>
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<table>
<thead>
<tr>
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<th>DESCRIPTION</th>
</tr>
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<tbody>
<tr>
<td>5.0</td>
<td>Clayey Sand, trace Gravel: brown, low plasticity fines, moist</td>
</tr>
<tr>
<td></td>
<td>Bottom of Boring</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>SAMPLES</th>
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<td>SC</td>
</tr>
<tr>
<td>TYPE</td>
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<tr>
<td>RECOVERY, IN.</td>
<td>1</td>
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<tr>
<td>PENETRATION BLOWS/FOOT</td>
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<tr>
<td>MOISTURE, %</td>
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</tr>
<tr>
<td>DRY DENSITY,pcf</td>
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</tr>
</tbody>
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---

**The stratification lines represent the approximate boundary lines between soil and rock types: in-situ, the transition may be gradual.**

**WATER LEVEL OBSERVATIONS**

<table>
<thead>
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</tr>
</thead>
<tbody>
<tr>
<td>WL</td>
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</tbody>
</table>

**BORING STARTED** 4-7-99

**BORING COMPLETED** 4-7-99

**RIG** CME-75

**FOREMAN**

**APPROVED** B.P. JOB # 63995050
APPENDIX B
### Specimen Identification and Classification

<table>
<thead>
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<th>Specimen Identification</th>
<th>Classification</th>
<th>DD</th>
<th>MC%</th>
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</thead>
<tbody>
<tr>
<td>B-3</td>
<td>Clayey Sand, trace Gravel (SC)</td>
<td>94</td>
<td>11</td>
</tr>
</tbody>
</table>

---

**PROJECT**
Pima Community College Expansion

**JOB NO.**
63996050

**DATE**
4/28/99

**CONSOLIDATION TEST**
Terracon
Tucson, Arizona
## ATTERBERG LIMITS' RESULTS

**PROJECT**  
Pima Community College Expansion -

**JOB NO.** 63995050

**DATE** 4/28/99

**Terracon**

**Tucson, Arizona**

### Specimen Identification Table

<table>
<thead>
<tr>
<th>Specimen Identification</th>
<th>LL</th>
<th>PL</th>
<th>PI</th>
<th>Fines</th>
<th>Classification</th>
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<tbody>
<tr>
<td>● B-1</td>
<td>0.0</td>
<td>44</td>
<td>26</td>
<td>18</td>
<td>44.5 Clayey Sand, trace Gravel (SC)</td>
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<tr>
<td>☐ B-10</td>
<td>0.0</td>
<td>37</td>
<td>30</td>
<td>7</td>
<td>16.3 Silty Sand, trace Gravel (SM)</td>
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<tr>
<td>△ B-7</td>
<td>0.0</td>
<td>35</td>
<td>21</td>
<td>14</td>
<td>19.2 Clayey Sand, trace Gravel (SC)</td>
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<tr>
<td>★ B-9</td>
<td>0.0</td>
<td>48</td>
<td>40</td>
<td>8</td>
<td>13.1 Silty Sand, with Gravel (SM)</td>
</tr>
<tr>
<td>○ P-1</td>
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<td>47</td>
<td>27</td>
<td>20</td>
<td>25.8 Clayey Sand, trace Gravel (SC)</td>
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<tr>
<td>☠ P-2</td>
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<td>42</td>
<td>22</td>
<td>20</td>
<td>27.4 Clayey Sand, with Gravel (SC)</td>
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<tr>
<td>○ P-3</td>
<td>0.0</td>
<td>46</td>
<td>20</td>
<td>26</td>
<td>28.4 Clayey Sand, trace Gravel (SC)</td>
</tr>
<tr>
<td>△ P-4</td>
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<td>41</td>
<td>19</td>
<td>22</td>
<td>42.5 Clayey Sand, trace Gravel (SC)</td>
</tr>
<tr>
<td>☠ P-5</td>
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<td>32</td>
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<td>11</td>
<td>28.3 Clayey Sand, trace Gravel (SC)</td>
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</table>
# SOIL PROPERTIES

