

PROJECT MANUAL

FOR

# Center at Bishop Park Boiler Replacement

FOR THE CITY OF BRYANT PARKS AND  
RECREATION DEPARTEMENT

6401 Boone Road  
BRYANT, ARKANSAS 72022

February 22, 2018

**CITY OF BRYANT BID # 19-001**

Project No. WHG #19005

**WHGRANT**  
& associates, inc

Consulting Engineers  
P.O. Box 242523 Little Rock, Ar 72223

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The Engineer of Record for  
City of Bryant  
The Center at Bishop Park  
Boiler Replacements  
Bryant, AR  
is:



DATE: February 22, 2019

**WHGRANT**  
& associates, inc  
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P.O. Box 242523 Little Rock, Ar 72223

**SECTION 00020**  
**INVITATION TO BID**  
**City of Little Rock Bid # 19-001**

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PROJECT: BOILER REPLACEMENTS  
The Center at Bishop Park  
6401 Boone Road  
Bryant, AR 72022

OWNER: City of Bryant

ENGINEER: WH Grant & Associates

ISSUE DATE : February 22, 2019

Sealed bids for PURCHASE and INSTALLATION of equipment as outlined in these CONTRACT DOCUMENTS will be received by the Owner, City of Bryant, at the City of Bryant Parks and Recreation Building, 6401 Boone Road, Bryant, AR 72022. The Parks and Recreation Building is located behind the Aquatic Center in Bishop Park. Bids will be received until **2:00PM on March 8, 2019** at which time they will be opened and read aloud. Bids received after the stated time will be returned unopened.

Bids shall be submitted in accordance with the Instructions to Bidders which is bound in the Project Manual. *Bids from all Bidders will be accepted, as long as they meet ALL of the requirements outlined in the Contract Documents (Instructions, Summary, Equipment Specifications, etc.).*

Copies of the BID DOCUMENTS may be obtained at the following locations:

City of Bryant Parks and Recreation Department  
6401 Boone Road  
Bryant, AR 72022  
(501) 943-0444

David N. Yarbrough, PE  
W.H. Grant & Associates, Inc.  
11319 Barrett Road  
Roland, AR 72135  
(501) 372-6927 office  
(501) 529-2006 mobile  
[david@whgrantengineering.com](mailto:david@whgrantengineering.com)

Bonafide Bidders may obtain up to 3 sets of documents with a deposit of \$20.00 per set. Deposits will be returned if documents are returned in good shape within 10 days of the bid opening. Bidders, subcontractors and suppliers may obtain additional sets of documents at the cost of printing. Bid security in the amount of five percent of the Bid shall accompany the Bid as described in the Instructions to Bidders. All parties receiving copies of Bid Documents shall provide the owner with their company name and address, name of contact person, and daytime phone and email address for the contact person at the time the documents are received.

Direct inquiries to: David N. Yarbrough, PE  
W.H. Grant & Associates, Inc.

11319 Barrett Road  
Roland, AR 72135  
(501) 372-6927 office  
(501) 529-2006 mobile  
[david@whgrantengineering.com](mailto:david@whgrantengineering.com)

The Owner reserves the right to reject any or all Bids and to waive any informalities. The Owner may hold the Bids for a period not to exceed 60 days from the date of opening the Bids for the purpose of reviewing the Bids and investigating the qualifications of Bidders prior to awarding the contract.

Pursuant to Ark. Code Ann. § 22-9-203, the City encourages all small and minority business enterprises to submit bids for purchase of equipment by the OWNER.

END OF SECTION

**SECTION 00100**  
**WHG #19-005**  
**INSTRUCTION TO BIDDERS**  
**CITY OF BRYANT BID # 19-001**

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To be considered responsive, Bids must be made in accordance with the following instructions:

1. PRE-BID CONFERENCE: There will be a **mandatory pre-bid conference**, held at the project site at **8:30 am Wednesday, March 6, 2019** on this project. Bidders will be disqualified if they fail to attend this meeting.

2. RECEIPT AND OPENING OF BIDS:

The City of Bryant (hereinafter called the "Owner") invites Bids on the Bid Form attached hereto, all blanks of which must be appropriately filled in. Bids will be received by the Owner, City of Bryant, at the City of Bryant Parks and Recreation Building, 6401 Boone Road, Bryant, AR 72022 until **2:00 p.m. Friday March 8, 2019**. The Parks and Recreation Building is located behind the Aquatic Center in Bishop Park.

The Owner may consider informal any Bid not prepared and submitted in accordance with the provisions hereof and may waive any irregularities or reject any or all Bids. Any bid may be withdrawn prior to the above scheduled time for the opening of Bid or authorized postponement thereof. Bids received prior to the time of opening will be kept, unopened. Any Bid received after the time and date specified will not be considered. No responsibility will be assumed by any person for the premature opening of a bid not properly addressed and identified.

3. PREPARATION OF BID:

Use Bid Form bound in Project Manual. Bid prices must be written in ink or typewritten, in both words and numbers. The signature of the individual authorized to bind the Bidder shall be in longhand. Each Bid must be submitted in a sealed envelope bearing on the outside the name of Bidder, his address, and name of project for which Bid is submitted.

4. BID SECURITY:

Bids must be accompanied by a bidder's bond in an amount equal to 5% of the Bid, executed by a surety company meeting the requirements of paragraph 5 below. The Bidder may furnish a certified check, in an amount equal to 5% of Bid, drawn on a national bank or a bank having a membership in the Federal Reserve System and signed by the President or Cashier, in lieu of Bond. Such bond or check and the amount thereof shall become the property of the Owner as noted in the Bid Form, as liquidated damages, if the Bidder whose Bid is accepted shall fail upon receipt of written notice of the acceptance of his bid, to execute a contract in accordance with good and sufficient surety or sureties, within ten calendar days after the prescribed forms are presented for signature.

5. BOND REQUIREMENTS

Pursuant to Act 1015 of 2013 which becomes effective on August 16, 2013, all bonds submitted to OWNER (bid bonds and Performance/Payment Bonds) must be issued by surety companies that are listed on current United State Department of Treasury's Listing of Approved Sureties. On and after this date:

Any bid bonds submitted by a bidder that are not issued by a surety company qualified and authorized to do business within Arkansas and listed as an approved surety on the US

Department of Treasury list will be rejected.

Any performance and payment bonds provided by the Contractor that are not issued by a surety company qualified and authorized to do business within Arkansas and listed as an approved surety on the US Department of Treasury list shall be considered as a contractor's default in failing to execute and deliver the contract and bonds. The contractor is liable to the project owner in the amount of the 5% bid surety.

To verify current list of surety companies, please go to: <https://www.fiscal.treasury.gov/surety-bonds/list-certified-companies.html> and search surety company name in the A to Z database listing.

#### 6. CONDITIONS OF WORK:

Before submitting a Bid, Bidders shall carefully examine the Drawings and the Specifications under this work, visit the site of the work, fully inform themselves as to all existing conditions and limitations, and shall include in the Bid the sums to cover the cost of all items included in the Contract.

Insofar as possible, the Contractor, in carrying out his work, must employ such methods or means as will not cause any interruption of, or interference with, the work of any other Contractor.

#### 7. SERVICES AND MATERIALS PROVIDED BY OWNER:

The following items will be provided by the Owner including all materials and labor. Only coordination with the contractor will be required, since this work will be completed as the contractors work is done:

- The owner will provide up to 6 parking spaces in the parking lot for lay-out, storage and temporary parking during the construction process, if necessary.

#### 8. SUBSTITUTIONS:

To obtain approval to use unspecified products, bidders must submit written requests at least three days before the bid date and hour. Requests received after this time will not be considered. Requests shall clearly describe the product for which approval is asked, including all data necessary to demonstrate acceptability. If the product is acceptable, the Engineer will approve it in an addendum issued to all prime bidders on record.

#### 9. ADDENDA AND INTERPRETATIONS:

Should a Bidder find discrepancies in, or omissions from the Drawings, Specifications or other pre-bid documents, or should the Bidder be in doubt as to their meaning, the Owner should be notified at once. Any and all such interpretations and any supplemental instructions will be in the form of written addenda to the Bid Documents which, if issued, will be mailed to all prospective Bidders (at the respective addresses furnished for such purposes), not later than three days prior to the date fixed for the opening of bids. All addenda so issued shall become part of the Contract Documents.

#### 10. SUBMISSION OF POST-BID INFORMATION:

Upon receipt of written notice of contract award, the successful Bidder shall execute a contract, in accordance with good and sufficient surety or sureties, within ten calendar days after the prescribed forms are presented for signature. Required bond and insurance documents shall be furnished with the executed contract.

**11. SECURITY FOR FAITHFUL PERFORMANCE:**

Simultaneously with his delivery of the executed contract, the Contractor shall furnish an executed Performance Bond and an executed Labor and Material Payment Bond, each in the amount of 100% of the Contract Sum, as security for faithful performance of this contract and for the payment of all persons performing labor on the project under this contract and furnishing materials in connection with this contract, as specified. The surety on such bond shall be a Surety Company that meets the requirements of paragraph 5 above.

**12. POWER OF ATTORNEY:**

Attorneys-in-fact who sign bid bonds or contract bonds must file with each bond a certified and effectively dated copy of their power-of attorney.

**13. LAWS AND REGULATIONS:**

The Bidder's attention is directed to the fact that all applicable state laws, municipal ordinances, and the rules and regulations of all authorities have jurisdiction over construction of the project and shall apply to the Contract throughout, and they will be deemed to be included in the Contract the same as though written out in full.

**14. METHOD OF AWARD:**

If the Base Bid is within the amount of funds available to finance the construction contract, and the Bidder has met all other qualifications as specified in this and the attached documents, then contract award will be made to that responsible responsive Bidder submitting the low Base Bid.

**15. OBLIGATION OF OWNER:**

The Owner, within ten calendar days of receipt of acceptable Bonds and Agreement signed by the party to whom the contract was awarded shall sign the Agreement and return to such party an executed duplicate of the Agreement. Should the Owner not execute the Agreement within such period, the Bidder may, with WRITTEN NOTICE, withdraw his signed Agreement. Such notice of withdrawal shall be effective upon receipt of the notice by the Owner.

The NOTICE TO PROCEED will be issued within ten calendar days of the execution of the Agreement by the Owner. Should there be reasons why the Notice to Proceed cannot be issued within such period, the time may be extended by mutual agreement between the Owner and Contractor. If the Notice to Proceed has not been issued within the ten day period or within the period mutually agreed upon, the Contractor may terminate the Agreement without further liability on the part of either party.

**16. MINORITY PARTICIPATION:**

Pursuant to Ark. Code Ann. § 22-9-203, the State encourages all small and minority business enterprises to submit bids for capital improvements. Encouragement is also made to all general contractors that in the event they subcontract portions of their work, consideration be given to the identified groups.

**17. ALLOWANCES: Not Applicable****18. ADDITIVE ALTERNATES: As noted in the project documents.****20. LIQUIDATED DAMAGES:**



The Bidder shall understand that, if awarded the Contract, the Contract Time provided, WHICH FOR THIS CONTRACT IS 90 CALENDAR DAYS and is in the Agreement, is an essential condition of the Contract. If the Contractor shall neglect, fail, or refuse to complete the work within the time established, or any proper extension thereof, the Agreement will provide that the Contractor pay to the Owner the amount of \$150.00 (One Hundred Fifty Dollars) not as a penalty, but as liquidated damages for such breach of contract, for each calendar day that the Contractor shall be in default after the time stipulated in the Contract for completion of the work. The said amount is fixed and agreed upon by and between the Contractor and the Owner because of the impracticability and extreme difficulty of fixing and ascertaining the actual damages. The Owner would, in such event, sustain and said amount is agreed to be the amount of damages that the Owner would sustain.

21. WAGE RATES:

Arkansas Wage Rate Determination 15-493 shall apply to all work included in this contract.

END OF SECTION

**SECTION 00300  
BID FORM  
CITY OF BRYANT BID # 19-001**

Proposal of (hereinafter called "BIDDER") \_\_\_\_\_  
organized and existing under the laws of the State of Arkansas doing business as

\_\_\_\_\_  
(Insert "a corporation", "a partnership", or "an individual", as applicable.)

To the City of Bryant, Arkansas (hereinafter called "OWNER").

In compliance with your Invitation to Bid, BIDDER hereby proposes to perform all WORK included in the section in which he is bidding for the Center at Bishop Park Boiler Replacement for the City of Bryant Parks and Recreation Department located at 6401 Boone Road, Bryant, AR 72022, in strict accordance with the CONTRACT DOCUMENTS, within the time set forth therein, and at the prices stated below.

By submission of this BID, each BIDDER certifies, and in the case of a joint BID each party thereto certifies as to his own organization, that this BID has been arrived at independently, without consultation, communication, or agreement as to any matter relating to this Bid with any other BIDDER or with any competitor. BIDDER hereby agrees to commence WORK under this contract on or before a date to be specified in the NOTICE TO PROCEED and to complete the entire work of the contract within 90 (sixty) calendar days. BIDDER further agrees to pay as liquidated damages, the sum of \$150.00 (one hundred fifty dollars) for each consecutive calendar day after the completion date.

The Bidder, in compliance with your advertisement for bids for the Center at Bishop Park Boiler Replacement for the City of Bryant Parks and Recreation Department located at 6401 Boone Road, Bryant, AR 72022, having examined the plans and specifications with related documents and the site of the proposed work, and being familiar with all the conditions surrounding the construction of the proposed project, including the availability of materials and supplies, agrees to construct the project in accordance with the Contract Documents, within the time set forth therein, and at the prices stated below. These prices are to cover all expenses incurred in performing the as described in the Contract Documents, of which this proposal is a part. This price to include any allowances established as part of this bid.

**1. BASE PROPOSAL:** Replacement of Boilers

BASE BID PROPOSAL: \$ \_\_\_\_\_

\_\_\_\_\_ dollars.

Amount shall be shown in both written form and figures. In case of discrepancy between the written amount and the figures, the written amount shall govern.

**2. ADDITIVE ALTERNATES:** Replacement of Domestic Water Heaters

ADDITIVE ALTERNATE BID PROPOSAL: \$\_\_\_\_\_

\_\_\_\_\_dollars.

Amount shall be shown in both written form and figures. In case of discrepancy between the written amount and the figures, the written amount shall govern.

**3. ACCEPTANCE OR REJECTION OR PROPOSAL**

In submitting this BID, it is understood that the OWNER reserves the right to reject any and all BIDS. If written notice of acceptance of this bid is mailed, telegraphed or delivered to the Undersigned within 60 (sixty) calendar days after opening of the BID, the Undersigned agrees to execute and deliver a contract in prescribed form and furnish required Bond within 10 (ten) days after contract is presented for signature.

**4. ADDENDA RECEIPT**

BIDDER acknowledges receipt of the following ADDENDA:

Addendum No. \_\_\_\_\_ Dated \_\_\_\_\_

Addendum No. \_\_\_\_\_ Dated \_\_\_\_\_

**5. FIRM NAME**

Business Name: \_\_\_\_\_

Business Address: \_\_\_\_\_

\_\_\_\_\_

Business Phone: \_\_\_\_\_

Business Email: \_\_\_\_\_

Authorized Signature: \_\_\_\_\_  
(Title)

Seal (if Corporation):

Corporate Secretary: \_\_\_\_\_

License Number: \_\_\_\_\_

END OF SECTION

## **GENERAL CONDITIONS**

1. Definitions
2. Additional Instruction & Detail Drawings
3. Schedules, Reports & Records
4. Drawings and Specification
5. Shop Drawings
6. Materials, Services & Facilities
7. Inspection & Testing
8. Substitutions
9. Patents
10. Surveys, Permits & Regulations
11. Protection of Work, Property & Persons
12. Supervision by Contractor
13. Changes in the Work
14. Changes in Contract Price
15. Time for Completion & Liquidated Damages
16. Correction of Work
17. Subsurface Conditions
18. Suspension of Work, Termination & Delay
19. Payments to Contractor
20. Acceptance of Final Payment as Release
21. Insurance
22. Contract Security
23. Assignments
24. Indemnification
25. Separate Contracts
26. Subcontracting
27. Land & Rights of Way
28. Guaranty
29. Taxes
30. ENGINEER's Authority

### **1. DEFINITIONS**

- 1.1** Wherever used in the CONTRACT DOCUMENTS, the following terms shall have the meanings indicated which shall be applicable to both the singular and plural thereof:

- 1.2** AGREEMENT - Contract between the OWNER and CONTRACTOR regarding the PROJECT.
- 1.3** ADDENDA - Written or graphic instruments issued prior to the time of opening the bids which modify or interpret the CONTRACT DOCUMENTS, DRAWINGS and SPECIFICATIONS, by additions, deletions, clarification or corrections.
- 1.4** BID - The offer or proposal of the BIDDER submitted on the prescribed form setting forth the prices for the WORK to be performed.
- 1.5** BIDDER - Any person, firm or corporation submitting a BID for the WORK.
- 1.6** BONDS - Bid, Performance, and Payment Bonds, and other instruments of security, furnished by the CONTRACTOR and his surety in accordance with the CONTRACT DOCUMENTS.
- 1.7** CHANGE ORDER - A written order to the CONTRACTOR authorizing an addition, deletion or revision of the WORK within the general scope of the CONTRACT DOCUMENTS, or authorizing an adjustment in the CONTRACT PRICE or CONTRACT TIME.
- 1.8** CONTRACT DOCUMENTS - The contract, including BID, AGREEMENT, Payment Bond, Performance Bond, General Conditions, SUPPLEMENTARY CONDITIONS; NOTICE OF AWARD, NOTICE TO PROCEED, CHANGE and FIELD ORDERS, DRAWINGS, SPECIFICATIONS, and ADDENDA.
- 1.9** CONTRACT PRICE - The total monies payable to the CONTRACTOR under the terms and conditions of the CONTRACT DOCUMENTS.
- 1.10** CONTRACT TIME - the number of calendar days stated in the CONTRACT DOCUMENTS for the completion of the WORK.
- 1.11** CONTRACTOR - The person, firm or corporation with whom the OWNER has executed the Agreement.
- 1.12** DRAWINGS - The part of the CONTRACT DOCUMENTS which show the characteristics and scope of the WORK to be performed and which have been prepared or approved by the ENGINEER.
- 1.13** ENGINEER- The person, firm or corporation named as such in the CONTRACT DOCUMENTS.

- 1.14** FIELD ORDER - A written order effecting a change in the WORK not involving an adjustment in the CONTRACT PRICE, or an extension of the CONTRACT TIME, issued by the ENGINEER and OWNER to the CONTRACTOR during construction.
- 1.15** NOTICE OF AWARD - The written notice of the acceptance of the BID from the OWNER to the successful BIDDER.
- 1.16** NOTICE TO PROCEED - Written communication issued by the OWNER to the CONTRACTOR authorizing him to proceed with the WORK and establishing the date of commencement of the WORK.
- 1.17** OWNER - A public or quasi-public body or authority, corporation, association, partnership, or individual for whom the WORK is to be performed.
- 1.18** PROJECT - The undertaking to be performed as provided in the CONTRACT DOCUMENTS.
- 1.19** PROJECT COORDINATOR or RESIDENT PROJECT REPRESENTATIVE - The authorized representative of the OWNER who is assigned to the PROJECT site, or any part thereof.
- 1.20** SHOP DRAWINGS - All drawings, diagrams, illustrations, brochures, schedules and other data which are prepared by the CONTRACTOR, a SUBCONTRACTOR, MANUFACTURER, SUPPLIER or distributor, which illustrate how specific portions of the WORK shall be fabricated or installed.
- 1.21** SPECIFICATIONS - A part of the CONTRACT DOCUMENTS consisting of written descriptions of a technical nature of materials, equipment, construction systems, standards, and workmanship.
- 1.22** SUBCONTRACTOR - An individual, firm or corporation having a direct contract with the CONTRACTOR, or with any other SUBCONTRACTOR, for the performance of a part of the WORK at the site.
- 1.23** SUBSTANTIAL COMPLETION - That date, when the construction of the PROJECT, or a specified part thereof, is sufficiently completed in accordance with the CONTRACT DOCUMENTS, so that the PROJECT, or specified part, can be utilized for the purposes for which it is intended.

- 1.24** SUPPLEMENTARY CONDITIONS - Modifications to adapt the General Conditions to the specific requirements of the Project and that may be imposed by applicable federal, state, and local laws.
- 1.25** SUPPLIER - Any person or organization who supplies materials or equipment for the WORK, including that fabricated to a special design, but who does not perform labor at the site.
- 1.26** WORK - All labor necessary to produce the construction required by the CONTRACT DOCUMENTS, and all materials and equipment incorporated or to be incorporated in the PROJECT. Unless otherwise specified, all materials shall be new, and both workmanship and materials shall be of a good quality. The CONTRACTOR shall, if required, furnish satisfactory evidence as to the kind and quality of materials.
- 1.27** WRITTEN NOTICE - Any notice to any party of the Agreement relative to any part of this Agreement shall be in writing and considered delivered and the service thereof completed, when posted by certified or registered mail to the said party or his authorized representative.

## **2. ADDITIONAL INSTRUCTION AND DETAIL DRAWINGS**

- 2.1** The CONTRACTOR may be furnished additional instruction and detail drawings, by the ENGINEER, as necessary to carry out the WORK required by the CONTRACT DOCUMENTS.
- 2.2** The additional drawings and instruction thus supplied will become a part of the CONTRACT DOCUMENTS. The CONTRACTOR shall carry out the WORK in accordance with the additional detail drawings and instructions.

## **3. SCHEDULES, REPORTS AND RECORDS**

- 3.1** The CONTRACTOR shall submit to the OWNER, upon request, such schedule of quantities and costs, progress schedules, payrolls, reports, estimates, and other such records pertaining to the PROJECT.
- 3.2** Prior to the first partial payment estimate, the CONTRACTOR shall submit construction progress schedules showing the order in which he proposes to

carry on the WORK, including dates at which he will start the various parts of the WORK, estimated date of completion of each part and, as applicable:

- 3.2.1** The dates at which special detail drawings will be required; and
- 3.2.2** Respective dates for submission of SHOP DRAWINGS, the beginning of manufacture, the testing and the installation of materials, supplies and equipment.

#### **4. DRAWINGS AND SPECIFICATIONS**

- 4.1** The intent of the DRAWINGS and SPECIFICATIONS is that the CONTRACTOR shall furnish all labor, materials, tools, equipment, and transportation necessary for the proper execution of the WORK in accordance with the CONTRACT DOCUMENTS, and all incidental work necessary to complete the PROJECT in an acceptable manner, ready for use, occupancy or operation by the OWNER.
- 4.2** It is understood and agreed that the CONTRACTOR has, by careful examination, satisfied himself as to the nature and location of the WORK, the conformation of the ground, the character of equipment and facilities needed preliminary to and during the execution of the WORK, the character, quality and quantity of the materials to be encountered, the general and local conditions, and all other matters which can, in any way, affect the WORK under this CONTRACT.
- 4.3** In case of conflict between the DRAWINGS and SPECIFICATIONS, the SPECIFICATIONS shall govern. Figure dimensions on DRAWINGS shall govern over scale dimensions, and detailed DRAWINGS shall govern over general DRAWINGS.
- 4.4** Any discrepancies found between the DRAWINGS and SPECIFICATIONS and site conditions, or any inconsistencies or ambiguities in the DRAWINGS or SPECIFICATIONS, shall be immediately reported to the ENGINEER, in writing, who shall promptly correct such inconsistencies or ambiguities in writing. WORK done by the CONTRACTOR after his discovery of such discrepancies, inconsistencies or ambiguities shall be done at the CONTRACTOR'S risk.



- 4.5** CONTRACTOR acknowledges that, based upon the CONTRACTOR'S examination of the Drawings and Specifications which comprise a part of the Contract Documents, the CONTRACTOR has not observed anything in the Contract Documents indicating that same are incomplete or inconsistent or otherwise contain any error or omission that would cause the CONTRACTOR to be entitled to make any claim for increases in the CONTRACT PRICE or the CONTRACT TIME.
- 4.6** The intent of the CONTRACT DOCUMENTS is to include all items necessary for the proper execution and completion of the WORK by the CONTRACTOR. The CONTRACT DOCUMENTS are complimentary, and what is required by one shall be as binding as if required by all; performance by the CONTRACTOR shall be required to the extent inferable from the CONTRACT DOCUMENTS as being necessary to produce the intended results given the CONTRACTOR'S experience in general construction. The SPECIFICATIONS are written in the imperative and abbreviated form. The imperative language is directed to the CONTRACTOR, unless specifically noted otherwise. Any incomplete sentences shall be completed by inserting "shall," "the CONTRACTOR shall," "shall be," and similar mandatory phrases by inference in the same manner as they are applied to notes on the DRAWINGS. The words "shall be" shall be supplied by inference where a colon (:) is used within sentences or phrases. Except as worded to the contrary, all indicated requirements shall be performed whether stated imperatively or otherwise. Further, whenever the term "WORK Includes" or "Section Includes" is used as an article or paragraph heading in a SPECIFICATIONS section, it is merely a listing of the significant items described within the section and is not intended to limit the scope of the section or to imply a trade responsibility.
- 4.7** Conflicts or discrepancies among the Contract Documents shall be resolved in the following order of priority:
1. The AGREEMENT;
  2. AMENDMENTS and revisions of later date take precedence over those of earlier date;
  3. SUPPLEMENTARY CONDITIONS;
  4. The GENERAL CONDITIONS;

5. The Project Manual;
6. DRAWINGS and SPECIFICATIONS: DRAWINGS GOVERN SPECIFICATIONS for quantity and location, and SPECIFICATIONS govern for quality and performance. In the event of an ambiguity in quantity or quality, the greater quantity and the better quality shall govern;
7. Figure dimensions govern scale dimensions and large scale DRAWINGS govern small scale DRAWINGS; and,
8. SUBMITTALS; if and only if OWNER concludes, in its sole discretion, that a conflict or discrepancy cannot be otherwise resolved.

## **5. SHOP DRAWINGS**

- 5.1 The CONTRACTOR shall provide SHOP DRAWINGS as may be necessary for the prompt prosecution of the WORK as required by the CONTRACT DOCUMENTS. The ENGINEER shall promptly review all SHOP DRAWINGS.
- 5.2 When submitted for the ENGINEER'S review, SHOP DRAWINGS shall bear the CONTRACTOR'S certification that he has reviewed, checked, and approved the SHOP DRAWINGS and that they are in conformance with the requirements of the CONTRACT DOCUMENTS.
- 5.3 Portions of the WORK requiring a SHOP DRAWING or sample submission shall not begin until the SHOP DRAWING or submission has been reviewed by the ENGINEER. A copy of each processed SHOP DRAWING and each approved sample shall be kept in good order by the CONTRACTOR at the site and shall be available to the ENGINEER AND OWNER.

## **6. MATERIALS, SERVICES AND FACILITIES**

- 6.1 It is understood that, except as otherwise specifically stated in the CONTRACT DOCUMENTS, the CONTRACTOR shall provide and pay for all materials, labor, tools, equipment, water, sewer, light, utilities, power, transportation, supervision, temporary construction of any nature, and all other services and facilities of any nature whatsoever necessary to execute, complete, and deliver the WORK within the specified time.
- 6.2 Materials and equipment shall be so stored as to ensure the preservation of their quality and fitness for the WORK. Stored materials and equipment to be

incorporated in the WORK shall be located so as to facilitate prompt inspection.

- 6.3** Manufactured articles, materials and equipment shall be applied, installed, connected, erected, used, cleaned and conditioned as directed by the manufacturer.
- 6.4** Materials, supplies and equipment shall be in accordance with samples submitted by the CONTRACTOR and approved by the ENGINEER.
- 6.5** Materials, supplies or equipment to be incorporated into the WORK shall not be purchased by the CONTRACTOR or the SUBCONTRACTOR(S) subject to a chattel mortgage or under a conditional sale contract or other agreement by which an interest is retained by the seller.

## **7. INSPECTION AND TESTING**

- 7.1** All materials and equipment used in the construction of the PROJECT shall be subject to adequate inspection and testing in accordance with generally accepted standards, as required and defined in the CONTRACT DOCUMENTS.
- 7.2** The OWNER shall provide all inspection and testing services not required by the CONTRACT DOCUMENTS.
- 7.3** The CONTRACTOR shall provide, at the CONTRACTOR'S expense, the testing and inspection services required by the CONTRACT DOCUMENTS, unless otherwise noted.
- 7.4** If the CONTRACT DOCUMENTS, laws, ordinances, rules, regulations, or orders of any public authority having jurisdiction require any WORK to specifically be inspected, tested, or approved by someone other than the CONTRACTOR, the CONTRACTOR shall give the ENGINEER AND OWNER timely notice of readiness. The CONTRACTOR will then furnish the ENGINEER AND OWNER the required certificates of inspection, testing or approval.
- 7.5** Inspections, tests, or approvals by the ENGINEER, OWNER or others shall not relieve the CONTRACTOR from his obligations to perform the WORK in accordance with the requirements of the CONTRACT DOCUMENTS.

- 7.6** The ENGINEER, OWNER and their representatives will, at all times, have access to the WORK. In addition, authorized representatives and agents of any participating federal or state agency shall be permitted to inspect all work, materials, payrolls, records of personnel, invoices of materials, and other relevant data and records. The CONTRACTOR shall provide proper facilities for such access and observation of the WORK and also for any inspection or testing thereof.
- 7.7** If any WORK is covered contrary to the written instructions of the ENGINEER OR OWNER, it shall, if requested by the ENGINEER OR OWNER, be uncovered for their observation and replaced by the CONTRACTOR at no increase in Contract Price.

## **8. SUBSTITUTIONS**

- 8.1** Whenever a material, article or piece of equipment is identified on the DRAWINGS or SPECIFICATIONS by reference to brand name or catalogue number, it shall be understood that this is referenced for the purpose of defining the performance or other salient requirements and that other products of equal capacities, quality and function shall be considered. The CONTRACTOR may recommend the substitution of a material, article, or piece of equipment of equal substance and function for those referred to in the CONTRACT DOCUMENTS by reference to brand name or catalogue number, and if, in the opinion of the OWNER, such material, article, or piece of equipment is of equal substance and function to that specified, the OWNER may approve its substitution and use by the CONTRACTOR. Any cost differential shall be deducted from the CONTRACT PRICE and the CONTRACT DOCUMENTS shall be appropriately modified by CHANGE ORDER. The CONTRACTOR warrants that if substitutes are approved, no major changes in the function or general design of the PROJECT will result. Incidental changes or extra component parts required to accommodate the substitute shall be made by the CONTRACTOR without a change in the CONTRACT PRICE or CONTRACT TIME.

## **9. PATENTS**

- 9.1** The CONTRACTOR shall pay all applicable royalties and license fees. The CONTRACTOR shall defend all law suits or claims for infringement of any patent rights and save the OWNER AND ENGINEER harmless from loss on account thereof; however, if the CONTRACTOR has reason to believe that

the design, process or product specified is an infringement of a patent, he shall be responsible for such loss unless he promptly gives such information to the OWNER AND ENGINEER.

## **10. SURVEYS, PERMITS, AND REGULATIONS**

- 10.1** The OWNER will furnish all boundary surveys and establish all base lines for locating the principal component parts of the WORK, together with a suitable number of bench marks adjacent to the WORK as shown in the CONTRACT DOCUMENTS. From the information provided by the OWNER, unless otherwise specified in the CONTRACT DOCUMENTS, the CONTRACTOR shall develop and make all detail surveys needed for construction such as slope sheets.
- 10.2** The CONTRACTOR shall carefully preserve bench marks, reference points and stakes and, in case of willful or careless destruction, the CONTRACTOR shall be charged with the resulting expense and shall be responsible for any mistakes that may be caused by their unnecessary loss or disturbance.
- 10.3** Permits and licenses of a temporary nature necessary for the prosecution of the WORK shall be secured and paid for by the CONTRACTOR unless otherwise stated in the SUPPLEMENTARY CONDITIONS. Permits, licenses and easements for permanent structures or permanent changes in existing facilities shall be secured and paid for by the OWNER, unless otherwise specified. The CONTRACTOR shall give all notices and comply with all laws, ordinances, rules and regulations bearing on the conduct of the WORK as drawn and specified. If the CONTRACTOR observes that the CONTRACT DOCUMENTS are at variance therewith, he shall promptly notify the ENGINEER AND OWNER, in writing, and any necessary changes shall be adjusted as provided in Section 13, CHANGES IN THE WORK.

## **11. PROTECTION OF WORK, PROPERTY AND PERSONS**

- 11.1** The CONTRACTOR shall be responsible for initiating, maintaining and supervising all safety precautions and programs in connection with the WORK. The CONTRACTOR will take all necessary precautions for the safety of, and will provide the necessary protection to prevent damage, injury or loss to all employees on the WORK and other persons who may be affected thereby, all the WORK and all materials or equipment to be incorporated

therein, whether in storage on or off the site, and 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.

