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ORIGINAL

BID OF BACHMANN CONSTRUCTION COMPANY, INC.

2015

PROPOSAL, CONTRACT, BOND AND SPECIFICATIONS

FOR

HVAC UPGRADE FOR OLBRICH BOTANICAL GARDENS- PHASE I

CONTRACT NO. 7383

PROJECT NO. 53W1440

MUNIS NO. 10124

IN

MADISON, DANE COUNTY, WISCONSIN

AWARDED BY THE COMMON COUNCIL  
MADISON, WISCONSIN ON APRIL 21, 2015

CITY ENGINEERING DIVISION  
1600 EMIL STREET  
MADISON, WISCONSIN 53713

<https://bidexpress.com/login>

**HVAC UPGRADE FOR OLBRICH BOTANICAL GARDENS- PHASE I  
CONTRACT NO. 7383**

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This Proposal, and Agreement have  
been prepared by:

**CITY ENGINEERING DIVISION  
CITY OF MADISON  
MADISON, DANE COUNTY, WISCONSIN**



Robert F. Phillips, P.E., City Engineer

RFP: ps

## SECTION A: ADVERTISEMENT FOR BIDS AND INSTRUCTIONS TO BIDDERS

### REQUEST FOR BID FOR PUBLIC WORKS CONSTRUCTION CITY OF MADISON, WISCONSIN

#### A BEST VALUE CONTRACTING MUNICIPALITY

|  |   |
|--|---|
| PROJECT NAME:                                | HVAC UPGRADE FOR OLBRICH BOTANICAL GARDENS- PHASE I |
| CONTRACT NO.:                                | 7383  |
| SBE GOAL                                     | 5%  |
| BID BOND                                     | 5%  |
| PRE BID MEETING (1:00 P.M.)                  | MARCH 20, 2015                                      |
| PREQUALIFICATION APPLICATION DUE (1:00 P.M.) | MARCH 20, 2015                                      |
| BID SUBMISSION (1:00 P.M.)                   | MARCH 27, 2015                                      |
| BID OPEN (1:30 P.M.)                         | MARCH 27, 2015                                      |
| PUBLISHED IN WSJ                             | 3/6/15, 3/13/15 & 3/20/15                           |

PRE BID MEETING: Representatives of the Affirmative Action Department will be present to discuss the Small Business Enterprise requirements at 1600 Emil Street, Madison Wisconsin.

#### **PRE-BID WALK THROUGH MEETING:**

A single pre-bid meeting shall be conducted for the purposes of a pre-bid site walk through. All bidding contractors are encouraged to attend.

1. The meeting will be held on **Wednesday March 18<sup>th</sup>, 2015** and will begin at **1:00pm**.
2. This on site meeting will take place at **Olbrich Botanical Gardens located at 3330 Atwood Ave**. Enter through the main entrance.
3. A representative from Hein Engineering Group and the City Staff will be on hand to conduct the building walk through, discuss the plans, specifications and expectations of the contract.
4. Questions, clarifications will be answered per addendum.

PREQUALIFICATION APPLICATION: Forms are available on our website, [www.cityofmadison.com/business/pw/forms.cfm](http://www.cityofmadison.com/business/pw/forms.cfm). If not currently prequalified in the categories listed in Section A, an amendment to your Prequalification will need to be submitted prior to the same due date. Postmark is not applicable.

**BIDS TO BE SUBMITTED** by hand to 1600 EMIL ST., MADISON, WI 53713 or online at [www.bidexpress.com](http://www.bidexpress.com).

THE BID OPENING is at 1600 EMIL ST., MADISON, WI 53713.

#### **STANDARD SPECIFICATIONS**

The City of Madison's Standard Specifications for Public Works Construction - 2015 Edition, as supplemented and amended from time to time, forms a part of these contract documents as if attached hereto.

These standard specifications are available on the City of Madison Public Works website, [www.cityofmadison.com/Business/PW/specs.cfm](http://www.cityofmadison.com/Business/PW/specs.cfm).

The Contractor shall review these Specifications prior to preparation of proposals for the work to be done under this contract, with specific attention to Article 102, "BIDDING REQUIREMENTS AND CONDITIONS" and Article 103, "AWARD AND EXECUTION OF THE CONTRACT." For the convenience of the bidder, below are highlights of three subsections of the specifications.

## SECTION 102.1: PRE-QUALIFICATION OF BIDDERS

In accordance with Wisconsin State Statutes 66.0901 (2) and (3), all bidders must submit to the Board of Public Works proof of responsibility on forms furnished by the City. The City requires that all bidders be qualified on a biennial basis.

Bidders must present satisfactory evidence that they have been regularly engaged in the type of work specified herein and they are fully prepared with necessary capital, materials, machinery and supervisory personnel to conduct the work to be contracted for to the satisfaction of the City. All bidders must be pre-qualified by the Board of Public Works for the type of construction on which they are bidding prior to the opening of the bid.

In accordance with Section 39.02(9)(a)l. of the General Ordinances, all bidders shall submit in writing to the Affirmative Action Division Manager of the City of Madison, a Certificate of Compliance or an Affirmative Action Plan at the same time or prior to the submission of the proof of responsibility forms.

The bidder shall be disqualified if the bidder fails to or refuses to, prior to opening of the bid, submit a Certificate of compliance, Affirmative Action Plan or Affirmative Action Data Update, as applicable, as defined by Section 39.02 of the General Ordinances (entitled Affirmative Action) and as required by Section 102.11 of the Standard Specifications.

## SECTION 102.4 PROPOSAL

No bid will be accepted that does not contain an adequate or reasonable price for each and every item named in the Schedule of Unit Prices.

A lump sum bid for the work in accordance with the plans and specifications is required. The lump sum bid must be the same as the total amounts bid for the various items and it shall be inserted in the space provided.

All papers bound with or attached to the proposal form are considered a part thereof and must not be detached or altered when the proposal is submitted. The plans, specifications and other documents designated in the proposal form will be considered a part of the proposal whether attached or not.

A proposal submitted by an individual shall be signed by the bidder or by a duly authorized agent. A proposal submitted by a partnership shall be signed by a member/partner or by a duly authorized agent thereof. A proposal submitted by a corporation shall be signed by an authorized officer or duly authorized registered agent of such corporation, and the proposal shall show the name of the State under the laws of which such corporation was chartered. The required signatures shall in all cases appear in the space provided thereof on the proposal.

Each proposal shall be placed, together with the proposal guaranty, in a sealed envelope, so marked as to indicate name of project, the contract number or option to which it applies, and the name and address of the Contractor or submitted electronically through Bid Express ([www.bidexpress.com](http://www.bidexpress.com)). Proposals will be accepted at the location, the time and the date designated in the advertisement. Proposals received after the time and date designated will be returned to the bidder unopened.

The Bidder shall execute the Disclosure of Ownership form. REFER TO SECTION F.

## SECTION 102.5: BID DEPOSIT (PROPOSAL GUARANTY)

All bids, sealed or electronic, must be accompanied with a Bid Bond equal to at least 5% of the bid or a Certificate of Annual/Biennial Bid Bond or certified check, payable to the City Treasurer. Bid deposit of the successful bidders shall be returned within forty-eight (48) hours following execution of the contract and bond as required.

PREVAILING WAGE RATES

Prevailing Wage Rates may be required and are attached in Section J of the contract. See Special Provisions to determine applicability.

**Bidders for this Contract(s) must be Pre-Qualified for at least one of the following type(s) of construction denoted by an**

Building Demolition

- 101  Asbestos Removal  
 120  House Mover

- 110  Building Demolition

Street, Utility and Site Construction

- 201  Asphalt Paving  
 205  Blasting  
 210  Boring/Pipe Jacking  
 215  Concrete Paving  
 220  Con. Sidewalk/Curb & Gutter/Misc. Flat Work  
 221  Concrete Bases and Other Concrete Work  
 222  Concrete Removal  
 225  Dredging  
 230  Fencing  
 235  Fiber Optic Cable/Conduit Installation  
 240  Grading and Earthwork  
 241  Horizontal Saw Cutting of Sidewalk  
 242  Infrared Seamless Patching  
 245  Landscaping, Maintenance  
 250  Landscaping, Site and Street  
 251  Parking Ramp Maintenance  
 252  Pavement Marking  
 255  Pavement Sealcoating and Crack Sealing  
 260  Petroleum Above/Below Ground Storage Tank Removal/Installation  
 262  Playground Installer  
 265  Retaining Walls, Precast Modular Units

- 270  Retaining Walls, Reinforced Concrete  
 275  Sanitary, Storm Sewer and Water Main Construction  
 276  Sawcutting  
 280  Sewer Lateral Drain Cleaning/Internal TV Insp.  
 285  Sewer Lining  
 290  Sewer Pipe Bursting  
 295  Soil Borings  
 300  Soil Nailing  
 305  Storm & Sanitary Sewer Laterals & Water Svc.  
 310  Street Construction  
 315  Street Lighting  
 318  Tennis Court Resurfacing  
 320  Traffic Signals  
 325  Traffic Signing & Marking  
 332  Tree pruning/removal  
 333  Tree, pesticide treatment of  
 335  Trucking  
 340  Utility Transmission Lines including Natural Gas, Electrical & Communications  
 399  Other \_\_\_\_\_

Bridge Construction

- 501  Bridge Construction and/or Repair

Building Construction

- 401  Floor Covering (including carpet, ceramic tile installation, rubber, VCT)  
 402  Building Automation Systems  
 403  Concrete  
 404  Doors and Windows  
 405  Electrical - Power, Lighting & Communications  
 410  Elevator - Lifts  
 412  Fire Suppression  
 413  Furnishings - Furniture and Window Treatments  
 415  General Building Construction, Equal or Less than \$250,000  
 420  General Building Construction, \$250,000 to \$1,500,000  
 425  General Building Construction, Over \$1,500,000  
 428  Glass and/or Glazing  
 429  Hazardous Material Removal  
 430  Heating, Ventilating and Air Conditioning (HVAC)  
 433  Insulation - Thermal  
 435  Masonry/Tuck pointing

- 437  Metals  
 440  Painting and Wallcovering  
 445  Plumbing  
 450  Pump Repair  
 455  Pump Systems  
 460  Roofing and Moisture Protection  
 464  Tower Crane Operator  
 461  Solar Photovoltaic/Hot Water Systems  
 465  Soil/Groundwater Remediation  
 466  Warning Sirens  
 470  Water Supply Elevated Tanks  
 475  Water Supply Wells  
 480  Wood, Plastics & Composites - Structural & Architectural  
 499  Other \_\_\_\_\_

State of Wisconsin Certifications

- 1  Class 5 Blaster - Blasting Operations and Activities 2500 feet and closer to inhabited buildings for quarries, open pits and road cuts.  
 2  Class 6 Blaster - Blasting Operations and Activities 2500 feet and closer to inhabited buildings for trenches, site excavations, basements, underwater demolition, underground excavations, or structures 15 feet or less in height.  
 3  Class 7 Blaster - Blasting Operations and Activities for structures greater than 15' in height, bridges, towers, and any of the objects or purposes listed as "Class 5 Blaster or Class 6 Blaster".  
 4  Petroleum Above/Below Ground Storage Tank Removal and Installation (Attach copies of State Certifications.)  
 5  Hazardous Material Removal (Contractor to be certified for asbestos and lead abatement per the Wisconsin Department of Health Services, Asbestos and Lead Section (A&LS). See the following link for application: [www.dhs.wisconsin.gov/Asbestos/Cert](http://www.dhs.wisconsin.gov/Asbestos/Cert). State of Wisconsin Performance of Asbestos Abatement Certificate must be attached.  
 6  Certification number as a Certified Arborist or Certified Tree Worker as administered by the International Society of Arboriculture  
 7  Pesticide application (Certification for Commercial Applicator For Hire with the certification in the category of turf and landscape (3.0) and possess a current license issued by the DATCP)  
 8  State of Wisconsin Master Plumbers License.

SECTION B: PROPOSAL

Please refer to the  
Bid Express Website  
at <https://bidexpress.com>  
look up contract number  
and go to  
Section B: Proposal Page

You can access all City of Madison bid solicitations for FREE at [www.bidexpress.com](http://www.bidexpress.com)

Click on the "Register for Free" button and follow the instructions to register your company and yourself. You will be asked for a payment subscription preference, since you may wish to bid online someday. Simply choose the method to pay on a 'per bid' basis. This requires no payment until / unless you actually bid online. You can also choose the monthly subscription plan at this time. You will, however, be asked to provide payment information. Remember, you can change your preference at anytime. You will then be able to complete your free registration and have full access to the site. Your free access does not require completion of the 'Digital ID' process, so you will have instant access for viewing and downloading. To be prepared in case you ever do wish to bid online, you may wish to establish your digital ID also, since you cannot bid without a Digital ID.