Proposed Pima Community College Expansion

<table>
<thead>
<tr>
<th>Boring No.</th>
<th>Depth (ft)</th>
<th>Soil Class.</th>
<th>Soil Property</th>
<th>Initial Dry Density (pcf)</th>
<th>Initial Water Content (%)</th>
<th>Percent Passing #200 Sieve</th>
<th>Atterberg Limits</th>
<th>Expansion</th>
<th>Corrosivity</th>
<th>Remarks</th>
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<tbody>
<tr>
<td></td>
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<td></td>
<td>Soil Property</td>
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<td>B-1</td>
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<td>102</td>
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<td>44</td>
<td>18</td>
<td>144</td>
<td>0.9</td>
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<td>105</td>
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<td>19.2</td>
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<td>14</td>
<td>144</td>
<td>0.9</td>
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<tr>
<td>B-7</td>
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<td>SC</td>
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<td>111</td>
<td>9.7</td>
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<td>8</td>
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<td>0.0</td>
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<td>B-9</td>
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<td>SM</td>
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<td>96</td>
<td>17.6</td>
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<td>SC</td>
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<td>P-3</td>
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<td>SC</td>
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<td>P-4</td>
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<td>SC</td>
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<td></td>
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<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Note:** Initial Dry Density and Initial Water Content are in-situ values unless otherwise noted.

**REMARKS**

1. Compacted density (approximately 95% of ASTM D698 maximum density at moisture content slightly below optimum).
2. Compacted density (approximately 95% of ASTM D1557 maximum density at moisture content slightly below optimum).
3. Submerged to approximate saturation.
4. Dry density determined from one or more rings of a multi-ring sample.
5. Visual Classification.
APPENDIX C
DRILLING & SAMPLING SYMBOLS:

| SS | Split Spoon - 1 7/8" I.D., 2" O.D., unless otherwise noted |
| ST | Thin-Walled Tube - 2" O.D., unless otherwise noted |
| PA | Power Auger |
| HA | Hand Auger |
| DB | Diamond Bit = 4", N, B |
| AS | Auger Sample |
| HS | Hollow Stem Auger |
| R  | Ring Sample - 2.42" I.D., 3" O.D., unless otherwise noted |

| PS | Pison Sample |
| WS | Wash Sample |
| FT | Fish Tail Bit |
| RB | Rock Bit |
| BS | Bulk Sample |
| PM | Pressure Meter |
| DC | Dutch Cone |
| WB | Wash Bore |

Standard "N" Penetration: Blows per foot of a 140 pound hammer falling 30 inches on a 2-inch O.D. split spoon, except where noted.

WATER LEVEL MEASUREMENT SYMBOLS:

| WL | Water Level |
| WCI | Wet Cave in |
| DCI | Dry Cave in |
| AB | After Boring |

| WS | While Sampling |
| WD | While Drilling |
| BCR | Before Casing Removal |
| ACR | After Casing Removal |

Water levels indicated on the boring logs are the levels measured in the borings at the time indicated. In pervious soils, the indicated levels may reflect the location of groundwater. In low permeability soils, the accurate determination of groundwater levels is not possible with only short term observations.

DESCRIPTIVE SOIL CLASSIFICATION:

Soil Classification is based on the Unified Soil Classification system and the ASTM Designations D-2487 and D-2488. Coarse Grained Soils have more than 50% of their dry weight retained on a #200 sieve; they are described as: boulders, cobbles, gravel or sand. Fine Grained Soils have less than 50% of their dry weight retained on a #200 sieve; they are described as: clays, if they are plastic, and silts if they are slightly plastic or non-plastic. Major constituents may be added as modifiers and minor constituents may be added according to the relative proportions based on grain size. In addition to gradation, coarse grained soils are defined on the basis of their relative in-place density and fine grained soils on the basis of their consistency. Example: Lean clay with sand, trace gravel, stiff (CL); silty sand, trace gravel, medium dense (SM).