- 11.2** The CONTRACTOR shall comply with all applicable laws, ordinances, rules regulations and orders of any public body having jurisdiction. The CONTRACTOR shall erect and maintain, as required by the conditions and progress of the WORK, all necessary safeguards for safety and protection. The CONTRACTOR will notify owners of adjacent utilities when prosecution of the WORK may affect them. The CONTRACTOR shall remedy all damage, injury or loss to any property caused, directly or indirectly, in whole or in part, by the CONTRACTOR, any SUBCONTRACTOR or anyone directly or indirectly employed by any of them or anyone for whose acts any of them be liable, except damage or loss attributable to the fault of the CONTRACT DOCUMENTS or to the acts or omissions of the ENGINEER or OWNER or anyone employed by them or anyone for whose acts either of them may be liable, and not attributable, directly or indirectly, in whole or in part, to the fault or negligence of the CONTRACTOR.
- 11.3** In emergencies affecting the safety of persons or the WORK or property at the site or adjacent thereto, the CONTRACTOR, without special instruction or authorization from the ENGINEER or OWNER, shall act to prevent threatened damage, injury or loss. The CONTRACTOR shall give the ENGINEER and OWNER prompt WRITTEN NOTICE of any significant changes in the WORK or deviations from the CONTRACT DOCUMENTS caused thereby, and a CHANGE ORDER shall thereupon be issued covering the changes and deviations involved.
- 11.4** The CONTRACTOR shall confine operations at the PROJECT site to areas permitted by law, ordinances, permits and this AGREEMENT and shall not unreasonably encumber the PROJECT site with materials or equipment.
- 11.5** The CONTRACTOR shall at all times keep the premises free from accumulation of waste materials or rubbish.

## **12. SUPERVISION BY CONTRACTOR**

**12.1** The CONTRACTOR shall supervise and direct the WORK. The CONTRACTOR shall be solely responsible for the means, methods, techniques, sequences and procedures of construction. The CONTRACTOR shall employ and maintain on the WORK a qualified supervisor or superintendent who shall have been designated in writing by the CONTRACTOR as the CONTRACTOR'S representative at the site. The supervisor shall have full authority to act on behalf of the CONTRACTOR, and all communications given to the supervisor shall be as if given to the CONTRACTOR. The supervisor shall be present on the site at all times as required to perform adequate supervision and coordination of the WORK.

### **13. CHANGES IN THE WORK**

**13.1** The ENGINEER, UPON the OWNER's approval, may, at any time, as the need arises, order changes within the scope of the WORK without invalidating the Agreement. If such changes increase or decrease the amount due under the CONTRACT DOCUMENTS, or in the time required for performance of the WORK, an equitable adjustment shall be authorized by a CHANGE ORDER.

**13.2** The **ENGINEER**, UPON the OWNER's approval, may, at any time, by issuing a FIELD ORDER, make changes in the details of the WORK. The CONTRACTOR shall proceed with the performance of any changes in the WORK so ordered by the ENGINEER and **OWNER** unless the CONTRACTOR believes that such FIELD ORDER entitles the CONTRACTOR to a change in CONTRACT PRICE or CONTRACT TIME, or both, in which event the CONTRACTOR shall give the ENGINEER and OWNER WRITTEN NOTICE thereof within seven (7) days after the receipt of the ordered change. Thereafter, the CONTRACTOR shall document the basis for the change in CONTRACT PRICE or CONTRACT TIME within thirty (30) days. The CONTRACTOR shall not execute such changes pending the receipt of an executed CHANGE ORDER or further instruction from the ENGINEER and OWNER.

### **14. CHANGES IN CONTRACT PRICE**

**14.1** The CONTRACT PRICE may be changed only by a CHANGE ORDER. The value of any WORK covered by a CHANGE ORDER or of any claim for increase or decrease in the CONTRACT PRICE shall be determined by one or more of the following methods in the order of precedence listed below:

- (A) Unit prices previously approved.
- (B) An agreed lump sum.
- (C) The actual cost for labor, direct overhead, materials, supplies, equipment, and other services necessary to complete the WORK.

## **15. TIME FOR COMPLETION AND LIQUIDATED DAMAGES**

- 15.1** The date of beginning and the time for completion of the WORK are essential conditions of the CONTRACT DOCUMENTS and the WORK embraced shall be commenced on a date specified in the written NOTICE TO PROCEED.
- 15.2** The CONTRACTOR shall proceed with the WORK at such rate of progress to ensure full completion within the CONTRACT TIME. It is expressly understood and agreed, by and between the CONTRACTOR and the OWNER, that the CONTRACT TIME for the completion of the WORK described herein is a reasonable time, taking into consideration the average climatic and economic conditions and other factors prevailing in the locality of the WORK.
- 15.3** If the CONTRACTOR shall fail to complete the WORK within the CONTRACT TIME, or extension of time granted by the OWNER, then the CONTRACTOR shall pay, to the OWNER, the amount for liquidated damages as specified in Section 3.2 of the AGREEMENT for each calendar day that the CONTRACTOR shall be in default after the time stipulated in the CONTRACT DOCUMENTS.
- 15.4** The CONTRACTOR shall not be charged with liquidated damages or any excess cost when the delay in completion of the WORK is due to the following, and the CONTRACTOR has promptly given WRITTEN NOTICE of such delay to the ENGINEER and OWNER:
- 15.4.1** To any preference, priority or allocation order duly issued by the ENGINEER or OWNER;
  - 15.4.2** To unforeseeable causes beyond the control, and without the fault or negligence of, the CONTRACTOR, restricted to acts of God or of the public enemy, acts of the ENGINEER or OWNER, acts of another CONTRACTOR in the performance of a contract with the OWNER, fires, floods, epidemics, quarantine restrictions, strikes and freight embargoes; and



- 15.4.3** To any delays of SUBCONTRACTORS occasioned by any of the causes specified in paragraphs 15.4.1 and 15.4.2 of this article.

## **16. CORRECTION OF WORK**

- 16.1** The CONTRACTOR shall promptly remove from the premises all WORK rejected by the ENGINEER or OWNER for failure to comply with the CONTRACT DOCUMENTS, whether incorporated in the construction or not, and the CONTRACTOR shall promptly replace and re-execute the WORK in accordance with the CONTRACT DOCUMENTS and without expense to the OWNER and shall bear the expense of making good all WORK of other CONTRACTORS destroyed or damaged by such removal or replacement.
- 16.2** All removal and replacement WORK shall be done at the CONTRACTOR'S expense. If the CONTRACTOR does not take action to remove such rejected WORK within ten (10) days after receipt of WRITTEN NOTICE, the OWNER may remove such WORK and store the materials at the expense of the CONTRACTOR.

## **17. SUBSURFACE CONDITIONS**

- 17.1** The CONTRACTOR shall promptly, and before such conditions are disturbed, except in the event of an emergency, notify the ENGINEER and OWNER by WRITTEN NOTICE of:
- 17.1.1** Subsurface or latent physical conditions at the site differing materially from those indicated in the CONTRACT DOCUMENTS; or
- 17.1.2** Unknown physical conditions at the site, of an unusual nature, differing materially from those ordinarily encountered and generally recognized as inherent in WORK of the character provided for in the CONTRACT DOCUMENTS.
- 17.2** The ENGINEER and OWNER will promptly investigate the conditions, and if ENGINEER and OWNER jointly find that such conditions do so materially differ and cause an increase or decrease in the cost of, or in the time required for, performance of the WORK, an equitable adjustment will be made and the CONTRACT DOCUMENTS will be modified by a CHANGE ORDER. Any claim

of the CONTRACTOR for adjustment hereunder will not be allowed unless the CONTRACTOR has given the required WRITTEN NOTICE, provided that the ENGINEER and OWNER may, if ENGINEER and OWNER jointly determine the facts so justify, consider and adjust any such claims asserted before the date of final payment.

## **18. SUSPENSION OF WORK, TERMINATION AND DELAY**

- 18.1** The OWNER may suspend the WORK, or any portion thereof, for a period of not more than ninety (90) days, or such further time as agreed upon by the CONTRACTOR, by WRITTEN NOTICE to the CONTRACTOR, which notice will fix the date on which WORK shall be resumed. The CONTRACTOR will be allowed an increase in the CONTRACT PRICE or an extension of the CONTRACT TIME, or both, directly attributable to any such suspension.
- 18.2** If the CONTRACTOR is adjudged as bankrupt or insolvent, or if the CONTRACTOR makes a general assignment for the benefit of the CONTRACTOR'S creditors, or if a trustee or receiver is appointed for the CONTRACTOR or for any of his property, or if the CONTRACTOR files a petition to take advantage of any debtor's act, or to reorganize under the bankruptcy or applicable laws, or if the CONTRACTOR repeatedly fails to supply sufficient skilled workmen or suitable materials or equipment, or if the CONTRACTOR repeatedly fails to make prompt payments to SUBCONTRACTORS or for labor, materials or equipment or if he disregards laws, ordinances, rules, regulations or orders of any public body having jurisdiction of the WORK, or if the CONTRACTOR otherwise violates any provision of the CONTRACT DOCUMENTS, then the OWNER may, without prejudice to any other right or remedy and after giving the CONTRACTOR and the CONTRACTOR'S surety a minimum of twenty (20) days' WRITTEN NOTICE, terminate the services of the CONTRACTOR and take possession of the PROJECT and of all materials, equipment, tools, construction equipment and machinery thereon owned by the CONTRACTOR, and finish the WORK by whatever method the OWNER may deem expedient. In such case, the CONTRACTOR shall not be entitled to receive any further payment until the WORK is finished. If the unpaid balance of the CONTRACT PRICE exceeds the direct and indirect costs of completing the PROJECT, including compensation for additional professional services, such excess WILL BE PAID

TO THE CONTRACTOR. If such costs exceed such unpaid balance, the CONTRACTOR SHALL PAY THE DIFFERENCE TO THE OWNER. Such costs incurred by the OWNER will be incorporated in a CHANGE ORDER. **The OWNER has the right to withhold any such costs incurred by the OWNER from any payments due the CONTRACTOR.**

- 18.3** Where the CONTRACTOR'S services have been so terminated by the OWNER, said termination shall not affect any right of the OWNER against the CONTRACTOR then existing or which may thereafter accrue. Any retention or payment of monies by the OWNER due the CONTRACTOR will not release the CONTRACTOR from compliance with the CONTRACT DOCUMENTS.
- 18.4** After ten (10) days from delivery of a WRITTEN NOTICE to the CONTRACTOR, the OWNER may, without cause and without prejudice to any other right or remedy, elect to abandon the PROJECT and terminate the contract. In such case, the CONTRACTOR will be paid for all WORK executed up to the date of termination.
- 18.5** If, through no act or fault of the CONTRACTOR, the WORK is suspended for a period of more than ninety (90) days by the OWNER, or the WORK is suspended under an order of a court of competent jurisdiction for more than ninety (90) days, or the OWNER fails to pay the CONTRACTOR substantially the sum requested within sixty (60) days of approval and receipt of a request for payment by the OWNER, then the CONTRACTOR may, after thirty (30) days from delivery of a WRITTEN NOTICE to the OWNER, such thirty (30) day WRITTEN NOTICE also giving the OWNER an opportunity to cure any default, terminate the CONTRACT and recover from the OWNER payment for all WORK executed up to the date of termination. In addition and in lieu of terminating the CONTRACT, if the OWNER has failed to make any payment as aforesaid, the CONTRACTOR may, upon twenty (20) days WRITTEN NOTICE to the OWNER, stop the WORK until the CONTRACTOR has been paid all amounts then due, in which event and upon resumption of the WORK, CHANGE ORDERS shall be issued for adjusting the CONTRACT PRICE or extending the CONTRACT TIME, or both, to compensate for the costs and delays attributable to the stoppage of the WORK.
- 18.6** If, through no act or fault of the CONTRACTOR, the performance of all or any portion of the WORK is suspended, delayed, or interrupted as a result of a failure of the OWNER to act within the time specified in the CONTRACT

DOCUMENTS, including default cure time periods, or if no time is specified, within a reasonable time, an adjustment in the CONTRACT PRICE or an extension of the CONTRACT TIME, or both, will be made by CHANGE ORDER to compensate the CONTRACTOR for the costs and delays directly caused by the failure of the OWNER.

## **19. PAYMENTS TO CONTRACTOR**

- 19.1** At least ten (10) days before each progress payment falls due, but not more often than once a month, the CONTRACTOR shall submit to the ENGINEER a Partial Payment Estimate filled out and signed by the CONTRACTOR covering the WORK performed during the period covered by the Partial Payment Estimate and supported by such data as the ENGINEER or OWNER may reasonably require. If payment is requested on the basis of materials and equipment not incorporated in the WORK but delivered and suitably stored at or near the site, the partial payment estimate shall also be accompanied by such supporting data, satisfactory to the ENGINEER and OWNER, as will establish the OWNER'S title to the material and equipment and protect the OWNER'S interest therein, including applicable insurance. The ENGINEER will, within ten (10) days after receipt of each partial payment estimate, either indicate in writing the ENGINEER'S approval of payment, or return the partial payment estimate to the CONTRACTOR indicating, in writing, the reasons for refusing to approve payment. In the latter case, the CONTRACTOR may make the necessary corrections and resubmit the partial payment estimate. The OWNER will, within thirty (30) days of presentation to the OWNER of an approved partial payment estimate, pay the CONTRACTOR a progress payment on the basis of the approved partial payment estimate. In accordance with Ark. Code Ann. § 22-9-604, the ENGINEER will prescribe retainage of five percent (5%) of the earned amount of the WORK progress shown on the partial payment estimate, excluding materials and equipment on hand but not installed, and upon certification by the ENGINEER that the WORK progress is fifty percent (50%) complete, based on the adjusted contract price, there will be no additional retainage on account of WORK completed, in which case the remaining progress payments prior to SUBSTANTIAL COMPLETION will be in an amount equal to one hundred percent (100%) of the WORK completed. Further, upon certification of SUBSTANTIAL COMPLETION of the WORK, the retained amount may be reduced to only that amount necessary to assure completion. On completion and acceptance of a part of the WORK on which the price is

stated separately in the CONTRACT DOCUMENTS, payment may be made in full, including retained percentages, less authorized deductions.

- 19.2** The request for payment may also include an allowance for the cost of such major materials and equipment which are suitably stored either at or near the site.
- 19.3** Prior to SUBSTANTIAL COMPLETION, the OWNER may use any completed or substantially completed portions of the WORK. Such use shall not constitute an acceptance of such portions of the WORK.
- 19.4** The OWNER will have the right to enter the premises for the purpose of doing work not covered by the CONTRACT DOCUMENTS. This provision shall not be construed as relieving the CONTRACTOR of the sole responsibility for the care and protection of the WORK, or the restoration of any damaged WORK, except such as may be caused by agents or employees of the OWNER.
- 19.5** Upon completion and acceptance of the WORK, and after the receipt of all lien waivers and other proper documentation from the CONTRACTOR, the OWNER will sign the final payment request as its certification that the WORK has been accepted by the OWNER under the conditions of the CONTRACT DOCUMENTS. The entire balance found to be due the CONTRACTOR, including the retained percentages, but except such sums as may be lawfully retained by the OWNER, will be paid to the CONTRACTOR within thirty (30) days of completion and final acceptance of the WORK by the OWNER.
- 19.6** The CONTRACTOR shall indemnify and save the ENGINEER and OWNER, or the ENGINEER'S and OWNER'S agents, harmless from all claims growing out of the lawful demands of SUBCONTRACTORS, laborers, workmen, mechanics, materialmen, and furnishers of machinery and parts thereof, equipment, tools, and all supplies, incurred in the furtherance of the performance of the WORK. The CONTRACTOR shall furnish the OWNER and ENGINEER satisfactory evidence that all obligations of the nature designated above have been paid, discharged, or waived. If the CONTRACTOR fails to do so, the OWNER may, after having notified the CONTRACTOR, either pay unpaid bills or withhold from the CONTRACTOR'S unpaid compensation a sum of money deemed reasonably sufficient to pay any and all such lawful claims until satisfactory evidence is furnished that all liabilities have been fully

discharged, where upon payment to the CONTRACTOR shall be resumed, in accordance with the terms of the CONTRACT DOCUMENTS, but in no event shall the provisions of this sentence be construed to impose any obligations upon the ENGINEER or OWNER to either the CONTRACTOR, his Surety, or any third party. In paying any unpaid bills of the CONTRACTOR, any payment, so made by the OWNER shall be considered as a payment made under the CONTRACT DOCUMENTS by the OWNER to the CONTRACTOR and the OWNER will not be liable to the CONTRACTOR for any such payments made in good faith.

- 19.7 The CONTRACTOR warrants that upon submittal of a request for payment, all work for which payment has been received by the CONTRACTOR shall be free and clear of liens, claims, security interests or encumbrances in favor of the CONTRACTOR, subcontractors, material suppliers, or other persons or entities making a claim by reason of having provided labor, materials or equipment relating to the work or project.**
- 19.8 Any payment to the CONTRACTOR by the OWNER, final or otherwise, shall not constitute an acceptance of any WORK not in accordance with the CONTRACT DOCUMENTS.**

## **20. ACCEPTANCE OF FINAL PAYMENT AS RELEASE**

- 20.1** The acceptance by the CONTRACTOR of final payment shall be and shall operate as a release to the OWNER of all claims and all liability to the CONTRACTOR, other than claims in stated amounts as may be specifically excepted by the CONTRACTOR, for all things done or furnished in connection with this WORK and for every act and neglect of the OWNER and others relating to, or arising out of, this WORK. Any payment, however, final or otherwise, will not release the CONTRACTOR or his sureties from any obligations under the CONTRACT DOCUMENTS or the Performance BOND and Payment BOND.

## **21. INSURANCE**

- 21.1 Contractor's Liability Insurance:** CONTRACTOR shall purchase and maintain, in a company or companies licensed to do business in the State of Arkansas, such commercial general liability and other insurance as is appropriate for the WORK being performed and furnished and as will provide protection from claims set forth below which may arise out of or result from

CONTRACTOR'S performance and furnishing of the WORK and CONTRACTOR'S other obligations under the CONTRACT DOCUMENTS, whether it is to be performed or furnished by CONTRACTOR, by any Subcontractor, by anyone directly or indirectly employed by any of them to perform or furnish any of the WORK, or by anyone for whose acts any of them may be liable:

- 21.1.1** Claims under workers or workmen's compensation, disability benefits, and other similar employee benefit acts;
  - 21.1.2** Claims for damages because of bodily injury, occupational sickness or disease, or death of CONTRACTOR'S employees;
  - 21.1.3** Claims for damages because of bodily injury, sickness or disease, or death of any person other than CONTRACTOR'S employees;
  - 21.1.4** Claims for damages insured by personal injury liability coverage which are sustained (a) by any person as a result of an offense directly or indirectly related to the employment of such person by CONTRACTOR, or (b) by any other person for any other reason;
  - 21.1.5** Claims for damages, other than to the Work itself, because of injury to or destruction of tangible property wherever located, including loss of use resulting therefrom;
  - 21.1.6** Claims arising out of operation of Laws or Regulations for damages because of bodily injury or death of any person or for damage to property;
  - 21.1.7** Claims for damages because of bodily injury or death of any person or property damage arising out of the ownership, maintenance or use of any motor vehicle; and
  - 21.1.8** Claims involving contractual liability insurance applicable to the Contractor's obligations under Article 24.
- 21.2** The insurance required by paragraph 21.1 shall include the specific coverages and be written for not less than the limits of liability and coverages

provided in the SUPPLEMENTARY CONDITIONS, or required by law, whichever is greater. All such insurance shall remain in effect until final payment and at all times thereafter when CONTRACTOR may be correcting, removing, or replacing defective WORK in accordance with paragraph 28.1. In addition, CONTRACTOR shall maintain completed operations insurance for at least one (1) year after date of final completion and furnish OWNER with evidence of continuation of such insurance at final completion.

- 21.3** The CONTRACTOR shall purchase and maintain in the name of the ENGINEER and OWNER an Owner's and Contractor's Protective Liability Policy as will protect the ENGINEER and OWNER against claims which may arise from operations under the contract. Coverage shall not exceed coverage of CONTRACTOR'S Commercial General Liability policy.
- 21.4** The CONTRACTOR shall acquire and maintain, if applicable, Fire and Extended Coverage insurance upon the PROJECT to the full insurable value thereof for the benefit of the OWNER, the CONTRACTOR, and SUBCONTRACTORS as their interest may appear. This provision shall in no way release the CONTRACTOR or CONTRACTOR'S surety from obligations under the CONTRACT DOCUMENTS to fully complete the PROJECT.
- 21.5** The CONTRACTOR shall procure and maintain, at the CONTRACTOR'S own expense, during the CONTRACT TIME, in accordance with the provisions of the laws of the state in which the WORK is performed, Workers' Compensation Insurance, including occupational disease provisions, for all of CONTRACTOR'S employees at the site of the PROJECT and in case any work is sublet, the CONTRACTOR shall require such SUBCONTRACTOR similarly to provide Workers' Compensation Insurance, including occupational disease provisions for all of the latter's employees unless such employees are covered by the protection afforded by the CONTRACTOR. In case any class of employees engaged in hazardous work under this AGREEMENT at the site of the PROJECT is not protected under Workers' Compensation statute, the CONTRACTOR shall provide, and shall cause each SUBCONTRACTOR to provide, adequate and suitable insurance for the protection of his employees not otherwise protected.
- 21.6** Certificates of Insurance acceptable to the Owner shall be filed with the Owner prior to commencement of the Work. These Certificates and the insurance policies required by Paragraph 21.1 shall contain a provision that



coverages afforded under the policies will not be canceled or allowed to expire until at least thirty (30) days' prior written notice has been given to the Owner.

## **22. CONTRACT SECURITY**

**22.1** The CONTRACTOR shall, within ten (10) days after the receipt of the NOTICE OF AWARD, furnish the OWNER with a Performance BOND and a Payment BOND, each in penal sums equal to the amount of the CONTRACT PRICE, conditioned upon the performance by the CONTRACTOR of all undertakings, covenants, terms, conditions and agreements of the CONTRACT DOCUMENTS, and upon the prompt payment by the CONTRACTOR to all persons supplying labor and materials in the prosecution of the WORK provided by the CONTRACT DOCUMENTS. Such BONDS shall be executed by the CONTRACTOR and a corporate bonding company licensed to transact such business in the state in which the WORK is to be performed and named on the current list of "Surety Companies Acceptable on Federal Bonds" as published in the Treasury Department Circular Number 570. The expense of these BONDS shall be borne by the CONTRACTOR. If, at any time, a surety on any such BOND is declared a bankrupt or loses its right to do business in the state in which the WORK is to be performed or is removed from the list of "Surety Companies Acceptable on Federal Bonds," CONTRACTOR shall, within ten (10) days after notice from the OWNER to do so, substitute an acceptable BOND (or BONDS) in such form and sum and signed by such other surety or sureties as may be satisfactory to the OWNER. The premiums on such BOND shall be paid by the CONTRACTOR. No further payments shall be deemed due nor shall be made until the new surety or sureties shall have furnished an acceptable BOND to the OWNER.

## **23. ASSIGNMENTS**

**23.1** Neither the CONTRACTOR nor the OWNER shall sell, transfer, assign or otherwise dispose of this AGREEMENT, the CONTRACT DOCUMENTS, or any portion thereof, or of the right, title or interest therein, or any obligation thereunder, without written consent of the other party.

## **24. INDEMNIFICATION**

- 24.1** The CONTRACTOR shall indemnify and hold harmless the OWNER, and their agents and employees, from and against all claims, damages, losses and expenses, including attorney's fees, arising out of or resulting from the performance of the WORK, provided that any such claims, damage, loss or expense is attributable to bodily injury, sickness, disease or death, or to injury to or destruction of tangible property, including the loss of use resulting therefrom, and is caused in whole or in part by any negligent or willful act or omission of the CONTRACTOR, any SUBCONTRACTOR, anyone directly or indirectly employed by any of them, or anyone for whose acts any of them may be liable.
- 24.2** In any and all claims against the OWNER, or any of their agents or employees, by any employee of the CONTRACTOR, any SUBCONTRACTOR, anyone directly or indirectly employed by any of them, or anyone for whose acts any of them may be liable, the indemnification obligation shall not be limited in any way by any limitation on the amount or type of damages, compensation of benefits payable by or for the CONTRACTOR or any SUBCONTRACTOR under workmen's compensation acts, disability benefit acts or other employee benefits acts.
- 24.3** CONTRACTOR hereby releases, indemnifies and holds harmless the OWNER, its officers, agents and employees from and against any and all loss, damage and expense including, but not limited to; any claim, demand or action for injury, liability or damage to persons or property or, for loss of life; and any and all claims or actions brought by any person, firm, government body or other entity, resulting from, arising from or in connection with contamination of, or threatened contamination of, or adverse effects on, the environment, or violation of any environmental or other statute, ordinance, rule, regulation, order, permit or judgment of any government or judicial entity; and from and against any damages, liabilities, costs, fees, fines, charges, causes of action, law suits, judgments and penalties assessed, including, but not limited to, reasonable investigation and legal expenses in connection with defending any such action, arising from any matter or circumstance on the property regarding the performance of the Work and services under the Agreement between the CONTRACTOR, its officers, agents, employees and assigns, and the OWNER for Work and services provided to the OWNER pursuant to such Agreement.

To evidence proper disposal of all solid waste associated with the Work performed under said Agreement in a legally permitted solid waste disposal

facility, CONTRACTOR will provide the OWNER with a receipt for each dump load of solid waste so disposed.

- 24.4** The obligation of the CONTRACTOR under this paragraph shall not extend to the liability of the ENGINEER, its agents or employees, arising out of the preparation or approval of maps, DRAWINGS, opinions, reports, surveys, CHANGE ORDERS, designs or SPECIFICATIONS.

## **25. SEPARATE CONTRACTS**

- 25.1** The OWNER reserves the right to let separate contracts for this PROJECT. The CONTRACTOR shall afford other contractors reasonable opportunity for the introduction and storage of their materials and the execution of their WORK, and shall properly connect and coordinate its WORK with theirs. If the proper execution or results of any part of the CONTRACTOR'S WORK depends upon the WORK of any other contractor, the CONTRACTOR shall inspect and promptly report to the ENGINEER and OWNER any defects in such WORK that render it unsuitable for such proper execution and results.
- 25.2** The OWNER may perform additional WORK related to the PROJECT itself, or the OWNER may let other contracts containing provisions similar to these CONTRACT DOCUMENTS. The CONTRACTOR will afford the other contractors who are parties to such contracts, or the OWNER if the OWNER is performing the additional WORK, reasonable opportunity for the introduction and storage of materials and equipment and the execution of WORK, and shall properly connect and coordinate his WORK with theirs.
- 25.3** If the performance of additional WORK by other contractors or the OWNER is not noted in the CONTRACT DOCUMENTS prior to the execution of the CONTRACT, WRITTEN NOTICE thereof shall be given by the OWNER to the CONTRACTOR prior to starting any such additional WORK. If the CONTRACTOR believes that the performance of such additional WORK by the OWNER or others involves additional expense to the CONTRACTOR, or entitles the CONTRACTOR to an extension of the CONTRACT TIME, the CONTRACTOR may make a claim therefor as provided in Sections 14 and 15.

## **26. SUBCONTRACTING**

- 26.1** The CONTRACTOR may utilize the services of specialty SUBCONTRACTORS on those parts of the WORK which, under normal contracting practices, are performed by specialty SUBCONTRACTORS.
- 26.2** All SUBCONTRACTORS and material suppliers utilized on this Project shall be experienced in the type of work required by the Project, reputable, qualified and shall be acceptable to the OWNER.
- 26.3** The CONTRACTOR shall be fully responsible to the OWNER for the acts and omissions of the CONTRACTOR'S SUBCONTRACTORS and material suppliers on this PROJECT, and of persons either directly or indirectly employed by them, as the CONTRACTOR is for the acts and omissions of persons directly employed by the CONTRACTOR.
- 26.4** The CONTRACTOR shall cause appropriate provisions to be inserted in all subcontracts relative to the WORK to bind SUBCONTRACTORS to the CONTRACTOR by the terms of the CONTRACT DOCUMENTS insofar as applicable to the WORK of SUBCONTRACTORS, and to give the CONTRACTOR the same power as regards terminating any subcontract that the OWNER may exercise over the CONTRACTOR under any provision of the CONTRACT DOCUMENTS.
- 26.5** Nothing contained in the CONTRACT DOCUMENTS will create any contractual relationship between any SUBCONTRACTOR or material supplier and the OWNER.

## **27. LAND AND RIGHTS-OF-WAY**

- 27.1** Prior to issuance of NOTICE TO PROCEED, the OWNER will obtain all land and rights-of-way necessary for carrying out and for the completion of the WORK to be performed pursuant to the CONTRACT DOCUMENTS, unless otherwise mutually agreed.
- 27.2** The OWNER will provide to the CONTRACTOR information which delineates and describes the lands owned and rights-of-way acquired.
- 27.3** The CONTRACTOR shall provide at the CONTRACTOR'S own expense and without liability to the OWNER any additional land and access thereto that

the CONTRACTOR may desire for temporary construction facilities, or for storage of materials.

## **28. GUARANTY**

**28.1** The CONTRACTOR shall guarantee all materials and equipment furnished and WORK performed for a period of one (1) year from the date of SUBSTANTIAL COMPLETION. The CONTRACTOR warrants and guarantees, for a period of one (1) year from the date of SUBSTANTIAL COMPLETION of the system and PROJECT, that the completed system and PROJECT are free from all defects due to faulty materials or workmanship, and the CONTRACTOR shall promptly make such corrections as may be necessary by reason of such defects, including the repairs of any damage to other parts of the system or PROJECT resulting from such defects. The OWNER will give notice of observed defects with reasonable promptness. In the event that the CONTRACTOR should fail to make such repairs, adjustments, or other WORK that may be made necessary by such defects, the OWNER may do so and charge the CONTRACTOR the cost thereby incurred. The Performance BOND shall remain in full effect throughout the guarantee period.

## **29. TAXES**

**29.1** The CONTRACTOR shall pay all sales, consumer, use and other similar taxes required by the law of the place where the WORK is performed.

## **30. ENGINEER'S RESPONSIBILITIES**

**30.1** The ENGINEER will act as the OWNER'S representative during the construction period. The ENGINEER will jointly decide with the OWNER questions which may arise as to quality and acceptability of materials furnished and WORK performed. The ENGINEER and the OWNER will jointly interpret the intent of the CONTRACT DOCUMENTS in a fair and unbiased manner. The ENGINEER or OWNER will make visits to the site and determine if the WORK is proceeding in accordance with the CONTRACT DOCUMENTS.

**30.2** The CONTRACTOR will be held strictly to the intent of the CONTRACT DOCUMENTS in regard to the quality of materials, workmanship, and execution of the WORK. Inspections may be made at the factory or fabrication plant of the source of material supply.

- 30.3 The ENGINEER will not be responsible for the construction means, controls, techniques, sequences, procedures, or construction safety.
- 30.4 The ENGINEER and OWNER will jointly make prompt decisions relative to interpretation of the CONTRACT DOCUMENTS.

**END OF DOCUMENT**

SUPPLEMENTARY CONDITIONS  
Section 00800

**MODIFICATIONS TO GENERAL CONDITIONS- Section 00810**

ARTICLE 11 - INSURANCE AND BONDS

1 Subparagraph 11.1.1, add the following sentence:

The amount of such insurance shall be not less than the following or any limits required by law.

2 Subparagraph 11.1.2, add the following clause:

11.1.2.2 Worker's Compensation:

- A. State: Statutory
- B. Applicable Federal Statutory
- C. Employer's Liability \$ 100,000.00 per Accident  
\$ 500,000.00 Disease, Policy Limit  
\$1,000.00 Disease, each Employee

3 Subparagraph 11.1.3, add the following clause:

11.1.3.2 Comprehensive General Liability

- General Aggregate: \$ 1,000,000.00
- Completed Operations to be maintained for one year after final payment:  
\$ 1,000,000.00 Aggregate
- Personal Injury \$ 1,000,000.00 Each Occurrence
- Each Occurrence Limit \$ 1,000,000.00 Each Occurrence
- Automobile Liability (including owned, non-owned, and hired vehicles) \$  
1,000,000.00 Combined Single Limit
- Umbrella Excess Liability \$ 1,000,000.00

4 Subparagraph 11.1.4, add the following clause:

- Owner's and Contractor's Protection Liability \$ 1,000,000.00 Combined Single  
Limit

END OF DOCUMENT

SECTION 01010  
SUMMARY OF WORK

## PART 1 - GENERAL

## 1.01 SCOPE:

- A. The scope of this project is to provide complete "turn key" replacement of the boiler systems at The Center at Bishop Park for the City of Bryant.