If you have any problems with the free registration process, you can call the bidexpress help team, toll free at 1-888-352-2439 (option 1, option1).

## **SECTION C: SMALL BUSINESS ENTERPRISE**

### **Instructions to Bidders City of Madison SBE Program Information**

#### **2 Small Business Enterprise (SBE) Program Information**

##### **2.1 Policy and Goal**

The City of Madison reaffirms its policy of nondiscrimination in the conduct of City business by maintaining a procurement process which remains open to all who have the potential and ability to sell goods and services to the City. It is the policy of the City of Madison to allow Small Business Enterprises (SBE) maximum feasible opportunity to participate in City of Madison contracting. The bidder acknowledges that its bid has been submitted in accordance with the SBE program and is for the public's protection and welfare.

Please refer to the "ADVERTISEMENT FOR BIDS" for the goal for the utilization of SBEs on this project. SBEs may participate as subcontractors, vendors and/or suppliers, which provide a commercially useful function. The dollar value for SBE suppliers or 'materials only' vendors shall be discounted to 60% for purposes of meeting SBE goals.

A bidder which achieves or exceeds the SBE goal will be in compliance with the SBE requirements of this project. In the event that the bidder is unable to achieve the SBE goal, the bidder must demonstrate that a good faith effort to do so was made. Failure to either achieve the goal or demonstrate a good faith effort to do so will be grounds for the bidder being deemed a non-responsible contractor ineligible for award of this contract.

A bidder may count towards its attainment of the SBE goal only those expenditures to SBEs that perform a commercially useful function. For purposes of evaluating a bidder's responsiveness to the attainment of the SBE goal, the contract participation by an SBE is based on the percentage of the total base bid proposed by the Contractor. The total base bid price is inclusive of all addenda.

Work performed by an SBE firm in a particular transaction can be counted toward the goal only if it involves a commercially useful function. That is, in light of industry practices and other relevant considerations, does the SBE firm have a necessary and useful role in the transaction, of a kind for which there is a market outside the context of the SBE Program, or is the firm's role a superfluous step added in an attempt to obtain credit towards goals? If, in the judgment of the Affirmative Action Division, the SBE firm will not perform a commercially useful function in the transaction, no credit towards goals will be awarded.

The question of whether a firm is performing a commercially useful function is completely separate from the question of whether the firm is an eligible SBE. A firm is eligible if it meets the definitional criteria and ownership and control requirements, as set forth in the City of Madison's SBE Program.

If the City of Madison determines that the SBE firm is performing a commercially useful function, then the City of Madison must then decide what that function is. If the commercially useful function is that of an SBE vendor / supplier that regularly transacts business with the respective product, then the City of Madison will count 60% of the value of the product supplied toward SBE goals.

To be counted, the SBE vendor / supplier must be engaged in selling the product in question to the public. This is important in distinguishing an SBE vendor / supplier, which has a regular trade with a variety of customers, from a firm which performs supplier-like functions on an ad hoc basis or for only one or two contractors with whom it has a special relationship.

A supplier of bulk goods may qualify as an eligible SBE vendor / supplier if it either maintains an inventory or owns or operates distribution equipment. With respect to the distribution equipment; e.g., a fleet of trucks, the term "operates" is intended to cover a situation in which the supplier leases the equipment on a regular basis for its entire business. It is not intended to cover a situation in which the firm simply provides drivers for trucks owned or leased by another party; e.g., a prime contractor, or leases such a party's trucks on an ad hoc basis for a specific job.

If the commercially useful function being performed is not that of a qualified SBE vendor / supplier, but rather that of delivery of products, obtaining bonding or insurance, procurement of personnel, acting as a broker or manufacturer's representative in the procurement of supplies, facilities, or materials, etc., only the fees or commissions will apply towards the goal.

For example, a business that simply transfers title of a product from manufacturer to ultimate purchaser; e. g., a sales representative who re-invoices a steel product from the steel company to the Contractor, or a firm that puts a product into a container for delivery would not be considered a qualified SBE vendor / supplier. The Contractor would not receive credit based on a percentage of the cost of the product for working with such firms.

Concerning the use of services that help the Contractor obtain needed supplies, personnel, materials or equipment to perform a contract: only the fee received by the service provider will be counted toward the goal. For example, use of a SBE sales representative or distributor for a steel company, if performing a commercially useful function at all, would entitle the Contractor receiving the steel to count only the fee paid to the representative or distributor toward the goal. This provision would also govern fees for professional and other services obtained expressly and solely to perform work relating to a specific contract.

Concerning transportation or delivery services: if an SBE trucking company picks up a product from a manufacturer or a qualified vendor / supplier and delivers the product to the Contractor, the commercially useful function it is performing is not that of a supplier, but simply that of a transporter of goods. Unless the trucking company is itself the manufacturer or a qualified vendor / supplier in the product, credit cannot be given based on a percentage of the cost of the product. Rather, credit would be allowed for the cost of the transportation service.

The City is aware that the rule's language does not explicitly mention every kind of business that may contribute work on this project. In administering these programs, the City would, on a case-by-case basis, determine the appropriate counting formula to apply in a particular situation.

## **2.2 Contract Compliance**

Questions concerning the SBE Program shall be directed to the Contract Compliance Officer of the City of Madison Department of Civil Rights, Affirmative Action Division, 210 Martin Luther King, Jr. Blvd., Room 523, Madison, WI 53703; telephone (608) 266-4910.

## 2.3 Certification of SBE by City of Madison

The Affirmative Action Division maintains a directory of SBEs which are currently certified as such by the City of Madison. Contact the Contract Compliance Officer as indicated in Section 2.2 to receive a copy of the SBE Directory or you may access the SBE Directory online at [www.cityofmadison.com/dcr/aaTBDir.cfm](http://www.cityofmadison.com/dcr/aaTBDir.cfm).

All contractors, subcontractors, vendors and suppliers seeking SBE status must complete and submit the **Targeted Business Certification Application** to the City of Madison Affirmative Action Division by the time and date established for receipt of bids. A copy of the Targeted Business Certification Application is available by contacting the Contract Compliance Officer at the address and telephone indicated in Section 2.2 or you may access the Targeted Business Certification Application online at [www.cityofmadison.com/dcr/aaTBDir.cfm](http://www.cityofmadison.com/dcr/aaTBDir.cfm). Submittal of the Targeted Business Certification Application by the time specified does not guarantee that the applicant will be certified as a SBE eligible to be utilized towards meeting the SBE goal for this project.

## 2.4 Small Business Enterprise Compliance Report

### 2.4.1 Good Faith Efforts

Bidders shall take all necessary affirmative steps to assure that SBEs are utilized when possible and that the established SBE goal for this project is achieved. A contractor who self performs a portion of the work, and is pre-qualified to perform that category of work, may subcontract that portion of the work, but shall not be required to do so. When a bidder is unable to achieve the established SBE goal, the bidder must demonstrate that a good faith effort to do so was made. Such a good faith effort should include the following:

- 2.4.1.1 Attendance at the pre-bid meeting.
- 2.4.1.2 Using the City of Madison's directory of certified SBEs to identify SBEs from which to solicit bids.
- 2.4.1.3 Assuring that SBEs are solicited whenever they are potential sources.
- 2.4.1.4 Referring prospective SBEs to the City of Madison Affirmative Action Division for certification.
- 2.4.1.5 Dividing total project requirements into smaller tasks and/or quantities, where economically feasible, to permit maximum feasible SBE participation.
- 2.4.1.6 Establishing delivery schedules, where requirements permit, which will encourage participation by SBEs.
- 2.4.1.7 Providing SBEs with specific information regarding the work to be performed.
- 2.4.1.8 Contacting SBEs in advance of the deadline to allow such businesses sufficient time to prepare a bid.
- 2.4.1.9 Utilizing the bid of a qualified and competent SBE when the bid of such a business is deemed reasonable (i.e. 5% above the lowest bidder), although not necessarily low.
- 2.4.1.10 Contacting SBEs which submit a bid, to inquire about the details of the bid and confirm that the scope of the work was interpreted as intended.

### 2.4.2 Reporting SBE Utilization and Good Faith Efforts

The Small Business Enterprise Compliance Report is to be submitted by the bidder with the bid. This report is due by the specified bid closing time and date. Bids submitted without a completed SBE Compliance Report as outlined below

shall be deemed non-responsible and the bidder ineligible for award of this contract.

2.4.2.1 If the Bidder meets or exceeds the goal established for SBE utilization, the Small Business Enterprise Compliance Report shall consist of the following:

2.4.2.1.1 **Cover Page**, Page C-6; and

2.4.2.1.2 **Summary Sheet**, C-7.

2.4.2.2 If the bidder does not meet the goal established for SBE utilization, the Small Business Enterprise Compliance Report shall consist of the following:

2.4.2.2.1 **Cover Page**, Page C-6;

2.4.2.2.2 **Summary Sheet**, C-7; and

2.4.2.2.3 **SBE Contact Report**, C-8 and C-9. (A separate Contact Report must be completed for each applicable SBE which is not utilized.)

## 2.5 Appeal Procedure

A bidder which does not achieve the established goal and is found non-responsible for failure to demonstrate a good faith effort to achieve such goal and subsequently denied eligibility for award of contract may appeal that decision to the Small Business Enterprises Appeals Committee. All appeals shall be made in writing, and shall be delivered to and received by the City Engineer no later than 4:30 PM on the third business day following the bidder's receipt of the written notification of ineligibility by the Affirmative Action Division Manager. Postmark not acceptable. The notice of appeal shall state the basis for the appeal of the decision of the Affirmative Action Division Manager. The Appeal shall take place in accordance with Madison General Ordinance 33.54.

## 2.6 SBE Requirements After Award of the Contract

The successful bidder shall identify SBE subcontractors, suppliers and vendors on the subcontractor list in accordance with the specifications. The Contractor shall submit a detailed explanation of any variances between the listing of SBE subcontractors, vendors and/or suppliers on the subcontractor list and the Contractor's SBE Compliance Report for SBE participation.

No change in SBE subcontractors, vendors and/or suppliers from those SBEs indicated in the SBE Compliance Report will be allowed without prior approval from the Engineer and the Affirmative Action Division. The contractor shall submit in writing to the City of Madison Affirmative Action Division a request to change any SBE citing specific reasons which necessitate such a change. The Affirmative Action Division will use a general test of reasonableness in approving or rejecting the contractor's request for change. If the request is approved, the Contractor will make every effort to utilize another SBE if available.

The City will monitor the project to ensure that the actual percentage commitment to SBE firms is carried out.

## **2.7 SBE Definition and Eligibility Guidelines**

A Small Business Enterprise is a business concern awarded certification by the City of Madison. For the purposes of this program a Small Business Enterprise is defined as:

- A. An independent business operated under a single management. The business may not be a subsidiary of any other business and the stock or ownership may not be held by any individual or any business operating in the same or a similar field. In determining whether an entity qualifies as a SBE, the City shall consider all factors relevant to being an independent business including, but not limited to, the date the business was established, adequacy of its resources for the work in which it proposes to involve itself, the degree to which financial, equipment leasing and other relationships exist with other ineligible firms in the same or similar lines of work. SBE owner(s) shall enjoy the customary incidents of ownership and shall share in the risks and profits commensurate with their enjoyment interests, as demonstrated by an examination of the substance rather than form or arrangements that may be reflected in its ownership documents.
- B. A business that has averaged no more than \$4.0 million in annual gross receipts over the prior three year period and the principal owner(s) do not have a personal net worth in excess of \$1.32 million.

Firm and/or individuals that submit fraudulent documents/testimony may be barred from doing business with the City and/or forfeit existing contracts.

SBE certification is valid for one (1) year unless revoked.

## SECTION D: SPECIAL PROVISIONS

### HVAC UPGRADE FOR OLBRICH BOTANICAL GARDENS- PHASE I CONTRACT NO. 7383

It is the intent of these Special Provisions to set forth the final contractual intent as to the matter involved and shall prevail over the Standard Specifications and plans whenever in conflict therewith. In order that comparisons between the Special Provisions can be readily made, the numbering system for the Special Provisions is equivalent to that of the Specifications.

Whenever in these Specifications the term "Standard Specifications" appears, it shall be taken to refer to the City of Madison Standard Specifications for Public Works Construction and Supplements thereto.

#### SECTION 102.10: PREVAILING WAGE

For this project, payment of prevailing wages (white sheet) shall be required unless the box indicating prevailing wages are not required is checked below.

Prevailing wages shall not be required when this box is checked.

If prevailing wages (white sheets) are required, the wages and benefits paid on the contract shall not be less than those specified in the Prevailing Wage Determination included with these contract documents for the following types of work:

- Building or Heavy Construction
- Sewer, Water, or Tunnel Construction
- Local Street or Miscellaneous Paving Construction
- Residential or Agricultural Construction

When multiple boxes are checked, worker's wages may vary according to the type and area of work performed. It is the responsibility of the Contractor to determine and apply the appropriate wage rate for the specific work assigned.