CONSISTENCY OF FINE-GRAINED SOILS:

<table>
<thead>
<tr>
<th>Unconfined Compressive Strength, Qu. psf</th>
<th>Consistency</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt; 500</td>
<td>Very Soft</td>
</tr>
<tr>
<td>500 - 1,000</td>
<td>Soft</td>
</tr>
<tr>
<td>1,001 - 2,000</td>
<td>Medium</td>
</tr>
<tr>
<td>2,001 - 4,000</td>
<td>Stiff</td>
</tr>
<tr>
<td>4,001 - 8,000</td>
<td>Very Stiff</td>
</tr>
<tr>
<td>8,001 - 16,000</td>
<td>Very Hard</td>
</tr>
</tbody>
</table>

RELATIVE DENSITY OF COARSE-GRAINED SOILS:

<table>
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<tr>
<th>N-Blows/ft</th>
<th>Relative Density</th>
</tr>
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<tbody>
<tr>
<td>0 - 3</td>
<td>Very Loose</td>
</tr>
<tr>
<td>4 - 9</td>
<td>Loose</td>
</tr>
<tr>
<td>10 - 29</td>
<td>Medium Dense</td>
</tr>
<tr>
<td>30 - 49</td>
<td>Dense</td>
</tr>
<tr>
<td>50 - 80</td>
<td>Very Dense</td>
</tr>
<tr>
<td>80 +</td>
<td>Extremely Dense</td>
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RELATIVE PROPORTIONS OF SAND AND GRAVEL

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<th>Descriptive Term(s) (of Components Also Present in Sample)</th>
<th>Percent of Dry Weight</th>
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</thead>
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<tr>
<td>Trace With Modifier</td>
<td>Trace With Modifier</td>
</tr>
<tr>
<td>&lt; 15</td>
<td>15 - 29</td>
</tr>
<tr>
<td>&gt; 30</td>
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GRAIN SIZE TERMINOLOGY

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<th>Major Component of Sample</th>
<th>Size Range</th>
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<tbody>
<tr>
<td>Boulders</td>
<td>Over 12 in. (300mm)</td>
</tr>
<tr>
<td>Cobbles</td>
<td>12 in. to 3 in. (300mm to 75mm)</td>
</tr>
<tr>
<td>Gravel</td>
<td>3 in. to #4 sieve (75mm to 4.75mm)</td>
</tr>
<tr>
<td>Sand</td>
<td>#4 to #200 sieve (4.75mm to 0.075mm)</td>
</tr>
<tr>
<td>Silt or Clay</td>
<td>Passing #200 Sieve (0.075mm)</td>
</tr>
</tbody>
</table>

RELATIVE PROPORTIONS OF FINES

<table>
<thead>
<tr>
<th>Descriptive Term(s) (of Components Also Present in Sample)</th>
<th>Percent of Dry Weight</th>
</tr>
</thead>
<tbody>
<tr>
<td>Trace With Modifier</td>
<td>Trace With Modifier</td>
</tr>
<tr>
<td>&lt; 5</td>
<td>5 - 12</td>
</tr>
<tr>
<td>&gt; 12</td>
<td></td>
</tr>
</tbody>
</table>
### Unified Soil Classification System

| Coarse-Grained Soils more than 50% retained on No. 200 sieve | Gravels more than 50% of coarse fraction retained on No. 4 sieve | Gravels with Fines more than 12% fines | Gravels classify as ML or MH | Gravels classify as CL or CH | Sands 50% or more of coarse fraction passes No. 4 sieve | Sands with Fines more than 12% fines | Clean Sands Less than 5% fines | Clean Sands Less than 5% fines | Clean Sands Less than 5% fines | Clean Gravels Less than 5% fines | Soil Classification |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | | Group Symbol |
| | | | | | | | | | | | | Group Name |
| GW | Well-graded gravel |
| GP | Poorly graded gravel |
| GM | Silty gravel, G, H |
| GC | Clayey gravel, G, H |
| SW | Well-graded sand |
| SP | Poorly graded sand |
| SM | Silty sand, S, M |
| SC | Clayey sand, S, M |
| CL | Lean clay, L, M |
| ML | Silt, L, M |
| OL | Organic clay, L, M, N |
| CH | Fat clay, L, M |
| MH | Elastic Silt, L, M |
| OH | Organic clay, L, M, P |
| PT | Peat |

---

**For classification of fine-grained soils:**

- **Plasticity Index (PI):** 
  \[ PI = LL - PL \]