## 1.02 DESCRIPTION OF WORK

- A. The replacement of the boiler systems described in these project documents shall include all materials (e.g., boilers, pumps, piping, valves, insulation, disconnects, wiring, etc.), labor, controls, electrical, etc. to complete the work outlined herein, and additive alternate pricing shall be included to replace the domestic water heating in the facility, as well.
- B. In general, these pricing and construction documents are written for a mechanical contractor to price and perform all of the work included. This shall include obtaining pricing from the owner's controls contractor, Commercial Air, for modifying, adding, or extending controls to the new and replaced systems. The mechanical contractor shall obtain and coordinate the work of a qualified, commercially licensed & insured electrical contractor to perform the work specified herein as required to disconnect & modify electrical circuits for reconnection to systems replaced and to add circuits as required for any new systems included herein. The contractors shall coordinate with the Owner to contact the Owner's water treatment company, and the contractors shall include pricing in their work to adjust and maintain treatment in the heating water system during and after installation to maintain operability of the system.
- C. The Contractors shall utilize the schedules, equipment specifications, and general specifications documents to guide them for pricing and installation of the work. Submittals for equipment specified in these documents shall be submitted to the Engineer for approval. Substitutions of any equipment specified herein is not allowed without the express written consent from the Engineer of Record for this work. Any questions pertaining to these documents may be addressed to the Engineer of Record, David N. Yarbrough, PE, W.H. Grant & Associates, Inc., Consulting Engineers, P.O. Box 242523, Little Rock, AR 72223, (501) 529-2006, [david@whgrantengineering.com](mailto:david@whgrantengineering.com)

## 1.03 CONTRACTOR USE OF THE PREMICES

- A. Confine operations at the site to areas permitted under Contract.



1. Keep existing driveways and entrances serving premises clear and available to Owner and his employees at all times. Do not use these areas for parking or storage of materials.
  2. Lock automotive type vehicles, such as passenger cars and trucks and other mechanized or motorized construction equipment, when parked and unattended, to prevent unauthorized use. Do not leave vehicles or equipment unattended with motor running or ignition key in place.
  3. Coordinate all work schedule with the City of Bryant and with understanding that this building is in use and safety for the public is the highest priority.
- B. Smoking and other tobacco products will not be permitted within building enclosures or within legal distances of confined spaces.
- C. Open fires will not be permitted on premises.

#### 1.04 INDUSTRY STANDARDS

- A. Applicability of Standards: Except where more explicit or stringent requirements are written into the contract documents, applicable construction industry standards have the same force and effect as if bound into or copied directly into contract documents. Such industry standards are made a part of the contract documents by reference. Individual specification sections indicate which codes and standards the Contractor must keep available at project site for reference.
- B. Conflicting Requirements: Where compliance with two or more standards is specified, and where these standards establish different or conflicting requirements for minimum quantities or quality levels, the most stringent requirement will be enforced, unless the contract documents specifically indicate otherwise. Refer requirements that are different, but apparently equal, and uncertainties as to which quality level is more stringent to the Engineer for a decision before proceeding.
- C. Copies of Standards: The Contract Documents require that each entity performing work be experienced in that part of the work being performed. Each entity is also required to be familiar with industry standards applicable to that part of the work. Copies of applicable standards are not bound with the contract documents. Where copies of standard are needed for proper performance of the work, the Contractor is required to obtain such copies directly from the publication source.

- D. Abbreviations and Names: Trade association names and titles of general standards are frequently abbreviated. Where acronyms or abbreviations are used in the specifications or other contract documents they are defined to mean the recognized name of the trade association, standards generating organization, governing authority, or other entity applicable to the context of the text provisions.

#### 1.05 PROJECT MEETINGS

- A. Pre-Construction Meeting: Within 15 days after execution of agreement between the owner and the contractor, the Engineer will prepare an agenda and schedule a pre-construction meeting. Written notice of meeting date, time and place and agenda items will be sent to the Owner, Contractor. The Contractor shall be responsible for notifying major subcontractors of meeting.
- B. Progress Meetings: The Contractor shall schedule and hold regular (as deemed necessary) progress meetings to coordinate, expedite and schedule work of all contracts.

SECTION 01300  
SUBMITTALS AND SUBSTITUTIONS

PART 1 - GENERAL

- 1.01 SCOPE: Provide all submittals, including shop drawings, product data, samples, schedules and requests for substitutions as required by the bidding and contract documents in strict accordance with the provisions of this section.
- 1.02 RELATED WORK SPECIFIED IN OTHER SECTIONS:
  - A. Contractual Requirements for Submittals: General Conditions and Supplementary Conditions.
  - B. Detailed Individual Submittals Required are covered in pertinent sections of these specifications.

PART 2 - PRODUCTS

- 2.01 SUBSTITUTIONS:
  - A. Prior to bidding approval is required only on those items so specified in each section. Other materials do not require prior to bidding approval.
  - B. After Award of Contract substitution Requests:
    - 1. Substitution requests will be considered only under one of the following conditions:
      - a. Unavailability of specified product due to a strike, lockout, bankruptcy, discontinuance of the manufacture of a product or natural disasters. Submit proof that orders were placed within ten days after review by the ENGINEER of the item listed in the specifications. Failure to order materials in time for proper delivery is not an acceptable condition.
      - b. When guarantee of performance is required and, in the judgment of the contractor, the specified product or process will not produce the desired result.
    - 2. Submit request for such substitutions in writing to the ENGINEER within ten days of the date of ascertaining unavailability of material or equipment specified, or that the performance cannot be guaranteed.
    - 3. If any substitution will affect a correlated function, adjacent construction or the work of other trades or contractors, the necessary changes and modifications to the affected work will be considered as part of the substitution, to be accomplished without additional cost to the Owner, if and when accepted.
    - 4. Approved substitutions will be affected by a change order. Under no circumstances shall the ENGINEER's acceptance of any such substitution relieve the contractor from timely, full and proper performance of the work.
  - C. No substitutes allowed: Some materials specified are the only acceptable products allowed. No substitutions will be allowed. These products are identified by a no-substitution clause in that section of this specification.

## 2.02 SHOP DRAWINGS:

- A. Submit required shop drawings drawn to a scale sufficiently large to show all pertinent features of the item and its method of connection to the work. Submit related shop drawings together, partial submittals will not be accepted. Provide manufacturer's name and model number of prefabricated items and indicated methods of attachment and clearances required relative to other trades affecting all elements of the work. Identify deviations from the contract documents (if any). Check dimensions, check that trades have been coordinated and that no conflict will develop in this installation. After reviewing the shop drawings, indicate contractor's approval by signing and dating on contractor's stamp. Failure to follow these procedures will result in rejection of the submission and no additional contract time will be allowed for the delay from this cause.
- B. Submit one transparency and one print of contractor's stamped and approved shop drawings for ENGINEER's review. The ENGINEER will review the transparency and stamp it with indication of action as appropriate. The ENGINEER will retain the print for his record, and will return the transparency to the Contractor. For transparencies returned "Return for Correction - Re-Submit" correct the original drawings, make a new transparency reproduction and print, and re-submit. For transparencies returned "Approved Subject to Contract Requirements" or "Approved as Noted", provide each number of prints of the transparency as may be needed for field distribution.

2.03 PRODUCT DATA AND SAMPLES: Submit a minimum of 3 copies of product data for ENGINEER's review for items specified in the various specification sections (five copies required for mechanical and electrical data). Make all submissions affecting color selection within thirty days after signing the contract. Mark data clearly to indicate exact items submitted, and note deviations from contract documents (if any). After reviewing the submittals, indicate approval by signing and dating on contractor's stamp, and submit to the ENGINEER for review.

## 2.04 PROJECT SCHEDULE:

- A. Within 7 days after Notice to Proceed, submit to the ENGINEER a bar chart type progress schedule indicating a time bar for each trade or operation of work to be performed at the site. Time bar shall demonstrate planned work, properly sequenced and intermeshed for expeditious completion of work. Identify phases, if required.
- B. Submit with bar chart a tabulation (by date) of all submittals required, either by date period relation in contract documents or as necessitated by lead time related to individual time bar shown on progress schedule for the associated work. At contractor's option, submittal dates may be shown on bar chart schedule, in lieu of being tabulated.
- C. Submit monthly updates of bar chart accurately depicting actual progress to the first day of the month. Indicate percentage of completion on time bars at 10% increase.
- D. Submit progress schedule on transparency or other reproducible stock.
- E. Distribute progress schedule including all updates to ENGINEER, Owner, subcontractors, suppliers, fabricators, and others with a need to know schedule compliance requirements. Post copy in field office.

- 2.05 SCHEDULE OF VALUES: Submit schedule of values on AIA Document G703 (Continuation Sheet for G702). Itemize separate line cost for each major item of work and each subcontracted item of work (use Sections under Division 2 through 16 in Table of Contents as a basis for listed).
- 2.06 APPLICATION AND CERTIFICATION FOR PAYMENT: Submit Application and Certificate for Payment on AIA Document G702 and G703 (4/78 edition).
- 2.07 CHANGE ORDERS: Submit standard form provided by ENGINEER for submitting proposals for Change Orders.
- 2.08 MANUAL: Upon completion of work, and prior to the final payment, submit to the ENGINEER a loose leaf hard cover binder with the project name printed on it, containing five indexed sections as follows:
- A. Subcontractors; A listing of all subcontractors for the project, including portions of work done, address and telephone number of the firm familiar with the project.
  - B. Guarantee and Warranty: One fully executed copy of each guarantee and warranty period.
  - C. Certificates: One fully executed copy of each certificate specified.
  - D. Instructions: One operating service and maintenance manual or instruction sheet for each item specified.
  - E. List of As-Built Drawings, Record Drawings, Shop Drawings, Product Data and Samples.
- 2.09 DRAWINGS AND SUBMITTALS PACKAGE: Upon completion of the work and prior to the final payment, submit to the ENGINEER a package labeled with the project name and containing one copy of all final record drawings, specifications, shop drawings, product data and samples (see AIA A201, Paragraph 4.111.). This package and the manual will be presented by the ENGINEER to the Owner upon completion of the project. In addition, submit one set of record drawings to be retained by the ENGINEER.

### PART 3 - EXECUTION

- 3.01 IDENTIFICATION OF SUBMITTALS: Completely identify each submittal and re-submittal by showing at least the following information.
- A. Name and address of submitter, plus name and telephone number of the individual who may be contracted for further information.
  - B. Name of project as it appears on each page of these specifications.
  - C. Drawing number and specifications section number to which the submittal applies.
  - D. Whether this is an original submittal or resubmittal.
- 3.02. TIMING OF SUBMITTALS
- A. General: Make all submittals far enough in advance of scheduled dates of installation to provide all required time for reviews, for securing necessary approvals, for possible revision and re-submittal and for placing orders and securing delivery.

- B. Delays: Costs of delays due to late submittals may be back charged as necessary and shall not be borne by the Owner.

END OF SECTION 01300

SECTION 01700  
CONTRACT CLOSEOUT

PART 1 GENERAL

1.01 REQUIREMENTS INCLUDE:

- A. Closeout procedures
- B. Final cleaning of rooftop, building and grounds
- C. Manufacturer's and Contractor's warranties

1.02 RELATED REQUIREMENTS:

- A. Sections 15010 and 16010

1.03 CLOSEOUT PROCEDURES

- A. When the contractor considers the work has reached final completion, submit written certification that Contract Documents have been reviewed, the work has been inspected and that work is complete in accordance with Contract Documents.
- B. In addition to submittals required by the conditions of the Contract, provide submittals required by governing authorities, and submit a final statement of accounting, giving total adjusted Contract Sum, previous payments and sum remaining due. Submit required documentation the ENGINEER (Release of Lien, Consent of Surety for Final Payment- if contract amount is over \$20,000).

1.04 FINAL CLEANING OF ROOFTOP, BUILDING AND GROUNDS

- A. Execute prior to final inspection.

1.05 MANUFACTURER'S AND CONTRACTOR'S WARRANTIES:

- A. Submit all written (original) to the ENGINEER, for approval and distribution, prior to final application for payment.

END OF SECTION

SECTION 15010 – BASIC MECHANICAL REQUIREMENTS

PART 1 – GENERAL

1. GENERAL CONDITIONS

The General conditions, Supplementary General Conditions, Information to Bidders, Division A and all other pertinent documents issued by the Architect, are a part of these specifications and shall be complied with in every respect.

2. SCOPE AND CONDITIONS OF WORK

The mechanical work consists of furnishing all labor and materials, and performing all operations necessary in the installation of the mechanical systems in accordance with the Drawings and Specifications. In case of conflict between the Mechanical Drawings and Specifications the most stringent shall govern. In case of conflict between this section and other sections of Division 15 (Mechanical) the most stringent shall govern.

3. SPECIAL INSPECTION

The Architect will inspect the piping systems, duct systems and equipment systems when they are ready for testing. The Mechanical Contractor shall notify the Architect 24 hours prior to this time so that the Architect can make inspection and give approval of or indicate corrective action before systems are concealed.

4. PAINTING

Unless otherwise specified, job finish painting will be done by the General Contractor, and mechanical equipment shall be baked enamel finish. The Mechanical Contractor shall restore damaged painted surfaces of mechanical equipment to its original condition.

5. CODES AND STANDARDS

Materials and workmanship shall comply with the Contract Documents and applicable codes and standards. If applicable codes and standards and the Contract Documents differ, the Contractor shall promptly notify the Architect in writing of such difference. If the Contractor performs any work that does not comply with the requirements of applicable codes and standards, he shall bear all costs in correcting such defect. Applicable codes and standards shall include all state laws, local ordinances, utility company regulations and applicable requirements of nationally accepted codes and standards. All pressure vessels, including hot water storage containers, shall be constructed in compliance with the rules and regulations of the Boiler Inspection Division of the State of Arkansas, and installation of such equipment shall be made by firms licensed by the Boiler Inspection Division. Where



required, duct, piping, mechanical systems, equipment, and support systems shall be installed in accordance with Arkansas Act 1100 of 1991 for earthquake resistant design.

6. COORDINATION OF WORK

- A. The Mechanical Drawings show the general arrangement of piping, equipment and appurtenances, and shall be followed as closely as practicable. The Mechanical work shall conform to the requirements shown on all of the drawings. General and Structural Drawings shall take precedence over Mechanical Drawings. It is not practical to indicate all offsets, fittings, and accessories required. The Contractor shall study the structural and finish conditions affecting the work, and arrange his work accordingly, providing fittings, valves, and accessories required. The Contractor shall study the structural and finish conditions affecting the work, and arrange his work accordingly, providing fittings, valves, and accessories required to meet such conditions.
- B. The Contractor shall compare the Mechanical Drawings and Specifications with the Drawings and Specifications for other trades and report any discrepancies between them to the Architect and obtain from him written instructions for changes necessary in the Mechanical work. The Mechanical work shall be installed in cooperation with other trades installing interrelated work. Before installation, the Contractor shall make proper provisions to avoid interferences. Changes required in the work of the contractor caused by his neglect to do so shall be made by him at his own expense.
- C. Anchor bolts, sleeves, inserts, and supports for the Mechanical work shall be furnished and installed by the Mechanical Contractor.
- D. Slots, chases, openings and recesses through floors, walls, ceilings and roofs in new construction will be provided by the various trades in their respective materials, but the trade requiring them shall see that they are properly located and shall do any cutting and pay for any patching caused by the neglect to do so.
- E. Locations of pipes, ducts, equipment, fixtures, etc., shall be adjusted to accommodate the work to interferences anticipated and encountered. The contractor shall determine the exact route and location of each pipe and duct prior to fabrication.
- F. Lines that pitch shall have the right of way over those which do not pitch. For example, plumbing drains shall normally have right of way. Lines whose elevations cannot be changed shall have the right of way over lines whose elevations can be changed.

- G. Transitions and changes in direction in pipe and ducts shall be made as required to maintain proper head room and pitch of sloping lines. The contractor shall furnish and install traps, air vents, sanitary vents, etc., required to effect these offsets and changed in directions.
- H. The contractor shall provide access panels in walls, ceilings, equipment, ducts, etc., as required for inspection of interiors and for proper maintenance.

7. FEES, PERMITS, AND INSPECTION

Fees, permits, and inspections shall be obtained and paid for by the Contractor under the section of the Specifications for which they are required. The Contractor shall furnish a certificate of final inspection to the Architect from the inspection department having jurisdiction.

8. EQUIPMENT AND MATERIALS

- A. Materials shall be new and bear the manufacturer's name, trademark, and the UL label in every case where a standard has been established for the particular material. Equipment shall be the standard product of a manufacturer regularly engaged in the production of that type of equipment, and shall be the manufacturer's latest approved design.
- B. Equipment shall be protected against moisture, dirt, damage and theft. Fixtures, equipment and materials shall be cleaned and polished and turned over to the owner in a condition satisfactory to the Architect. Rusted surfaces shall be refinished.
- C. The contractor shall make field measurements to ascertain space requirements, including those for connections, and shall furnish and install such sizes and shapes of equipment that the final installation shall suit the intent of the Drawings and Specifications.
- D. Manufacturer's directions shall be followed in the delivery, storage, protection and installation of equipment and materials. The contractor shall promptly notify the Architect in writing of any conflict between any requirement of the Contract Documents and the manufacturer's directions, and shall obtain the Architect's written instruction before proceeding with the work. Should the Contractor perform any work that does not comply with the manufacturer's directions or such written instructions from the Architect, he shall bear all cost arising in correcting deficiencies.

9. EQUIPMENT ACCESSORIES

- A. The Contractor shall furnish and install equipment, accessories, connections, and incidental items necessary to complete the work, ready for use, occupancy and operation by the Owner.
- B. Where equipment requiring different arrangement or connections from those shown is approved, it shall be the responsibility of the Contractor to install the equipment to operate properly. He shall provide additional motors, controllers, supports, bases, valves, fittings, and other equipment, including required changes in affected trades. The contractor shall be responsible for the proper location of rough-ins and connections by other trades. All changes shall be made at no increase in the Contract amount or additional costs to other trades.
- C. The contractor shall support work and equipment plumb, rigid, and true to line. The Contractor shall study the General, Structural, Mechanical and Electrical Drawings, shop drawings, and catalog data to determine how equipment, fixtures, piping, ductwork, etc., are to be installed. The Contractor shall provide bolts, inserts, pipe stands, brackets, and accessories for proper support. When directed, the Contractor shall submit drawings showing supports for approval.

#### 10. CUTTING AND PATCHING

- A. The contractor shall be responsible for digging, cutting, etc., incident to his work, and shall make repairs thereafter to the satisfaction of the Architect, but no structural element, beam or column shall be cut without the written approval of the Architect.
- B. Pavements, sidewalks, roads, and curbs shall be cut, patched, repaired and/or replaced as required to permit the installation of underground work of the various trades and such cutting, patching, repairing and replacing shall be the responsibility of, and paid for by, the Contractor under the section of the Specifications of the trade requiring the work.
- C. Each trade shall bear the expense of cutting, patching, repairing or replacing of the work of other trades required because of his fault, error, or tardiness.

#### 11. EXCAVATION AND BACKFILLING

- A. Separate trenches shall be provided for each utility or service to the building unless otherwise noted or approved. All excavations shall be made by open cut. Banks of trenches shall be kept as nearly vertical as practicable, and trenches over 5 feet deep (and where required) shall be properly sheeted and braced.
- B. Water shall be removed as necessary to fully protect workmen and adjacent structures, and to permit proper installation of work. Under no circumstances shall pipe be laid or appurtenances installed in water; trenches shall be kept free from water until pipe joint material has hardened. Presence of ground

water in soil or necessity of sheeting or bracing trenches shall not constitute a condition for which any increase may be made in contract price. Sheeting left in place shall be cut off not less than two feet below finished grade.

- C. Material to be excavated shall be unclassified, and shall include all earth or other material encountered. Contract shall include removal of all such materials to depth and extent as required.
- D. Trenches shall be graded evenly on bottom to insure uniform bearing for full length of pipe. Bell holes shall be cut for joint making. Where bottom of trench is rock, cement, gravel or other similar hard materials, trench shall be excavated to an overdepth of at least three inches below trench depth otherwise required. Overdepth in the excavation shall be filled with firmly compacted sand or fine gravel, or with concrete.
- E. Trenches shall not be backfilled until all required tests have been performed and section tested meets requirements as specified herein. Trenches shall be carefully backfilled with excavated materials consisting of earth, loam, sandy clay, sand and gravel, soft shale, or other approved materials free from large clods of earth or stone, deposited in thoroughly compacted six-inch layers, loose thickness, until pipe has a cover of not less than one foot. Remainder of pipe shall be backfilled and compacted thoroughly with a runner of suitable weight, or with an approved mechanical tamper or if backfill material is granular, settling with water will be permissible. Areas which are subsequently to receive pavements, walks, or other surfacing shall be tamped solidly in layers not to exceed six inches loose thickness. Along all portions of trenches, except areas to receive pavements, walks, or other surfacing, ground shall be graded to a reasonable uniformity and mounding over the trenches left in a uniform and neat condition. Trenches under floor slabs shall be backfilled and compacted as directed by the Architect.

## 12. GENERAL PIPING INSTALLATION

- A. The Contractor shall furnish and install a complete system of piping, valved as indicated and necessary to control the entire apparatus and appurtenances. The piping drawings are diagrammatic and indicate the general location and connections.
- B. Piping shall be properly supported, and adequate provisions made for expansion, contraction, slope and anchorage. Piping shall be cut accurately for fabrication to the measurements taken at the site, and shall be worked into place without springing or farcing, clearing windows, doors, and other openings and equipment. Pipes shall have burr and cutting slag removed by reaming or other cleaning methods.

- C. Piping shall be arranged to permit removal of equipment, access to openings, removal of coils, filters, etc., so that there will be no interference with the installation of equipment, ducts, etc., and to insure noiseless circulation. Valves and specialties shall be placed to permit easy operation and access, and valves shall be regulated, packed and glands adjusted so as to avoid liquid or air pockets. Eccentric reducers shall be used where changes in pipe sizes occur, and the reducers shall be located approximately 18" beyond the nearest upstream branch. Expansion and contraction of piping shall be provided by expansion loops, bends, and/or expansion joints to prevent injury to connections, piping, equipment or the building.
- D. Minimum slope of piping shall be in accordance with the following, unless otherwise required:
  - 1. Waste and vent piping  $\frac{1}{4}$ " per foot.
  - 2. Main building sewer and storm sewer, 4" and larger.  $\frac{1}{8}$ " per foot (Minimum).
  - 3. Water piping (where practical). 1" in 40 ft. to drain points.
- E. Unions or flanges shall be installed on bypasses, ahead of traps, and at all equipment connections to permit removal of equipment.
- F. Sleeves shall be provided around pipes passing through walls, floors, ceilings, partitions, structural members or other building parts. Sleeves through floors or walls below grade and exterior walls shall be schedule 40 galvanized iron pipes two sizes larger than the pipe or insulation, so that pipe or insulation shall pass through freely with space for movement. Sleeves through floors shall be extended  $\frac{1}{4}$ ' above floor finish in toilets or in rooms where domestic water is used. In other rooms, sleeves shall be flush with the floor. Sleeves through outside walls and floor shall be sealed with Non-Asbestos fireproof and watertight packing. Sleeves through inside walls and floors above grade may be 18-gauge galvanized steel.
- G. Plates: Spring clamp plates (escutcheons) shall be provided where pipes are exposed through walls, floors, or ceilings, except in concealed spaces. Plates shall be chrome-plated spun brass, set tight on the pipe and to the building surface.
- H. Flashing: Piping passing through new built-up roof shall be flashed with a square sheet of 4-pound soft lead or 16 oz. Copper extended to the top of pipe and turned over top and into pipe  $\frac{1}{2}$ " or extended to flashing collar where pipe continues beyond roof.

Flashings through metal building roofs and existing roofs shall be as directed by the Architect.

- I. Protection: Ends of pipes and equipment shall be capped to keep foreign matter out of the system. Plugs of rags, waste, or similar materials shall not be used.
- J. Hangers and Supports: Pipe hooks, chains or perforated iron shall not be used for pipe support. Hangers shall be attached to floor inserts or expansion shields.
  - 1. Hangers, support rods, and other support accessories for bare copper tubing shall be copper plated.
  - 2. Vertical Piping: Riser clamps shall be placed at each floor and at each coupling or fitting. Clamps shall be supported by structural members which are supported directly from the building structure. Clamps for bare copper tubing shall be copper plated.
- K. Cleaning: Remove dirt, grease, and other foreign matter from pipe before making connections.
- L. Installation of Underground Pipe: Each pipe shall be laid true to line and grade and in such manner as to form a close concentric joint with adjoining pipe and to prevent sudden offset to flow line.
- M. Pipe Sizes: If pipe sizes are not clearly evident, the Contractor shall request instructions as to proper sizing. Changes resulting from the Contractor's failure to request clarification shall be at his own expense.
- N. Pressure Regulators: Where water supply pressure can exceed 75 psi, the Contractor shall install two (2) pressure-reducing valves sized for 1/3 and 2/3 flow to maintain a maximum of 75 psi.

### 13. ELECTRICAL WIRING

- A. Electrical wiring for mechanical equipment is separated into two main wiring divisions: "Power Wiring" and "Control Wiring."
  - 1. Power Wiring – Shall be the energy source and includes circuit protective devices, motor starters or controllers, conduit, wiring and safety disconnects beginning at the Power Supply and terminating at the motor or terminals on equipment.
  - 2. Control Wiring – Comprises conduit and wiring not included in power wiring, including automatic temperature control wiring, interlock wiring, pilot light and signal wiring, etc., that is not included as part of prewired equipment, but necessary for the proper operation and safety of the equipment.

- B. Unless otherwise noted, Power wiring shall be done by the Electrical Contractor under the supervision of the equipment supplier, and Control Wiring shall be done by the Contractor furnishing the equipment. All wiring shall be done in compliance with the Electrical Division (Division 16) of these Specifications.

14. MOTOR AND EQUIPMENT CONTROL

- A. Each motor, electrical equipment or group of motors and equipment shall be provided with starters and pilot devices that will perform the functions as specified. Starters and pilot devices shall conform to NEMA Standard LCL and UL Standard for Industrial Control Equipment.
- B. Manual Starter shall be provided for manually started single phase motors under ½ horsepower or as noted on the Drawings. Starters shall be single or two pole with selector switches, push button, pilot lights and interlocking attachments are required. Contactors may be used in lieu of manual starter if motor has integral overload protections.
- C. Magnetic starters shall be provided for motors ½ horsepower and larger, and motors started by pilot devices. Starters shall have necessary control devices in cover, three interlocking contacts, and low-voltage protection.
- D. Starters shall have overload relays in all ungrounded conductors. Overload relays shall be sized to protect the motor with consideration given to ambient temperature of the motor and controller.
- E. Starters, pushbutton stations, selector switches, pilot lights, relays, automatic temperature controllers, safety devices, solenoids, and similar devices that are not a part of a motor control center or switchgear, shall be furnished and installed by the Contractor furnishing the equipment, except starters and contactors in individual enclosures shall be furnished to the Electrical Contractor for his installation.
- F. Starters, pilot lights, contactors, pushbuttons, and similar devices located in finished spaces shall be flush-mounted and surface-painted to match surrounding finish.
- G. Inverter Duty Motors operated by Variable Frequency Drives (VFD). Where VFDs are not specified to be provided with the equipment in the contract drawings, schedules, or specifications, it shall be the control contractor's responsibility to provide VFDs where required. If the mechanical contractor also provides controls for the project, then the mechanical contractor shall provide VFDs where required. Coordinate with electrical for required circuits, overcurrent protection, and disconnects for VFDs.

15. ELECTRICAL MOTORS

- A. Motors shall be of recognized American manufacturer and shall conform to latest standards of manufacture and performance of NEMA and AIEE. Motors shall be highest efficiency and shall meet the current energy code requirements.
- B. Motors shall be rated for continuous duty at 100 percent of rated capacity, and temperature rise shall be 40 degrees C open type: 50 degrees C drip and splash proof: 55 degrees C explosion proof and totally enclosed, above an ambient of 40 degrees C.
- C. Unless otherwise required, integral horsepower polyphase motors shall be Class B, general purpose, squirrel cage, open type induction motors.
- D. Motors ½ horsepower or less shall have integral overcurrent protection.
- E. Motors 10 horsepower and above shall have positive temperature coefficient thermistors embedded in the phase windings of the motor. 120 mechanical degrees part. P.T.C. thermistors, or Westinghouse Guardistor.
- F. Motors inside building or suitable housing shall be open type drip-proof. Motors exposed to weather shall be totally enclosed. Fan-cooled. Motors in hazardous locations of duty shall be explosion proof of the type required for the service.

16. AIR BALANCE (BY INDEPENDENT CONTRACTOR)

- A. All air quantities shall, after completion of the job, be adjusted to provide air quantities shown on plans. After complete adjustment, additional re-adjustment shall be performed to satisfy desired temperature. All measurements during setting operations shall be made by means of the "Velometer" or "Anemometer" method. Instruments used for check of air quantities shall have recent certification of correctness.

In order to be considered to be qualified, Independent Air Balance Contractor shall submit evidence of qualifications as follows:

- a. Resume of firms experience in air balance representing a minimum of two (2) years as an Air Balance Contractor. Resume shall include a list of air balance projects within the last five (5) years.
- b. Resume of air Balance Technician(s) to be used on the project, including list of major air balance projects within the last five (5) years. Minimum acceptable experience shall be three (3) years as Air Balance Technician and five (5) projects similar in size and complexity.
- c. Evidence of certification of calibration of equipment.



17. NOISE CONTROL

It is intended that the mechanical system as installed under this contract be free from objectionable noise when the system is operating, Isolate equipment, pipelines, ductwork, etc., as directed so as to insure an acceptable noise level in all of the mechanical systems.

18. CLEANING AND REPAIR

Do not allow waste material and rubbish to accumulate in or about the premises. After completion of this work, remove rubbish, tools, scaffolding and surplus materials from and about the building and leave all work clean and ready for use. Clean all equipment, pipes, valves and fittings, of grease, metal cuttings and sludge. Repair any stoppage, discoloration or other damage to parts of the building, its finish or furnishings due to failure to properly clean the mechanical systems, without additional cost to the Owner.

19. SYSTEM OPERATING TESTS

For start-up of equipment, the Contractor shall balance circulating or water, air and other fluids to provide proper quantities to spaces or items of equipment. He shall adjust valves, dampers, and similar items to insure that the Mechanical systems perform as intended. A report shall be provided containing a summary of all tests. After the successful completion of all equipment start-up and test requirements, perform the following tests on the complete mechanical systems:

- A. First Operating Test by contractor: Prove the operation of the mechanical systems and of each individual item in the systems. Give at least 10 days' notice to the Engineer of such tests. Should any item of the systems fail to perform in an approved manner, repeat this test until approved by the Engineer.
- B. Checking by Owner and Engineer: Following the successful completion of first operating tests by the Contractor, the Owner and the Engineer have the privilege of making such tests as they may desire during a period of three weeks to ascertain in detail if any corrections are to be made to the system. At the end of the testing by the Owner and the Engineer, the Engineer may direct the Contractor in writing to make such corrections to the systems as are within the scope of the contract.
- C. Contractor's Corrections to Systems: Make all required corrections to the systems and notify the Engineer in writing that the corrections outlined have been completed. Give at least seven (7) days' notice of a final three-day operating test.
- D. Three-Day Operating Test: Perform an operating test to the satisfaction of the Engineer for a period of three (3) days. Should any element of the systems not perform properly, make all required corrections and repeat three day test until successfully performed.

- a. Submit the Form of record proposed by the Contractor for the recording of all measurements to the Engineer for approval at least two weeks before the approved form will be required by the Contractor.
- b. Measurements: Make the following measurements at two-hour intervals (5 measurements per 8-hour day) during the three-day operating test.
  - (1) Electrical: Running amperes and voltage of each motor 3/4 horsepower or larger.
  - (2) Water pressures at each pump suction and discharge.
  - (3) Air temperatures in each heated or air conditioned space and outdoor temperatures.
- c. Instruments: Provide all instruments, materials and labor to perform the tests and to obtain and record the measurements specified herein, including the furnishing of all required record forms as approved by the Engineer. Submit for the Engineer's Approval, complete shop drawings or catalog data for all instruments to be used for the three-day operating test and obtain approval at least two weeks before the instruments will be required for test measurements.
- d. Report: Submit four (4) copies of a written report of the three-day operating test on the approved form of record to the Engineer for approval and subsequent transmittal to the Owner.

20. ACCESS PANELS

Provide access panels as required and in all walls, ceilings and ductwork to service and have access to all valves, operating parts and duct mounted fire dampers. For all ceiling and wall access doors that are required in gypsum board and plaster, provide 24" X 24" Milcor type appropriate for the construction involved.

21. TEMPORARY HEAT OR COOLING

1. Do not use the permanent heating or cooling systems as a temporary source of heat, cooling, or dehumidification during construction. When the building is substantially complete and only after approval of the Owner may the permanent building heating systems be utilized.
2. Do not turn water into the system until the systems have been thoroughly cleaned and approved by the Engineer.

22. INSTRUCTIONS OF OWNER'S REPRESENTATIVE:

The Contractor shall instruct the representatives of the Owner in the operation and maintenance of the Mechanical system.