#### SECTION 102.12: BEST VALUE CONTRACTING

This Contract shall be considered a Best Value Contract if the Contractor's bid is equal to or greater than \$55,500 for a single trade contract; or equal to or greater than \$271,500 for a multi-trade contract pursuant to MGO 33.07(7).

#### SECTION 103 AWARD AND EXECUTION OF THE CONTRACT

The awarded Contractor shall completely execute the signing of all contract documents and submit them to City Engineering prior to 12:00pm on April 21<sup>st</sup>, 2015. No exceptions or extensions to the above date will be permitted.

#### SECTION 109.2 PROSECUTION OF THE WORK

Work shall begin only after the contract is completely executed and the start work letter is received. It is anticipated that the start work letter shall be issued on or before **May 11<sup>th</sup>, 2015**. After receiving this letter, the contractor shall order all necessary materials, supplies and equipment with substantial lead times in order to ensure that all necessary items are on site to begin construction work and obtain compliance with the dates as outlined in the Building Operations Schedule in Section 109.7.

**SECTION 109.7 TIME OF COMPLETION**

**Construction Closeout:** The point in the contract where all contractual requirements associated with the execution of the work as described in the plans, specifications, and other documents have been successfully met.

**Contract Closeout:** The point in the contract where all contractual requirements associated with the City of Madison, Board of Public Works contract has been successfully met.

**BUILDING OPERATIONS SCHEDULE:**

The existing boilers are planned to be take out of service on **Friday May 29<sup>th</sup>, 2015** and shall be available to the contractor for demolition on **Monday, June 1<sup>st</sup>, 2015**. The contractor shall have access to the site beginning **May 11<sup>th</sup>, 2015** to conduct any pre-demolition work. The contractor shall prepare a schedule as stated in the General Requirements, Section 1.17 Schedule of Operations. This schedule shall be approved by the City Project Manager prior to starting any construction work.

The boilers system shall be back in operation on or before **September 1<sup>st</sup>, 2015**.

When replacing the water heater, the interruption of potable hot water service to the facility shall be minimized. Coordinate demolition/installation times with the owner's representative.

Construction Closeout shall occur on or before **September 30<sup>th</sup>, 2015**.

Contract Closeout shall occur on or before **November 13<sup>th</sup> 2015**.

# BIDDING DOCUMENTS

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## HVAC UPGRADE FOR OLBRICH BOTANICAL GARDENS PHASE 1

CONTRACT# 7383

### OLBRICH BOTANICAL GARDENS

3330 Atwood Avenue  
Madison, Wisconsin 53704

March 6, 2015

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OWNER:  
CONTACT:

City of Madison  
Paul Stauffer, Project Manager  
Engineering Division  
City-County Building, Room 118  
210 Martin Luther King, Jr. Boulevard  
Madison, WI 53703  
608-266-4366

ENGINEER:  
CONTACT:

HEIN Engineering Group  
Michael Hein, PE, Project Engineer  
17 Applegate Court, Suite #200  
Madison, WI 53713  
608-288-9260  
Project No. H1207

DATE: March 6, 2015

PROJECT: HVAC UPGRADE FOR OLBRICH BOTANICAL GARDENS - PHASE 1

**TABLE OF CONTENTS - SPECIFICATION INDEX**

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**DIVISION 1 – GENERAL REQUIREMENTS**

Section 01 00 00 GENERAL REQUIREMENTS

**DIVISION 22 – PLUMBING**

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54 **PART 1 – GENERAL**

55  
56 **1.1. SCOPE**

57 A. The work under this section includes general rules for the project.

58 Work under this contract is for the replacement of the hot water boiler system at the Olbrich Botanical Gardens located at  
59 3330 Atwood Avenue Madison WI. The scope of the work includes, but is not limited to; all work and materials required to  
60 replace the existing three boilers, pumps, water heater, plumbing, flue gas piping, electrical and controls per plans and  
61 specifications.  
62

1 **1.2. PRE-BID INFORMATION**

- 2 A. There will be a pre-bid tour of the existing building on **March 18<sup>th</sup>, 2015 at 1:00 pm** to provide bidders the opportunity to  
3 acquaint themselves with the project. A representative from the designer's office will be present to take questions that will  
4 be answered by addendum.  
5 B. If you are unable to attend the above meeting, contact the Project Manager to schedule a site visit.  
6

7 **1.3. CONTACTS**

- 8 A. Send all pre-bid inquiries to the owner's project management  
9 B. The owner's designee for project management:  
10 1. Paul Stauffer  
11 2. City of Madison- Facility Services  
12 3. Address: Room 115, 210 Martin Luther King Jr. Blvd.  
13 4. Phone: 608-266-4366  
14 5. Email: pstauffer@cityofmadison.com  
15 C. The owner's designee for architecture and engineering is:  
16 1. Michel Hein  
17 2. Company: Hein Engineering Group  
18 3. Address: 17 Applegate Court, Suite #200  
19 4. Phone: 608-288-9260  
20 5. Email: hein@chorus.net  
21 D. The owner's representative is:  
22 1. Don Saunders  
23 2. City of Madison- Olbrich Maintenance  
24 3. Address: 3330 Atwood Avenue  
25 4. Phone: 608-220-3127  
26 5. Email: dsaunders@cityofmadison.com  
27

28 **1.4. QUALIFICATIONS OF BIDDER**

- 29 A. By submitting the bid, the bidder and each subcontractor certifies as to meeting the following requirements:  
30 1. Has completed one projects of at least 50% of the size or value of the division of work being bid and the type of work  
31 completed is similar to that being bid. Additional requirements will be described in the appropriate technical section of  
32 these specifications.  
33 2. Has access to all necessary equipment and has organizational capacity and technical competence necessary to do the  
34 work properly and expeditiously.  
35 3. Maintains a permanent place of business.  
36

37 **1.5. WORK BY THE OWNER AND OWNER FURNISHED EQUIPMENT**

- 38 A. **On January 20, 2015, A & A Environmental, Inc collected bulk samples of thermal insulation materials in the boiler room.**  
39 **The bulk samples were analyzed for asbestos content by polarized light microcopy. All samples were reported as no as-**  
40 **bestos detected.**  
41 1. Sample 01-White mastic on pump insulation.  
42 2. Sample 02-Breaching jacket on boiler #1.  
43 3. Sample 03-Breaching insulation cement on boiler #1  
44 4. Sample 04-Pink breaching insulation on boiler #1  
45 5. Sample 05-Breaching jacketing on boiler #1  
46 6. Sample 06-Gray breaching insulation cement on boiler #3  
47 7. Sample 07-White breaching insulation on boiler #3  
48 8. Sample 08-White fiber insulation on boiler #3  
49 9. Sample 09-Brown mineral insulation block on boiler #3  
50 10. Sample 10-White insulation around access door on boiler #1  
51 11. Sample 11-Gray insulating cement on boiler #1  
52 The insulation under the metal jacket on all of the boilers is mineral wool-sample 09.  
53 **A&A Environmental, Inc. was unable to access the cement/gasket material on the boilers because all of the boilers**  
54 **were in operation. These material should be sampled once the boilers are out of operation and ready to be demol-**  
55 **ished. The City shall schedule and pay for this testing. The contractor shall not proceed with demolition until these**  
56 **sample have been taken and analyzed.**  
57 B. There is no asbestos removal anticipated for this project other than noted above, however, existing building materials that  
58 may have hazardous content and are located within the work area (example: floor tile, ceiling tile, pipe insulation) shall be  
59 sampled, tested, and removed by the City. If any suspect hazardous building materials are found by the contractor during  
60 demolition or renovation work that have not been sampled and tested, work must stop and a certified hazardous material  
61 inspector must be contacted by the City to assess the situation. Inaccessible areas may exist within the facility. **Any hazard-**  
62 **ous building material removal shall be performed by owner under a separate contract at no cost to the contractor.**  
63 C. The following work will be accomplished by the owner or will be let under separate contracts and will not be included under  
64 this Contract:

- 1 1. The City shall hire a contractor to provide patching or flashing repairs to the copper or EPDM roofing system under a  
2 separate contract as stated in the plans. The Contractor is responsible for protecting any opening from the elements  
3 and coordinating this work with the City Project Manager.
- 4 2. If the cement/gasket material on the boilers should test positive for asbestos, the City shall hire a contractor and ar-  
5 range and pay for its removal. The Contractor is responsible for coordinating this work with the City Project Manager.  
6

#### 7 1.6. SALVAGE MATERIALS

- 8 A. No materials removed from this project shall be reused except as specifically noted below. All materials removed shall be-  
9 come the property of and shall be disposed of by the Contractor.

#### 10 1.7. PROVISIONS FOR FUTURE WORK

- 11 A. Do not disconnect any electrical circuits that are part of the emergency power system. If such circuit is specified or labeled  
12 on drawings as to be disconnected or removed, verify with owner.
- 13 B. Space has been indicated on the plans for future equipment such as a boiler, two chillers with pumps. The contractor  
14 shall maintain this open space for this future equipment installation. Any plumbing, electrical lines or other equipment  
15 that run thru these areas that will interfere with the installation of this future equipment shall be relocated at contrac-  
16 tors 's expense.  
17

#### 18 1.8. SPECIAL SITE CONDITIONS

- 19 A. Unless otherwise noted, construction operations shall be limited to the hours between 7:00 a.m. and 6:00 p.m., Mondays  
20 through Fridays, except for holidays. A request must be made to the owner forty-eight hours in advance for approval of  
21 work days or hours other than those stated above. Compliance is required with applicable Noise Ordinances.
- 22 B. Temporary toilets are not required. The Contractor's labor force may use owner facilities upon approval by the owner. The  
23 Contractor shall maintain the toilets and other spaces provided by the owner in clean and sanitary condition at all times.
- 24 C. TOILETS:
  - 25 1. The Contractor has the option to provide and maintain sanitary temporary toilets, located where directed by the owner,  
26 in sufficient number required for the force employed. The toilets shall comply with International Building Code Chapter  
27 29 on Plumbing Systems. Toilets shall be self-contained chemical type.
  - 28 2. The Contractor shall maintain the temporary toilets in a sanitary condition at all times and shall supply toilet paper until  
29 completion of the job.
- 30 D. CONTRACTOR PARKING: Limited parking shall be provided in the overflow area of the parking lot. Coordinate with the  
31 owner's representative.
- 32 E. CONTRACTOR ON SITE MATERIAL STORAGE: A limited material lay down area and workspace area outside of the boiler  
33 room shall be provided to the contractor. Coordinate with the owner's representative.
- 34 F. ON SITE TRASH CONTAINERS: No permanently reserved on-site space for a trash container shall be provided. Occasionally  
35 a trash container may be brought in for a short duration (e.g. two to three days) if arranged in advance with the owner's  
36 representative. Waste from the project shall not be disposed into the building owner's trash receptacles.
- 37 G. FIELD OFFICES: Not applicable.  
38

#### 39 1.9. ALTERNATES

- 40 A. Not applicable.  
41

#### 42 1.10. STANDARD SPECIFICATIONS

- 43 A. The City of Madison Standard Publications for Public Works Construction (Edition at publication date of this bid) forms a  
44 part of these contract documents as if attached hereto. These Standard Specifications are available from the City Engineer,  
45 City Engineering Division, Room 115, City County Building, 210 Martin Luther King Jr. Blvd., Madison, WI 53710 or electroni-  
46 cally from the City Website <http://www.cityofmadison.com/business/pw/specs.cfm>. The Contractor shall review these  
47 standard specifications prior to preparation of proposal for the work to be done under this contract. Failure to do so does  
48 not relive the Contractor from meeting all requirements.  
49

#### 50 1.11. GENERAL REQUIREMENTS

- 51 A. All articles in these General Requirements are applicable to all Divisions fully as if repeated within that Division. The Condi-  
52 tions of the Contract, General and Supplementary General Conditions, and these General Requirements shall apply to the  
53 Contractor engaged in this work. Items listed under Scope of Work are not necessarily all inclusive. These specifications and  
54 drawings are intended to include everything necessary to perform the entire work properly. Every item necessarily required  
55 might not be specifically mentioned or shown. Unless expressly stated, all systems and equipment shall be complete and  
56 operable. All devices and installation methods necessary for a functioning system are considered included in this contract  
57 even if a detail is missing or unclear. The words "furnish", "install", "as required", and "provide" shall mean the same in a  
58 sense that the Contractor shall furnish and install all the necessary materials, apparatus, and devices to complete the  
59 equipment and systems installation herein specified, except such parts as are specifically exempted herein. This also in-  
60 cludes that the contractor demolishes and disposes of an existing item if demolition is required to install the new item, even  
61 if demolition drawings or specification don't mention demolition of the specific item. If an item is either called for in the  
62 specifications or shown on the plans, it shall be considered sufficient for the inclusion of said item in this contract.
- 63 B. The terms "city", "owner", city engineer" and "project manager" are used interchangeably. The terms "contractor", "sub-  
64 contractor" and "general contractor" are used interchangeably.