- **Liquid Limit (LL):**
  - **For non-plastic clays:** 
    \[ LL = 25.5 + 18.6 \times \frac{D_{50}^2}{D_{60}^2} \]
  - **For clayey sands:** 
    \[ LL = 25.5 + 18.6 \times \frac{D_{50}^2}{D_{60}^2} \]

- **Plastic Limit (PL):**
  - **For non-plastic clays:** 
    \[ PL = LL - 15 \]
  - **For clayey sands:** 
    \[ PL = LL - 15 \]

---

**Notes:**
- 1If field sample contained cobbles or boulders, both, add "with cobbles or boulders, or both" to group name.
- 2If fines classify as ML-ML, use dual symbol.
- 3If fines with 5 to 12% fines require dual symbol:
  - SW-GM well-graded sand with silt
  - SW-SC well-graded sand with clay

---

**Criteria for Assigning Group Symbols and Group Names Using Laboratory Tests:**

- **Plasticity Index (PI):**
  \[ PI = LL - PL \]

- **Liquid Limit (LL):**
  - **For non-plastic clays:** 
    \[ LL = 25.5 + 18.6 \times \frac{D_{50}^2}{D_{60}^2} \]
  - **For clayey sands:** 
    \[ LL = 25.5 + 18.6 \times \frac{D_{50}^2}{D_{60}^2} \]

- **Plastic Limit (PL):**
  - **For non-plastic clays:** 
    \[ PL = LL - 15 \]
  - **For clayey sands:** 
    \[ PL = LL - 15 \]

---

Terracon
TO: Cinthia Sylvester, Facilities Project Manager
FROM: Ouatfa Chuffe-Moscoso, Environmental Program Coordinator
SUBJECT: Asbestos Building Inspection
RE: Science & Technology Building – Downtown Campus

The OSHA/AHERA\(^1\) required Asbestos Building Inspection for the Science & Technology Building at Downtown Campus has been completed. The intent of the inspection was to identify, to the extent feasible\(^2\), all suspect asbestos-containing building materials\(^3\). Samples were collected and analyzed and no asbestos-containing building materials were identified.

The following materials were found to be asbestos free.

- Acoustical ceiling tile
- Floor tiles and adhesive
- Baseboard and adhesive
- Sheetrock/Texture
- Window caulk
- Door caulk
- Building caulk
- Stucco
- Roofing materials
- Pipe insulation sealants
- Block
- Mortar
- Concrete

\(^1\) Asbestos Hazard Emergency Response Act

\(^2\) Efforts to identify all suspect asbestos-containing materials were made, additional suspect materials may be concealed by building components (i.e., pipes concealed between walls and duct seam tape). If during the renovation, suspect materials are found, they should be assumed to contain asbestos unless further testing proves otherwise. Please call Ouatfa Chuffe-Moscoso PCC Environmental Program Coordinator (520) 206-2765.

\(^3\) Attachment: Asbestos Sampling & Results Log

Cc: Casilda Quinones, Director of Health and Safety
    Albert Quihuis, Facilities Plant Manager
# ASBESTOS SAMPLING & RESULTS LOG