23. SUBMITTALS:

The Contractor shall submit within thirty days after the awarding of the contract, six brochures of descriptive data of proposed material and equipment. Failure by the Contractor to comply shall make him liable for the expense of delays and changes in construction. If the Contractor fails to comply, the Architect may go directly to the manufacturer and obtain details necessary. Cost of changes in connection with this procedure shall be borne by the Contractor. Thermofax or electronic copies are not acceptable; only permanent-type prints will be allowed. Submittals shall designate the exact item offered. Submittals shall not cover detailed installation drawings prepared for the Contractor's own use, but shall be limited to necessary departures from the Contract Drawings.

24. SUBSTITUTION OF MATERIALS:

Competition is requested and where a definite material or equipment is specified, it is not the intent to discriminate against any "approved equal" product. However, no substitution shall be made unless authorized in writing by the Architect.

25. UTILITIES LOCATION

Location and elevations of utilities are offered as a guide only, without guarantee as to accuracy. The contractor shall verify location and elevation of utilities and their relation to the work with the Owner before starting any work.

26. GUARANTEE

The Contractor shall guarantee his materials, equipment, and labor to be free of defects for one year from date of final acceptance, and should any defects appear within this period, the defect will be replaced or repaired without additional expense to the Owner. This guarantee shall include the replacement of drive belts, bearings, seals, and other similar items whose improper installation, or lack of attention could be cause for failure within the one-year period. This guarantee does not include the replacement of air filters, lamps or similar expendable items.

27. RECORD DRAWINGS

The Mechanical Contractor shall prepare record drawings to be delivered to the Architect prior to final acceptance. These drawings shall show systems as installed, including location, medium conveyed, pipe size, pipe material of all underground lines.

Also, shown location, size, medium conveyed, pressure, material of all existing underground lines encountered during installation of systems under this contract.

28. PROJECT SUPERVISION

A full time English speaking supervisor shall be provided. The supervisor shall have a minimum of 5 years' experience with similar projects and clients.

29. BOND REQUIREMENTS

100% Performance and Payment bonds for each subcontractor.

30. SUBCONTRACTOR CAPABILITIES

All subcontractors shall have new construction installation crews and Service Company capable of less than 4 hours response time any day of the year. Including nights, holidays and weekends

END OF SECTION

SECTION 15120 - VALVES

PART 1 - GENERAL

1.01 Scope of Work:

- A. Valves specified in this section are for general use. See specifications for specific system for special valves.
- B. Submit brochures and other data for approval of all items differing from those specified.

PART 2 - PRODUCTS

2.01 Gate Valves:

- A. 1/4" through 2": NIBCO SCOTT T-113, 125 lb. SWP, 200lb. WOG. Bronze, screw-in bonnet, threaded ends, non-rising stem, and solid wedge.
- B. 2-1/2" through 12": NIBCO SCOTT F-619, 125lb. SWP, 200 lb. WOG, iron body, inside screw, bronze mounted, flanged ends, non-rising stem, solid wedged.

2.02 Globe Valves:

- A. 1/8" through 2": NIBCO SCOTT T-211, 125 lb., SWP, 200 lb. WOG, bronze, screw-in bonnet, threaded ends, Buna-N seat disc for water, oil, or gas (W), Teflon seat disc for steam (Y).
- B. 2-1/2" through 10": NIBCO SCOTT F-718, 125 lb. SWP, 200 lb. WOG, iron body, outside screw and yoke, bronze mounted, flanged ends, Buna-N seat disc for water, oil or gas (W), composition seat disc for steam (S).

2.03 Swing Check Valves:

- A. 1/4" through 2": NIBCO SCOTT T-413, 125 lb. SWP, 200 lb. WOG, Bronze, threaded ends, Buna-N seat disc for water, oil or gas (W), Teflon seat disc for steam (S).
- B. 2-1/2" through 10": NIBCO SCOTT F-918, 125 lb. SWP, 200 lb. WOG, iron body, bronze mounted, flanged ends, Buna-N seat disc for water, oil, or gas (W), composition seat disc for steam (S).

2.04 Butterfly Valves:

- A. 2-1/2" through 8": Norrseal Series R3310-13SS, 150 lb. WWP, lug type cast iron body, ductile iron disc, 416 stainless steel, shaft, EPDM seat, disc shall not seal in shaft hole, extended neck, infinite position throttling handle with memory stop.

2.05 Ball Valves:

- A. 1/4" through 2-1/2": NIBCO SCOT T-595, 150 lb. steam, 400 lb. WOG, bronze, full port, threaded ends, Buna-N seat for water, oil, or gas (W), Teflon seat for steam (Y).

2.06 Balancing Valves:

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- A. 3/4" and Below: Sarco Sarcofow balancing fittings, 20 psi cold liquid, 175 PSI at 150 degrees F, brass, screwdriver slot adjustment, screwed ends, air vent if required.
- B. 1/2" through 2": Nordstrom No. 114, 125 lb. SWP, 200 lb. WOG, semi-steel lubricated, and wrench operated threaded ends.
- C. 2-1/2" through 12": Nordstrom No. 143, 175 lb. WOG, semi-steel lubricated, wrench operated flanged ends.

### 2.07 Pressure Reducing Valves:

- A. Zurn Wilkins No. 600XLHTSTSC for 1/2" to 2-1/2" standard capacity water reducing valve 25 to 75 psi adjustable range.

### 2.08 GAS COCKS

- A. 2 inch and smaller: Bronze body, bronze tapered plug, nonlubricated, teflon

## PART 3 - EXECUTION

### 3.01 Arrangement or Location:

- A. Locate valves in an accessible position. Where several valves are related as to function, group in a battery.
- B. No valve shall be installed with stem below horizontal position without prior approval.
- C. Provide special handles or operators as might be required or as indicated on the drawings.
- D. Valves specified under specific systems shall take precedence over those as specified herein.
- E. Valves in copper pipe shall have threaded ends (except where size dictates flanged ends), use copper to MPT adapters.
- F. The use of threaded ends or flanged ends is the Contractor's option within the size listed.

### 3.02 Valve Boxes:

- A. All valves located below slabs or grade shall be housed in cast iron boxes. Cover shall be properly identified as to the services controlled by the valve.
- B. Furnish Owner with proper key and valve-operator extensions.

END OF SECTION

EXPANSION COMPENSATION

SECTION 15121

PART 1 - GENERAL

1.01 Work Included

- A. Flexible pipe connections.
- B. Pipe loops, offsets, and swing joints.

1.02 Related Work

- A. Plumbing And Mechanical Piping: Section 15410
- B. Supports and Anchors: Section 15140

PART 2 - PRODUCTS

2.01 Flexible Pipe Connections

- A. For steel piping, construct with stainless steel inner hose and braided exterior sleeve.
- B. For copper piping, construct with bronze inner hose and braided exterior sleeve.
- C. Use connectors suitable for minimum 125 psi WSP and 450 X degrees F.

2.02 Connections:

- A. Provide flexible pipe connections suitable to adjoining piping as specified for pipe joints. Use pipe sized units.

PART 3 - EXECUTION

3.01 Installation:

- A. Install flexible pipe connectors on pipes connected to equipment supported by vibration isolation.
- B. Accomplish structural work and provide equipment required to control expansion and contraction of piping, loops, pipe offsets, and swing joints, and provide corrugated bellows type expansion joints where required.
- C. Install flexible connectors at right angles to displacement. Install one end immediately adjacent to isolated equipment and anchor other end.
- D. Rigidly anchor pipe to end structure where necessary. Provide pipe guides so that movement takes place along axis of pipe only.

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- E. Brace piping in accordance with Arkansas Act 1100 of 1991 for earthquake resistant design.

END OF SECTION



PIPING SPECIALTIES

SECTION 15130

PART 1 - GENERAL

1.01 Scope of Work:

- A. Specific requirements for specialties indicated on drawings or in other sections of these specifications shall take precedence over items as specified in this section.
- B. Submit brochures and other supportive data as might be required for approval of all items differing from those specified.
- C. Ranges for thermometer, gauges or similar instruments shall be selected so that normal operation will be near center of scale. Range shall not be longer than required. Use compound gauge where vacuum may be encountered.
- D. Combination instruments for thermometers and gauges will not be acceptable.

PART 2 - PRODUCTS

2.01 Thermometers:

- A. Thermometers shall be equal to Trerice Series BX9, Nine (9) inch, adjustable type. Stem length shall be a minimum of 1/4 of the pipe diameter, plus socket extension.
- B. Provide brass separable sockets. For insulation, separable socket shall have extension neck.

2.02 Thermometer Wells:

- A. Thermometer wells shall be brass with cap and chain.
- B. For uninsulated pipe, wells shall be Trerice No. 5571, 5573, or 5578.
- C. For insulated pipe, wells shall be Trerice No. 5574 or 5579.
- D. Use maximum stem length compatible with pipe size.

2.03 Gauges:

- A. Gauges shall be equal to Trerice Series 800, 3-1/2" size.
- B. Provide snubber and cock for each gauge.

2.04 Test Plugs:

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- A. Test plugs shall be equal to Peterson Engineering company #110, 1/4" size, with brass body, dust cap, and "Nordel" valve cover material.

2.05 Strainers:

A. "Y" Type:

- 1. 1/2" through 3": Muessco No. 11, iron body, 250 lb. SWP, 400 lb. WOG, Monel or stainless steel screen, blow-off outlet, screwed ends.
- 2. 2" and larger: Muessco No. 751, iron body, 125 lb. SWP, 175 WG, brass screen, blow-off outlet, flanged ends.

B. Screens-Water:

- 1. Brass.
- 2. Perforations: up to 2", 1/10" diameter, 29 per sq. in. 2-1/2" to 4", 1/8" diameter, 32 per sq. in.; 5" up, 1/4" diameter, 8 per sq. in.

C. Basket Type:

- 1. Shall be equal to Thompson MLS-10

2.06 Flexible Pipe Connectors:

- A. Equal to Garlock, Garflex, Style 8100, Nitrile-Neoprene Nylon Concentric Spool Type, 250 lb. WWP, 22 degrees F. to 212 degrees F, flanged.

PART 3 - EXECUTION

3.01 Gauges, Thermometers, and Test Plugs:

- A. Provide thermometers where indicated on drawings.
- B. Provide gauges across all pumps and as shown on drawings.
- C. Arrange thermometers and gauges so they might be read standing in a normal position on the floor.
- D. Provide test plugs on inlet and outlet piping of all equipment. Test plugs shall be accessible and shall be installed on the equipment load side of three-way by-pass valves.
- E. Locate gauges, thermometers and test plugs as close as possible to equipment being monitored.

END OF SECTION

SECTION 15140 - MECHANICAL SUPPORTING SYSTEMS

PART 1 GENERAL

1.01 SCOPE OF WORK

- A. Provide adequate pipe, equipment foundation and suspension system in accordance with recognized engineering practices. Where possible, use standard, commercially-accepted hangers and accessories.

1.02 CODES

- A. All pipe hangers and supports shall conform to the latest requirements of the code for Pressure Piping, Refrigeration Society of ANSI/ASME B 31.5-74 and Manufacturers' Standardization Society of Valve and fittings industry documents MASS-SP-58-75 and MASS-SP- 69-76.
- B. All auxiliary steel necessary for the installation of the pipe hangers and supports shall be designed in accordance with the AISC, as indicated on the drawings.
- C. It is the intention of the drawings to show supports for major mechanical equipment and piping. Supporting steel not shown for the equipment shall be designed, supplied and erected by the Contractor. (The supporting steel is that steel which is connected to the structural members shown on the drawings and carries the weight of the mechanical items). This supporting steel design must carry the dead weight and dynamic load imposed by the equipment or piping.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Products shall be equal to Fee & Mason. Devices by Grinnell or Blaw-Knox will be acceptable.

2.02 PIPE HANGERS

- A. All hangers for piping two (2) inch or larger shall be provided with means of vertical adjustment.
- B. Where thermal movement causes the hanger rod to deviate more than five (5) degrees from the vertical, or where longitudinal expansion causes a movement of more than 1/2" in the piping supported from below, roller hangers shall be used in conjunction with a protection saddle to suite the insulation thickness. On insulated pipe the hanger must be placed on the outside of the insulation with a shield.

2.03 BRACKETS AND RACKS

- A. Multiple pipe racks or trapeze hangers shall be fabricated from B-line, FAMET, or UNISTRUT channel, clamps and accessories.

PART 3 EXECUTION

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3.01 ATTACHING TO STRUCTURE

- A. Where equipment or piping is supported from building steel, beam-clamps or welded beam attachments shall be used. Holes drilled in building steel for hanger support rods will not be permitted.
- B. All vertical runs of piping shall be supported at the floor.

3.02 HANGER ROD AND SPACING

- A. Where hanger rod sizes are catalog-listed for a specified hanger, this size shall govern. Where hanger rod sizes are not catalog-listed, the load on the hanger shall be the determining factor and the maximum recommended hanger rod load as catalog-listed, shall govern.
- B. Pipe hangers shall be installed at each change in direction not more than two feet (2') from end of run. On straight runs, support at each joint and intermediately, so the spacing shall not exceed the following, whichever is closer:

<u>Size</u>	<u>Steel pipe</u>	<u>Copper pipe</u>
To 3/4"	7'	5'
1" to 2"	10'	8'
2-1/2" to 4"	12'	10'
5" to 8"	16'	10'
10" and larger	20'	10'

- C. Provide supports at concentrated loads such as equipment, in-line pumps, valves and other piping, to prevent line sag and/or excess stress in the piping systems.
- D. For cast iron pipe, provide a hanger at each joint or fitting with a maximum spacing of five (5) feet on center.
- E. Where distance between riser clamp and hanger exceed ten (10) feet in height, intermediate clamps shall be installed to provide support or alignment at a maximum of every ten (10) feet.

3.03 AUXILIARY STEEL

- A. Furnish all miscellaneous structural members necessary to hang or support pipe or mechanical equipment. Material of members shall be consistent with that of the main structural system.
- B. All auxiliary steel shall receive one shop coat of primer paint prior to installation.
- C. Notify Engineer of any adjustment in main structural system for support of major equipment or piping.

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3.04 CONCRETE PADS

- A. Provide concrete pads under floor-mounted equipment and apparatus as indicated on drawings and coordinate with structural drawings.

3.05 INSULATION INSERTS OR SADDLES

- A. Provide insulation inserts or saddles at all points of support on insulated pipe. Insert to be same thickness as adjoining pipe insulation.

END OF SECTION

TESTING, BALANCING AND ADJUSTING

SECTION 15180

PART 1 - GENERAL

1.01 Scope of Work:

- A. Air Balance: A complete air and water balance of this project will be required as specified in sections herein.

1.02 Report:

- A. The report shall include the following information:
  - 1. Complete testing and balancing data.
  - 2. All equipment start-up logs.

1.03 Start-up:

- A. All major equipment shall be started by a factory-trained service mechanic, or certified technician that is experienced in the service and operation of that piece of equipment. The contractor shall start-up and place into operation all auxiliary equipment such as fans, pumps, etc.
- B. Include all these start-up logs in his report for submission to the Engineer and Contractor.

1.04 Acceptance:

- A. The Owner and Engineer will not accept the building until the system has been properly started up, balanced, and is operating as per the design.

PART 2 - PRODUCTS

2.01 Preparation:

- A. The Contractor shall have complete all duct work and installed all grilles, registers, diffusers, dampers, access doors, turning vanes, air and water specialties, etc., before the testing and balancing begins.
- B. The Contractor shall have completed the installation of all piping, specialties, insulation, controls, and shall have thoroughly checked out the piping systems and action of all control devices and placed the entire system into operation.

2.02 TBA Air System:

- A. Perform the following tests, and balance system in accordance with the following requirements:

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- (1) Test and adjust blower RPM to design requirements. If equipped, adjust VFD settings as required for design performance.
- (2) Test and record motor full-load amperes.
- (3) Make pitot tube traverse of main supply ducts and obtain design cfm at fans.
- (4) Test and record system static pressures, Fan Suction and discharge pressures.
- (5) Test and adjust system for design recirculated air, cfm.
- (6) Test and adjust system for design cfm outside air.
- (7) Test and record entering air temperatures (DB heating and cooling)
- (8) Test and record leaving air temperatures (WB cooling).
- (9) Test and record leaving air temperatures (DB heating and cooling).
- (10) Test and record leaving air temperatures (WB cooling).
- (11) Adjust all main supply and return air ducts to proper design cfm.
- (12) Adjust all zones to proper design cfm, supply and return.
- (13) Test and adjust each diffuser, grille and register to within +/- 5% of design requirements.
- (14) Each grille, diffuser and register shall be identified as to location and area.
- (15) Size, type and manufacturer of diffusers, grilles, registers and tested equipment shall be identified and listed. Manufacturer's ratings on all equipment shall be used to make required calculations.
- (16) Readings and test of diffusers, grilles and registers shall include required fpm velocity. Measure cfm after adjustment. All diffusers, grilles and registers shall be adjusted to minimize drafts.
- (17) Set adjustments of dampers to operate as specified, indicate and/or noted. Check all controls for proper calibrations and list all controls requiring adjustment by control installers.

### 2.03 TBA Water System Preparation:

- A. Prepare the water systems for balancing in the following manner:
  - (1) Open all valves to full open position. Close bypass stop valves.
  - (2) Check pump rotation.

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(3) Check expansion tanks to determine that they are not air bound and the system is completely full of water. Adjust water in expansion tanks to proper level and set makeup valve to proper pressure.

(4) Check all air vents at high points of water systems and determine that all are installed and operating freely.

(5) Check operation of bypass valve.

(6) Check and set operating temperatures of boilers, chillers, and condenser water loop.

### 2.04 TBA Water System:

- A. Balance pumps to proper gallons per minute delivery.
- B. Adjust flow of Chilled water.
- C. Adjust flow of Condenser water.
- D. Adjust flow of Hot Water.
- E. Check and record leaving water temperatures and return water temperatures.
- F. Check water temperature at inlet side and leaving side of fan coil units and air handlers. Note rise or drop of temperature from source.
- G. Proceed to balance each unit.
- H. Upon completion of flow readings and adjustments at units, mark all settings and record data.
- I. After adjustments to units are made, recheck settings at the pumps, and re-adjust if required.
- J. Check pump operating suction and discharge pressure and final TDH.
- K. List rated and actual running amperage of pump motor.

### 2.05 Submit Report:

- A. After the above phases are completed the Project Engineer supervising the Testing and Balancing shall analyze the data and forward to the Design Engineer and Contractor a report of all tests performed.

## PART 3 – EXECUTION

### 3.01 Work Included:

- A. Provide test and balance personnel with minimum 5 years experience in starting of this type system. Personnel shop shall be within 50 miles of the facility. System shall be started with skilled craftsman



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familiar with the types of systems and controls.

- B. Provide all equipment necessary for testing and starting.
- C. Submit complete test and balance report to Engineer for Review upon completion.

END OF SECTION

PIPE AND VALVE IDENTIFICATION

SECTION 15190

PART 1 - GENERAL

1.01 Pipe Identification:

- A. All piping shall be identified with pressure-sensitive pipe markers with color bands of the proper size. Markers shall have proper legend and meet OSHA specifications. Where pipes are too small for such application, a 1-1/2" brass tag shall be used.
- B. Markers shall be applied to the piping at the following locations:
  - 1. Adjacent to each valve.
  - 2. At each branch and riser take-off.
  - 3. At each pipe passage through wall, floor and ceiling construction.
  - 4. At each pipe passage to underground.
  - 5. At not more than forty (40) feet spacing on straight pipe runs.
- C. Markers shall be placed so as to be easily read. Arrows shall be applied to indicate direction of flow.

1.02 Valve Identifications:

- A. Provide brass tags for all valves with legend describing function of each valve. Tag shall also indicate normally-open or normally-closed.

PART 2 - PRODUCTS:

2.01 Valve Tags:

- A. Brass tags shall be a minimum of two (2) inches diameter of 3-1/2" oval, to accommodate 1" height numbers. Tag shall be equipped with a 3/16" X 6" long brass chain.

2.02 Pipe Markers and Bands:

- A. Markers and band sizes shall conform to the following:

<u>Outside Diameter of Pipe or Insulation</u>	<u>Width of Color band</u>	<u>Lettering Height</u>
To 1"	3/4"	3/8"

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1" to 3"	1-1/2"	3/4"
3" to 6"	2-1/2"	2"
6" and over	4"	3-1/2"

- B. Marker band colors, and marker legends shall conform to OSHA.
- C. Arrows shall be of same color as bands, and shall point in direction of flow and downstream of pipe legend.

PART 3 - EXECUTION

3.01 Work Included:

- A. Legends shall be securely fixed to the pipe with full circumference bands on each side of legend. Arrows downstream of legend shall have full circumference band at the arrow end.
- B. Valve tags shall be numbered in accordance with a valve chart, to be framed, and mounted in the equipment room. Said chart shall describe valve location and function.

END OF SECTION

SECTION 15252 - PIPING AND EQUIPMENT INSULATION

PART 1 GENERAL

1.01 WORK INCLUDED

- A. Piping Insulation
- B. Adhesive, tie wires, tapes.
- C. Insulate all domestic hot and cold water piping above floor.
- D. Insulate all refrigerant suction piping.
- E. Insulate all chilled water, condenser water, and hot water piping.

1.02 PROJECT CONDITIONS

- A. Deliver material to project site in original non-broken factory packaging, labeled with manufacturer's density and thickness.
- B. Perform work at ambient and equipment temperatures as recommended by the adhesive manufacturer.

PART 2 PRODUCTS

2.01 GENERAL

- A. Adhesives and insulation materials: composite fire and smoke hazard ratings of maximum 25 for flame spread and 50 for smoke developed. Adhesives to be waterproof.

2.02 INSULATION MATERIALS

- A. Cold and hot domestic water piping: Fine glass fiber insulation, with factory applied vapor barrier jacket, molded to conform to piping "K" value at 75°F, maximum 0.24 BTU\*inch/(hr\*ft<sup>2</sup>\*°F) Insulation shall be equal to Johns Manville Micro-Lok<sup>®</sup> with vapor barrier jacket, self-sealing lap and butt strips.
- B. Refrigerant piping: Flexible elastomeric thermal insulation with "K" value at 75°F, maximum 0.25 BTU\*inch/(hr\*ft<sup>2</sup>\*°F). Insulation shall be equal to Armaflex AP closed-cell insulation.
- C. Chilled Water, Heating Hot Water, and Condenser Water Piping: Fine glass fiber insulation, with factory applied vapor barrier jacket, molded to conform to piping "K" value at 75°F, maximum 0.24 BTU\*inch/(hr\*ft<sup>2</sup>\*°F) Insulation shall be equal to Johns Manville Micro-Lok<sup>®</sup> with vapor barrier jacket, self-sealing lap and butt strips.

PART 3 EXECUTION

3.01 PREPARATION

- A. Do not install covering before piping and equipment has been tested and approved.
- B. Ensure surface is clean and dry prior to installation and during application. Finish with systems at operating conditions.
- C. All underground chilled water and condenser water piping shall be coated for corrosion protection with Denso Protal 7200 liquid coating or a suitable equivalent coating/method prior to insulating and burying pipe.

3.02 INSTALLATION

- A. Ensure insulation is continuous through inside walls. Pack around pipes with fireproof self-supporting insulation material, fully sealed.
- B. Insulate fittings and valves. Do not insulate unions, flanges, strainer, flexible connections, and expansion joints. Terminate insulation neatly with plastic material troweled on bevel. Provide removable bands of flexible fiberglass insulation with vapor sealed jacket over all insulated surfaces previously described.
- C. Finish insulation neatly at hangers, supports and other protrusions.
- D. Locate insulation or cover seams in least visible locations and install aluminum bands on 8" centers.
- E. Domestic Cold & hot water piping, chilled water piping, and service hot water piping: Cover fittings and valves with equivalent thickness of insulation material. Cover with open mesh glass cloth sealed with vapor barrier sealant. Seal lap joints with 100 percent coverage of vapor barrier sealant and adhesive. Seal butt joints with 4-inch wide strips of vapor barrier sealed with vapor barrier adhesive. For exposed fittings and valves, apply hydraulic setting cement paste over insulation material before applying finish.
- F. Insulate bowls of roof drains to prevent condensation.
- G. Repair separation of joints or cracking of insulation due to thermal movement or poor workmanship.
- H. Install .020 aluminum recovering on all exterior piping. All insulated and jacketed piping above grade outdoors shall be painted per architect (verify).
- I. All piping shall be sleeved for expansion compensation and appropriately sealed where passing through building walls or retaining walls.
- J. Chilled Water Pumps and other equipment that require insulation and jacketing shall be insulated with removable insulated housings, removable access panels, or other means of servicing equipment and reconnecting insulation. Removable insulation systems shall be designed such that they shall remain intact, even under frequent service. Consult pump and equipment manufacturer's details for

City of Bryant - The Center at Bishop Park Boiler Replacement

removable, serviceable insulating methods.

3.03 INSULATION THICKNESS SCHEDULE:

<u>Piping or Equipment</u>	<u>Pipe Size Inches</u>	<u>Insulation Thickness</u>
Domestic Cold Water Piping	1/4 thru 1/2"	1/2 inch
Domestic Hot Water Piping	All Sizes	1 inch
Domestic Hot & cold Water Piping	3/4" and Larger	1 inch
Cold Condensate Drains	All sizes	1/2 inch
Refrigerant Suction	All Sizes	1/2" Armaflex
Roof Drain Piping Above Slab	All Sizes	1/2 inch
Chilled Water Piping	All Sizes	2" - (1" min. where space does not allow 2")
Condenser Water Piping	All Sizes	2" - (1" min. where space does not allow 2")
Heating Hot Water Piping	All Sizes	2" - (1" min. where space does not allow 2")

END OF SECTION

PLUMBING AND MECHANICAL PIPING

SECTION 15410

PART 1 - GENERAL

1.01 Work Included:

- A. Pipe and Pipe Fittings.
- B. Valves.
- C. Sanitary sewer piping system.
- D. Storm Drain & Roof Drain piping system.
- E. Domestic water piping system.
- F. Chilled Water Piping.
- G. Cold Condensate drain piping system.
- H. Hot Water Space Heating Piping System
- I. Compressed Air Piping
- J. Natural Gas Piping
- K. Refrigerant Piping

PART 2 - PRODUCTS

2.01 Sanitary Sewer and storm drain piping, Buried beyond 5 feet of building.

- A. Cast Iron Pipe: ASTM A74, service weight. Fittings: Cast Iron. Joints; ASTM C564, neoprene gasketing system or lead and oakum.

2.02 Sanitary Sewer Piping, Buried under and within 5 feet of building.

- A. Cast Iron Pipe: ASTM A74 service weight. Fittings: Cast Iron. Joints: Hub-and-spigot, CISPI HSN compression type with ASTM C564 neoprene gaskets or lead and oakum.

2.03 Sanitary Sewer and roof drain piping, above grade.

- A. Cast Iron Pipe: ASTM A74, service weight. Fittings: Cast Iron Joints: Hub-and-Spigot, CISPI HSN compression type with ASTM C564 neoprene gasket or lead and oakum.
- B. Cast Iron Pipe: CISPI 301, hubless, service weight. Fittings: Cast iron, Joints: Neoprene gaskets

## City of Bryant - The Center at Bishop Park Boiler Replacement

and stainless steel heavy duty clamp-and shield assemblies.

- C. Copper Pipe: ASTM B306, DWV. Fittings: ANSI/ASME B16.3, cast bronze, or ANSI/ASME B16.29, wrought copper. Joints: ANSI/ASTM B32, solder, Grade 50B.

### 2.04 Water Piping, Buried Beyond 5 feet of building.

- A. Ductile Iron Pipe: ASNI/AWWA C151, Fittings: Ductile iron standard thickness. Joints: ANSI/AWWA C111, Rubber gasket with 3/4 inch diameter rods.
- B. Copper tubing: ASTM B88, Type "K" soft. Fittings: ANSI/ASME B16.29, wrought copper. Silver Braze.

### 2.05 Water Piping, Buried Under and Within 5 feet of Building.

- A. Copper tubing: ASTM B88, Type "K" hard or soft drawn. Fittings: ANSI/ASME B16.29, wrought copper. Silver Braze.

### 2.06 Water Piping, Above Ground.

- A. Copper Tubing: ASTM B88, Type "L" hard drawn. Fittings: ANSI/ASME B16.23, cast brass, or ANSI/ASME B16.29, wrought copper. Joints: ASNI/ASTM B32, solder, Grade 95 TA.

### 2.07 Condensate Drain Piping, Above Ground.

- A. Copper tubing: ASTM B88, type "M" hard drawn. Fittings: ANSI/ASME B16.23 cast brass of ANSI/ASME B16.29 wrought copper. Joints: ANSI/ASME B32, solder, Grade 95TA.

### 2.08 Chilled and Space Heating Hot Water Piping, above grade inside building.

- A. Less than 4" copper tubing, ASTM B88, Type "K" hard fittings ANSI B16.29 Wrought copper silver brazed.
- B. 4" and larger Steel Pipe: ASTM A53 or A120. Schedule 40 Black. Fittings ANSI/ASME B16.3, malleable iron, or ASTM A234, forged steel welding type. Joints: Screwed for pipe two inches and under ANSI/AWS D1.1 welded, for all pipe sizes (optional)

### 2.09 Compressed Air Piping, Above Grade Inside Building.

- A. Less than 4" copper tubing Type "K", Silver brazed 95/5

### 2.10 Couplings and Unions.

- A. Pipe size under 2 inches: 150 psig malleable iron for threaded ferrous piping; bronze unions for copper pipe.
- B. Dielectric Connections: Union with galvanized or plated steel threaded end, copper solder end, water impervious isolation barrier.



2.12 Valves (Refer to Section 15120)

2.13 Condensate Drain Piping, Above Ground

- A. Copper tubing: ASTM B88, type "M" hard drawn. Fittings: ANSI/ASME B16.23 cast brass or ANSI/ASME B16.29 wrought copper. Joints: ANSI/ASME B32. Solder. Grade 95TA.

2.14 Natural Gas Piping, Above Grade Inside Building

- A. Steel Pipe: ASTM A53 or A120. Schedule 40 Black. Fittings ANSI/ASME B16.3 malleable iron, or ASTM A234. forged steel welding type. Joints: Screwed for pipe two inches and under ANSI/AWS D1.1 welded, for all pipe sizes (optional).

2.15 Natural Gas Piping, Above Grade or Exposed Outside

- A. Pipe shall be schedule 40 black steel with X-tru or equal external coating.

2.16 Natural Gas Piping Outside Underground

- A. Schedule 40 black steel with X-tru or Equal external coating.
- B. Polyethylene Plastic ASTM-D2513 with compatible fitting thermally welded where approved by authorities and Architect.

2.17 Refrigerant Piping - See Section 15183.

PART 3 - EXECUTION

3.01 Preparation

- A. Ream pipe and tube ends. Remove Burrs.
- B. Remove scale and dirt, on inside and outside, before assembly.
- C. Prepare piping connections to equipment with flanges or unions.
- D. All underground steel piping shall be coated for corrosion protection with Denso Protal 7200 liquid coating or a suitable equivalent coating/method prior to insulating and burying pipe.

3.02 Installation

- A. Provide non-conducting dielectric connections wherever jointing dissimilar metals.
- B. Route piping in orderly manner and maintain gradient.
- C. Install piping to conserve building space and not interfere with use of space or access to equipment.

## City of Bryant - The Center at Bishop Park Boiler Replacement

- D. Install piping to allow for expansion and contraction without stressing pipe, joints, or connected equipment.
- E. Provide clearance for installation of insulation and access to valves and fittings.
- F. Provide access where valves and fittings are not exposed.
- G. Slope water piping and arrange to drain at low points.
- H. Establish elevations of buried piping outside the building to ensure adequate cover. (24 inch minimum cover)
- I. Establish invert elevations, slopes for drainage of 1/8" inch per foot minimum within building for Pipe 4" larger. Slope smaller sizes 1/4" per foot minimum. Maintain gradient.
- J. Install valves with stems upright or horizontal, not inverted.

### 3.03 Application:

- A. Install unions downstream of valves at equipment or apparatus connections.
- B. Install brass male adapters each side of valves in copper piped system. Sweat solder adapters to pipe.
- C. Install gate or ball valves for shut-off and to isolate equipment.

### 3.04 Disinfection of Domestic Water Piping System:

- A. Prior to starting use, verify system is complete, flushed and clean.
- B. Comply with all requirements of the Little Rock Water Dept. and Arkansas State Health Department.

### 3.05 Coordination:

- A. Consult and verify with serving utility the exact location, size, depth and requirements of all utility services.

### 3.06 Specialties

- A. Multi-Stage Domestic Water Filtration System - See Section 15445

END OF SECTION

HYDRONIC SPECIALTIES

SECTION 15515

PART 1 - GENERAL

1.01 Work Included:

- A. Expansion tanks.
- B. Air vents.
- C. Air separators.
- D. Combination fittings.
- E. Flow controls.
- F. Relief valves.
- G. Chemical shot feeders

1.02 Quality Assurance:

- A. For each product specified, provide components by same manufacturer throughout.

1.03 Submittals:

- A. Submit product data for manufactured products and assemblies.
- B. Include component sizes, rough-in requirements, service sizes, and finishes. Include product description, model.
- C. Submit manufacturer's installation instructions.