- 1 C. Portions of these specifications are of the abbreviated, simplified type and may include incomplete sentences. Omissions of  
2 words or phrases such as "the Contractor shall", "in conformity with", "shall be", "as noted on the drawings", "in accord-  
3 ance with details", are intentional. Omitted words or phrases shall be supplied by inference in the same manner, as they  
4 are when a note occurs on the drawings. Such terms as approved, reviewed, equal, as directed, , as permitted, acceptable,  
5 satisfactory mean by or to the owner.
- 6 D. If a conflict exists within the Specifications or exists within the Drawings, the Contractor shall furnish the item, system, or  
7 workmanship, which is the highest quality, largest, largest quantity or most closely fits the owner's intent. Materials and  
8 labor shall be new (unless noted or stated otherwise), first class, and workmanlike, and shall be subject at all times to the  
9 owner's inspections, tests and approval from the commencement until the acceptance of the completed work. Whenever a  
10 particular manufacturer's product is named, it is intended to establish a level of quality and performance requirements un-  
11 less more explicit restrictions are stated to apply. It must be understood that the details and drawings are diagrammatic.  
12 The Contractor shall verify all dimensions at the site and be responsible for their accuracy. If items are too large to fit into  
13 existing space Contractor shall provide smaller model of same type upon approval by owner at no cost to owner. All sizes as  
14 given are minimum except as noted. Prior to bidding, bidder must visit site to become familiar and verify existing condi-  
15 tions. Failure to do so does not relieve the bidder from the responsibility to verify existing conditions, to point out errors in  
16 drawings or specifications or code violations.
- 17 E. The area to be set aside for the work under this contract is shown on the drawings, and the Contractor shall confine the  
18 construction to the immediate area within the construction limits. The Contractor shall immediately upon entering the site  
19 for purpose of beginning work, locate general reference points and take such action as is necessary to prevent their de-  
20 struction. The Contractor shall lay out its work and be responsible for all lines, elevations and measurements of the build-  
21 ing and other work executed under its Contract. The Contractor must exercise proper precaution to verify dimensions on  
22 the drawings before laying out work and will be held responsible for any error resulting from failure to exercise such pre-  
23 caution. The Contractor shall verify grades, lines, levels, locations, and dimensions as shown on drawings and report any er-  
24 rors or inconsistencies to owner before commencing work. Starting of work by the Contractor shall imply acceptance of ex-  
25 isting conditions. Confine all operations, equipment, apparatus and storage of materials, to the immediate area of work to  
26 the greatest possible extent. Contractor shall ascertain, observe and comply with all rules and regulations in effect on the  
27 project site, including but not limited to parking and traffic regulations, use of walks, security restrictions and hours of al-  
28 lowable ingress and egress. Any special traffic control during construction involving lane closures shall be in accordance  
29 with the federal standard, Manual of Uniform Traffic Control Devices.
- 30 F. The work site shall be kept clean and neat at all times. Accumulation of debris shall be avoided and all new equipment and  
31 material shall be stored neatly and protected. Failure to comply will result in the contractor responsible for the disorderly  
32 conditions to be removed from job site.
- 33 G. Owner will not furnish Watchpersons. The Contractor shall provide such precautionary measures, to include the furnishing  
34 of watchpersons if deemed necessary, to protect persons and property from damage or loss where the Contractor's work is  
35 involved. The contractor is responsible for securing any material stored on site. In case of theft or damage  
36

#### 37 **1.12. CONTRACTOR'S RESPONSIBILITY PRIOR BIDDING**

- 38 A. Bidders shall bring inadequacies, omissions or conflicts to owner's attention at least ten (10) days before the date set for  
39 bid submission. Prompt clarification will be supplied to all bidders of record by addendum. Failure to request clarification or  
40 interpretation of the drawings and specifications will not relieve the successful Bidder of responsibility. Signing of the con-  
41 tract will be considered as implicitly denoting that the Contractor has thorough understanding of the scope of work, existing  
42 conditions, and comprehension of the contract documents. Owner is not responsible for verbal instructions.
- 43 B. During bidding time owner will allow contractors to visit the site to familiarize themselves with the existing conditions and  
44 to ask questions for clarification. Failure to attend the scheduled walkthrough implies that the contractor accepts all exist-  
45 ing conditions and includes all work to handle existing conditions in his bid price.
- 46 C. Prior bidding, bidder must obtain information on payment conditions, discounts, shipping charges, and other cost from  
47 vendor and/or manufacturer of the products specified.  
48

#### 49 **1.13. PAYMENT AND CHANGE ORDERS**

- 50 A. PAYMENTS: will be made based on progress of work. No payments will be made for occurred overhead cost that did not  
51 materialize in actual installation. Examples of cost to the contractor that is not part of partial payment are project manage-  
52 ment cost, bond cost etc. These cost will be covered proportionally for actual work done on site. No payments shall be  
53 made for material that is not installed.
- 54 B. PAY APPLICATION: The Contractor is responsible for providing the Owner partial payment applications on form AIA Docu-  
55 ment G702 Application for Payment and AIA Document G703 Continuation Sheet (with schedule of values). Before the  
56 first Application for Payment, the Contractor shall submit to the A/E a schedule of values of the various portions of the  
57 Work, including quantities if required by the A/E aggregating the total Contract Sum, divided so as to facilitate payments to  
58 Subcontractors. Prepare a schedule of values in such form and supported by such substantiating data as the A/E and Owner  
59 may require. Each item in the schedule of values shall include its proper share of overhead and profit. This schedule, when  
60 approved by the A/E, shall be used only as a basis for reviewing the Contractor's Applications for Payment.
- 61 C. CHANGE ORDERS: Changes only will be accepted if approved prior work done. No payment shall be made if contractor if  
62 contractor commences work without a cost is agreed on. In case of field change orders a price range has to be agreed on at  
63 minimum. If contractor does not provide cost before the additional work is done, it is assumed the contractor agreed that  
64 this work was part of the original contract.

- 1 D. CHANGE ORDER MARKUP: Contractor shall supply all documentation for evaluation of reasonableness of change order  
2 price. These include but are not limited to subcontractor quotes, supplier quotes, time estimates and others. Markup on  
3 subcontractor price shall not exceed the value allowed by the Standard Specifications referenced in this contract. This  
4 markup will cover all the contractor expenses including added bond, insurance and other cost.  
5

#### 6 **1.14. COOPERATION AND RESPONSIBILITIES BETWEEN TRADES**

- 7 A. The Contractor assumes responsibility for all work specified in this contract except for work explicitly noted as be done by  
8 owner or a Contractor separately hired by owner. The Contractor coordinate the work of all trades on the project. If plans  
9 or specifications designate parts of the work to be done by a specific trade it is meant as a suggestion only. It is up to the  
10 trades to agree on division of work and cost. Any work not done by a subcontractor will be the responsibility of the contrac-  
11 tor (general contractor, party the owner is in contract with).
- 12 B. All Contractors shall work in cooperation with the Contractor and with each other, and fit their work into the structure as  
13 job conditions may demand. Owner shall make all final decisions as to the right-of-way and run of pipe, ducts, etc., at pre-  
14 arranged meetings with responsible representatives of the Contractors involved. Contractor(s) shall coordinate the work  
15 with adjacent work with other Contractors prior to installation and shall cooperate with all other trades to facilitate the  
16 general progress of the work. The Contractor shall coordinate and schedule the work of all its subcontractors, and shall  
17 furnish all information required by them for proper scheduling and execution of the work. In the same manner, the Con-  
18 tractor shall coordinate the work with that of owner, and any other Contractor operating in the area, including reasonable  
19 adjustments of schedule in order to allow other Contractors or the owner to do their work. Any installed work that is not  
20 coordinated and that interferes with other Contractor's work shall be removed or relocated at the Contractor's expense.
- 21 C. In case it is indicated which trade is responsible for which work, this is meant as a suggestion and it is the Contractor's re-  
22 sponsibility in its contracts with subcontractors to clarify who ultimately will do the work. If conflicts arise between the Con-  
23 tractor and subcontractor about who is responsible for which work to be done it is the Contractor's responsibility to make  
24 sure the work gets done in time even if the dispute between Contractor and subcontractor gets settled later.  
25

#### 26 **1.15. SUBMITTALS**

- 27 A. Documents have to be submitted in electronic form (PDF) as described elsewhere in addition to hardcopies no later than 3  
28 business days after start work letter is issued. Owner will review, and process shop drawings and other required submittals  
29 with reasonable promptness. No delay will be allowed in the progress of the job attributable to Contractor's failure to sup-  
30 ply submittals in time. PDF shall be in good quality in electronic original from manufacturer. Scanned PDF are not accepta-  
31 ble.
- 32 B. The Contractor shall submit three (3) prints of all shop drawings, submittal data consisting of brochures, catalogs, material  
33 lists, wiring diagrams, Material Safety Data Sheets (MSDS), samples, erection drawings, and equipment layouts for review  
34 by owner. General catalog sheets showing a series of the same device is not acceptable unless the specific model is clearly  
35 marked. Each submittal shall be provided together with a transmittal letter or form. Each original transmittal shall be as-  
36 signed a transmittal number. The number shall begin with the first initial of the name of the Contractor's firm followed by a  
37 serial number. The re-submittals shall indicate the same number with numerical suffix in sequence. Each transmittal shall  
38 itemize the enclosures and indicate the distribution of the transmittal and the enclosures. The following information shall  
39 be included on all submitted documents: Agency/Location/Address obtained, project number, building name, project name.  
40 Submittals shall be grouped to include complete submittals of related systems, products, and accessories in a single submit-  
41 tal. Mark dimensions and values in units to match those specified. Include wiring diagrams of electrically powered equip-  
42 ment.
- 43 C. Submit all original documents providing information regarding sustainability requirements including but not limited to recy-  
44 cled content, VOC, certified wood, disposal certificates and transportation distance. Contractor is required to prove that  
45 material and methods used meet all requirements specified elsewhere.
- 46 D. Owner will return the marked and stamped drawings together with transmittal letter or form to Contractor. If re-submittal  
47 is required, owner will so note and Contractor shall make another submission for review after correction resolving the re-  
48 view comments on the prior submittals. The above procedure shall be repeated until owner favorably reviews the submit-  
49 tal. The submittals must be approved before material is ordered and fabrication is authorized.
- 50 E. Owner's favorable review of shop drawings and other submittals shall not relieve the Contractor of responsibility for devia-  
51 tions from drawings or specifications, unless the Contractor has in writing called the owner's attention to such deviations at  
52 the time of submission, and the owner has acknowledged in writing such deviations; nor shall it relieve the Contractor from  
53 responsibility for errors of any sort in such drawings. If deviations, discrepancies, or conflicts between shop drawing submit-  
54 tals and the drawings and specifications are discovered either prior to or after the shop drawing submittals are reviewed by  
55 owner, the drawings and specifications shall control and shall be followed. The Contractor shall be responsible for and shall  
56 check the correctness of all documents including those subcontractors prior to submitting them to owner for review.
- 57 F. The Contractor shall furnish prints of the favorably reviewed final shop drawings, erection drawings, equipment layouts and  
58 vendor data to subcontractors and suppliers for the proper coordination of their work. The Contractor shall keep one (1)  
59 complete set of the above documents at the job site for the use by owner.
- 60 G. After the completion of the project, and prior to final payment, submit:
- 61 1. One (1) copy of the Waste Manifest Records to the owner, if required in accordance with "Safety and Environment" Re-  
62 quirements Article "HAZARDOUS SUBSTANCES".
  - 63 2. The original and one (1) copy of all guarantee/warranty documents.
  - 64 3. Final copy O&M Manual.
- 65

1 **1.16. GUARANTEES**

- 2 A. All work, material and equipment is guaranteed by the Contractor to be free of faults for at least one year or longer if speci-  
3 fied elsewhere. This year begins from the date of final acceptance from owner. The Contractor agrees to return to the pro-  
4 ject and commence work as directed upon notification by owner and will furnish at his own expense all necessary labor and  
5 material to make proper repairs or corrections made necessary by defective material or inferior workmanship furnished or  
6 performed under this contract. If a subcontractor is not complying, the Contractor is held responsible.
- 7 B. All corrections and repairs are to be made no more than 30 days after notification of the Contractor for equipment and  
8 material that is not critical to the operation of the building. Critical equipment and material, including but not limited to  
9 HVAC, roofing, electrical, elevator, shall be repaired or brought into temporary and safe working condition in less than 7  
10 days and temporary alternatives have to be provided by the Contractor if function is critical for use of the facility. If Con-  
11 tractor fails to do so the owner reserves the right to perform the work himself or subcontract a different Contractor and  
12 charge the Contractor the full cost of the repair and correction and cost of any material, rental fee, labor and equipment to  
13 provide temporary relief and protection to enable safe operation of the building.
- 14 C. All equipment and material warranty by the manufacturer that lasts longer than the 1-year warranty by the contractor re-  
15 quires sufficient documentation acceptable by the manufacturer to honor the warranty beyond the first year. documents  
16 required include manufacturer's warranty certification for this specific material and equipment at the job site, purchase or-  
17 ders or any other documents that will be required beyond the first year for the manufacturer to honor warranty.