**Project:** DC – Science & Technology Renovation  
**Building/Location:** DC – ST Building

<table>
<thead>
<tr>
<th>Homogenous Area &amp; Sample #</th>
<th>Material Type</th>
<th>Sample Location</th>
<th>Friable Y/N</th>
<th>Damaged Y/N + %</th>
<th>Sample Date</th>
<th>Sample Analyzed</th>
<th>Result</th>
<th>Comments</th>
</tr>
</thead>
</table>
| Acoustical Ceiling Tiles (2,7,10,23,30,46,47)  
Layer # 1  
Layer # 2 | White paint  
Tan acoustical tile | Rooms: 105,118,151, 181,205,208, 216 | N | N | 05/24/13 | 05/29/12 | Negative | No asbestos detected |
| White/Black Speck Floor Tile 12”x12”  
& Adhesive (3,4,18,19,25,26,31,32,45)  
Layer # 1  
Layer # 2  
Layer # 3 | Off-white floor tile  
Yellow mastic  
Off-white leveling compound | Rooms: 105,114,151, 181,236 | N | N | 05/24/13 | 05/29/12 | Negative | No asbestos detected |
| Beige w/ tan streak Floor Tile 12”x12”  
& Adhesive (13,14,20,21)  
Layer # 1  
Layer # 2 | Tan floor tile  
mastic | Rooms: 100,105,200 | N | N | 05/24/13 | 05/29/12 | Negative | No asbestos detected |
| Beige Baseboard & Adhesive (5,12,24,33,44)  
Layer # 1  
Layer # 2 | Off-white base cove  
Off-white mastic | Rooms: 105,151,181, 205,208 | N | N | 05/24/13 | 05/29/12 | Negative | No asbestos detected |
| Brown base board & Adhesive (8,7,22)  
Layer # 1  
Layer # 2 | Brown base cove  
Clear mastic | Rooms: 100,200,205 | N | N | 05/24/13 | 05/29/12 | Negative | No asbestos detected |
| Sheetrock & Texture (1,6,16,22B,27,29,34,35,43,48)  
Layer # 1  
Layer # 2  
Layer # 3  
Layer # 4 | Off-white paint  
White texture/joint compound  
Tan paper/cardboard  
White drywall core | Rooms: 105,107,118, 151,171,181, 208,211,216 | N | N | 05/24/13 | 05/29/12 | Negative | No asbestos detected |
| Window caulk (11,15,28)  
Layer # 1  
Layer # 2  
Layer # 3  
Layer # 4 | Off-white paint  
Gray sealant  
White texture/joint compound | Rooms: 107,205,211 | N | N | 05/24/13 | 05/29/12 | Negative | No asbestos detected |
| Door caulk (40)  
Layer # 1  
Layer # 2 | Off-white paint  
Gray sealant | Room: 186 south door | N | N | 05/24/13 | 05/29/12 | Negative | No asbestos detected |
<table>
<thead>
<tr>
<th>Homogenous Area &amp; Sample #</th>
<th>Material Type</th>
<th>Sample Location</th>
<th>Friable Y/N</th>
<th>Damaged Y/N + %</th>
<th>Sample Date</th>
<th>Sample Analyzed</th>
<th>Result</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Block (49)</td>
<td>Layer # 1</td>
<td>Off-white paint</td>
<td>180 West Bldg</td>
<td>N</td>
<td>05/24/13</td>
<td>05/29/12</td>
<td>Negative</td>
<td>No asbestos detected</td>
</tr>
<tr>
<td></td>
<td>Layer # 2</td>
<td>Gray Block</td>
<td></td>
<td>N</td>
<td>05/24/13</td>
<td>05/29/12</td>
<td>Negative</td>
<td>No asbestos detected</td>
</tr>
<tr>
<td>Mortar (50)</td>
<td>Layer # 1</td>
<td>Off-white paint</td>
<td>180 West Bldg</td>
<td>N</td>
<td>05/24/13</td>
<td>05/29/12</td>
<td>Negative</td>
<td>No asbestos detected</td>
</tr>
<tr>
<td></td>
<td>Layer # 2</td>
<td>Gray Block</td>
<td></td>
<td>N</td>
<td>05/24/13</td>
<td>05/29/12</td>
<td>Negative</td>
<td>No asbestos detected</td>
</tr>
<tr>
<td>Exterior Stucco (51,52,53,54)</td>
<td>Layer # 1</td>