1.04 Operation and Maintenance Data:

- A. Submit operation and maintenance data.
- B. Include installation instruction, assembly, views, lubrication instructions, and replacement parts list.

PART 2 - PRODUCTS

2.01 Expansion Tank (Specified on Drawings - See Mechanical Plans & Schedules)

2.02 Relief Valves:

City of Bryant - The Center at Bishop Park Boiler Replacement

- A. Bronze body, teflon seat stainless steel stem and springs, automatic, direct pressure actuated, capacities ASME certified and labeled.

2.03 Chemical feeder

- A. Griswold water system Model FB-5-SB-CS-Z or Equal.

2.04 Spirotherm Air Separator

- A. Include accessory funnel kit, heavy duty leg mounting with drain port
- B. Provide with Automatic fill kit by Griswold or Equal.

PART 3 - EXECUTION

3.01 Installation and Application:

- A. Install specialties in accordance with manufacturer's instructions to permit intended performance.
- B. Support tanks from building structure or floor in accordance with manufacturer's instructions.

END OF SECTION

City of Bryant - The Center at Bishop Park Boiler Replacement

SECTION 15550 - MECHANICAL EQUIPMENT

PART 1 GENERAL

1.01 WORK INCLUDED

- A. High Turndown, High Efficiency, Condensing Boilers
- B. Variable Speed Boiler Circulator Pumps
- C. Plate Frame Heat Exchanger Domestic Water Heater
- D. Heating Water Secondary Pumps
- E. Domestic Hot Water Circulator Pumps

1.02 REFERENCES

- A. Arkansas Mechanical Code (most current edition).

1.03 SUBMITTALS

- A. Submit shop drawings and product data showing, dimensions, connections, arrangements, accessories, and controls for all equipment specified and scheduled on the drawings.
- B. Submit manufacturer's installation instructions.

1.04 OPERATION AND MAINTENANCE DATA

- A. Submit manufacturer's descriptive literature, operating instruction, and maintenance and repair data.

1.05 WARRANTY

- A. Provide manufacturer's standard warranties on equipment.

1.06 QUALITY ASSURANCE

- A. Conform to requirements of applicable codes.
- B. Unit shall be certified in accordance with ANSI Z21.47b/CSA 2.3b and ANSI Z83.8/CSA 2.6, Safety Standard Gas-Fired Furnaces.

City of Bryant - The Center at Bishop Park Boiler Replacement

- C. Unit shall be safety UL/ETL listed or both.

PART 2 PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

- A. Boilers: Lochinvar or Engineer Approved Equal.
- B. Variable Speed Boiler Pumps: Lochinvar or Engineer Approved Equal.
- C. Plate Frame Heat Exchanger Domestic Water Heater: Lochinvar or Engineer Approved Equal.
- D. Heating Water Secondary Pumps: Armstrong or Engineer Approved Equal.
- E. Domestic Hot Water Circulator Pumps: Armstrong or Engineer Approved Equal.

2.02 SCHEDULED EQUIPMENT

- A. See equipment schedules, equipment spec sheets, and equipment brochures for equipment, manufacturer details, and riser for installation attached to this section.

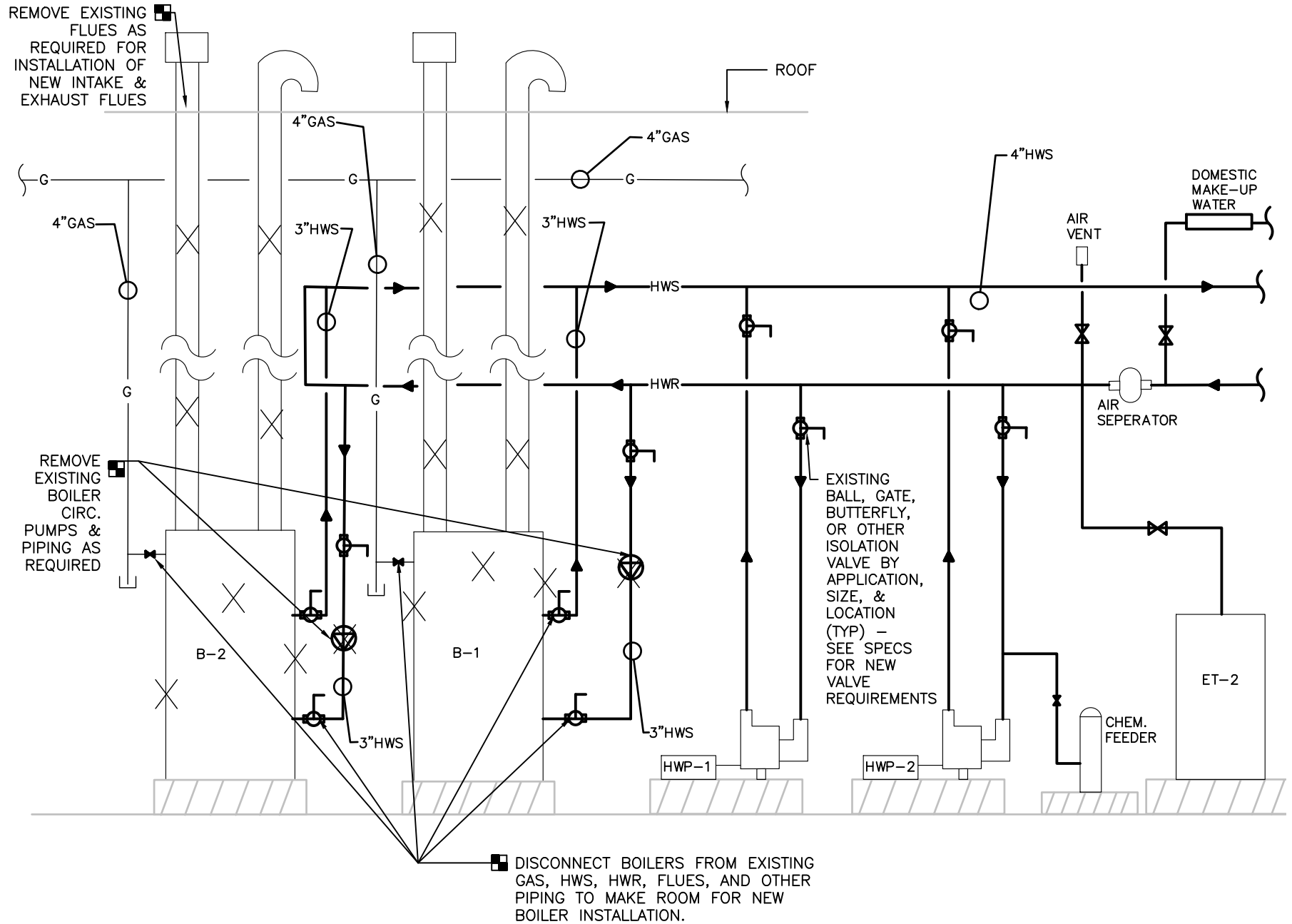
PART 3 EXECUTION

3.01 INSTALLATION

- A. Install Units as indicated in attached risers. Field coordinate exact mounting locations and elevations with all existing and new equipment.
- B. Coordinate sequence of installation and start-up of new systems with other trades.
- C. Install all equipment in accordance with the manufacturer's installation instructions and recommendations.
- D. All plumbing, piping, and equipment shall be installed by mechanics skilled in this type of work.
- E. Provide start-up of systems as required in Specifications – Coordinate with Controls Contractor.
- F. Installation, Operation and Maintenance manual shall be supplied with the all units.
- G. Controls for all systems by control contractor (Commercial Air) shall be in compliance with all of the manufacturer's required equipment and installation procedures. Installation of controls, including field-installed components, shall be in accordance with Installation, Operation, and Maintenance manual instructions.

3.02 RISERS & SCHEDULES, EQUIPMENT DATA, & EQUIPMENTS SPECIFICATIONS

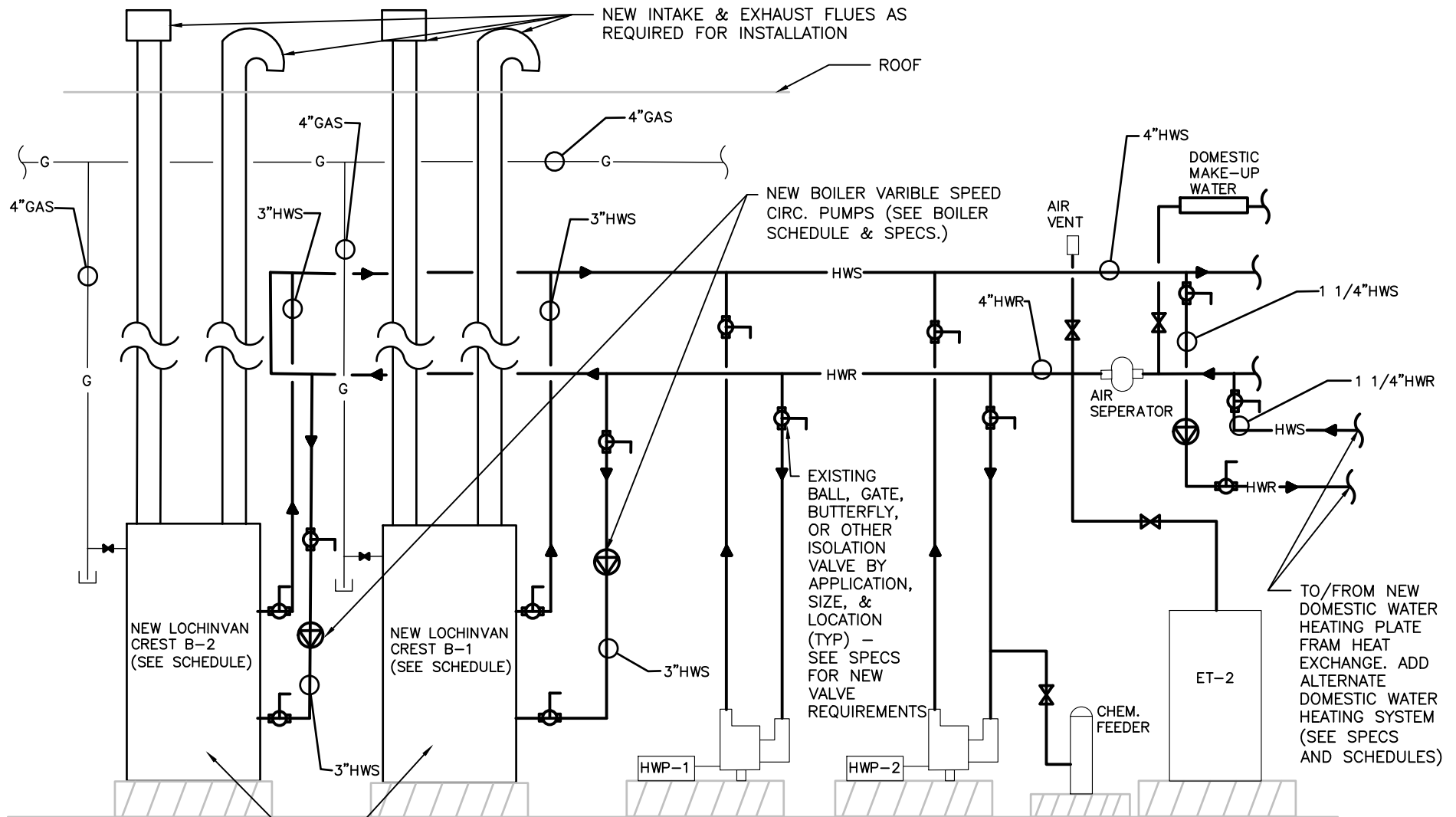
# SECTION 15550: RISERS & SCHEDULES



1

## EXISTING BOILER DEMO RISER

SCALE: NTS



INSTALL NEW BOILERS,  
GAS TRAINS, VARIABLE  
SPEED BOILER CIRC.  
PUMPS, INTAKE &  
EQUIPMENT TO CONNECT  
TO EXISTING SYSTEM.

2

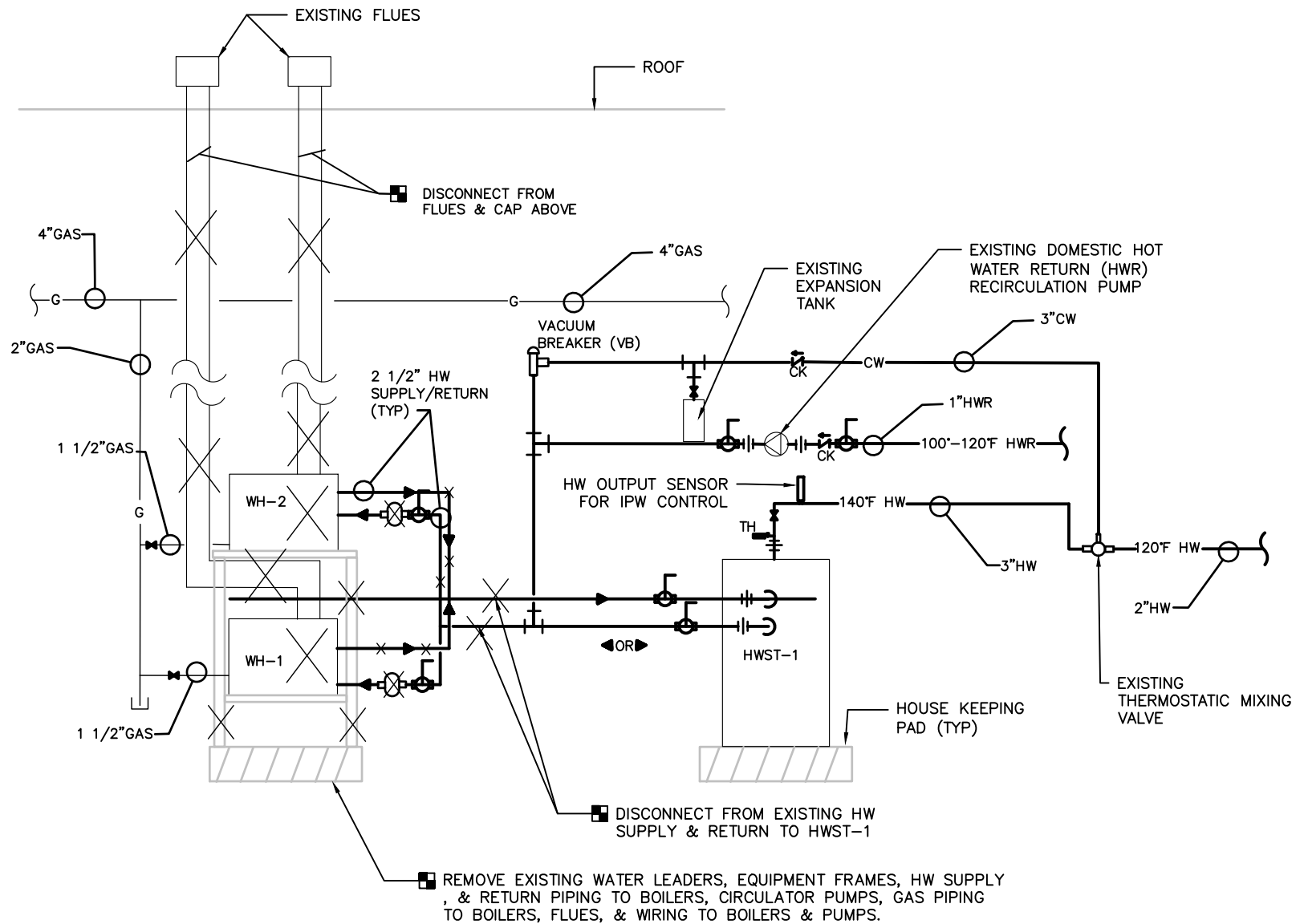
## NEW BOILERS + HW SYSTEM RISER

SCALE: NTS

### NOTES:

- 1) REMOVE EQUIPMENT SHOWN IN RISERS AND INSTALL NEW EQUIPMENT SCHEDULED AND SHOWN IN RISERS. NO SUBSTITUTIONS WITHOUT PRIOR APPROVAL OF OWNER AND ENGINEER.
- 2) FIELD VERIFY CONDITIONS AND ALL PIPING, JOINTS, VALVES, ETC. REQUIRED FOR INSTALLATION PRIOR TO PRICING WORK FOR OWNER.
- 3) ENSURE AIR VENTS ARE INSTALLED AT HIGH POINTS IN SYSTEM.
- 4) INSTALL THERMOMETERS (OR REPLACE WHERE NEEDED) IN HWS & HWR LINES. ALSO, INCLUDE THERMOMETERS IN ADD ALTERNATE PRICING FOR NEW BRANCH HWS/HWR FOR REPLACEMENT DOMESTIC HW.
- 5) INSTALL PRESSURE GAUGES FOR MEASURING DIFFERENTIAL PRESSURE ACROSS PUMPS & HEAT EXCHANGERS.
- 6) INSTALL PETE'S PLUGS ACROSS ALL EQUIPMENT, HEAT EXCHANGER, & PUMPS.
- 7) COORDINATE AND INCLUDE PRICING FOR ELECTRICAL WIRING AND MODIFICATIONS TO INSTALL NEW EQUIPMENT.
- 8) COORDINATE AND INCLUDE CONTROLS PRICING FROM THE OWNER'S CONTROLS CONTRACTOR (COMMERCIAL AIR) FOR ADDING CONTROLS TO NEW SYSTEMS AND INTEGRATION INTO THE OWNER'S BMS.

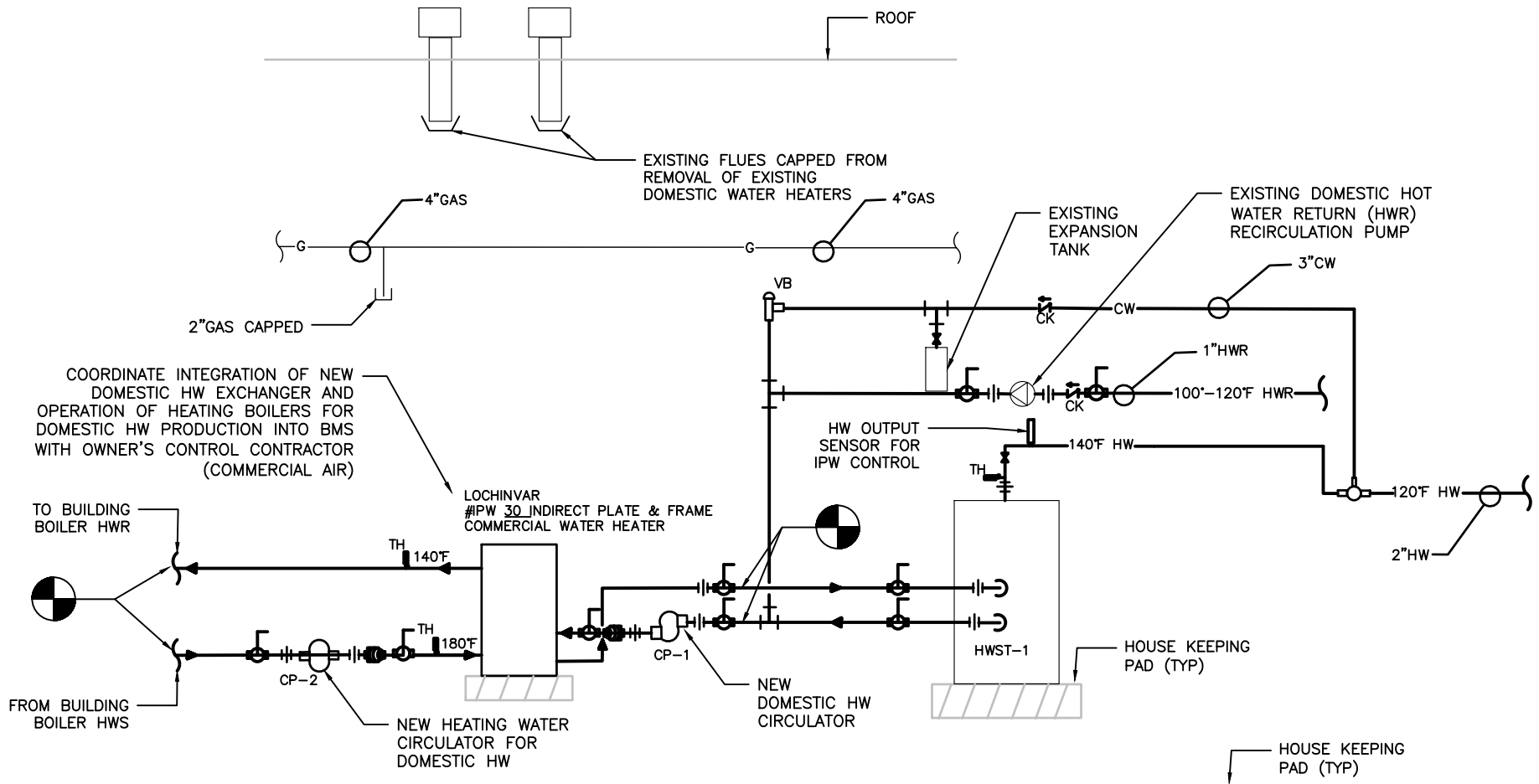




3

**ADD ALTERNATE DEMO EXISTING DOMESTIC HOT WATER SYSTEM RISER**

SCALE: NTS



4

**ADD ALTERNATE NEW DOMESTIC HOT WATER SYSTEM RISER**

SCALE: NTS

PUMP SCHEDULE									
MARK	MANUFACTURER	MODEL	SIZE	SERVES	VOLTAGE	PHASE	GPM	HEAD (FT. H2O)	NOTES
CP-1	ARMSTRONG	H20-20 SS FLANGE	7-5/64"x4"x8-9/16"	DOMESTIC HW	115 VAC	1P	12	5	
CP-2	ARMSTRONG	H-53-1	1'8-23/64"x1'1-17/64"	DHW (BOILER SIDE)	115 VAC	1P	30	15	
<b>NOTES:</b> 1) CONTRACTOR PROVIDE PUMPS WITH ISOLATION BALL VALVES, UNIONS, AND TRIPLE DUTY VALVES									

PLATE AND FRAME DOMESTIC WATER HEATER SCHEDULE							DOMESTIC WATER HEATER				BOILER		NOTES
MARK	MANUFACTURER	MODEL	TYPE	QTY	VOLTS	PHASE	CW IN	DHW OUT	GPM	DHW PRESS. DROP (PSI)	GPM BOILER WATER	BW PRESS. DROP (PSI)	
PFWH-1	LOCHINVAR	IPW030DW	INDIRECT	1	120	1P	40°F	140°F	10-15	1	30	16	
<b>NOTES:</b>													

BOILER SCHEDULE																		
MARK	MANUFACTURER	MODEL	INPUT MBH MIN/MAX	GROSS OUTPUT MBH	MAX/MIN INPUT GAS PRESS.	WATER FLOW (GPM)	WATER CONN. SIZE & CONTENT	VOLT/PHASE	MCA	MOCP	THERMAL EFF.	NET AHRI RATING MBH	TURN-DOWN	GAS CONN.	WATER IN/OUT	AIR INTAKE	VENT SIZE	NOTES
BOILER-1	LOCHINVAR	FBN1001	50-999	962	14" W.C.	96	77 GALLONS	120/1PH	6	20/1P	96.2%	837	20:1	1-1/4"	3"	6"	6"	1
BOILER-2	LOCHINVAR	FBN1001	50-999	962	14" W.C.	96	77 GALLONS	120/1PH	8	20/1P	96.2%	837	20:1	1-1/4"	3"	6"	6"	1
<b>NOTES:</b> 1) PROVIDE EACH BOILER WITH A LOCHINVAR VARIABLE SPEED CIRCULATOR PUMP MODEL#PUM20078																		

SECTION 15550: EQUIPMENT DATA

**CREST  
COMMERCIAL  
CONDENSING BOILER**  
*Submittal Sheet*



**Lochinvar**<sup>®</sup>  
HIGH EFFICIENCY BOILERS & WATER HEATERS

**MODELS  
FB 0751 - FB 6001**



**FBN-Sub-09**

Job Name: \_\_\_\_\_

Location: \_\_\_\_\_

Contractor: \_\_\_\_\_

Type Gas: \_\_\_\_\_

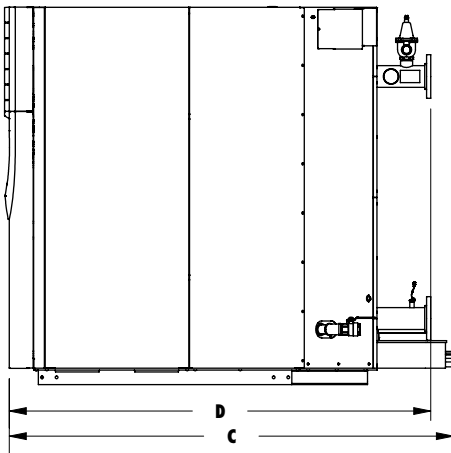
Engineer: \_\_\_\_\_

Model #: \_\_\_\_\_

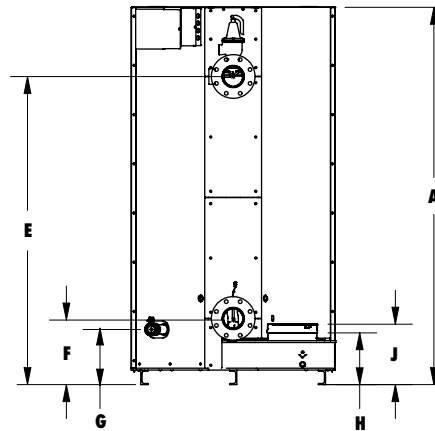
Agent/Wholesaler: \_\_\_\_\_

Equipment Tag(s): \_\_\_\_\_

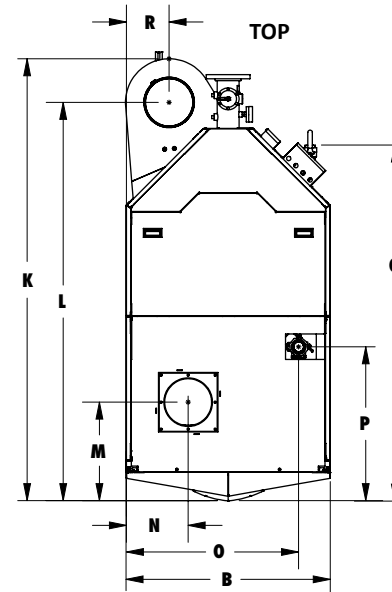
**SIDE**



**BACK**



**TOP**



**JOB NOTES:**

*Notes:*

- \* Insert "N" for natural gas, "L" for LP gas models and "D" for dual fuel.
- Indoor installation only. Information subject to change without notice.
- Low NOx Operation.
- Lochinvar should be consulted before selecting a boiler for installations having unusual piping and pickup requirements, such as intermittent system operation, extensive piping systems, etc.
- The ratings have been determined under the provisions governing forced draft burners.
- The Net AHRI water ratings shown are based on a piping and pickup allowance of 1.15.

Model Number	Input MBH		Thermal %	Gross Output MBH	Net AHRI Rating MBH	Turn-down	A	B	C	D	E	F	G	H	J	K	L	M	N	O	P	Q	R	Gas Conn.	Water Inlet/Outlet	Air Intake	Vent Size	Oper. Weight (with water)	Ship. Weight (lbs.)
	Min	Max																											
FB*0751	50	750	96.2%	722	628	15:1	78"	30"	55-1/2"	57-5/8"	66-1/8"	11-7/8"	11-3/8"	11-1/4"	12-1/2"	55"	51"	13"	8-3/4"	26-3/4"	23-3/4"	49-1/2"	7-3/8"	1-1/4"	3"	6"	6"	1,768	1,560
FB*1001	50	999	96.2%	962	837	20:1	78"	30"	56-1/2"	57-5/8"	66-1/8"	11-7/8"	11-3/8"	11-1/4"	12-1/2"	56"	51"	13"	8-3/4"	26-3/4"	23-1/8"	49-1/2"	6-1/2"	1-1/4"	3"	6"	6"	1,838	1,596
FB*1251	63	1,250	96.2%	1,203	1,046	20:1	78"	30"	56-1/2"	57-3/4"	66-1/8"	11-7/8"	11-3/8"	11-1/4"	12-1/2"	56"	51-3/8"	13"	8-3/4"	26-3/4"	21-5/8"	49-1/2"	6-1/2"	1-1/4"	3"	6"	8"	1,975	1,648
FB*1501	60	1,500	96.2%	1,443	1,255	25:1	78"	30"	67-3/4"	68"	65-3/8"	12-3/8"	11-3/8"	11-1/4"	12-1/2"	67-1/4"	62-3/8"	15-7/8"	9"	26-7/8"	27-7/8"	59-1/4"	5-1/8"	1-1/2"	4"	8"	8"	2,307	1,961
FB*1751	70	1,750	96.2%	1,684	1,464	25:1	78"	30"	66-1/4"	68"	65-3/8"	12-3/8"	11-3/8"	11-1/4"	12-1/2"	65-3/4"	61-1/2"	15-7/8"	9"	27"	27-1/8"	58-3/4"	5-1/8"	1-1/2"	4"	8"	8"	2,458	2,017
FB*2001	80	1,999	96.2%	1,924	1,673	25:1	78"	30"	66-1/2"	68"	65-3/8"	12-3/8"	11-3/8"	11-1/4"	12-1/2"	66"	61-1/2"	15-7/8"	9"	27"	26-3/4"	58-3/4"	5-1/8"	1-1/2"	4"	8"	8"	2,570	2,087
FB*2501	125	2,500	96%	2,400	2,087	20:1	77-3/4"	35"	83-3/4"	83-3/4"	63-3/4"	13-1/2"	11-1/4"	10-1/2"	12-1/4"	83-1/4"	76-1/4"	19-3/4"	9-1/4"	28-3/4"	32"	71"	7-1/4"	2"	4"	8"	9"	3,600	2,577
FB*3001	150	3,000	96%	2,883	2,507	20:1	77-3/4"	35"	83-3/4"	83-3/4"	63-3/4"	13-1/2"	11-1/4"	10-1/2"	12-1/4"	83-1/4"	76-1/4"	19-3/4"	9-1/4"	28-3/4"	32"	71"	7-1/4"	2"	4"	10"	10"	3,900	2,881
FB*3501	175	3,500	96%	3,364	2,925	20:1	77-3/4"	42"	91-1/2"	86-3/4"	63-1/2"	13-1/4"	11-1/2"	10-3/4"	12-1/2"	91"	82"	20-1/4"	12-3/4"	35-1/2"	31-3/4"	73-1/4"	8-3/4"	2"	4"	10"	10"	4,600	3,218
FB*4001	333	3,999	96%	3,843	3,342	12:1	77-3/4"	45-1/2"	103-1/2"	99"	63-1/2"	13-3/4"	11-1/2"	10-3/4"	12-1/2"	103"	94"	24-3/4"	13-1/2"	39-1/2"	42-1/4"	85-1/4"	10-1/2"	2-1/2"	4"	12"	12"	5,200	3,805
FB*5001	500	4,999	96%	4,804	4,177	10:1	77-3/4"	46-1/2"	102-1/4"	99-1/2"	63-1/2"	15"	11-1/2"	10-3/4"	12-1/2"	101-3/4"	92-1/2"	22"	14"	39-3/4"	39-1/2"	84"	9"	2-1/2"	6"	12"	14"	5,900	4,101
FB*6001	600	6,000	96%	5,766	5,014	10:1	77-3/4"	50"	102-3/4"	99-3/4"	63-1/4"	14-3/4"	11-1/2"	10-3/4"	12-1/2"	102-1/2"	93-1/4"	20"	15-3/4"	43-1/2"	36-1/2"	83-3/4"	9-1/4"	2-1/2"	6"	14"	14"	6,900	4,711

# CREST<sup>®</sup>

## CONDENSING BOILER

### Codes & Registrations

ANSI Z21.13/CSA Certified

ASME Certified, "H" Stamp / National Board

California Code Compliant

Canadian Registration Number (CRN)

CSD1 / Factory Mutual / GE Gap Compliant

South Coast Air Quality Management District  
Qualified (FB 0751-2001)

### Smart Touch™ Features

#### CON-X-US Remote Connect

#### SMART TOUCH Touchscreen Operating Control

#### Full-Color 8" Touchscreen LCD Display

#### Built-in Cascading Sequencer for up to 8 Boilers

- › Built-in Redundancy
- › Cascade Multiple Sized Boilers
- › Lead/Lag Cascade
- › Efficiency Optimized Cascade

#### Front-End Loading Capability with Copper-Fin II® and Power-Fin® Boilers

#### Building Management System Integration with 0-10 VDC Input

#### BACnet MSTP Communications

#### Modbus Communication

#### Outdoor Reset Control with Outdoor Air Sensor

#### Password Security

#### Domestic Hot Water Prioritization

- › DHW tank piped with priority in the boiler loop
- › DHW tank piped as a zone in the system with the pumps controlled by the Smart System
- › DHW Modulation Limiting
- › Separately Adjustable SH/DHW Switching Times