18  
19 **1.17. SCHEDULE OF OPERATIONS**

- 20 A. Within 5 calendar days after the effective date of Start Work Letter, the Contractor shall provide a critical path method  
21 (CPM) network diagram and a preliminary construction progress schedule. The diagram shall show the order in which the  
22 Contractor proposes to accomplish the work. The CPM shall show interdependence and duration, along with installation  
23 man-hours by craft of each activity. Any work element longer than 15 days shall be broken down into component parts. The  
24 critical path and float for each activity shall also be shown. The diagram or bar chart shall be neatly lettered and legibly  
25 drawn to a time scale. This initial network diagram and all consecutive versions shall include preliminary dates throughout  
26 the end of the project.
- 27 B. Install work in phases to accommodate owner 's occupancy requirements. **Refer to Section D : Special Provisions, 109.7 for**  
28 **critical dates as required by the City.** During the construction period coordinate electrical schedule and operations with  
29 owner.
- 30 C. After the initial submittal, the Contractor shall update the schedule monthly by entering actual progress for the period and  
31 submit copies as part of the payment request. Contractor shall maintain and provide a 6-week construction schedule that is  
32 compatible and complimentary to the general CONSTRUCTION SCHEDULE, and shall include detail of daily tasks over a 6-  
33 week period to be updated weekly and communicated and coordinated at the weekly Trade Meetings by the Contractor's  
34 field supervisor.
- 35 D. Include tests activities in the schedule

36  
37 **1.18. DRAWINGS, SPECIFICATIONS AND OTHER DOCUMENTS**

- 38 A. Drawings indicate approximate locations of the various items. These items are shown approximately to scale and attempt  
39 to show how these items should be integrated with building construction. Locate all the various items on-the-job measure-  
40 ments in conformance with code and cooperation with other trades. Before locating items, confer with the owner as to de-  
41 sired location in the various areas. In no case items shall be located by scaling drawings. Contractor must relocate items and  
42 bear cost of redoing work or other trades' work necessitated by failure to comply with this requirement.
- 43 B. Demolition drawings, location, circuit numbers, number and type of fixtures, type of mounting and control devices may not  
44 be correct. All sizes are approximations and have to be field-verified by contractor. In case of a discrepancy within and be-  
45 tween the drawings that would cause and awkward or improper installation the engineer has to be notified for clarification  
46 prior to installation. Any work in conflict with the drawings shall be corrected at contractor's expense and at no cost to the  
47 owner. Contractor shall determine if scheduled devices fit into space and shall advice if not BEFORE ordering fixtures or de-  
48 vices.
- 49 C. Information pertaining to existing conditions that are described in the specifications or appear on the drawings is based on  
50 available records. While such data has been collected with reasonable care, there is no expressed or implied guarantee  
51 that conditions so indicated are entirely representative of those actually existing. This information is provided to inform the  
52 Contractor of known, existing conditions so that due diligence is taken by the Contractor to avoid damage. Where site ob-  
53 servation or documents indicate existing underground utilities/services in close proximity (within four feet horizontally  
54 and/or four feet vertically) to necessary new construction work, the Contractor shall be responsible to test, probe or oth-  
55 erwise determine exact locations so as to prevent damage to such utilities/services.
- 56 D. Standard References such as ANSI, AASHO, AWWA, AISC, Commercial Standards, Federal Specifications, NEMA, UL, and the  
57 like incorporated in the requirements by reference shall be those of the latest edition at time of receiving bids, unless oth-  
58 erwise specified. The manufacturers, producers and their agents of required materials shall have such specifications avail-  
59 able for reference and are fully familiar with their requirements as pertains to their product or material.
- 60 E. The Contractor shall not take advantage of any apparent error or omission in the plans or specifications, and the owner  
61 shall be permitted to make such corrections and interpretations as may be deemed necessary for the fulfillment of the in-  
62 tent of the plans and specifications.
- 63 F. In addition to verifying at the site all measurements shown on the Drawings, Contractor shall consult the Drawings and  
64 Specifications of related work or existing construction that may in any manner affect the work of this contract. Contractor  
65 shall promptly report to the owner, in writing, any errors, omissions, violations, or inconsistencies that may be discovered

1 as a result of such verifications; otherwise, it shall be understood that Contractor accepts all such related data and condi-  
2 tions without reservations.

- 3 G. Each trade shall keep one set of plans and specifications on site. In addition construction bulletins, change orders etc. as  
4 applicable to the trades shall be on site.
- 5 H. It shall be the responsibility of the Contractor to submit to the owner within ten (10) days after final inspection, one com-  
6 plete marked-up set of contract drawings fully illustrating all revisions made by all the crafts in the course of the work. This  
7 shall include all field changes, adjustments, variances, substitutions and deletions, whether covered by Change Order or  
8 not. Underground utility installations must be located precisely as constructed on the marked-up drawings. Contractor shall  
9 markup changes for as-built drawings on a daily base.
- 10 I. Layout of existing piping, conduits, and locations of equipment are shown as exactly as could be determined during design  
11 of the facilities; but their accuracy, particularly when such layouts and drawings are schematic, cannot be guaranteed. Con-  
12 tractor shall check all Specifications including the Drawings for possible interference with electrical, mechanical, and struc-  
13 tural details, as well as interference with existing building or equipment, and shall notify the owner of the interference for  
14 resolution of the interference before commencing work. Any completed work that interferes shall be corrected by Contrac-  
15 tor at Contractor expense so that the original design can be followed.
- 16 J. Electronic design files may be provided by the owner at its digression as they are needed for the contractor to perform the  
17 work. Contractor shall use electronic design files on their own risk and assume all liability. Electronic documents are not  
18 contract documents and significant discrepancies may exist between these electronic files and contract documents and ac-  
19 tual site conditions.
- 20 K. Contractor shall provide list with all equipment installed. This list shall contain, but not limited to, type, make and special  
21 product key and number. For grant purposes the contractor may have to provide detailed information about equipment in-  
22 stalled and labor provided to third party institutions, such as Focus on Energy.
- 23 L. Using datum, the lot lines and present levels have been established as shown on the drawings. Other grades, lines, levels  
24 and benchmarks, shall be established and maintained by the Contractor, who shall be responsible for them. As work pro-  
25 gresses, the Contractor shall lay out on forms and floor, the locations of all partitions, walls and fix column centerlines as a  
26 guide to all trades. The Contractor shall make provision to preserve property line stakes, benchmarks, or datum point. If  
27 any are lost, displaced or disturbed through neglect of any Contractor, Contractor's agents or employees, the Contractor re-  
28 sponsible shall pay the cost of restoration.

#### 29 30 **1.19. QUALITY ASSURANCE**

- 31 A. Any installed material not meeting the specification requirements must be replaced with material that meets these specifi-  
32 cations without additional cost to owner.
- 33 B. All products and materials used are to be new, undamaged, clean and in good condition. Existing products and materials  
34 are not to be reused unless specifically indicated.
- 35 C. Where equipment or accessories are used which differ in arrangement, configuration, dimensions, ratings, or engineering  
36 parameters from those indicated on the contract documents, the Contractor is responsible for all costs involved in integrat-  
37 ing the equipment or accessories into the system and for obtaining the performance from the system into which these  
38 items are placed. This may include changes found necessary during the testing, adjusting, and balancing phase of the pro-  
39 ject.
- 40 D. Welding procedures, welders, and welding operators for all building service piping to be in accordance with certified weld-  
41 ing procedures of the National Certified Pipe Welding Bureau and Section 927.5 of ASME B31.9 Building Services Piping or  
42 AWS 10.9 Qualification of Welding Procedures and Welders for Piping and Tubing. Before any metallic welding is per-  
43 formed, Contractor to submit his Standard Welding Procedure Specification together with the Procedure Qualification Rec-  
44 ord as required by Section 927.6 of ASME B31.9 Building Services Piping. Before any metallic welding is performed, Contrac-  
45 tor to submit his Standard Welding Procedure Specification together with the Procedure Qualification Record as required by  
46 Section IX of the ASME Boiler and Pressure Vessel Code and/or the National Certified Pipe Welding Bureau. Before any pol-  
47 yethylene fusion welding is performed, Contractor to submit certification that the welders to be used on this project have  
48 successfully demonstrated proper welding procedures in accordance with the Code of Federal Regulations, Title 49, Part  
49 192, Section 192.285.
- 50 E. Contractor shall assume the responsibility for the protection of all finished construction under the Contract and shall repair  
51 and restore any and all damage of finished work to its original state. Wheeling of any loads over any type of floor, either  
52 with or without plank protection, will be permitted only in rubber-tired wheelbarrows, buggies, trucks or dollies. Where  
53 structural concrete is also the finished surface, care must be taken to avoid marking or damaging those surfaces. All struc-  
54 tures and equipment shall be constructed, installed and operated with guards, controls and other devices in place.
- 55 F. Contractor shall obtain complete data at the site and inspect surfaces that are to receive the Work before proceeding with  
56 fabricating, assembling, fitting or erecting any work under this contract. Contractor shall notify owner in writing in case of  
57 discrepancies between existing work and drawings, and of any defects in such surfaces that are to receive the Contractor's  
58 work. Owner will evaluate the notice and direct what remedial action will be taken.
- 59 G. Starting of work implies acceptance of existing work or the work of others. Removal and replacement of work applied to  
60 defective surfaces, in order to correct defects, shall be done at the expense of the Contractor who applied work to defec-  
61 tive surfaces.
- 62 H. For outdoor work the Contractor shall:
- 63 1. Provide, erect and maintain all required planking, barricades, guard rails, temporary walkways, etc., of sufficient size  
64 and strength necessary for protection of stored material and equipment; paved surfaces, walks, curbs, gutters and

- 1 drives; streets adjacent to or within project area; adjoining property and all project work to prevent accidents to the
- 2 public and the workmen at the job site.
- 3 2. Notify adjacent property owners if their property interferes with the work so that arrangements for proper protection
- 4 can be made.
- 5 3. Provide and maintain proper shoring and bracing to prevent earth from caving or washing into the building excavation.
- 6 Provide temporary protection around openings through floors and roofs, including elevator openings, stairwells, and
- 7 edge of slabs.
- 8 4. Provide and maintain proper shoring and bracing for existing underground utilities, sewers, etc., encountered during
- 9 excavation work, to protect them from collapse or other type of damage until such time as they are to be removed, in-
- 10 corporated into the new work, or can be properly backfilled upon completion of new work.
- 11 5. Provide protection against rain, snow, wind, ice, storms, or heat to maintain all work, materials, apparatus, and fixtures,
- 12 incorporated in the work or stored on the site, free from injury or damage. At the end of the day's work, cover all new
- 13 work likely to be damaged. Remove snow and ice as necessary for safety and proper execution of the work.
- 14 6. Protect the building and foundations from damage at all times from rain, ground water and back up from drains or
- 15 sewers. Provide all equipment and enclosures as necessary to provide this protection.
- 16 7. Damaged property shall be repaired or replaced in order to return it to its original condition. Damaged lawns shall be
- 17 replaced with sod.
- 18 8. Protect materials, work and equipment, not normally covered by above protection, until construction proceeds to a
- 19 point where the general building protection of the area where located, dispenses with the necessity therefore. Protect
- 20 work outside of the building lines such as trenches and open excavations, as specified above.
- 21 9. Take all necessary precautions to protect owner 's property as well as adjacent property, including trees, shrubs, build-
- 22 ings, sanitary and storm sewers, water piping, gas piping, electric conduit or cable, etc., from any and all damage which
- 23 may result due to work on this project.
- 24 10. Repair work outside of property line in accordance with the requirements of the authority having jurisdiction.
- 25 11. Repair any work, damaged by failure to provide proper and adequate protection, to its original state to the satisfaction
- 26 of owner or remove and replace with new work at the Contractor's expense.
- 27 I. The contractor shall be fully responsible for inspecting the work of its suppliers, and subcontractors to assure that the work
- 28 complies with the standards for materials and workmanship required by the contract documents. The Contractor shall:
- 29 1. Monitor quality control over subcontractors, suppliers, manufacturers, products, services, site conditions, and work-
- 30 manship, to produce work of the quality specified in the contract documents.
- 31 2. Comply fully with manufacturer's instructions, including each step in sequence.
- 32 3. Request clarification from owner before proceeding with work when manufacturers' instructions or reference stand-
- 33 ards conflict with Subcontract Documents.
- 34 4. Comply with specified standards as a minimum quality for the work except when more stringent tolerances, codes, or
- 35 manufactures instructions require more precise workmanship.
- 36 5. Ensure that work is performed by persons specializing in the specific trade and class of work required, and qualified to
- 37 produce workmanship of specified quality.
- 38 6. Secure products in place with positive anchorage devices designed and sized to withstand seismic, static and dynamic
- 39 loading, vibration, physical distortion or disfigurement.
- 40 J. If reference standards or manufacturers' instructions contain provisions that would alter or are at variance with relation-
- 41 ships between the parties to the contract set forth in the contract Documents, the provisions in the contract Documents
- 42 shall take precedence.
- 43 K. When required by individual Specification sections, Contractor shall provide the following services from a manufacturer's
- 44 representative:
- 45 1. Review of Specifications and design and concurrence or suggestions for modification.
- 46 2. Site observation of conditions of use and substrate.
- 47 3. Observation of the installation work in progress and on completion.
- 48 4. Start up, testing, and adjustment of equipment.
- 49 5. Instruction to the owner in operation and maintenance.
- 50 6. Provide written signed report by manufacturer's representative documenting services provided and any comments or
- 51 recommendations.
- 52 L. Inspection or testing performed by the owner shall not relieve the Contractor from responsibility for performing his own
- 53 quality control and for complying with the requirements of the contract Documents. Owner will not be responsible for the
- 54 Contractor's failure to carry out work in accordance with the contract Documents.