<td>Off-white stucco</td>
<td>SW corner STE</td>
<td>N</td>
<td>05/24/13</td>
<td>05/29/12</td>
<td>Negative</td>
<td>No asbestos detected</td>
</tr>
<tr>
<td></td>
<td>Layer # 2</td>
<td>Gray stucco</td>
<td>SE corner STE</td>
<td>N</td>
<td>05/24/13</td>
<td>05/29/12</td>
<td>Negative</td>
<td>No asbestos detected</td>
</tr>
<tr>
<td></td>
<td>Layer # 3</td>
<td>Gray stucco</td>
<td>SE Corner STW</td>
<td>N</td>
<td>05/24/13</td>
<td>05/29/12</td>
<td>Negative</td>
<td>No asbestos detected</td>
</tr>
<tr>
<td>Roof Composite (55,56,57,58)</td>
<td>Layer # 1</td>
<td>White sealant</td>
<td>SWC STW-Bldg</td>
<td>N</td>
<td>05/24/13</td>
<td>05/29/12</td>
<td>Negative</td>
<td>No asbestos detected</td>
</tr>
<tr>
<td></td>
<td>Layer # 2</td>
<td>Silver paint</td>
<td>NE STW-Bldg</td>
<td>N</td>
<td>05/24/13</td>
<td>05/29/12</td>
<td>Negative</td>
<td>No asbestos detected</td>
</tr>
<tr>
<td></td>
<td>Layer # 3</td>
<td>Black caulk</td>
<td>SE STW-Bldg</td>
<td>N</td>
<td>05/24/13</td>
<td>05/29/12</td>
<td>Negative</td>
<td>No asbestos detected</td>
</tr>
<tr>
<td></td>
<td>Layer # 4</td>
<td>Black roof ply</td>
<td>SW STW-Bldg</td>
<td>N</td>
<td>05/24/13</td>
<td>05/29/12</td>
<td>Negative</td>
<td>No asbestos detected</td>
</tr>
<tr>
<td></td>
<td>Layer # 5</td>
<td>Black roof ply</td>
<td>Center STE-Bld</td>
<td>N</td>
<td>05/24/13</td>
<td>05/29/12</td>
<td>Negative</td>
<td>No asbestos detected</td>
</tr>
<tr>
<td>Roof Sealant (59,60)</td>
<td>Layer # 1</td>
<td>White sealant</td>
<td>At penetration</td>
<td>N</td>
<td>05/24/13</td>
<td>05/29/12</td>
<td>Negative</td>
<td>No asbestos detected</td>
</tr>
<tr>
<td></td>
<td>Layer # 2</td>
<td>Silver paint</td>
<td>STW-Bldg</td>
<td>N</td>
<td>05/24/13</td>
<td>05/29/12</td>
<td>Negative</td>
<td>No asbestos detected</td>
</tr>
<tr>
<td></td>
<td>Layer # 3</td>
<td>Black caulk</td>
<td></td>
<td>N</td>
<td>05/24/13</td>
<td>05/29/12</td>
<td>Negative</td>
<td>No asbestos detected</td>
</tr>
<tr>
<td>Sealant on Pipes (62)</td>
<td>Layer # 1</td>
<td>White sealant</td>
<td>Equipment Area-STW</td>
<td>N</td>
<td>05/24/13</td>
<td>05/29/12</td>
<td>Negative</td>
<td>No asbestos detected</td>
</tr>
<tr>
<td>Building caulk (63)</td>
<td>Layer # 1</td>
<td>White sealant</td>
<td>Equipment Area-STW</td>
<td>N</td>
<td>05/24/13</td>
<td>05/29/12</td>
<td>Negative</td>
<td>No asbestos detected</td>
</tr>
<tr>
<td>Tan sealant on insulation (36,37)</td>
<td>Layer # 1</td>
<td>Off-white insulation wrap</td>
<td>Room 186</td>
<td>N</td>
<td>05/24/13</td>
<td>05/29/12</td>
<td>Negative</td>
<td>No asbestos detected</td>
</tr>
<tr>
<td>White sealant on insulation (38,39,41,42)</td>
<td>Layer # 1</td>
<td>Off-white sealant</td>
<td>Room 186</td>
<td>N</td>
<td>05/24/13</td>
<td>05/29/12</td>
<td>Negative</td>
<td>No asbestos detected</td>
</tr>
</tbody>
</table>

Laboratory Analyzing Samples: Fiberquant Analytical Services 5025 S. 33rd Street Phoenix, AZ 85040

Report Reviewed by AHERA Certified Inspector: Quatfa M. Chuffe-Moscoso Certificate # ETC 0573914880 Expiration Date: April 09, 2014

Signature: Quatfa Chuffe MOSCOO
Date: 06/03/13

EH&SAsbestosSamplingLog&Results.OMC