#### Low Water Flow Safety Control & Indication

#### Inlet & Outlet Temperature Readout

#### Freeze Protection

#### Service Reminder

#### Time Clock

#### Data Logging

- › Hours Running, Space Heating
- › Hours Running, Domestic Hot Water
- › Hours Running, Modulation Rate
- › Ignition Attempts
- › Last 10 Lockouts

#### Programmable System Efficiency Optimizers

- › Night Setback
- › Anti-Cycling
- › Outdoor Air Reset Curve
- › Ramp Delay
- › Boost Temperature & Time
- › Modulation Factor Control

#### Three Pump Control

- › System Pump
- › Boiler Pump
- › Domestic Hot Water Pump



#### High-Voltage Terminal Strip

- › 120 VAC / 60 Hertz / 1 Phase Power Supply (FB 0751-2001)
- › 208 VAC / 60 Hertz / 3 Phase Power Supply (FB 2501-3501)
- › 480 VAC / 60 Hertz / 3 Phase Power Supply (FB 4001-6001)
- › System Pump, Boiler Pump and DHW Pump Power

#### Low-Voltage Terminal Strip

- › 24 VAC Auxiliary Device Relay
- › Auxiliary Proving Switch Contacts
- › Alarm on Any Failure Contacts
- › Runtime Contacts
- › DHW Thermostat Contacts
- › Unit Enable/Disable Contacts
- › System Sensor Contacts
- › DHW Tank Sensor Contacts
- › Outdoor Air Sensor Contacts
- › Cascade Contacts
- › 0-10 VDC BMS External Control Contact
- › 0-10 VDC Variable Speed Boiler Pump Control Contact

### Standard Features

Proof of Closure Valve (FB 6001)

Modulating Burner with up to 25:1 Turndown

Direct-Spark Ignition

Low NOx Operation

Sealed Combustion

Air Inlet Filter

Low Gas Pressure Operation

#### Vertical and Horizontal Direct Venting

- › Direct Vent up to 100 Feet
- › PVC, CPVC, Polypropylene or AL29-4C (FB 0751-3501)
- › AL29-4C (FB 0751-6001)

ASME "H" Stamped Heat Exchanger

316L Stainless Steel Fire Tubes

160 psi Working Pressure

On/Off Switch

Adjustable High Limit with Manual Reset

Low Water Cutoff with Manual Reset & Test

High & Low Gas Pressure Switches w/Manual Reset

Low Air Pressure Switches

Condensate Trap w/Blocked Drain Switch

Drain Valve

System Sensor

Outdoor Air Sensor

Inlet & Outlet Temperature Sensors

High-Voltage Terminal Strip

Low-Voltage Terminal Strip

Downstream Gas Test Cocks

50 psi ASME Relief Valve

Temperature & Pressure Gauge

Zero Clearances to Combustible Materials

High Altitude Models Available

10-Year Limited Warranty (See Warranty for Details)

1-Year Warranty on Parts (See Warranty for Details)

### Optional Equipment

Alarm Bell

BMS Gateway - BACnet IP or LonWorks

Condensate Neutralization Kit

Common Vent Kits Damper

Motorized Isolation Valve

Variable Speed Boiler Pump

Wireless Outdoor Temperature Sensor

75 psi ASME Relief Valve

100 psi ASME Relief Valve

125 psi ASME Relief Valve

150 psi ASME Relief Valve

#### Electrical Options (Shipped Loose):

› FB 0751-2001

208V/ 3Ø/60 Hz → 120V/ 1Ø/60Hz

480V/ 3Ø/60 Hz → 120V/ 1Ø/60Hz

600V/ 3Ø/60 Hz → 120V/ 1Ø/60Hz

› FB 2501-3501

480V/ 3Ø/60 Hz → 208V/ 3Ø/60Hz

600V/ 3Ø/60 Hz → 208V/ 3Ø/60Hz

› FB 4001-6001

208V/ 3Ø/60Hz → 480V/ 3Ø/60 Hz

600V/ 3Ø/60 Hz → 480V/ 3Ø/60Hz



Lochinvar, LLC  
300 Maddox Simpson Parkway  
Lebanon, Tennessee 37090  
P: 615.889.8900 / F: 615.547.1000  
Lochinvar.com



**CREST BOILER PRODUCT SUMMARY**  
**(FB) 750,000 - 2,000,000 BTU/HR**

	FB-0751	FB-1001	FB-1251	FB-1501	FB-1751	FB-2001
<b>WATER</b>						
GALLON CAPACITY	73	77	87	94	106	111
HEATING SURFACE (SQ. FT.)	80	97	132	153	176	187
INLET WATER CONNECTION	3" Flanged	3" Flanged	3" Flanged	4" Flanged	4" Flanged	4" Flanged
OUTLET WATER CONNECTION	3" Flanged	3" Flanged	3" Flanged	4" Flanged	4" Flanged	4" Flanged
DRAIN	1-1/2"	1-1/2"	1-1/2"	1-1/2"	1-1/2"	1-1/2"
MAXIMUM FLOW RATE	350	350	350	350	350	350
MINIMUM FLOW RATE	18	18	18	25	25	25
20°F ΔT WATER FLOW (GPM)	72	96	120	144	168	192
HEAD LOSS (FT. OF HD.)	1.5	2.1	3.0	3.1	3.7	4.3
40°F ΔT WATER FLOW (GPM)	36	48	60	72	84	96
HEAD LOSS (FT. OF HD.)	0.5	0.6	0.9	0.9	1.1	1.3
MAX. WORKING PRESSURE (PSI)	160	160	160	160	160	160
# OF RELIEF VALVES	1	1	1	1	1	1
RELIEF VALVE SIZE	1"	1"	1"	1"	1"	1 1/4"
RELIEF VALVE RATING (MBH)	1,954,000	1,954,000	1,954,000	1,954,000	1,954,000	3,075,000
RELIEF VALVE PRESSURE RATING (PSI)	50	50	50	50	50	50
<b>GAS</b>						
BTU/HR INPUT	750,000	1,000,000	1,250,000	1,500,000	1,750,000	2,000,000
BTU/HR OUTPUT (HIGH FIRE)	720,000	960,000	1,200,000	1,440,000	1,680,000	1,920,000
BTU/HR OUTPUT (LOW FIRE)	48,100	48,100	60,125	57,720	67,340	76,960
INLET CONNECTION	1 1/4"	1 1/4"	1 1/4"	1 1/2"	1 1/2"	1 1/2"
MAX. INLET PRESSURE, NAT	14" w.c.	14" w.c.	14" w.c.	14" w.c.	14" w.c.	14" w.c.
MIN. INLET PRESSURE, NAT	4" w.c.	4" w.c.	4" w.c.	4" w.c.	4" w.c.	4" w.c.
MAX. INLET PRESSURE, LP	14" w.c.	14" w.c.	14" w.c.	14" w.c.	14" w.c.	14" w.c.
MIN. INLET PRESSURE, LP	4" w.c.	4" w.c.	4" w.c.	4" w.c.	4" w.c.	4" w.c.
<b>ELECTRICAL *</b>						
VOLTAGE/HEATER (VAC)	120/1PH	120/1PH	120/1PH	120/1PH	120/1PH	120/1PH
VOLTAGE/CONTROL (VAC)	24	24	24	24	24	24
TOTAL AMPS (FLA)	5	6	7	10	10	13
MINIMUM CIRCUIT AMPS (MCA)	6	8	9	13	13	16
# OF ELECTRICAL CONNECTIONS	1	1	1	1	1	1
<b>DIMENSIONS</b>						
HEIGHT	78"	78"	78"	78"	78"	78"
WIDTH	30"	30"	30"	30"	30"	30"
DEPTH	54"	54"	54"	66"	66"	66"
SHIPPING WEIGHT (lbs.)	1,560	1,596	1,648	1,961	2,017	2,087
OPERATING WEIGHT (lbs.)	1,768	1,838	1,975	2,307	2,458	2,570
<b>SERVICE CLEARANCES (RECOMMENDED)</b>						
FRONT	30"	30"	30"	30"	30"	30"
REAR	24"	24"	24"	24"	24"	24"
RIGHT SIDE	24"	24"	24"	24"	24"	24"
LEFT SIDE	24"	24"	24"	24"	24"	24"
TOP	24"	24"	24"	24"	24"	24"
<b>DIRECT VENTING</b>						
VENT SIZE	6"	6"	8"	8"	8"	8"
AIR INLET SIZE	6"	6"	6"	8"	8"	8"
VENT CATEGORY	II or IV	II or IV	II or IV	II or IV	II or IV	II or IV
VENT MATERIAL	SS, CPVC, PVC, Polypro	SS, CPVC, PVC, Polypro	SS, CPVC, PVC, Polypro	SS, CPVC, PVC, Polypro	SS, CPVC, PVC, Polypro	SS, CPVC, PVC, Polypro

\* Electrical - For alternate voltages and amp draws, please consult the factory or the installation and operation manual.



### VARIABLE SPEED PUMP

Job Name: \_\_\_\_\_ Model No. \_\_\_\_\_

Location: \_\_\_\_\_ Equipment Tag(s): \_\_\_\_\_

Engineer: \_\_\_\_\_

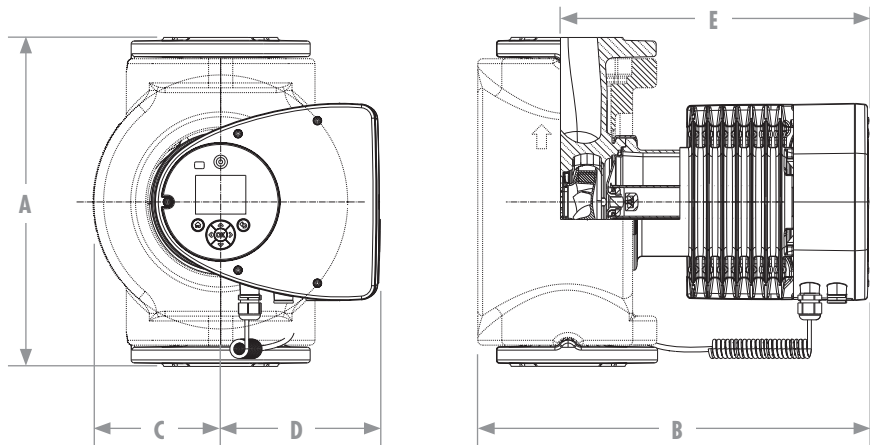
Agent/Wholesaler: \_\_\_\_\_

Contractor: \_\_\_\_\_

**NOTES:**

**STANDARD FEATURES**

- Digital Display
- Composite Rotor Can
- 316 L Stainless Steel Shaft
- Composite Impeller
- Cast Iron Housing
- Pump Status Indicator
- Alarm Contacts



Legacy Number	SAP Part No.	Volt	Max Amps	Pipe Size	A	B	C	D	E
PUM20077	100208411	115 VAC	2.5	1-1/2"	8-1/2"	14-3/4"	4-1/4"	6-1/2"	12"
PUM20078	100208412	115 VAC	5.6	2"	11"	15-3/4"	5"	6-1/2"	12"
PUM20079	100277760	208/230 VAC 1PH	4.6	3"	14-1/4"	17"	6-1/2"	6-1/2"	12-1/2"
PUM20080	100189240	208/230 VAC 1PH	7.0	4"	17-3/4"	17-3/4"	7"	6-1/2"	13"

# INSTALLATION INSTRUCTIONS

## GRUNDFOS MAGNA 3 VARIABLE SPEED PUMP WITH LOCHINVAR BOILERS

### FOR KNIGHT 400 - 801, FTXL 400 - 850 AND CREST 751- 5000

### Installation and Setup Procedure

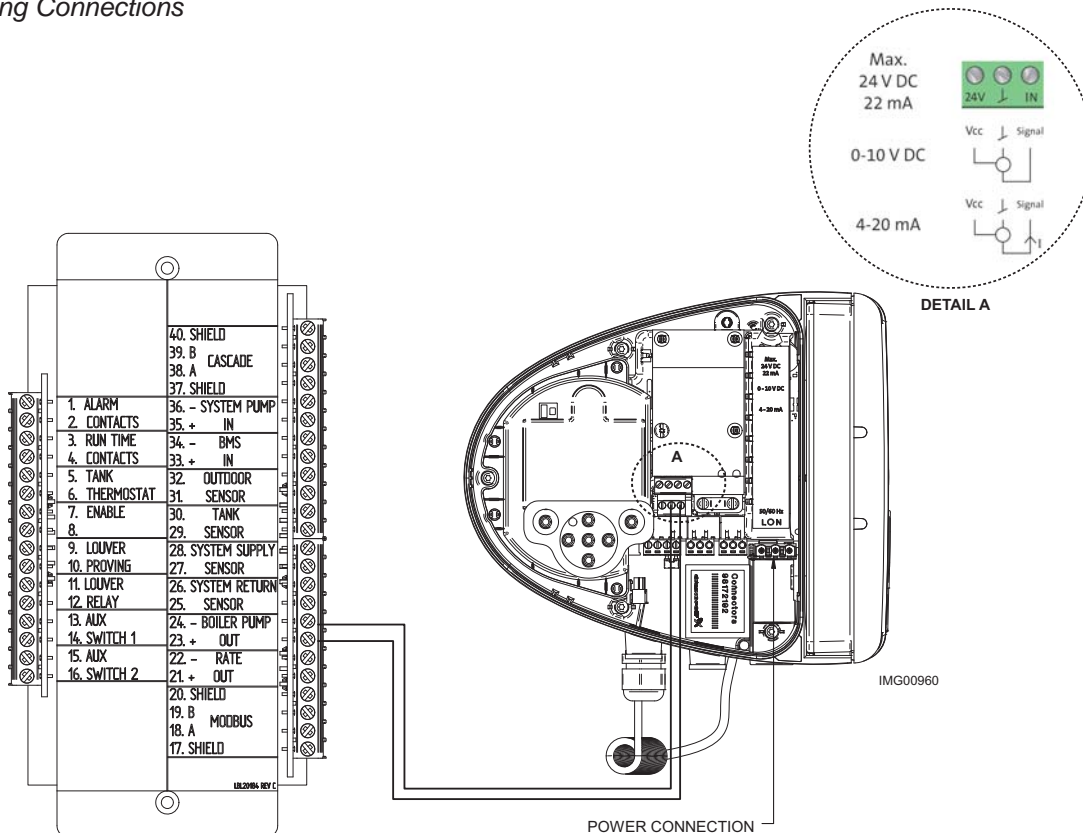
1. Refer to the installation manual provided by the pump manufacturer to install the pump. NOTE: The boiler MUST be installed in the Primary / Secondary piping configuration. A system supply sensor MUST be installed in the Primary (building) loop. Refer to the installation and operation manual provided by the boiler manufacturer to ensure the proper system piping configuration.
2. Reference FIG. 1 to connect wiring to the boiler's low voltage control board on the "Boiler Pump Out" terminal:
  - a) Connect the (+) wire from the boiler to "In" connection on the pump 0-10V wiring terminal.
  - b) Connect the (-) wire from the boiler to the ground terminal on the pump 0-10V wiring terminal.
3. Connect line voltage by supplying it directly to the pump.
 

**For Knight and FTXL Models:** Wire the boiler pump dry contacts located on the boiler's line voltage terminal directly to the Magna 3 start/stop connection.

**For Crest Models:** Wire a relay to the 115V boiler pump connections on the boiler's line voltage terminal. Connect the relay to the Magna 3 start/stop connection.

This method of line voltage supply allows the pump screen to stay on even when the boiler is in Standby mode. For additional information always reference the "Wiring" section in the boiler Installation and Operation Manual.
4. Reference Tables 1A, 1B and 1C on this instruction sheet to determine the setpoint percentage of the pump.
5. Follow the procedure below to apply the pump setpoint:
  - a) From the pump Home screen use the arrow keys to select "Setpoint".
  - b) Select "OK" to go to the Setpoint screen.
  - c) Use the arrow keys to assign a setpoint based on the information provided in FIG. 2, on page 3.
  - d) Select "OK" to save the setting.
  - e) Select the "Home" button to return to the Home screen.
6. The pump is pre-programmed for 0-10V operation, but the boiler will require set-up to control the variable speed pump. Follow the instructions for variable speed pump setup in the boiler installation manual.

**Figure 1** Wiring Connections





**TABLE 1A - KNIGHT XL TEMPERATURE RISE APPLICATIONS**

Model	20°F			25°F		
	GPM	Magna 3	Setpoint (%)	GPM	Magna 3	Setpoint (%)
400	37	40-80	92%	30	40-80	75%
501	46	50-150	42%	37	50-150	83%
601	55	50-150	79%	44	50-150	67%
701	65	50-150	79%	52	50-150	64%
801	74	50-150	100%	60	50-150	69%

**TABLE 1B - FTXL TEMPERATURE RISE APPLICATIONS**

Model	20°F			30°F			40°F		
	GPM	Magna 3	Setpoint (%)	GPM	Magna 3	Setpoint (%)	GPM	Magna 3	Setpoint (%)
400	38	40-80	54%	N/A			N/A		
500	48	40-80	68%	32	40-80	45%	N/A		
600	57	40-80	79%	38	40-80	53%	29	32-60	64%
725	69	40-80	88%	46	40-80	60%	34	40-80	46%
850	81	50-150	50%	55	40-80	70%	40	40-80	53%

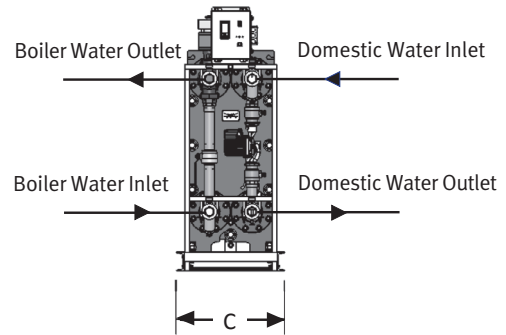
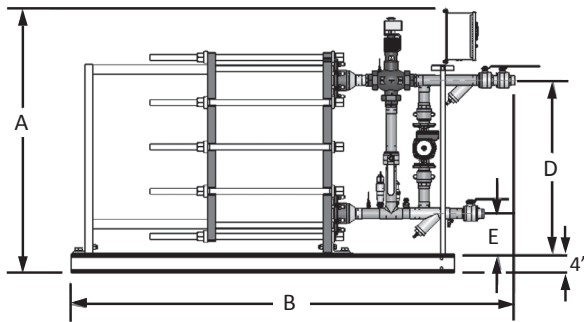
**TABLE 1C - CREST TEMPERATURE RISE APPLICATIONS**

Model	20°F			40°F			60°F		
	GPM	Magna 3	Setpoint (%)	GPM	Magna 3	Setpoint %	GPM	Magna 3	Setpoint %
751	72	50-150	42%	48*	40-80	60%	N/A		
1001	96	50-150	60%	48	40-80	60%	N/A		
1251	120	50-150	67%	60	40-80	75%	40	40-80	50%
1501	144	50-150	78%	72	40-80	91%	48	40-80	60%
1751	168	80-100	64%	84	50-150	48%	56	40-80	70%
2001	192	80-100	70%	96	50-150	54%	64	40-80	81%
2500	230	80-100	82%	115	50-150	57%	77	40-80	96%
3000	277	80-100	97%	138	50-150	69%	92	50-150	46%
3500	323	100-120	97%	161	50-150	81%	108	50-150	59%
4000	248*	80-100	87%	186	80-100	64%	124	50-150	61%
5000	310*	100-120	92%	233	80-100	79%	155	50-150	77%

\*Based on 30°F Temperature Rise

**INDIRECT PLATE AND FRAME WATER HEATER**

JOB NAME \_\_\_\_\_  
 LOCATION \_\_\_\_\_  
 ENGINEER \_\_\_\_\_  
 WHOLESALER \_\_\_\_\_  
 CONTRACTOR \_\_\_\_\_  
 MODEL NO. \_\_\_\_\_  
 TYPE GAS \_\_\_\_\_  
 EQUIPMENT TAG \_\_\_\_\_  
 NOTES \_\_\_\_\_



**Indirect Plate and Frame Dimensions and Specifications**

Model Number	A	B	C	D	E	Water Connections
IPW015DW	50"	66"	17"	31"	6"	1-1/4"
IPW030DW	50"	74"	17"	31"	6"	1-1/4"
IPW050DW	50"	87"	17"	31"	6"	2"
IPW070DW	50"	97"	17"	31"	6"	2"
IPW090DW	56"	101"	23"	37"	6"	2"
IPW105DW	56"	107"	23"	37"	6"	2-1/2"
IPW120DW	56"	107"	23"	37"	6"	2-1/2"

**Standard Features**

- ASME Double Wall Heat Exchanger
  - 316L Stainless Steel
  - 150 psi Working Pressure
- Digital Display
  - Set Point Range 90°F to 180°F
- Advance Temperature Control
- Modulating Control Valve
- Scale Reduction Pump
- Automatic Air Vent
- ASME Temperature and Pressure Relief Valve
  - 210°F and 150 psi
- Adjustable High Limit
- Wye Strainers
- Isolation Valves
- Modbus Communication
- 5 Year Limited Warranty (See Warranty for Details)
- 1 Year Parts Warranty (See Warranty for Details)

# SERIES S&H ECM | ECM CIRCULATORS | SUBMITTAL

File No: 10.515  
 Date: DECEMBER 20, 2017  
 Supersedes: 10.515  
 Date: MARCH 01, 2017

Job: \_\_\_\_\_ Representative: \_\_\_\_\_  
 \_\_\_\_\_ Ordered by: \_\_\_\_\_ Date: \_\_\_\_\_  
 Engineer: \_\_\_\_\_ Submitted by: \_\_\_\_\_ Date: \_\_\_\_\_  
 Contractor: \_\_\_\_\_ Approved by: \_\_\_\_\_ Date: \_\_\_\_\_

### PUMP DESIGN DATA

Pump model: \_\_\_\_\_ Flange size: \_\_\_\_\_  
 No. of pumps: \_\_\_\_\_ Note: \_\_\_\_\_  
 Capacity: \_\_\_\_\_ USgpm (L/s) Head: \_\_\_\_\_ ft (m)  
 Temperature: \_\_\_\_\_ °F (°C) Liquid: \_\_\_\_\_  
 Companion flanges: Included  
 All Bronze Circulators are NSF - 372 rated

### MATERIALS OF CONSTRUCTION

PART NAME	BRONZE FITTED	LEAD FREE BRONZE*
Pump Body	Cast iron	Lead free bronze

**Impeller:** Non-ferrous  
**Bearings:**  Sleeve - Oil lubricated for the H-63 to 67 and S-69 \*\*  
 'Maintenance free' bearings - No lubrication for the H-53, H-54, S-55 and S-57 \*\*\*

**Seal:** Mechanical  
**Stationary seal face:** Sintered silicon carbide

\* Contains less than 0.25% lead, weighted average.  
 \*\* Alloy shaft with copper sleeve.  
 \*\*\* Stainless steel shaft.

### CAUTION

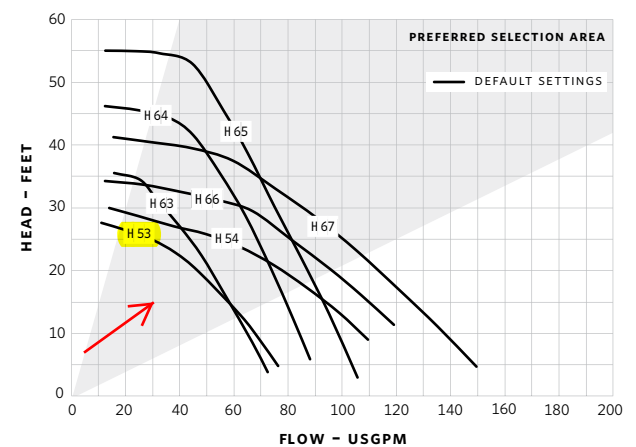
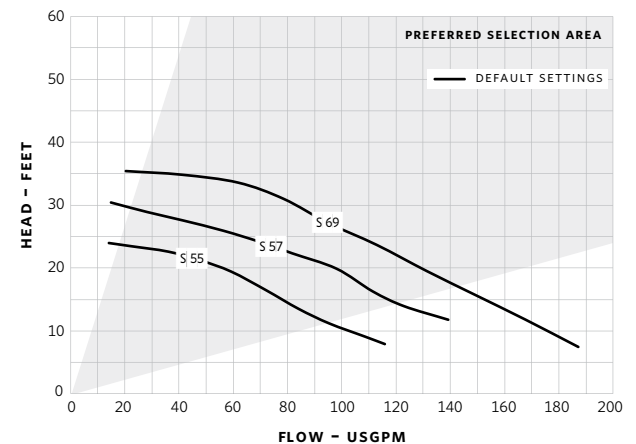


To avoid motor overheating and possible burnout, do not operate pump outside of the preferred operating range. To view these operating ranges, please see the submittals on our website, file numbers for S series 10.50 and H series 10.51.

### MAXIMUM PUMP OPERATING CONDITIONS

175 psig at 225°F (1206 kPa at 107°C)

### PERFORMANCE CURVE



Based on 1800 RPM, 60 Hz motors.  
 For 50 Hz motors write for special capacity charts.

MODEL	FLANGE SIZE (N.P.T)	MOTOR <sup>†</sup>		DIMENSIONS inches (mm)				WEIGHT
		HP	PHASE AND VOLT	A	B	C	D	lbs (kg)
H-53-1	1.5	1/2	1 phase 115 v	20.36 (517)	11.50 (292)	16.79 (426)	0.88 (22)	59 (26.8)
			1 phase 208-230 v	20.36 (517)	11.50 (292)	16.79 (426)	0.88 (22)	59 (26.8)
H-54-1	2	3/4	1 phase 115 v	20.42 (519)	11.50 (292)	19.93 (506)	0.88 (22)	66 (30.0)
			1 phase 208-230 v	20.42 (519)	11.50 (292)	19.93 (506)	0.88 (22)	66 (30.0)
H-63-1	1.5	1/2	1 phase 115 v	23.12 (587)	13.50 (343)	19.93 (506)	0.88 (22)	91 (41.4)
			1 phase 208-230 v	23.12 (587)	13.50 (343)	19.93 (506)	0.88 (22)	91 (41.4)
H-64-1	1.5	3/4	1 phase 115 v	23.12 (587)	13.50 (343)	19.93 (506)	0.88 (22)	95 (43.2)
			1 phase 208-230 v	23.12 (587)	13.50 (343)	19.93 (506)	0.88 (22)	95 (43.2)
H-65-1	1.5	1	1 phase 208-230 v	23.12 (587)	13.50 (343)	19.93 (506)	0.88 (22)	100 (45.4)
H-66-1	2	3/4	1 phase 115 v	23.53 (598)	14.02 (356)	20.04 (509)	0.88 (22)	115 (52.3)
			1 phase 208-230 v	23.53 (598)	14.02 (356)	20.04 (509)	0.88 (22)	115 (52.3)
H-67-1	2	1	1 phase 208-230 v	23.53 (598)	14.02 (356)	20.04 (509)	0.88 (22)	123 (55.9)
S-55-1	3	1/2	1 phase 115 v	20.24 (514)	12.00 (305)	16.93 (430)	1.00 (25)	77 (35.0)
			1 phase 208-230 v	20.24 (514)	12.00 (305)	16.93 (430)	1.00 (25)	77 (35.0)
S-57-1	3	3/4	1 phase 115 v	20.42 (519)	11.50 (292)	16.93 (430)	1.00 (25)	80 (36.4)
			1 phase 208-230 v	20.42 (519)	11.50 (292)	16.93 (430)	1.00 (25)	80 (36.4)
S-69-1	3	1	1 phase 208-230 v	24.44 (621)	14.25 (362)	19.93 (506)	1.00 (25)	113 (60.5)

Dimensions shown are for reference only. For exact dimensional data, contact factory.  
<sup>†</sup>All single phase motors are equipped with a built-in thermal overload protection.  
 Three phase motors require external overload protection.  
 Conduit box not supplied on 1/2 hp or greater.

TORONTO  
+1 416 755 2291

BUFFALO  
+1 716 693 8813

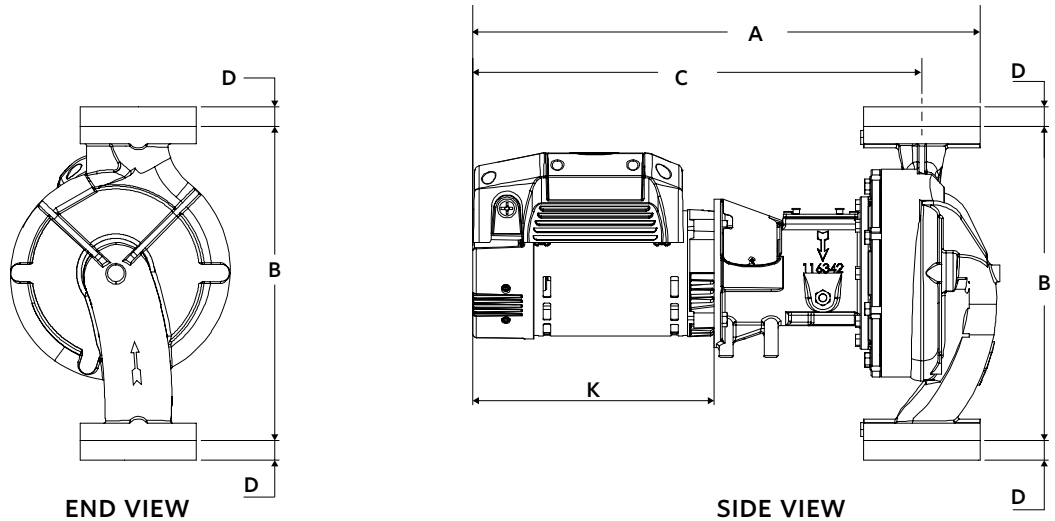
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+86 21 3756 6696

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+55 11 4781 5500



# COMPASS H | DESIGN ENVELOPE VARIABLE SPEED WET ROTOR CIRCULATORS | SUBMITTAL

File No: 10.65  
Date: OCTOBER 05, 2017  
Supersedes: 10.65  
Date: SEPTEMBER 20, 2016

Job: \_\_\_\_\_ Representative: \_\_\_\_\_  
 \_\_\_\_\_ Ordered by: \_\_\_\_\_ Date: \_\_\_\_\_  
 Engineer: \_\_\_\_\_ Submitted by: \_\_\_\_\_ Date: \_\_\_\_\_  
 Contractor: \_\_\_\_\_ Approved by: \_\_\_\_\_ Date: \_\_\_\_\_

## TECHNICAL DATA

Supply voltage: 1 × 115 V - 10%/+ 6%

	MINIMUM	MAXIMUM
Amp	0.05	0.72
Watt	5	45

**Motor protection:** The pump requires no external motor protection.

**Maximum working temperature:** 230°F (110°C) maximum

**Maximum working pressure:** 150 psi (10 bar).

**Maximum relative air humidity (rh):** 95%.

**Flow range:** 0 - 20 USgpm (0 to 1.26 L/s)

**Head range:** 0 - 20.0 feet (0 to 6.09 m)

**Enclosure class:** Type 2

**Insulation class:** H

**Certification:** ETL listed for US and Canada (conforms to ULSTD.778 certified to CSA STD. C22.2 NO.108-01)

\*NSF 372 (for stainless steel models)

## INLET PRESSURE

Minimum inlet pressure in relation to liquid temperature:

LIQUID TEMPERATURE	MINIMUM INLET PRESSURE
150°F (65°C)	3.0 ft (0.91 m)
167°F (75°C)	4.4 ft (1.34 m)
194°F (90°C)	9.2 ft (2.8 m)
230°F (110°C)	36.1 ft (11.0 m)

**Sound pressure level:** The sound pressure level of the pump is lower than 43 dB(A).

**Ambient temperature:** 32°F (0°C) - 104°F (40°C)

**Pumped liquids:** Water or water Glycol mix.

**Liquid temperature:** 36°F (2°C) - 230°F (110°C)\*\*

To avoid condensation in the control box and stator, the liquid temperature must always be higher than the ambient temperature.