#### 55 **1.20. CODES AND PERMITS**

- 57 A. Applicable provisions of Public Law, the Constitution and Laws and Statutes of the State of Wisconsin and the codes and
- 58 regulations of governmental departments are hereby referred to and made a part of this contract and all work performed
- 59 shall be in accordance with such laws, regulations and the latest edition or supplement or amendment thereto in effect at
- 60 the time of submittal of bid shall be considered to be the issue in effect (unless shown otherwise) of all applicable codes in-
- 61 cluding, but not limited to:
- 62 1. Wisconsin Building Code
- 63 2. Wisconsin Electrical Code
- 64 3. Wisconsin Mechanical Code
- 65 4. Wisconsin Plumbing Code

- 1 5. Wisconsin Energy Code
- 2 6. Wisconsin Fire Code
- 3 7. NFPA 70 National Electrical Code
- 4 8. General Services Administration 41 CFR Part 101-19
- 5 9. Americans with Disabilities Act (ADA)
- 6 10. Energy Conservation Performance Standards,
- 7 11. Local Codes
- 8 12. Occupational Safety and Health Act (OSHA)
- 9 13. Occupational Safety and Health Standards, Department of Labor
- 10 14. Safety and Health Regulations for Construction, Department of Labor
- 11 15. Wisconsin Fire Code
- 12 16. National Electrical Safety Code, ANSI C2
- 13 17. Environmental Protection Agency regulations
- 14 18. Clean Air Act
- 15 19. Clean Water Act
- 16 20. Resource Conservation and Recovery Act
- 17 21. Toxic substances Control Act
- 18 22. Wisconsin Department of Health and Family Services
- 19 23. State and Regional Water Quality Control Boards
- 20 24. County and Municipal ordinances
- 21 B. In case of conflict or overlap of the above references, the most stringent provision shall apply.
- 22 C. The newest version of the a code or standard shall apply even if an older version is adopted by the Jurisdiction Having Au-
- 23 thority.
- 24 D. If necessary, file and maintain Notification of Demolition and/or Renovation and Application for Permit Exemption (WDNR
- 25 Form 4500-113) in accordance with the Wisconsin Administrative Code Chapter NR447.
- 26 E. Contractor is expected to know or to ascertain, in general and in detail, the requirements of all codes and ordinances, and
- 27 all rulings and interpretations of code requirements being made by all authorities having jurisdiction over the work per-
- 28 formed by them, applicable to the construction and operation of systems covered by this contract. Where codes or stand-
- 29 ard specifications other than those listed in this paragraph are referred to in the different Divisions of these specifications, it
- 30 is understood that they apply as fully as if cited here. Where differences exist between codes affecting this work, the code
- 31 affording the greatest protection to the owner shall govern.
- 32 F. All cost for items and procedures necessary to satisfy requirements of all applicable codes, ordinances and authorities,
- 33 whether or not these are specifically covered by drawings or specifications. All cases of serious conflict or omission between
- 34 the drawings, specifications, and codes shall be brought to the owner's attention as herein before specified. The Contractor
- 35 shall carry out work and complete construction as required by applicable codes and ordinances and in such a manner as to
- 36 obtain approval of all authorities whose approval is required.
- 37 G. Contractor is responsible for obtaining permits at its own cost including expenses for supporting documents. Deliver origi-
- 38 nal permits to the owner before work starts. Apply for, arrange and pay for all required installation inspections required.
- 39 Deliver originals of these certificates to the owner. Include copies of the certificates in the Operating and Maintenance In-
- 40 structions. Contractor shall arrange all required inspections and correct all deficiencies at no cost to owner.
- 41 H. The Contractor must maintain all licenses required for the work performed and required by authorities. The Contractor
- 42 must submit proof of holding the license or certificate upon request. If a Contractor loses a license for whatever reason he
- 43 must inform the owner immediately after learning about that himself.
- 44 I. PERMIT TO PENETRATE GROUND OR EXISTING SURFACES OF OWNER PROPERTY:
- 45 1. Prior to any penetration of the ground or existing concrete surfaces (including the use of stakes or poles) in excess of
- 46 1.5", the Subcontractor shall obtain from the Project Representative a Permit to penetrate or Excavate Existing Surface
- 47 of owner property and shall adhere to the conditions of the permit during such work. The Permit and all conditions in it
- 48 shall be considered part of these specifications and shall be included in the contractor's bid amount.
- 49 2. In areas where a Permit to penetrate or excavate existing surfaces of owner property is not required, contractors shall
- 50 verify by safe means, prior to drilling, that no utilities or services are enclosed within the area to be drilled.
- 51 J. FIRE SAFETY PERMIT:
- 52 1. All operations with open flames or that cause sparks or is near gas lines or near combustible storage containers require
- 53 a daily Fire Safety Permit issued by the Project Representative. Contractor shall not commence such work until the
- 54 permit is issued. Activities requiring a Permit include, but are not limited to, electric arc and gas welding and flame cut-
- 55 ting, other open flame operations, tar kettles, powder activated tools and excavations. Fire watch personnel shall be
- 56 provided the contractor in sufficient number to continuously monitor all locations where work is conducting requiring a
- 57 fire permit. The fire watch personnel shall remain on the job at least thirty minutes after such operations are complet-
- 58 ed. Fire safety personnel may be installers or welders.
- 59 2. Noncombustible shields or covers shall be provided by the contractor on tables, floors, walls, around the workstation;
- 60 and over equipment to protect building structures, equipment and personnel from sparks and fragments of hot metal.
- 61 Contractor shall also take these precautions to protect against sparks and hot metallic oxides generated by grinding,
- 62 drilling or sawing operations.
- 63 K. AIR EMISSIONS PERMITS AND NOTIFICATIONS:
- 64 1. For all projects that involve demolition of a structure, the contractor shall complete the asbestos demolition forms and
- 65 notify all related authorities at least 10 working days in advance of the activity, regardless of the presence of asbestos.

2. For all projects that involve removal of regulated asbestos containing materials, the contractor shall complete the required asbestos removal forms and notify the authorities at least 10 working days in advance of the activity.
3. For any operations required to obtain an Authority to Construct or Permit to Operate from the authorities, the contractor shall provide in advance to the Project Manager the information needed for the application. Authorities may take more than 40 working days to process the application and issue the Authority to Construct or Permit to Operate; the contractor shall include this time in his Schedule of Operations; OWNER will grant no extra cost under this contract for this wait period.

#### 1.21. ENVIRONMENT, SAFETY AND HEALTH (EHS)

- A. The owner can request additional safety or environmental protection measures at any time. If contractor does not follow safety or environmental protection requirements, the owner can hire a different contractor or self-perform to ensure compliance and charge the original contractor for the cost.
- B. Contractor shall provide all labor, materials, equipment, services and supervision required to maintain work sites that meet the environment, safety and health (ES&H) requirements of all applicable federal, state, and local regulations and protect the environment and the safety and health of its employees, the employees of its lower tier subcontractors, owner employees and the general public.
- C. The contractor shall provide a qualified onsite EHS Representative with the authority to enforce all of the safety requirements and implement the contractor's Injury and Illness Prevention Program and Hazard Abatement Plan. The contractor shall remove and replace its Health and Safety Representative at the request of the owner, if the Safety Representative is unsuccessful in enforcing the EHS requirements. The contractor's EHS representative shall conduct safety inspections of the project operations, materials, and equipment frequently throughout the day to ensure that all safety deficiencies are identified and corrected. The owner reserves the right to enforce measures if the contractor's onsite EHS representative does not enforce all requirements. Inspection findings and corrective actions taken shall be documented, and the record shall be kept on the construction work site and be made available to owner upon request. If safety deficiencies are found, owner will issue a Safety Deficiency Notice to the contractor. Upon receipt of a written Safety Deficiency Notice from the Owner, the contractor shall take appropriate action to correct the deficiency and discontinue the hazardous activity until the hazard is abated. Failure to correct or eliminate violation(s) within the period specified might result in the order to stop all or any part of the work. The contractor shall submit to the owner a written response to the Safety Deficiency Notice describing what corrective action it has taken, the date such corrective action was completed and actions that it will take to prevent future recurrence of the same incident.
- D. Provide protection for workmen, public, adjacent construction and occupants of existing building(s). Personal Protective Equipment (PPE) such as hard hats, ear plugs and dust masks, shall be provided to all employees and use shall be enforced by the onsite EHS Representative. PPE also shall be provided to site visitors near the main entrances to the jobsite. PPE shall be provided in sufficient numbers to outfit typical number of visitors (i.e. designers, inspectors, shipment workers)
- E. WORK SITE SAFETY ORIENTATION: Each employee shall receive initial EH&S orientation prior to performing any work on the project. The contractor shall maintain on the work site a detailed outline of the orientation and a signed and dated roster of all employees who have completed the project EHS indoctrination. Make documentation available to owner on request. The orientation shall, at a minimum, cover the following points as it applies to the project:
  1. Employee rights and responsibilities.
  2. Construction contractor responsibilities.
  3. Alcohol and drug abuse policy
  4. Contractor's disciplinary procedures.
  5. First aid and medical facilities.
  6. Site and project specific hazards.
  7. Hazard recognition and procedures for reporting or correcting unsafe conditions or practices.
  8. Procedures for reporting accidents and incidents.
  9. Fire fighting and other emergency procedures to include local warning and evacuation systems.
  10. Hazard Communication Program.
  11. Access to employee exposure monitoring data and medical records.
  12. Protection of the environment, including air, water, and storm drains from construction pollutants.
  13. Location of and access to reviewed project illness and Injury Prevention Program, Hazard Analysis and Hazard Abatement Plan
  14. Location and contents of required postings
- F. A comprehensive EH&S program shall be established including but not be limited to:
  1. Confined Space Entry
  2. Site specific Emergency Response, First Aid, & Medical Services. Identify employees with CPR/First Aid certification available at the work site.
  3. Fire Protection and Prevention
  4. Hazard Communications
  5. Hazardous Waste Operations
  6. Hazardous Work Permits
  7. Toxic and Hazardous substances
  8. Inspection, Maintenance, and Certification of Heavy Equipment, Cranes, and Motor Vehicles
  9. Lock Out/Tag Out (LOTO) Subcontractors are required to include LOTO
  10. Personal Protective and Life Saving Equipment

- 1 11. Radiation Protection
- 2 12. Construction Safety Training
- 3 13. Control of silica dust released during demolition or drilling of concrete or released from work with other materials that
- 4 contain silica.
- 5 G. A comprehensive activity hazard analysis and hazard abatement plan shall be established including but not be limited to:
- 6 1. Description of work phase or activity
- 7 2. Identification of potential hazards associated with the activity
- 8 3. A list of the contractor's planned controls to mitigate the identified hazards
- 9 4. Name of the contractor's employee responsible for inspecting the activity and ensuring that all proposed safety
- 10 measures are followed
- 11 5. Construction activities for which an Activity Hazard Analysis and Hazard Abatement Plan may be required include, but
- 12 are not limited to:
- 13 6. Roofing
- 14 7. Hoisting and handling of materials
- 15 8. Excavations
- 16 9. Trenching and drilling
- 17 10. Concrete placement and false work
- 18 11. Welding
- 19 12. Steel erection
- 20 13. Work performed six feet or higher above ground
- 21 14. Electrical work
- 22 15. Demolition
- 23 16. Work in confined spaces
- 24 17. Work that causes the release of silica such as demolition or drilling of concrete or work with materials that contain sili-
- 25 ca.
- 26 18. Work with epoxy coatings
- 27 19. Work with or around hazardous materials
- 28 20. Work on hilly terrain
- 29 21. Use and handling of flammable materials
- 30 22. The owner must favorably review the Activity Hazard analysis and Hazard Abatement Plan before work can start on that
- 31 activity.
- 32 H. ELECTRICAL WORK:
- 33 1. Energized electrical work within panels and equipment is not allowed.
- 34 2. Workers shall be qualified to perform electrical tasks in accordance with OSHA 29 CFR 1910 and 1926 requirements.
- 35 3. Work practices must be compliant with NFPA 70E, newest edition – Standard for Electrical Safety in the Workplace.
- 36 I. Rubbish, debris and scrap shall not be thrown through any window or other opening, or dropped from any great height; it
- 37 shall be conducted to the ground, to waiting truck(s) or removable container(s) by means of approved chutes or other
- 38 means of controlled conveyance.
- 39 J. Form and scrap lumber shall have all nails withdrawn or bent over; shall be neatly stacked, placed in trash bins, or removed
- 40 from the premises.
- 41 K. Take all necessary precautions while dismantling piping containing gas, gasoline, oil or other explosive or toxic fluids or
- 42 gases. Purge lines and contain materials in accordance with all applicable regulations. Store such piping outdoors until
- 43 fumes are removed. Verify that all gas and electrical utilities have been abandoned or disconnected and associated hazards
- 44 mitigated, prior to beginning any demolition.
- 45 L. All material classified by authorities to be a material that needs special treatment must be recycled, reused or disposed of
- 46 by a special contractor that holds a valid license to work with such material. If hazardous materials are not anticipated, but
- 47 encountered, terminate operations and contact owner immediately.
- 48 M. CONTROL OF CRYSTALLINE SILICA DUST: The subcontractor shall provide all necessary control measures at the work site to
- 49 keep worker exposure to crystalline silica dust within the OSHA Established Permissible Exposure Limits (PEL's). Dust control
- 50 measures may require spraying of water or engineering controls at the dust generating points. It also may include the use
- 51 of respirators, industrial grade HEPA vacuums, and HEPA filtered locally exhausted tools. Construction operations known to
- 52 cause the release of silica dusts include, but are not limited to:
- 53 1. Chipping, sawing, grinding, hammering, and drilling of concrete, rock, or brick.
- 54 2. Work with cementitious materials such as grout, mortar, stucco, gunnite, etc.
- 55 3. Dry sweeping of dust originating from concrete or rock
- 56 N. CONSTRUCTION ACTIVITY POLLUTION PREVENTION:
- 57 1. Follow Requirements in Storm Water Pollution Prevention Plan (SWPPP) and Erosion and Sedimentation Control (ESC)
- 58 Plan
- 59 2. Stabilize any relocated and moved soil with fast growing grasses and place mulch (hay, woodchips, straw) on it to cover
- 60 and hold soil
- 61 3. Divert surface runoff from distributed areas into sediment basin or sediment traps with a mound of stabilized soil
- 62 4. Construct posts with filter fabric media to remove sediment from stormwater leaving the site.
- 63 5. Follow requirements in site development plan and don't disturb areas beyond the marked areas
- 64 O. INDOOR AIR QUALITY:

- 1 1. During construction the recommended control measures of the Sheet Metal and Air Conditioning Contractors National  
2 Association (SMACNA) IAQ guidelines for occupied buildings under construction, (1995, chapter 3) must be met or ex-  
3 ceeded.
- 4 2. Stored on-site or installed absorptive material must be protected from moisture damage.
- 5 3. In case permanently installed air handlers are used for ventilation, filtration media with a Minimum efficiency Reporting  
6 Value (MERV) of 8 shall be used at each return air grille, as determined by ASHRAE 52.2-1999. Contractor shall replace  
7 all filtration media immediately prior occupancy.
- 8 4. All to be installed ductwork, air handlers and other equipment later connected to the indoor air path are to be protect-  
9 ed from dirt and debris.
- 10 P. FIRE PROTECTION AND PREVENTION:
  - 11 1. The contractor shall develop and maintain an effective fire protection and prevention program at the job site through  
12 all phases of demolition, alteration, repair, and construction work. Contractor shall ensure the accessibility and availa-  
13 bility of fire protection and suppression equipment.
  - 14 2. Smoking is be prohibited everywhere on the job site – no exceptions. Signs shall be posted. In visible locations.
  - 15 3. No burning of rubbish or debris will be allowed at the site. Combustible waste shall be removed immediately or stored  
16 in fire resistive containers until disposed of in an approved manner.
  - 17 4. The Contractor shall provide and maintain in working order during the entire construction period, a minimum of three  
18 (3) fire extinguishers on each floor level, including basement of the building, and one (1) in temporary office. Extin-  
19 guishers shall be nonfreezing type such as A-B-C rated dry chemical, of not less than 10-pound capacity each. In addi-  
20 tion, any subcontractor who maintains an enclosed shed on the site shall provide and maintain, in an accessible loca-  
21 tion, one or more similar nonfreezing type fire extinguisher in each enclosed shed.
- 22 Q. ACCIDENTS AND SPILLS:
  - 23 1. The contractor shall immediately notify the owner of any accidents, injuries or occupational illnesses that occur on the  
24 project, regardless of the employer of the involved personnel or the owner of the involved materials or equipment. For  
25 OSHA recordable injuries, the subcontractor shall also furnish a copy of the OSHA Form 301(or equivalent) to the Pro-  
26 ject Representative within five days of the injury.
  - 27 2. In the event a job site accident occurs, the contractor shall immediately implement controls and restrictions on the ac-  
28 cident site to ensure the site remains undisturbed until released in writing by the owner to resume work. The contrac-  
29 tor shall provide accident investigation follow-up and shall support Owner's accident investigation and reporting proto-  
30 col.
  - 31 3. The contractor shall promptly report to owner any spill, deposit, leak, drainage, debris, residue, spoil, residual, and/or  
32 by-product, whether its presence at the jobsite is occasioned by accident, inadvertence, intent, discarding, or aban-  
33 donment by the Subcontractor or its lower tier subcontractors. This reporting requirement applies to petroleum prod-  
34 ucts, oil, lubricants, chemical substances, waste materials, and waste substances, which are in such quantities as to con-  
35 stitute a hazardous substance or hazardous waste. All such occurrences of any quantity involving paints, solvents, thin-  
36 ners, degreasers, PCBs, halogenated hydrocarbons, volatile organic compounds, and/or asbestos shall be deemed a re-  
37 portable event. These identification and reporting requirements shall be the responsibility of the contractor for both its  
38 own work forces as well as for any sub tier contractor, material man or supplier performing work on site for the con-  
39 tractor. All removal, cleanup, and associated costs, which result from contractor or lower tier subcontractor, material  
40 man, or supplier presence at the jobsite, shall be at the contractor's sole expense.
- 41 R. WASTE MANAGEMENT:
  - 42 1. Recycle all recyclable material. This includes any material for which there is a recycling facility in Wisconsin.
  - 43 2. Separate all waste material in plastic, metal, paper, acoustical tile, brick, concrete, clean wood, glass, gypsum drywall,  
44 carpet and insulation and provide designated on-site collection areas.
  - 45 3. Keep track of volume and weight of each material and track if it was recycled, reused, donated or disposed otherwise.
  - 46 4. It is permissible to separate waste off-site by specialized recycling contractor. This contractor needs to be provide  
47 proof of recycling and needs to be WASTECAP certified as "Accredited Professional in Construction and Demolition  
48 Debris Recycling".
  - 49 5. Prior to demolition or construction activities, the General Contractor, with input of all contractors and their subcon-  
50 tractors, shall develop and submit a Waste Management Plan to owner. Priority is given to reuse, followed by recy-  
51 cling followed by disposal including proper land filling or incineration. Disposal only will be acceptable if other meth-  
52 ods are not commercially available. The Waste Management Plan includes but is not limited to the following:
    - 53 a. A list of each material proposed to be salvaged, reused, or recycled, Materials to be included, at a minimum, are  
54 the following:
      - 55 i. Concrete: Clean concrete, concrete with rebar, asphalt concrete.
      - 56 ii. Metals: Steel, iron, galvanized sheet steel, stainless steel, aluminum, copper, zinc, lead, brass or bronze,  
57 including banding, ductwork, framing, roofing and siding, flashing, piping and rebar.
      - 58 iii. Clean Fill: Earth, rocks, and gravel.
      - 59 iv. Wood: Clean dimensional wood, wood pallets, engineered wood products including plywood, parti-  
60 cleboard, I joist.
      - 61 v. Biodegradable landscaping materials.
      - 62 vi. Cardboard, paper, packaging.
      - 63 vii. Masonry: Brick, ceramic tile, CMU.
      - 64 viii. Roofing: Clay or concrete tiles, asphalt shingles.
      - 65 ix. Gypsum board.

- x. Acoustic ceiling panels.
  - xi. Carpet and pad.
  - xii. Paint.
  - xiii. Insulation.
  - xiv. Plastics: ABS, PVC
  - xv. Beverage containers
  - xvi. Cardboard.
  - xvii. Concrete
  - xviii. Brick and concrete masonry units (CMU).
  - xix. Metals from banding, stud trim, ductwork, piping, rebar, roofing, other trim, steel, iron, galvanized sheet steel, stainless steel, aluminum, copper, zinc, lead, brass, and bronze.
  - xx. Gypsum wallboard.
  - xxi. Clean dimensional wood
  - xxii. Wood doors
  - xxiii. Acoustical ceiling tiles/panels
  - xxiv. Glass
- b. Separation and Materials Handling Procedures: How waste materials (as identified above), will be separated, cleaned (if necessary) and protected from contamination.
  - c. Waste Material Estimating Sheet (Appendix A at the end of this Section)
  - d. Proposed Alternatives to Land filling: List each material planned to be salvaged or recycled, quantities, and proposed destination.
6. The contractor shall provide separation, bins for temporary onsite storage, handling, transportation, recycling, salvage, and land filling for all demolition and waste materials and keep recycling and waste bins areas neat, clean and clearly marked in order to avoid contamination or mixing materials and maintain logs onsite for each load of materials removed from site.
  7. During the progress of the work, the General Contractor shall report to owner the quantity of each material recycled, reused, or salvaged, and the receiving party. All contractors shall maintain a record of weight tickets, manifests, receipts, and invoices for review by owner on request.
  8. At the completion of the project the General Contractor shall submit a final summary of the progress reports, including the percentage of recycled waste (weight or volume) to the quantity of waste that would have been otherwise land filled.
  9. Contractor is to provide the following documents upon request for payment:
    - a. Waste Materials Estimating Sheet (Appendix A at the end of this Section)
    - b. Landfill Log (Appendix B at the end of this Section)
    - c. Waste Diversion Log (Appendix C at the end of this Section)
    - d. Legible copies of manifests, weight tickets, and receipts. Manifests shall be from recycling and/or disposal site operators that can legally accept the materials for the purpose of reuse, recycling or disposal. These documents shall include the contract number and the job site name.
  10. Examples of documents include, but are not limited to:
    - a. Cover sheet for hazardous materials recycling contract
    - b. Vendor "Pickup Request"
    - c. Vendor "Certificate of Recycling and/or Disposal"
    - d. Vendor invoice
    - e. Maintain at the Project site Landfill Logs and Waste Diversion Logs for each load of materials removed from site.
    - f. Discuss Waste management plans and implementation during all construction-related meetings.
    - g. Immediately Inform the owner if hazardous materials are encountered or suspected, and stop work in the suspect area. Do not proceed with work in the suspect area until approved by the owner.
  11. The following resources are provided for information only, to aid the Contractor in managing the construction waste:
    - a. The Wisconsin DNR, Bureau of Waste Management <http://www.dnr.state.wi.us/org/aw/wm/>
    - b. The UW-Extension's Solid and Hazardous Waste Education Center <http://www1.uwex.edu/ces/shwec/>
    - c. WasteCap Wisconsin, Inc. <http://www.wastecapwi.org> or telephone: 414-961-1100 or 608-245-1100
  12. The contractor shall provide summaries of type and amount of material recycled, reused or disposed of. Those summaries shall include enough information and detail to satisfy requirements by external auditors. At a minimum the documentation needs to meet the current LEED requirements and requirements set by the EPA and federal government for federally funded projects. These requirements may or may not be mentioned specifically in this contract and the contractor is required to learn about specifics and to add documentation as required by such third party auditors.