AMBIENT TEMPERATURE	LIQUID TEMPERATURE	
	MIN.	MAX.
32°F (0°C)	35.6°F (2°C)	230°F (110°C)
50°F (10°C)	10°C (50°F)	230°F (110°C)
68°F (20°C)	68°F (20°C)	230°F (110°C)
86°F (30°C)	86°F (30°C)	230°F (110°C)
95°F (35°C)	95°F (35°C)	194°F (90°C)
104°F (40°C)	104°F (40°C)	176°F (80°C)

## MATERIALS OF CONSTRUCTION

**Pump body:** Cast iron (closed systems)

Stainless steel\*\* (open systems)

**Impeller:** Noryl

**Shaft:** Ceramic

**Bearings:** Ceramic

**Gasket material:** EPDM

## HARDWARE KIT

Companion flange kit (contains two (2) flanges, hardware and gaskets) (for flange models)

Union kit (contains two (2) union nuts, connection (sweat or nut) and gaskets)

**Cast iron:** 0.75", 1", 1.25", 1.5"

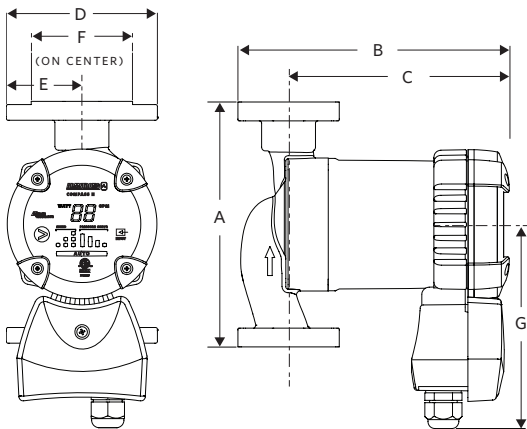
**Bronze:** 0.75", 1", 1.25", 1.5"

**DIMENSIONS AND WEIGHTS**

STAINLESS STEEL*	A	B	C	D	E	F	G	CONNECTION TYPE & SIZE	WEIGHT
Compass H 20-20 ss flange	6.50 (165)	7.08 (180)	5.75 (146)	4.00 (102)	2.00 (50)	3.25 (80)	5.31 (135)	Flange - (2) 1/2" dia. bolt holes	8.0 (3.6)
Compass H 20-20 ssu	6.00 (152)	7.08 (180)	5.75 (146)	4.00 (102)	2.00 (50)	1.25 (32)	5.31 (135)	1 1/4" Union	
CAST IRON	A	B	C	D	E	F	G	CONNECTION TYPE & SIZE	WEIGHT
Compass H 20-20 ci flange	6.50 (165)	7.08 (180)	5.75 (146)	4.00 (102)	2.00 (50)	3.25 (80)	5.31 (135)	Flange - (2) 1/2" dia. bolt holes	8.0 (3.6)

**NOTE:**  
All dimensions are in inches (mm) and weights in lbs (kg).  
\*Certified <0.25 weighted average percent lead and complies with California Health and Safety Code Section 116875 (commonly known as AB 1953).  
\*\* For open systems, it is recommended that the liquid temperature be less than 150°F (65°C) to avoid precipitation of calcium.

**COMPASS H FLANGE**



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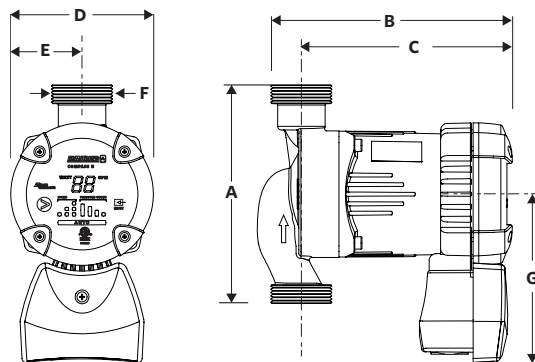
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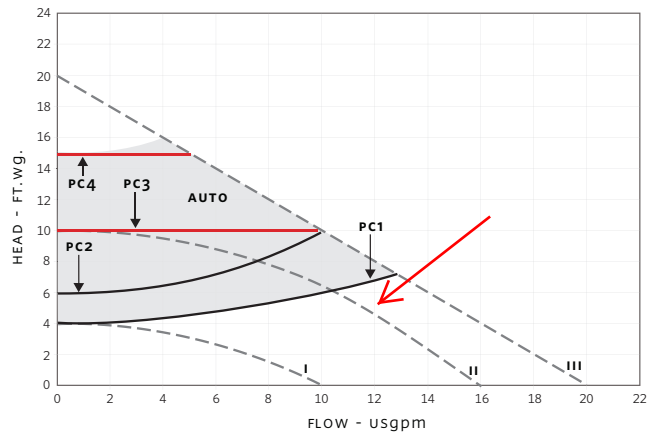
**COMPASS H UNION**



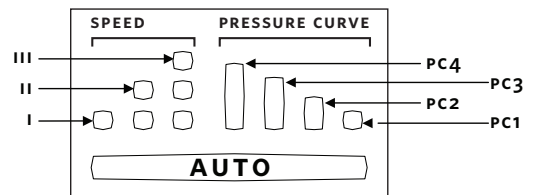
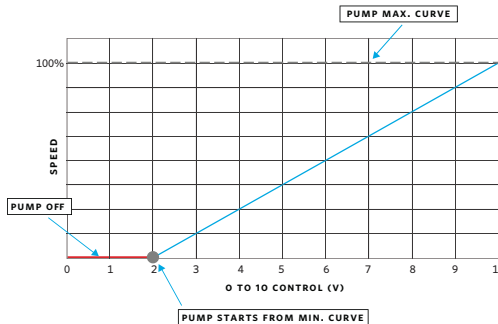
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**COMPASS H PERFORMANCE CURVES**



**0 - 10VDC OPERATION**



Lights on the display indicate the Control mode selected.



## Typical Specification

### FBNT-SPEC-04

## Typical Specification for Lochinvar® Crest Heating Boiler Models 750,000 – 6,000,000 Btu/Hr

The **BOILER** shall be a **LOCHINVAR** Crest Model **FB(N,L)** \_\_\_\_\_ having a modulating input rating of \_\_\_\_\_ Btu/Hr, an output of \_\_\_\_\_ Btu/Hr and shall be operated on (Natural Gas) (L.P. Gas). The **BOILER** shall be capable of following performance:

Model	Turndown	Minimum Input	Maximum Input
FB 0751	15:1	50,000	750,000
FB 1001	20:1	50,000	999,999
FB 1251	20:1	62,500	1,250,000
FB 1501	25:1	60,000	1,500,000
FB 1751	25:1	70,000	1,750,000
FB 2001	25:1	80,000	1,999,999
FB 2501	20:1	125,000	2,500,000
FB 3001	20:1	150,000	3,000,000
FB 3501	20:1	175,000	3,500,000
FB 4001	12:1	333,333	3,999,999
FB 5001	10:1	500,000	4,999,999
FB 6001	10:1	600,000	6,000,000

Maximum unit dimensions shall be: Length \_\_\_\_\_ inches, Width \_\_\_\_\_ inches and Height \_\_\_\_\_ inches. Maximum operating (wet) unit weight shall be \_\_\_\_\_ pounds.

The **BOILER** shall bear the ASME "H" stamp for 160 psi working pressure and shall be National Board listed. The **BOILER** shall have a fully welded 316L stainless steel, fire tube heat exchanger. There shall be a single pressure vessel. Multiple pressure vessels are not acceptable. Fire Tube shall be of the Wave Fire Tube design and capable of transferring 16,000 to 20,000 Btu's per tube. A liquid impact die shall be used to form the Wave Fire Tube. There shall be no banding material, bolts, gaskets or "O" rings in the heat exchanger construction. The Wave Fire Tube shall be robotically welded to the tube sheets. The heat exchanger shall be designed for a single-pass water flow to limit the water side pressure drop. Pressure drop shall be no greater than 3.2 psi at 180 gpm. The condensate collection basin shall be constructed of welded 316L stainless steel. The complete heat exchanger assembly shall carry a ten (10) year limited warranty.

The heat exchanger shall contain a volume of water no less than:

Model	Water Content
FB 0751	73 gallons
FB 1001	77 gallons
FB 1251	87 gallons
FB 1501	94 gallons
FB 1751	106 gallons
FB 2001	111 gallons
FB 2501	157 gallons
FB 3001	156 gallons
FB 3501	202 gallons
FB 4001	201 gallons
FB 5001	254 gallons
FB 6001	304 gallons

The **BOILER** shall be certified and listed by C.S.A. International under the latest edition of the harmonized ANSI Z21.13 test standard for the U.S. and Canada. The **BOILER** shall comply with the energy efficiency requirements of the latest edition of the ASHRAE 90.1 Standard and the minimum efficiency requirements of the latest edition of the AHRI BTS-2000 Standard as defined by the Department of Energy in 10 CFR Part 431. The **BOILER** shall operate at a minimum of 96.2% thermal efficiency (models FB 751 – FB 2001) or 96% thermal efficiency (models FB 2501 – FB 6001), at full fire as registered with AHRI. The registered combustion efficiency must be equal to or greater than the registered thermal efficiency. All models shall operate up to 98% thermal efficiency with return water temperatures at 70°F or below at 20°F temperature rise. The **BOILER** shall be certified for indoor installation.

The **BOILER** shall be constructed with a heavy gauge steel jacket assembly, primed and pre-painted on both sides. The combustion chamber shall be sealed and completely enclosed, independent of the outer jacket assembly, so that integrity of the outer jacket does not affect a proper seal. Two burner/flame observation ports shall be provided. The single burner shall be a premix design constructed of high temperature stainless steel with a woven Fecralloy outer covering to provide modulating firing rates. The **BOILER** shall be supplied with two gas valves designed with negative pressure regulation and be equipped with a pulse width modulation blower system, to precisely control the fuel/air mixture to provide modulating boiler firing rates for maximum efficiency. The **BOILER** shall operate in a safe condition with gas supply pressures as low as 4 inches of water column. The FB 6001 shall be supplied with a proof of closure valve (POC) and shall prevent the boiler from firing if the POC valve seat is detected open. Upon a call for heat, once the POC valve seat is proven to be closed, the pre-purge cycle will begin and the POC valve will begin to open. The burner flame shall be ignited by direct spark ignition with flame monitoring via a flame sensor.

The **BOILER** shall utilize a 24 VAC control circuit and components. The control system shall have a display for boiler set-up, boiler status, and boiler diagnostics. All components shall be easily accessed and serviceable from the front and top of the jacket. The **BOILER** shall be equipped with a temperature/pressure gauge; high limit temperature control with manual reset; ASME certified pressure relief valve set for 50 psi (standard); outlet water temperature sensor (dual thermistor); return water temperature sensor; outdoor air sensor, flue temperature sensor (dual thermistor); high and low gas pressure switches, low water cut off with manual reset, blocked drain switch and a condensate trap for the heat exchanger condensate drain.

The **BOILER** shall feature the “SMART TOUCH™” control with CON-X-US which is standard and factory installed with an 8” liquid crystal touch screen display, password security, outdoor air reset, pump delay with freeze protection, pump exercise, ramp delay featuring six steps, domestic hot water prioritization with limiting capabilities and PC port connection. A secondary control that is field mounted outside or inside the appliance is not acceptable. The **BOILER** shall have alarm contacts for any failure, runtime contacts and data logging of runtime at given modulation rates, ignition attempts and ignition failures. The **BOILER** shall have a built-in “Cascade” to sequence and rotate while maintaining modulation of up to eight boilers of different Btu inputs without utilization of an external controller. The internal “Cascade” function shall be capable of lead-lag, efficiency optimization, front-end loading, and rotation of lead boiler every 24 hours. The control must include cascade redundancy to allow a member boiler to become the temporary leader if the original lead boiler shall lose communication with the members. The **BOILER** shall be capable of controlling an isolation valve (valve shall be offered by manufacturer) during heating operation and rotation of open valves in standby operation for full flow applications. The control must be equipped with standard BACnet MSTP and Modbus communication protocol with a minimum 55 readable points. The **BOILER** shall have an optional gateway device which will allow integration with LON or BACnet (IP) protocols.

The “SMART TOUCH™” control shall include CON-X-US communication platform that will allow remote access via a smart phone or Tablet. This will allow the ability to monitor and manage multiple Crest Boilers and send alerts via text or e-mail notifying of changes in system status. A user shall have the ability to check system status or re-program any boiler function remotely.

The “SMART TOUCH™” control shall increase fan speed to boost flame signal when a weak flame signal is detected during normal operation. A 0 -10 VDC output signal shall control a variable speed boiler pump (pump to be offered by manufacturer) to keep a fixed delta t across the boiler regardless of the modulation rate. The **BOILER** shall have the capability to receive a 0 – 10 VDC input signal from a variable speed system pump to anticipate changes in system heat load in order to prevent flow related issues and erratic temperature cycling.

The **BOILER** shall be equipped with two terminal strips for electrical connection. A low voltage connection board with 30 data points for safety and operating controls, i.e., Alarm Contacts, Runtime Contacts, Louver Proving Switch, Tank Thermostat, Remote Enable/Disable, System Supply Sensor, Outdoor Sensor, Tank Sensor, Modbus Building Management System signal and Cascade control circuit. A high voltage terminal strip shall be provided for Supply voltage. Supply voltage shall be 120 volt / 60 hertz / single phase (FB 751 – FB 2001), 208 volt / 60 hertz / three phase (FB 2501 – FB 3501), or 480 volt / 60 hertz / three phase (FB 4001 – FB 6001). The boiler may be factory trimmed for optional supply voltages, i.e. 208 volt / 60 hertz / 3 phase, 480 volt / 60 hertz / 3 phase and 600 volt / 60 hertz / 3 phase. The high voltage terminal strip plus integral relays are provided for independent pump control of the System pump, the Boiler pump and the Domestic Hot Water pump.



The **BOILER** shall be installed and vented with a (select one):

**(a) Direct Vent system with horizontal sidewall termination** of both the exhaust vent and combustion air. The flue shall be Category IV approved PVC, CPVC, PP (FB 0751 – 3501) or Category IV approved Stainless Steel (FB 0751- 6001) sealed vent material terminating at the sidewall with the manufacturer’s specified vent termination. A separate pipe shall supply combustion air directly to the boiler from the outside. The air inlet pipe must be sealed and may be other materials listed in the Installation manual. The boiler’s total combined air intake length shall not exceed 100 equivalent feet. The boiler’s total combined exhaust venting length shall not exceed 100 equivalent feet. The air inlet must terminate on the same sidewall as the exhaust.

**(b) Direct Vent system with vertical roof top termination** of both the exhaust vent and combustion air. The flue shall be Category IV approved PVC, CPVC, PP (FB 0751 – 3501) or Category IV approved Stainless Steel (FB 0751 – 6001) sealed vent material terminating at the rooftop with the manufacturer’s specified vent termination. A separate pipe shall supply combustion air directly to the boiler from the outside. The air inlet pipe must be sealed and may be other materials listed in the Installation manual. The boiler’s total combined air intake length shall not exceed 100 equivalent feet. The boiler’s total combined exhaust venting length shall not exceed 100 equivalent feet. The air inlet must terminate on the rooftop with the exhaust.

**(c) Vent system with Vertical rooftop or Horizontal sidewall exhaust** with the combustion air intake in different pressure zones. The flue shall be Category IV approved PVC, CPVC, PP (FB 0751 – 3501) or Category IV approved Stainless Steel (FB 0751 – 6001) sealed vent material terminating at the rooftop or sidewall with the manufacturer’s specified vent termination. A separate pipe shall supply combustion air directly to the boiler from the outside in a different pressure zone from that of the exhaust vent. The air inlet pipe must be sealed and may be other materials listed in the Installation manual. The boiler’s total combined air intake length shall not exceed 100 equivalent feet. The boiler’s total combined exhaust venting length shall not exceed 100 equivalent feet.

**(d) Vertical rooftop or Horizontal sidewall exhaust** with the combustion air drawn from the equipment room. The flue shall be Category IV approved PVC, CPVC, PP (FB 0751 – 3501) or Category IV approved Stainless Steel (FB 0751 – 6001) sealed vent material. The boiler’s total exhaust venting length shall not exceed 100 equivalent feet (FB 751-2001) or 150 equivalent feet (FB 2501 – FB 6001). Combustion air draw from the equipment room shall be supplied with properly sized combustion and ventilation air openings based on NFPA requirements.

**(e) Common Vented** with multiple Crest boilers. The flue shall be Category II/IV approved PVC, CPVC, PP or Stainless Steel sealed vent material for models FB 0751 – FB 3501. Models FB 4001 – FB 6001 shall be Category II/IV approved Stainless Steel sealed vent only. The exhaust and air intake venting must use the exact diameter, length, placement, and terminations as specified by the designer.

The **BOILER** shall operate at altitudes up to 4,500 feet above sea level without additional parts or adjustments. High altitude operation shall be certified at a minimum of 4,500 feet above sea level by a 3<sup>rd</sup> party organization.

The **BOILER** shall be suitable for use with polypropylene glycol, up to 50% concentration. The de-rate associated with the glycol will vary per glycol manufacturer.

## **STANDARD CONSTRUCTION**

The **BOILER** shall be constructed in accordance with the following code requirements as standard equipment. Manufacturing of special models to meet the below code requirements is not acceptable.

### **California Code**

**CSD1 / Factory Mutual / GE Gap**

**Massachusetts Code**

**KY Kentucky Code**

**CRN Approval in Canada**

**Note: Due to the large disparity in CSD-1 interpretation from state to state, please confirm to the factory all controls required in your jurisdiction.**



**Lochinvar®**

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www.Lochinvar.com

## Typical Specification

### IPW(TEMP)-SPEC-01

## Typical Specification for Lochinvar Indirect Plate and Frame Water Heater *Water to Water*

The **Indirect Plate and Frame** shall be a **Lochinvar** Model no. IPW030DW. The plate and frame shall be constructed of a 316 stainless steel plate with EPDM gaskets. Maximum unit dimensions shall be: Length 74 inches, Width 17 inches and Height 50 inches.

The **Indirect Plate and Frame** shall be a double wall design to provide 21 GPM for a temperature rise of 40 degrees F to 140 degrees F when supplied with 180 degrees F boiler water. The plate and frame shall be constructed in accordance with the ASME Boiler and Pressure Vessel Code requirements, stamped and registered with the National Board of Boiler and Pressure Vessel Inspectors.

The **Indirect Plate and Frame** shall have a 150 psi working pressure and be supplied with an ASME temperature and pressure relief valve. Standard equipment shall include Wye Strainers, Isolation Valves, Automatic Air Vent, Scale Reduction Pump, Adjustable High Limit and drain valve

The temperature control shall provide + or - 4 degrees Fahrenheit accuracy with up to a 50% change in load. Setpoint range between 90 and 180. Modbus communication shall be standard equipment. The modulating valve shall have a 1000 to 1 turndown.

The **Indirect Plate and Frame** shall be suitable for use with polypropylene glycol, up to 50% concentration. The de-rate associated with the glycol will vary per glycol manufacturer.

### STANDARD CONSTRUCTION

The **Indirect Plate and Frame** shall be constructed in accordance with the following code requirements as standard equipment.

### **CRN Approval in Canada**

# Series S&H and S&H ECM In-Line Circulators

File No: 10.205  
Date: November 6, 2017  
Supersedes: 10.205  
Date: August 11, 2016

## Typical Specifications

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### General Description

Furnish and install as shown on the plans, Armstrong S&H or S&H ECM Series Circulating Pump, designed for quiet operation and guaranteed by the manufacturer for the intended application. The pump shall;

- Have a capacity of 30 USgpm (L/s)
- Handle (state liquid and temperature) against a total head of 20 ft (m)
- Be equipped with a 1/2 hp (kW), 115 Volt, phase, 60 Hz and 1800 rpm drip-proof mounted motor.

Pump shall be Lead-Free Bronze construction, three-piece design featuring the Armstrong shaft and bearing module which shall fit all models;

- S&H

- S-25 through S-57

- H-32 through H-54

- S&H ECM

- S55 ECM, S57 ECM and S69 ECM

- H53 ECM, H54 ECM and H63 ECM through H67 ECM

**Please select one of the above only**

Pump to be equipped with a water-tight, long-life silicon carbide mechanical seal and be suitable for \_\_\_\_\_ psi (kPa) working pressure.

# Compass

## Typical Specifications

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File No: 10.222  
Date: November 20, 2015  
Supersedes: New  
Date: New

### General Description

#### Design Envelope Wet Rotor Circulator

Furnish and install, as shown on the plans, Armstrong Compass circulating pump model with high efficiency ECM motor and 8 modes of control, in stainless steel/cast iron body and Noryl impeller. The pump shall have a capacity of   12   USgpm (L/s) against a total head of   5   ft (m). Armstrong Compass Series are 115V/230V/single phase/60 Hz and are cETLus listed.

Stainless steel body Compass is NSF 372 certified which complies with Section 116875 of the California Health and Safety Code and Vermont Act 193. (Lead content of all wetted surface is 0.25% or less.)

END OF SECTION 15550

SECTION 15950

AUTOMATIC TEMPERATURE CONTROLS/BUILDING AUTOMATION SYSTEM (EXTENSION)

Part 1 -General

1.1 Related Documents

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

1.2 Qualifications of Bidder and Pre-Bid Submittal

- A. All bidders must utilize the Owner's control system and control contractor, Commercial Air, for extension of the existing building automation system (BAS) controls for new equipment.

- A. Additional related sections and sub-sections can apply.

1. 15010 - Basic Mechanical Requirements
2. 15180 - Testing, Adjusting, & Balancing
3. 15550 - Mechanical Equipment
4. 16010 - Basic Electrical Requirements

1.4 Scope of Work

- A. The Contractor shall contact Commercial Air, Inc., 9811 Interstate 30, Little Rock, Arkansas 72209, 501-562-6982, for extension of the existing BAS to connect and operate new and replaced equipment in this project, as required.

Part 2 -Products

2.1 Pre-approved Manufacturers

- A. Subject to compliance with requirements, provide products by one of the following pre-qualified manufacturers:

Direct Digital Control Systems Devices: Schneider Electric I/A BACnet, LON, or NETWORK 8000 series, Continuum BACnet series, TAC Xenta LON series, or TAC I/NET series installed by Commercial Air, Inc., 9811 Interstate 30, Little Rock, Arkansas 72209, 501-562-6982

Part3 - Execution

3.1 Contractor Responsibilities

A. General

1. Installation of the extension of the building automation system shall be performed by the Contractor or a subcontractor. However, all installation shall be under the personal supervision of the Contractor. The Contractor shall certify all work as proper and complete. Under no circumstances shall the design, scheduling, coordination, programming, training, and warranty requirements for the project be delegated to a subcontractor.

B. Demolition

1. Remove controls which do not remain as part of the building automation system, all associated abandoned wiring and conduit, and all associated pneumatic tubing. The Owner will inform the Contractor of any equipment which is to be removed that will remain the property of the Owner. All other equipment which is removed will be disposed of by the Contractor.

C. Access to Site

1. Unless notified otherwise, entrance to building is restricted. No one will be permitted to enter the building unless their names have been cleared with the Owner or the Owner's Representative.

D. Code Compliance

1. All wiring shall be installed in accordance with all applicable electrical codes and will comply with equipment manufacturer's recommendations. Should any discrepancy be found between wiring specifications and Division 16, the most stringent shall govern.

E. Cleanup

1. At the completion of the work, all equipment pertinent to this contract shall be checked and thoroughly cleaned, and all other areas shall be cleaned around equipment provided under this contract.

3.2 Wiring, Conduit, and Cable

- A. All wire will be copper and meet the minimum wire size and insulation class listed below, except where in conflict with Div. 16:

Wire Class	Wire Size	Isolation Class
Power	12 Gauge	600 Volt
Class One	14 Gauge Std.	600 Volt
Class Two	18 Gauge Std.	300 Volt
Class Three	18 Gauge Std.	300 Volt
Communications	Per Mfr.	Per Mfr.

- B. Power and Class One wiring may be run in the same conduit. Class Two and Three wiring and communications wiring may be run in the same conduit.

- C. Where different wiring classes terminate within the same enclosure, maintain clearances and install barriers per the National Electric Code.
- D. Where wiring is required to be installed in conduit, EMT shall be used. Conduit shall be minimum 1/2 inch galvanized EMT. Set screw fittings are acceptable for dry interior locations. Watertight compression fittings shall be used for exterior locations and interior locations subject to moisture. Provide conduit seal-off fitting where exterior conduits enter the building or between areas of high temperature/moisture differential.
- E. Flexible metallic conduit (max. 3 feet) shall be used for connections to motors, actuators, controllers, and sensors mounted on vibration producing equipment. Liquid-tight flexible conduit shall be use in exterior locations and interior locations subject to moisture.
- F. Junction boxes shall be provided at all cable splices, equipment termination, and transitions from EMT to flexible conduit. Interior dry location J-boxes shall be galvanized pressed steel, nominal four-inch square with blank cover. Exterior and damp location JH-boxes shall be cast alloy FS boxes with threaded hubs and gasketed covers.
- G. Where the space above the ceiling is a supply or return air plenum, the wiring shall be plenum rated. Teflon wiring can be run without conduit above suspended ceilings.  
EXCEPTION: Any wire run in suspended ceilings that is used to control outside air dampers or to connect the system to the fire management system shall be in conduit.
- H. Fiber optic cable shall include the following sizes; 50/125, 62.5/125 or 100/140.
- I. Only glass fiber is acceptable, no plastic.
- J. Fiber optic cable shall only be installed and terminated by an experienced contractor. The BAS contractor shall submit to the Engineer the name of the intended contractor of the fiber optic cable with his submittal documents.

### 3.3 Hardware Installation

- A. Installation Practices for Wiring
- B. All controllers are to be mounted vertically and per the manufacturer's installation documentation.
- C. The 120VAC power wiring to each Ethernet or Remote Site controller shall be a dedicated run, with a separate breaker. Each run will include a separate hot, neutral and ground wire. The ground wire will terminate at the breaker panel ground. This circuit will not feed any other circuit or device.
- D. A true earth ground must be available in the building. Do not use a corroded or galvanized pipe, or structural steel.
- E. Wires are to be attached to the building proper at regular intervals such that wiring does not droop. Wires are not to be affixed to or supported by pipes, conduit, etc.
- F. Conduit in finished areas will be concealed in ceiling cavity spaces, plenums, furred spaces and wall construction. Exception; metallic surface raceway may be used in finished areas on masonry walls. All surface raceway in finished areas must be color matched to the existing finish within the limitations of standard manufactured colors.

- G. Conduit, in non-finished areas where possible, will be concealed in ceiling cavity spaces, plenums, furred spaces, and wall construction. Exposed conduit will run parallel to or at right angles to the building structure.
- H. Wires are to be kept a minimum of three (3) inches from hot water, steam, or condensate piping.
- I. Where sensor wires leave the conduit system, they are to be protected by a plastic insert.
- J. Wire will not be allowed to run across telephone equipment areas.

#### 3.4 Installation Practices for Field Devices

- A. Well-mounted sensors will include thermal conducting compound within the well to insure good heat transfer to the sensor.
- B. Actuators will be firmly mounted to give positive movement and linkage will be adjusted to give smooth continuous movement throughout 100 percent of the stroke.
- C. Relay outputs will include transient suppression across all coils. Suppression devices shall limit transients to 150% of the rated coil voltage.
- D. Water line mounted sensors shall be removable without shutting down the system in which they are installed.
- E. For duct static pressure sensors, the high pressure port shall be connected to a metal static pressure probe inserted into the duct pointing upstream. The low pressure port shall be left open to the plenum area at the point that the high pressure port is tapped into the ductwork.
- F. For building static pressure sensors, the high pressure port shall be inserted into the space via a metal tube. Pipe the low pressure port to the outside of the building.

#### 3.5 Enclosures

- A. For all I/O requiring field interface devices, these devices where practical will be mounted in a field interface panel (FIP). The Contractor shall provide an enclosure which protects the device(s) from dust, moisture, conceals integral wiring and moving parts.
- B. FIPs shall contain power supplies for sensors, interface relays and contactors, and safety circuits.
- C. The FIP enclosure shall be of steel construction with baked enamel finish; NEMA 1 rated with a hinged door and keyed lock. The enclosure will be sized for twenty percent spare mounting space. All locks will be keyed identically.
- D. All wiring to and from the FIP will be to screw type terminals. Analog or communications wiring may use the FIP as a raceway without terminating. The use of wire nuts within the FIP is prohibited.
- E. All outside mounted enclosures shall meet the NEMA-4 rating.
- F. The wiring within all enclosures shall be run in plastic track. Wiring within controllers shall be wrapped and secured.

#### 3.6 Identification



- A. Identify all control wires with labeling tape or sleeves using words, letters, or numbers that can be exactly cross-referenced with record drawings.
- B. All field enclosures, other than controllers, shall be identified with a Bakelite nameplate. The lettering shall be in white against a black or blue background.
- C. Junction box covers will be marked to indicate that they are a part of the BAS system.
- D. All I/O field devices (except space sensors) that are not mounted within FIP's shall be identified with name plates.
- E. All I/O field devices inside FIP's shall be labeled.
- F. Comply with Identification Requirements in Sections 15010 and 15190.

3.7 Existing Controls.

- A. Existing controls which are to be reused must each be tested and calibrated for proper operation. The BAS contractor shall coordinate with the contractor for the existing controls to maintain operation of the existing controls to remain. Existing controls which are to be reused and are found to be defective requiring replacement, will be noted to the Owner and Engineer. The BAS Contractor shall estimate and replace as additional services, if required.

3.8 Control System Switch-over

- A. Demolition of the existing control system will occur after the new temperature control system is in place including new sensors and new field interface devices.
- B. Switch-over from the existing control system to the new system will be fully coordinated with the Owner. A representative of the Owner will be on site during switch-over.
- C. The Contractor shall minimize control system downtime during switch-over. Sufficient installation mechanics will be on site so that the entire switch-over can be accomplished in a reasonable time frame.

3.9 Location

- A. The location of sensors is per mechanical and architectural drawings.
- B. Space humidity or temperature sensors will be mounted away from machinery generating heat, direct light and diffuser air streams.
- C. Outdoor air sensors will be mounted on the north building face directly in the outside air. Install these sensors such that the effects of heat radiated from the building or sunlight is minimized.
- D. Field enclosures shall be located immediately adjacent to the controller panel(s) to which it is being interfaced.

3.10 Training

- A. Provide application engineer to instruct owner in operation of systems and equipment.

END OF SECTION

BASIC ELECTRICAL REQUIREMENTS

SECTION 16010

PART 1 - GENERAL

1.01 Work Included:

- A. Furnish and install all electrical wiring, systems, equipment and accessories in accordance with the specifications and drawings. Specifications and drawings are complimentary except that, in case of conflict, the most stringent requirement will govern. Capacities, power ratings of motors, cable, panel board, motor controls and arrangement for specified items in general are shown on drawings.
- B. All ampacities herein specified or indicated on the drawings are based on copper conductors with the conduit and raceways accordingly sized. Aluminum conductors are not permitted.
- C. The General Conditions, Supplementary Conditions, and the General Requirements (Division 1) of these Specifications are an integral part of this Division and of the Contract for this project. Carefully note the contents and provisions in performance of the work.
- D. Examine all of the Contract drawings and specifications or otherwise determine the extent of related work in other divisions before submitting a quotation for the work in this division. Coordinate the work in this Division with work in other divisions through the General Contractor. No extra payment will be made for additional work required by failure to coordinate the work.
- E. Examine the premises in accordance with Division 1 (General Requirements) of the Specifications.
- F. Obtain all permits and pay all fees required by the work in this Division in accordance with the General Conditions of the Contract.
- G. Should the particular equipment which any bidder proposes to install, require other space conditions than those indicated on the drawings, arrange for such space with the Engineer before submitting a bid or purchasing any equipment. Should changes become necessary because of failure to comply with this clause, install changes without any additional expense.
- H. Where electrical equipment is installed that causes electrical noise interference with other electrical systems installed under this contract, equip the offending equipment with isolating transformers, filters, shielding or any other means as required for the satisfactory suppression of the interference as determined by the Engineer.
- I. Where required, conduit, electrical equipment, and support systems shall be installed in accordance with Arkansas Act 1100 of 1991 for earthquake resistant design.

1.02 Applicable Publications:

- A. The following publications of the issues as listed, but referred thereafter by basic designation only, form a part of this specification to the extent indicated by the reference thereto:

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1. Federal Specifications (Fed. Spec.)
2. American Society for testing and Materials (ASTM)
3. National Fire Protection Association (NFPA)
4. National Electrical Code (NEC)
5. Miscellaneous Standards:
  - a) American National Standards Institute, Inc. (ANSI)
  - b) Illuminating Engineering Society (IES)
  - c) Institute of Electrical and Electronic Engineers (IEEE)
  - d) Insulated Power Cable Engineers Association (IPCEA)
  - e) Joint Industrial Council (JIC)
  - f) National Electrical Manufacturers Association (NEMA)
  - g) National Electrical Safety Code (NESC)

### 1.03 Related work in other Divisions:

- A. Related work in other divisions requiring cooperation and coordination with this Division includes, but is not limited to, the following:
  1. Perform or coordinate all cutting and patching as required for this project and in conformance with Division 1 (General Requirements).
  2. Perform all earth work required by the work in this division. Ensure that excavating, back-filling and other earthwork conforms to Division 2 (Site Construction) except where described in other sections of this Division or on the drawings.
  3. Furnish all sleeves inserts anchors and supports required by this work to be installed in concrete or masonry and coordinate with the respective trades under Division 3 (Concrete) and 4 (Masonry) for proper locations and installation.
  4. Flash and seal roof penetrations in accordance with Division 7 (Thermal and Moisture Protection). Furnish locations and sizes and coordinate the installation with the respective trades.
  5. Perform painting of electrical equipment and materials in finished areas as required under Division 9 (Finishes). Touch up or prime any surfaces required in this Division in accordance with Division 9. Provide factory finishes as specified in other sections of this Division.
  6. Install branch circuits and make final connections to any equipment requiring electric power that is furnished and installed by the Contractor or by the Owner. Perform the electrical work according to approved shop drawings.
  7. Install empty raceways and outlet boxes or branch circuits for equipment to be furnished by others, or to be installed after completion of the Contract.
  8. Install and connect motor starters or variable frequency drives (VFD) furnished under

Division 15 (Mechanical) where starters are not integral parts of the equipment. Ensure that starters and VFDs generally conform to the requirements of this Division. Coordinate with mechanical and controls contractors.

9. Mechanical equipment controls and control wiring are furnished and installed under Division 15 in accordance with the requirements of this Division.
10. Motors are furnished and installed generally as an integral part of equipment specified under Division 15 and must conform to the requirements of this Division.

1.04 Standards:

- A. Ensure that all materials and equipment are listed, labeled or certified by Underwriters laboratories, Inc. where such standards have been established. Equipment and materials which are not covered by UL Standards will be accepted provided equipment and material is listed, labeled, certified or otherwise determined to meet safety requirements by a nationally recognized testing laboratory. If inspected or tested in accordance with national industrial standards, such as NEMA, IPECA or ANSI. Evidence of compliance must include certified test reports and definite shop drawings.

PART 2 - PRODUCTS

2.01 Approvals:

- A. Approvals are required of products or services of the proposed manufacturers, suppliers, and installers for this project. The will be based upon submission by Contractor of certifications.
- B. Manufacturer's Qualifications: Manufacturer regularly and presently manufactures as one of the manufacturer's principal products the following items and has manufactured these items for at least five (5) years.

- Wire and Cable - all types
- Light Fixtures
- Emergency Ballasts
- Lighting Switches and Receptacles
- Dimmers
- Molded Case Circuit Breakers
- Conduit
- Surge Protection Devices
- Plug-in Strip Receptacle Units
- Low Voltage Fusible and Non-fusible Switches
- Outlet Boxes
- Duct Sealing Compound
- Conduit Supports
- Panelboards
- Conduit Couplings
- Bushing and Fittings
- Wiring Devices
- Relay Panels

Fire Alarm Devices and Equipment

- C. Manufacturer's product submitted must have been in satisfactory operation on three installations similar to this project for approximately three (3) years.
- D. Installer must have the technical qualifications, experience, trained personnel and facilities to install specified items including at least three years of successful installation of electrical work similar to that required for this project. Approval will not be given where the experience record is one of unsatisfactory performance.

2.02 Manufactured Products:

- A. Ensure that materials and equipment furnished is of current production by manufacturers regularly engaged in the manufacture of such items for which replacement parts should be available. Items not meeting these requirements but which otherwise meet technical specifications and merits of which can be established through reliable test reports or physical examination of representative samples will be considered.
- B. Provide products of a single manufacturer when more than one unit of the same class of equipment or material is required.
- C. Equipment assemblies and components:
  - 1. All components of an assembled unit need not be products of the same manufacturer.
  - 2. Manufacturers of equipment assemblies which include components made by others must assume complete responsibility for the final assembled unit.
  - 3. Components must be compatible with each other and with the total assembly for the intended service.
  - 4. Constituent parts which are similar must be the product of a single manufacturer.
  - 5. Moving parts of any element of equipment of the unit normally requiring lubrication must have means provided for such lubrication and must be adequately lubricated at factory prior to delivery.
- D. Identify all factory wiring on the equipment being furnished and on all wiring diagrams.

2.03 Equipment ratings and approval of "Equal" Equipment:

- A. Equipment voltage ratings must be in accordance with the requirements indicated on the drawings and as specified.
- B. Obtain written approval for any equipment which differs from the requirements of the drawings and specifications.
  - 1. Furnish drawings showing all installation details, shop drawings, technical data, and other pertinent information as required.

2. Approval by the Engineer of the equal equipment does not relieve the Contractor of the responsibility of furnishing and installing the equipment at no additional cost.
  3. Furnish and install any other items required for the satisfactory installation of the equal equipment at no additional cost. This includes, but is not limited to, changes to branch circuits, circuit protective devices, conduits, wire, feeders, controls, panels, and correlation with other work, subject to the jurisdiction and approval of the Engineer.
- C. Where specifically called for, provide equipment of the named manufacturer with an alternate price for the acceptable "equal" equipment.

2.04 Equipment Protection:

- A. Store all materials and equipment to be installed in the work so as to ensure the preservation of their quality, workability and fitness for the work intended. Provide storage provisions for protection from the elements, rust, and physical damage. Place stored materials on clean, hard surfaces above ground and keep covered at all times to ensure protection from paint, plaster, dust, water and other construction debris or operations. Install heaters under the protective cover where the equipment may be damaged due to moisture and weather conditions. Keep conduit ends plugged or capped and all covers closed on boxes, panels, switches, fixtures, etc. until installation of each item. Store all plastic conduit or duct out of direct sunlight in shaded areas. Locate stored materials and equipment to facilitate prompt inspection.
- B. Protect during installation, all equipment, controls, controllers, circuit protective devices, etc., against entry of foreign matter on the inside and be vacuum clean both inside and outside before testing, operating and painting.
- C. Place damaged equipment, as determined by the Engineer, in first class operating condition or return to source of supply for repair or replacement.
- D. Protect painted surfaces with removable heavy kraft paper, sheet vinyl or equal, installed at the factory.

PART 3 - EXECUTION

3.01 General

- A. Field coordinate with other trades in ample time to build all chases and openings, set all sleeves, inserts and concealed materials, and provide clearances that may be required to accommodate materials and equipment. Lay out electrical work so that in case of interference with other items the layout may be altered to suit conditions encountered.
- B. Cutting of Holes:
  1. Cut holes through concrete and masonry in structures with a diamond core drill or concrete saw. Pneumatic hammer, impact electric, hand, or manual hammer type drills are not allowed except where permitted by the Engineer as required by limited working space.

2. Locate holes so as not to affect structural sections such as ribs or beams.
  3. Layout holes in advance. Advise the Engineer prior to drilling through structural sections for determination of proper layout.
- C. Floor, exterior wall and roof seals must be watertight. Sleeve walls and floors which are cored for installation of conduit with steel tubing, grouted, and the space between the conduit and sleeve filled as specified herein. Where conduits pierce the roof, refer to architectural specifications and drawing for details.
- D. Do not use electrical hangers and other supports for other than electrical equipment and materials. Provide not less than a safety factor of 5 and conform with any specific requirements as shown on the drawings or in the specifications.
- E. Do not deviate from the plans and Specifications without the full knowledge and consent of the Engineer. Should, at any time during the progress of the work, a new or existing condition be found which makes desirable a modification of the requirements of any particular item, report such item promptly to the Engineer for his decision and instruction.
- F. Notify all other Contractors of any deviation or special conditions. Resolve interferences between the work of the various Contractors prior to installation. Remove, if necessary, work installed, which is not in compliance with the plans and specifications as specified above, and properly reinstall without additional cost to Owner. Architect/Engineer or his representative is the mediating authority in all deviation and confliction disputes arising on this project.

3.02 Equipment Installation and Requirements:

- A. Installation:
1. "Provide" and "Install" as used on the drawings and in the specifications means furnish, install, connect, adjust and test except where otherwise specified.
  2. Install coordinate electrical systems, equipment and materials complete with auxiliaries and accessories.
- B. Equipment Location: As close as practicable to locations shown on drawings.
- C. Working Spaces: not less than specified in the National Electrical Code for all voltages specified.
- D. Inaccessible Equipment:
1. Where the Engineer determines that the Contractor has installed equipment not conveniently accessible for operation and maintenance, remove and reinstall equipment as directed at no additional cost.
  2. "Readily Accessible" is defined as being capable of being reached without the use of ladders or without climbing or crawling under or over obstacles such as motors, pumps, belt guards,

transformers, piping and ductwork.

E. Equipment and Materials:

1. Install new equipment and materials unless otherwise specified.
2. Ensure that equipment and materials are designed to provide satisfactory operating life for environmental conditions where being installed. NEC and other code requirements apply to the installation in areas requiring special protection such as explosion-proof, Vapor-proof, watertight and weatherproof construction.

3.03 Equipment Identification:

- A. In addition to the requirements of the National Electrical Code, install an identification sign which will clearly indicate information required for use and maintenance of items such as panelboards, cabinets, motor controllers (starters), safety switches, separately enclosed circuit breakers, individual breakers, and controllers in switchgear and motor control assemblies, control devices and other significant equipment.

3.04 Drawings and Specifications:

- A. The drawings and specifications indicate the requirements for the systems, equipment, materials, operation and quality. They are not to be construed to mean limitation of competition to the products of specific manufacturers.

3.05 System Voltages: Voltage ranges are defined as follows:

- A. High Voltage: Above 600 Volts.
- B. Low Voltage: 600 Volts and lower.

3.06 Submittals:

- A. Obtain the Engineer's approval for all equipment and material before delivery to the job site. Delivery, storage or installation of equipment or material which has not had prior approval is not permitted at the job site.
- B. Include in all submittals adequate descriptive literature, catalog cuts, shop drawings and other data necessary for the Engineer to ascertain that the proposed equipment and material comply with specification requirements. Catalog cuts submitted for approval must be legible and clearly identify equipment being submitted.
- C. Make submittals for individual systems and equipment assemblies which consist of more than one item or component for the system or assembly as a whole. Partial submittals will not be considered for approval.
- D. Submit within fifteen (15) days after the awarding of the Contract, six (6) complete brochures of shop drawings and descriptive data of all materials and equipment.



E. The submittals must include the following:

1. Information which confirms compliance with contract requirements. Include the manufacturer's name, model or catalog numbers, catalog information, technical data sheets, shop drawings, pictures, nameplate data and test reports as required.
2. Elementary and interconnection wiring diagrams for communication and signal systems, control system and equipment assemblies. All terminal points and wiring must be identified on wiring diagram.
3. Parts list which must include those replacement parts recommended by the equipment manufacturer.
4. Approval will be based on complete submission only.

F. Furnish shop drawing for the work involved in sufficient time so that no delay or changes will be caused. Thermofax and electronic copies are not acceptable; only permanent type prints are allowed.

G. Verify that shop drawings comply in all respect with the item originally specified. It is the Contractor's responsibility to procure the proper sizes, quantities, rearrangement, structural modifications or other modifications in order for the substituted item to comply with the established requirements.

H. Any shop drawings prepared to illustrate how equipment, conduit, fixtures, etc., can be fitted into available spaces will be examined under the assumption that the Contractor has verified all the conditions. Obtaining approval therein does not relieve the Contractor of responsibility in the event the material cannot be installed as shown on those drawings.

I. Shop drawings need not cover detailed installation drawings prepared for the Contractor's own use, but be limited, as in the case of raceways, to necessary departures from the plans as prepared by the Engineer.

J. Submit working scale drawings of apparatus and equipment which in any way varies from these specifications and plans, to be reviewed by the Engineer before the work is started. Correct interferences with the structural conditions before the work proceeds.

K. Submit all shop drawings at the same time in a loose-leaf binder with double index as follows:

1. List the products alphabetically by name.
2. List the name and manufacturers whose products have been incorporated in the work alphabetically together with their addresses and the name and addresses of the local sales representative.

3.07 Test and Demonstration:

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- A. As equipment and materials are being installed and connected, test the installation for the following:
  - 1. Short circuits and ground faults.
  - 2. Insulation resistance at 500 volts DC.
  - 3. Grounding continuity.
- B. After tests are completed and necessary corrections are made, put each system into operation and demonstrate its performance to the satisfaction of the Owner's authorized representative.
- C. Provide written documentation of test and performance as requested by the Owner's authorized representative.
- D. Furnish all, electricity, instruments, test equipment and personnel that are required for the particular test. Certify that equipment and instruments are in good working order. Remove equipment subject to damage during test from line before test is applied.

### 3.08 Completion and Acceptance:

- A. Upon completion of the work and before final acceptance, perform the duties and provide the documents as follows in accordance with the General conditions, Supplementary Conditions as Division 1 of the Contract.
- B. Remove all rubbish, tools and surplus materials accumulated during the execution of the work in this Division.
- C. Touch up any equipment or finishes damaged during delivery or installation of the work in this Division.
- D. Provide a written one-year guarantee of materials and work except for items that are specified to have a longer warranty. Items that have a published or normal life expectancy of less than one year, such as incandescent lamps are to be governed by the manufacturer's guarantee.
- E. Provide systems and equipment installation, operating and maintenance instructions and catalog data for transmittal to the Owner. Place the data in a loose-leaf binder which contains an index of the products listed alphabetically by name and a separate index listing the manufacturer's address of their local representative.
- F. Instruct the Owner's representative in the proper operation and maintenance of the systems and their elements as required or directed to familiarize the Owner in the operation and maintenance of the systems.

### 3.09 Record Drawings:

- A. Maintain one extra set of Blue or Black-line white print drawings for use as record drawings. Keep daily records using colored pencil. When the work is completed transfer relevant information to a reproducible set, to be given to the Engineer.

- B. Show as-built information to scale, using standard symbols listed in the legend. As a minimum, show the following:
1. Location of stub-outs, dimensioned from permanent building lines.
  2. Location and depth of under-slab and in slab raceways.
  3. All routing of raceways.
  4. Corrected panelboard and equipment schedules.
  5. Corrected circuit numbers as they appear on panelboard directories.
  6. Corrected motor horsepower and full load amperages.
  7. Number, size, type or insulation, number of wires in each conduit or multi-conductor cable whether in conduit or exposed.
  8. Location of junction boxes and splices.

3.10 Project Supervision

- A. A full time English speaking supervisor shall be provided. The supervisor shall have a minimum of 5 years' experience with similar projects and clients.

3.11 Bond Requirements

- A. 100% performance and payment bonds for each subcontractor

3.12 Subcontractor Capabilities

- A. All subcontractors shall have new construction installation crews and service company capable of less than 4 hours response time any day of the year, including nights, holidays and weekend.

END OF SECTION

SECTION 16109 - IDENTIFICATION

PART 1 - GENERAL

1.01 Work Included

- A. Provide and install identification makers.

1.02 Related Work

- A. Section 16111: Conduit
- B. Section 16130: Outlet and Pull Boxes
- C. Section 16120: Wires and Cables
- D. Section 16471: Panelboards
- E. Section 16491: Motor and Circuit Disconnects
- F. Section 16410: Switchboard

PART 2 - PRODUCTS

2.01 Materials

- A. Provide nameplates of laminated phenolic plastic with engraved letters 3/16" high at pushbutton stations, thermal overload switches, receptacles, wall switches and similar devices where the nameplate is attached to the device plate. At all other locations make lettering 1/4" high, unless otherwise detailed on the drawings. Securely fasten nameplates to the equipment with No. 4 Phillips, roundhead, cadmium plated, steel self-tapping screws or nickel plated brass bolts. Motor nameplates may be die stamped non-ferrous metal not less than 0.03" thick.
- B. Premarked, self-adhesive, wrap around type markers, manufacturers: Brady, T&B, E-Z code.
- C. Underground type plastic line marker: Manufacturer's standard permanent, bright colored, continuous printed plastic type, not less than 6" wide X 4 mils thick. Provide tape with printing which most accurately indicates type of service of buried cable.

PART 3 - EXECUTION

1.01 Installation

- A. General: Equip the following items with nameplates:
  - 1. All motors, motor starters, VFDs, motor control center, pushbutton stations, control panels, and time switches.

2. Disconnect switches, fused or non-fused, switchboards and panelboards, circuit breakers, contactors, or relays in separate enclosures.
  3. Power receptacles where the nominal voltage between any pair of contacts is greater than 150 volts.
  4. Wall switches controlling outlets for lighting fixtures or equipment where the outlets are not located within sight of the controlling switch.
  5. Special electrical systems at junction and pull boxes terminal cabinets and equipment racks.
- B. Adequately describe the function of or use of the particular equipment involved. Where nameplates are detailed on the drawings, use inscription and size of letters as shown. Include on nameplates for panelboards and switchboards the panel designation, voltage and phase of the supply. The name of the machine or the motor nameplates for a particular machine must be the same as the one used on all motor starter, disconnect and pushbutton station nameplates for that machine.
- C. Underground Cable Identification: During back filling/top soiling of each exterior underground electrical, signal or communication cable, install continuous underground type plastic line marker, located directly over buried line at 6" to 8" below finished grade. Where multiple small lines are buried in a common trench and do not exceed an overall width of 16", install a single line marker. Install line marker for every buried cable, regardless of whether it is direct buried, protected in conduit or encased in concrete.
- D. Operational Identification and Warnings: Wherever reasonably required to ensure safe and efficient operation and maintenance of electrical system, electrically connected mechanical systems, general systems and equipment and including the prevention of misuse of electrical facilities by unauthorized personnel, install self-adhesive plastic signs or similar equivalent identification, instruction or warnings on switches, outlets and other controls, devices and covers of electrical enclosures. Where detailed instructions or explanations are needed, provide plasticized tags with clearly written messages adequate for intended purposes.
- E. Danger Signs:
1. In addition to installation of danger signs required by governing regulations and authorities, install appropriate danger signs at locations indicated and at locations subsequently identified by the Installer of electrical work as constituting similar dangers for persons in or about the project.
  2. Critical Switches/Controls: Install danger signs on switches and similar controls, regardless of whether concealed or locked up, where untimely or inadvertent operation (by anyone) could result in significant danger to persons, or damage to or loss of property.
- F. Furnish and install a framed, full-size (24" X 36" min.) print of the electrical riser and distribution systems (emergency and normal). Include the main service entrance equipment, distribution panels, branch circuit panels, transformers, motor control centers, transfer switches, emergency generator, emergency distribution panels, emergency branch circuit panels, etc.

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1. Show each piece of electrical equipment on the print and identify with identical terminology as shown on the engraved plate on each piece of equipment installed throughout the building.
2. Submit "Record Drawing" to the Electrical Design Engineer for approval prior to installation.
3. Frame print in a suitable wooden frame under glass and install in the main service entrance equipment room at a location designated by the Owner.

END OF SECTION

SECTION 16111 - CONDUIT & RACEWAY

PART 1 GENERAL

1.01 WORK INCLUDED

- A. Rigid metal conduit and fittings.
- B. Intermediate metal conduit and fittings.
- C. Electrical metallic tubing and Fittings.
- D. Liquid tight flexible metal conduit and fittings.
- E. Non-metallic conduit and fittings.

1.02 INCLUDED SPECIFICATIONS

- A. Section 16010 - Basic Electric Work

1.03 REFERENCES

- A. ANSI C80.1 - Rigid Steel Conduit, Zinc Coated.
- B. ANSI C80.3 - Electrical Metallic Tubing, Zinc Coated.
- C. ANSI/NEMA FB 1 - Fittings and Supports for Conduit and Cable Assemblies.
- D. FS WW-C-563 Electrical Metallic Tubing.
- E. FS WW-C-566 Specification for Flexible Metal Conduit.
- F. FS WW-C-581 Specification for Galvanized Rigid Conduit.

PART 2 PRODUCTS

2.01 RIGID METAL CONDUIT AND FITTINGS

- A. Rigid Steel Conduit: ANSI C80.1
- B. Fittings and Conduit Bodies: ANSI/NEMA FB 1; threaded type, material to match conduit.

2.02 INTERMEDIATE METAL CONDUIT (IMC) AMF FITTINGS

- A. Conduit: Galvanized Steel.
- B. Fittings and Conduit Bodies: ANSI/NEMA FB 1; use fittings and conduit bodies specified above for rigid steel conduit.

2.03 ELECTRICAL METALLIC TUBING (EMT) AND FITTINGS

- A. CMT: ANSI C80.3. Galvanized tubing
- B. Fittings and Conduit Bodies: ANSI/NEMA FB 1; Steel or malleable iron, compression type.

2.04 LIQUIDTIGHT FLEXIBLE CONDUIT AND FITTINGS

- A. Conduit: Flexible metal conduit with PVC jacket.
- B. Fittings and Conduit Bodies: ANSI/NEMA FB 1.

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2.05 PLASTIC CONDUIT AND FITTINGS

- A. Conduit: NEMA TC 2 Schedule 40 PVC.
- B. Fittings and Conduit Bodies: NEMA TC 3

2.06 SURFACE METALLIC RACEWAY

- A. Surface Metallic Raceways: One-piece system of galvanized steel, base and cover preassembled.
  - 1. Acceptable Product: Wiremold 500 or 700 Series One Piece Metal Raceway by Legrand/Wiremold.
    - a. Construction: 3/4 inch (19 mm) wide by 17/32 (13.5mm) or 21/32 inch (17 mm) deep.
    - b. Include all matching fittings, devices, and fixture boxes.
    - c. Finish: Manufacturer's standard Ivory, White or custom color as selected.

2.07 CONDUIT SUPPORTS

- A. Conduit Clamps, Straps, and Supports corrosion resistant: Steel or malleable iron.

PART 3 EXECUTION

3.01 CONDUIT INSTALLATION SCHEDULE

- A. Underground installation buried more than 18" deep, Schedule 40 plastic conduit.
- B. Installation in or under concrete slab, or underground buried less than 18" deep, Rigid Steel Conduit.
- C. Exposed outdoor locations: Rigid Steel, Liquidtight flexible steel.
- D. Wet Interior Locations: Rigid Steel, Liquidtight flexible steel.
- E. Concealed Dry interior locations: Rigid Steel, Intermediate metal conduit, electric metallic tubing, liquidtight flexible steel.
- F. Exposed dry interior locations: Rigid Steel, Electrical metallic tubing, Liquidtight flexible steel.

3.02 CONDUIT SIZING, ARRANGEMENT, AND SUPPORT

- A. Size conduit for conductor type installed or for type THW conductors, whichever is larger: 3/4 inch minimum size underground and 1/2 inch minimum size above grade.
- B. Arrange conduit to maintain headroom and present a neat appearance.
- C. Route exposed conduit and conduit above accessible ceilings parallel and perpendicular to walls.
- D. Maintain minimum 6 inch clearance between conduit and piping. Maintain 12 inch clearance between conduit and heat sources such as flues, pipes, and heating appliances.
- E. Arrange conduit supports to prevent distortion of alignment by wire pulling operations. Fasten conduit using galvanized straps, lav-in adjustable hangers, clevis hangers, or bolted split stamped galvanized hangers.



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- F. Group conduit in parallel runs where practical and use conduit rack constructed of steel channel with conduit straps or clamps. Provide space of 25% percent additional conduit.
- G. Do not fasten conduit with wire or perforated pipe straps. Remove all wire used for temporary conduit support during construction, before conductors are pulled.

3.03 CONDUIT AND TUBING INSTALLATION

- A. Cut conduit and tubing square using a saw; de-burr cut ends.
- B. Bring tubing to the shoulder of fittings and couplings and fasten securely.
- C. Use conduit hubs or sealing locknuts for fastening conduit to cast boxes, and for fastening conduit to sheet metal boxes in damp or wet locations.
- D. Install no more than the equivalent of three 90-degree bends between boxes.
- E. Use hydraulic one-shot conduit bender or factory elbows for bends in conduit larger than 1 inch size.
- F. Avoid moisture traps.
- G. Install Wiremold raceway system in all exposed locations below ceiling line (verify elevation) from finished floor level.

END OF SECTION

SECTION 16120 - WIRE AND CABLE

PART 1 GENERAL

1.01 WORK INCLUDED

- A. Building Wire.
- B. Cable.
- C. Wiring connections and termination.

1.02 REFERENCES

- A. NEMA WC 3 - Rubber insulated wire and cable for the transmission and distribution of electrical energy.
- B. NEMA WC 5 - Thermoplastic insulated wire and cable for the transmission and distribution of electrical energy.

PART 2 PRODUCTS

2.01 BUILDING WIRE

- A. Feeders and Branch Circuits larger than 8 AWG; copper stranded conductor, 600 volt insulation, THHN/THWN or THW.
- B. Feeders and Branch Circuits smaller than 8 AWG; solid copper conductor, 600 volt insulation, THHN/THWN.
- C. Control Circuits: Copper, stranded conductor 600 volt insulation, THW or THHN/THWN.
- D. Communications System Wire per Owner or Equipment Manufacturer. The most stringent wiring type or system shall govern.

PART 3 EXECUTION

3.01 GENERAL

- A. Use no wire smaller than 12 AWG for power and lighting circuits, and no smaller than 14 AWG for control wiring unless noted.
- B. Use 10 AWG conductor for 20 ampere, 120 volt branch circuit home runs longer than 75 feet.
- C. Use 10 AWG conductor for 20 ampere, 277 volt branch circuit home runs over 150 feet.
- D. Splice only in junction or outlet boxes.

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- E. Neatly train and lace wiring inside boxes, equipment, and panelboards.
- F. Make conductor lengths for parallel circuits equal.

3.02 WIRING INSTALLATION IN RACEWAYS

- A. Pull all conductors into a raceway at the same time. Use UL listed wire pulling lubricate for pulling 4 AWG and larger wires if required.
- B. Install wire in raceway after interior of building has been physically protected from the weather and all mechanical work likely to injure conductors has been completed.
- C. Seal service entrances into building per codes and Utility Co. requirements.

3.03 WIRING CONNECTIONS AND TERMINATIONS

- A. Use solderless pressure connectors with insulating covers for copper wire splices and taps, 8 AWG and smaller. For 10 AWG and smaller, use insulated spring wire connectors with plastic caps or copper sleeve stacon connectors.
- B. Use pressure connectors for copper wire splices and taps, 6 AWG and larger. Tape uninsulated conductors and connectors with electrical tape to 150 percent of the insulation value of conductor.
- C. Thoroughly clean wires before installing lugs and connectors.
- D. Make splices, taps and terminations to carry full ampacity of conductors without perceptible temperature rise.
- E. Terminate spare conductors with wire nuts and electrical tape.
- F. The electrical contractor shall provide all wiring necessary to complete the electrical installation per plans and specifications.

3.04 FIELD QUALITY CONTROL

- A. Field inspection and testing will be performed under provisions of Section 16010.
- B. Inspect wire and cable for physical damage and proper connection.
- C. Torque test conductor connections and terminations to manufacturers recommended values.
- D. Perform continuity and insulation tests on all power and equipment branch circuit conductors. Verify proper phase connections.
- E. Strictly follow wire colors (see notes on plans)

END OF SECTION

SECTION 16130 - BOXES

PART 1 GENERAL

1.01 WORK INCLUDED

- A. Wall and ceiling outlet boxes.
- B. Floor boxes.
- C. Pull and junction boxes.

1.02 REFERENCES

- A. ANSI/NEMA OS 1 - Sheet Steel outlet boxes, device boxes, covers and box supports.
- B. NEMA 250 - Enclosure for Electrical Equipment (1000 volts maximum)

PART 2 PRODUCTS

2.01 OUTLET BOXES

- A. Sheet Metal Outlet boxes: ANIS/NEMA OS 1: Galvanized steel, with 1/2" inch male fixture studs where required.
- B. Cast Boxes: Aluminum, cast fer alloy, deep type, gasketed cover, threaded hubs.

2.02 PULL AND JUNCTION BOXES

- A. Sheet Metal Boxes: ANSI/NEMA OS 1; Galvanized steel.
- B. Cast Metal Boxes For outdoor and Wet location installation: NEMA 250: junction box, UL listed as raintight, Galvanized cast iron or cast aluminum box and cover with ground flange, neoprene gasket, and stainless steel cover screws.
- C. Wiremold boxes for V500 raceway systems in exposed areas below 8 feet from the finished floor.

PART 3 EXECUTION

3.01 COORDINATION

- A. Provide electrical boxes as shown on drawings, and as required for splices, taps, wire pulling, equipment connections, and code compliance.
- B. Electrical box locations shown on Contract drawings are approximate unless dimensioned. Verify location of floor boxes and outlets when shown or required prior to rough-in.

- C. Locate and install boxes to allow access.
- D. Locate and install to maintain headroom and to present a neat appearance.

3.02 OUTLET, PULL, SPLICE OR JUNCTION BOX INSTALLATION

- A. Do not install boxes back-to-back in walls. Provide minimum 6 inch separation.
- B. Locate boxes in masonry walls to required cutting of masonry unit in corner only. Coordinate masonry cutting to achieve neat openings for boxes.
- C. Provide knockout closures for unused openings.
- D. Support boxes independently of conduit, except for cast boxes that are connected to two rigid metal conduit, both supported within 12 inches of box.
- E. Use multiple-gang boxes where more than one device is mounted together: do not use sectional boxes. Provide barriers to separate wiring of different voltage systems.
- F. Install boxes in walls without damaging wall insulation.
- G. Coordinate mounting heights and locations of outlets mounted above counters, equipment and backsplashes.
- H. Position outlets to locate luminaries as shown on lighting and reflected ceiling plans.
- I. In inaccessible ceiling areas, position outlets and junction boxes, when required, within 6 inches of recessed luminaire, to be accessible through luminaire ceiling opening.
- J. Provide recessed corrosion resistant outlet boxes in finished areas; secure boxes to interior wall and partition studs, accurately positioning to allow surface finish thickness. Use stamped steel stud bridges for flush outlets in hollow stud wall, and adjustable steel channel fasteners for flush ceiling outlet boxes.
- K. Align wall-mounted outlet boxes for switches, thermostats, and similar devices.
- L. Provide corrosion resistant cast outlet boxes in exterior locations exposed to the weather and in other wet locations.

END OF SECTION

SECTION 16190 - SUPPORTING DEVICES

PART 1 GENERAL

1.01 WORK INCLUDED

- A. Conduit and equipment supports.
- B. Fastening hardware.

1.02 COORDINATION

- A. Coordinate size, shape and location of support systems with other contractors.

PART 2 PRODUCTS

2.01 MATERIAL

- A. Support channel: Galvanized or painted steel.
- B. Hardware: Corrosion resistant.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Fasten hanger rods, conduit clamps, and outlet and junction boxes to building structure or additional steel supports.
- B. Use toggle bolts or hollow wall fasteners in hollow masonry, plaster, or gypsum board partitions and walls; expansion anchors or preset inserts in solid masonry walls; self-drilling anchors or expansion anchor on concrete surfaces; sheet metal screws in sheet metal studs.
- C. Do not fasten supports to piping, ductwork, mechanical equipment, or conduit unless specifically indicated.
- D. Do not use powder-actuated anchors.
- E. Do not drill structural steel members.
- F. Fabricate supports from structural steel or steel channel, rigidly welded or bolted to present a neat appearance. Use hexagon head bolts with spring lock washers under all nuts.
- G. In wet locations, install electrical equipment watertight.
- H. Install surface-mounted cabinets and panelboards with a minimum of four anchors.

END SECTION

SECTION 16450 - GROUNDING

PART 1 GENERAL

1.01 WORK INCLUDED

- A. Electrical system grounding.

1.02 REGULATORY REQUIREMENTS

- A. Install a complete grounding system in accordance with National Electrical Code Article 250.

PART 2 PRODUCTS

2.01 GROUND RODS

- A. Ground rods shall be copper-clad steel 5/8 inch diameter X 10 feet minimum length.

2.02 CONDUCTORS

- A. Ground Conductors shall be copper type THHN/THWN.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Exothermically weld or clamp cable connection to ground rod in permanently visible location. Install service entrance ground conductor in PVC conduit from main service ground to ground rod.
- B. Bonding Jumpers: Provide bonding jumper. Connect ground bar neutral only at service entrance panel neutral bar.
- C. Bonding Wires: Install a Green Ground bonding wire in all conduit systems with bond wire conduit connected at each end to a grounding bar solderless lug, clamp or cup washer and screw. Ground all enclosures, boxes, receptacles, light fixtures, enclosures, etc.
- D. All existing panels to be reused shall have grounds & neutral bars separated. Insulate the neutral bars, & install neutrals on the neutral bars and green grounds on the green ground bars only.

3.02 Communication Grounding (Telephone/IT/Comm Rooms)

- A. Telephone:
  - 1. Provide one #6 THHN to Phone Board, unless otherwise noted (verify).
  - 2. Provide one #6 THHN to telephone service conduit, unless otherwise noted (verify).
  - 3. Provide one #6 THHN to IT/Comm Racks, unless otherwise noted (verify).

END OF SECTION

SECTION 16491 - DISCONNECT SWITCHES

PART 1 GENERAL

1.01 WORK INCLUDED

- A. Provide and install motor disconnects.
- B. Provide and install circuit disconnects.

1.02 REGULATORY REQUIREMENTS

- A. Conform to National Electrical Code and to applicable inspection Authority Having Jurisdiction.

PART 2 PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

- A. Square D (Schneider), Siemens, Cutler Hammer, Westinghouse.
- B. Substitutions: Under provisions of Section 16010.

2.02 COMPONENTS

- A. Motor and circuit disconnects shall have an underwriter's laboratory label.
- B. Single phase disconnect switches: Single or two pole toggle switch. A suitably rated twist lock receptacle and plug with power cord connection may be used for single phase fractional horsepower motors when approved by the Engineer and Inspector.
- C. Disconnect Switches: 2 or 3 pole heavy duty fusible or non-fusible 600 volt as required in NEMA type 1 or 3R enclosure to suit location.
- D. Fuses shall be equal "Fusetron" or as recommended by Equipment Manufacturer.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Install motor and circuit disconnect as recommended by manufacturer and as required by Code.

END OF SECTION