#### 1.22. STAIRS, SCAFFOLDS, HOISTS, ELEVATORS OR CRANES

- A. The Contractor shall furnish and maintain equipment such as temporary stairs, fixed ladders, ramps, chutes, runways and the like as required for proper execution of work by all trades, and shall remove them on completion of the work. The Contractor shall erect permanent stair framing as soon as possible. Provide stairs with temporary treads, handrails, and shaft protection. Contractors requiring scaffolds shall make arrangements with the Contractor, or shall provide their own and remove them on completion of the work. The Contractor shall underlay its interior scaffolds with planking to prevent up-rights from resting directly on the floor construction.

- 1 B. Contractor shall provide and pay for its own hoist/crane or other apparatus necessary for unloading/setting or moving their  
2 equipment and materials. Installation and removal of equipment for this activity must be accounted for in the Project  
3 Schedule. Equipment and operations for this activity shall comply with applicable Department of Commerce and OSHA re-  
4 quirements. No material hoist may be used to transport personnel unless it meets Department of Commerce and OSHA re-  
5 quirements for that purpose.
- 6 C. Existing elevators may be used on a limited basis with the owner's permission and agreement. The Contractor will pay  
7 costs of warranty extensions and additional service work required. Appropriate protection must be provided by the using  
8 Contractor and that Contractor shall be responsible for any structural, mechanical or finish damage to the elevator and its  
9 parts and to adjoining building finishes and components.

10  
11 **1.23. SAFEGUARDS - EXISTING EQUIPMENT, UNDERGROUND UTILITIES AND ARTIFACTS**

- 12 A. Existing utilities, including those listed as abandoned, shall not be moved or otherwise disturbed without written verifica-  
13 tion by the owner that the utility is abandoned.
- 14 B. When altering existing facilities, the Contractor shall take every precaution to preserve and protect existing facilities, both  
15 those to be altered and those to remain unaltered that are within the limits of the work.
- 16 C. The Contractor shall notify the owner of structural members, piping, conduit, or equipment not indicated for removal that  
17 may cause interference with the work. Work shall not proceed in the affected area until instructions have been issued. Do  
18 not drill or penetrate existing structures without prior permission. The removal of existing work shall be by methods that  
19 will not jeopardize the integrity of structures or systems that are to remain.
- 20 D. Existing utilities, including but not limited to roof drainage systems, underground cables, ducts, roadways, manholes,  
21 building fire alarm, public address or telecommunications wiring shall not be moved or otherwise disturbed, nor electrical  
22 circuits or switches operated or taken in or out of service, without prior consent of the owner. Contractor shall compen-  
23 sate loss to the owner resulting from damage to utilities, facilities and other owner or public items damaged.
- 24 E. Take measures necessary to safeguard all existing work and facilities that are inside and outside the limits of the work or  
25 items that are within the construction limits but are intended to remain. Report any damage to the owner immediately.  
26 Correct and pay for all damages.

27  
28 **1.24. OPERATION AND MAINTENANCE DATA**

- 29 A. All OM documents are to be submitted as electronic copy for review at the time the respective equipment is delivered. No  
30 hardcopy shall be provided until the OM manuals are approved.
- 31 B. Submit data bound in 8-1/2 x 11 inch (A4) text pages, Use three D side rings if necessary and binders with durable plastic  
32 covers. Submit all documents in electronic form as well as in hardcopy. Prepare binder cover with printed title  
33 "OPERATION AND MAINTENANCE INSTRUCTIONS", title of project and subject matter of binder when multiple binders are  
34 required.
- 35 C. Internally subdivide the binder contents with permanent page dividers, logically organized as described below; with tab  
36 titling clearly printed under reinforced laminated plastic tabs.
- 37 D. Contents: Prepare a Table of Contents for each volume, with each Product or system description identified, typed on 20-  
38 pound white paper, in three parts as follows:
- 39 E. Part 1: Directory, listing names, addresses, and telephone numbers of Architect/Engineer, Contractor, subcontractors, and  
40 major equipment suppliers.
- 41 F. Part 2: Operation and maintenance instructions, arranged by system and subdivided by specification section. For each  
42 category, identify names, addresses, and telephone numbers of subcontractors and suppliers. Identify the following:
- 43 1. Summary list of maintenance items indicating frequency and type of maintenance required for all systems covered in  
44 this contract.
- 45 2. List of equipment (including assigned equipment numbers).
- 46 3. A description of recommended replacement parts and materials, which the owner should stock.
- 47 4. Parts list for each component.
- 48 5. A summary of equipment vendors, or location where replacement parts can be purchased.
- 49 6. List indicating types and grades of oil and/or grease, packing materials, normal and abnormal tolerances for devices,  
50 and method of equipment adjustment.
- 51 7. Copies of all approved submittals.
- 52 8. Operating instructions.
- 53 9. Maintenance instructions for equipment and systems, Preventive maintenance recommendations.
- 54 10. Maintenance instructions for finishes, including recommended cleaning methods and materials, and special precau-  
55 tions identifying detrimental agents.
- 56 11. Manufacturer's wiring diagrams for electrically powered equipment.
- 57 12. A complete set of record control drawings.
- 58 a. Copies of all checkout tests and calibrations performed by the Contractor (not commissioning tests).
- 59 b. The manual shall be organized and subdivided with permanently labeled tabs for each of the following data  
60 in the given order:
- 61 i. Sequences of operation including points and schematics of operations
- 62 ii. Control drawings
- 63 iii. Points lists
- 64 iv. Controller / module data
- 65 v. Maintenance instructions, including sensor calibration requirements and methods by sensor type

- vi. Thermostats and timers
  - vii. Sensors and DP switches
  - viii. Valves and valve actuators
  - ix. Dampers and damper actuators
  - x. Program setups (software program printouts)
13. Additional information as indicated in the technical specification sections
- G. Part 3: Project documents and certificates, including the following:
1. Product data.
  2. Air and water balance reports.
  3. Certificates.
  4. Photocopies of warranties.
  5. Name, address, and telephone number of the person or office to contact for service during the warranty period.
  6. Name, address, and telephone number of the person or service organization to be contacted for service after the warranty period.
- H. Submit all O&M manuals in original electronic form (PDF). Scanned copies are not acceptable. PDF need to be of high quality and searchable.
- I. Submit 1 draft copy of completed volumes 15 [fifteen] days after approval of applicable submittal or receipt of the product. Revise content of all document sets as required prior to final submission. Submit 2 [two] sets of revised final volumes, within 10 [ten] days after final inspection.

#### 1.25. ACCESS PANELS AND DOORS

- A. All serviceable and replaceable devices, including but not limited to valves, boxes, and dampers shall receive an access at a location and in a size that enables proper servicing and repair of the device without removal of other material. Sizes described are minimum sizes and might be increased if the type and size of device requires it. Install all piping, conduit, ductwork, and accessories to permit access to equipment for maintenance. Coordinate the exact location of wall and ceiling access panels and doors with the owner making sure that access is available for all equipment and specialties. Relocate access panel or door if equipment is not properly accessible to perform all maintenance and repair at no cost to the owner. Minimum size is 12" by 12". Use "Cendrex" products or approved equal.
- B. LAY-IN CEILING: if 2 X 2 foot is not sufficient for access (i.e. VAV boxes require larger access), the grid shall be arranged in a manner to allow easy removal of grid sections.

#### 1.26. LOOSE AND DETACHABLE PARTS

- A. Contractor shall retain all loose and small detachable parts of apparatus and equipment furnished under this Contract, until completion of the work and shall turn them over to the owner to receive them.
- B. Furnish one can of touch-up paint for each different color factory finish furnished by the Contractor. Deliver touch-up paint with other "loose and detachable parts".

### PART 2 – PRODUCTS

#### 2.1. SPECIFIED ITEMS - SUBSTITUTES

- A. Wherever catalog numbers and specific or trade names are used in conjunction with a designated material, product, item, or service mentioned in these Specifications, they are used to establish the standards of quality, utility, and appearance required. Substitutions will be approved, subject to the following provisions:
- a. Contractors or manufacturers may request listing of their product in the bid documents up to 10 calendar days prior bid due date. All requests must be accompanied by sufficient information to judge its suitability for this project.
  - b. Owner may reject any substitute request without providing specific reasons.
  - c. Owner may accept substitution requests after contract award, but reserves the right to refuse review or acceptance of any requests without providing specific reasons.
  - d. All Substitutions must be accepted by the owner in writing. The owner will accept, in writing, such proposed substitutions as are in his or her opinion, equal in quality, utility, and appearance to the items or materials specified. Such acceptance shall not relieve the Contractor from complying with the requirements of the drawings and specifications, and the Contractor shall be responsible at Contractor's own expense for any changes resulting from Contractor proposed substitutions which affect the other parts of Contractor's own work or the work of others.
  - e. The manufacturer shall be a company specializing in the manufacture of the specified equipment and accessories with minimum five years documented experience.
  - f. Failure of the Contractor to submit proposed substitutions for approval in the manner described above and within the time prescribed shall be sufficient cause for disapproval by owner of any substitutions otherwise proposed.
- B. Specifications may mention other manufacturers than the specific device specified. Those are manufacturers that in general are acceptable, but may not have a product for this specific project. Those manufacturers still may be rejected without providing specific reasons. The bidder only can rely on using items specifically mentioned in the contract documents.

#### 2.2. APPROVED TESTING LABORATORIES

- A. The following laboratories are approved for providing electrical product safety testing and listing services as required in these specifications:
1. Underwriters Laboratories Inc.

1 2. Electrical Testing Laboratories, Inc.

2  
3 **2.3. HAZARDOUS SUBSTANCES**

4 A. The Subcontractor shall submit to the Project Representative, for review by the EH&S Division, any proposed procurement,  
5 stocking, installing, or other use of materials containing asbestos, cadmium, chromates, or lead.

6 B. All materials and applications shall comply with requirements of any and all Districts Regulations, including, but not limited  
7 to architectural coatings, general solvent and surface coatings, solvent cleaning operations, adhesive and sealants, visible  
8 emissions, and asbestos.

9 C. Contractor shall keep and maintain proof of compliance with the above-referenced regulations, including any recordkeep-  
10 ing obligations, for a period of two years after completion of the project. Contractor shall make such documents or evi-  
11 dence available if so requested by owner.

12 D. No materials outlawed in any of the 50 US states are to be used. Only equipment and material legal in all 50 states is to be  
13 used. All Federal, state, county and local codes and ordinances regarding are to be considered deciding if a piece of equip-  
14 ment or material is to be used.

15 E. The contractor assumes responsibility for proper removal, collection and storage of hazardous substances on site and dis-  
16 posal of those if hazardous substances were known to be present and pointed out in these specifications or on the plans. If  
17 hazardous substances are not known to be present and are found, the owner assumes responsibility for additional cost due  
18 to removal, collection and storage on site. All hazardous substances are to be disposed in accordance with all federal, state  
19 and local laws, codes and regulations. It is the contractor's responsibility to recognize typical hazardous substances not  
20 known to be present. This includes all substances that were used in buildings of that type in the period since original con-  
21 struction.

22 F. Contractor will assume that all electronic components, machinery, refrigeration devices and other common devices contain  
23 hazardous substances and include disposal of such in bid price, even if those substances are not mentioned separately. If  
24 special tests are necessary the owner assumes responsibility for such.

25 **G. ASBESTOS:**

26 1. Contractor's attention is directed to WAC NR 447, WAC HSS 159 and the Occupational Safety and Health Act (OSHA) in  
27 general, part 1926.1101--ASBESTOS in particular. Contractor is responsible for compliance with all applicable regula-  
28 tions when the work includes fastening to or coring through Asbestos Containing Materials (ACM) and disturbance of  
29 asbestos containing caulking and mastics. Unless otherwise indicated, all caulking, sealants, glazing compounds, gas-  
30 kets, asphalt roofing materials and miscellaneous adhesives are assumed to contain asbestos and are considered to be  
31 Category I non-friable ACM as defined in NR 447. Waste material containing Category I non-friable ACM, is regulated as  
32 Construction and Demolition (C&D) waste and may be disposed of at a Department of Natural Resources (DNR) ap-  
33 proved C&D waste landfill. If Contractor's work methods cause non-friable ACM to become friable, the Contractor is  
34 responsible for the disposal of the friable asbestos waste at a landfill specifically approved by DNR to accept friable as-  
35 bestos. A copy of the signed waste manifest for the disposal of all friable asbestos waste shall be provided to owner  
36 prior to request for final payment.

37 2. The regulations referenced above require removal of friable ACM and Category II non-friable ACM prior to demolition  
38 of a building. Category I non-friable ACM does not need to be removed from a building prior to demolition if the waste  
39 generated from the demolition is taken to a DNR approved C & D waste landfill. If the contractor chooses to recycle  
40 building materials from a building to be demolished, the contractor is responsible for removal and disposal of all Cate-  
41 gory I non-friable ACM in accordance with applicable regulations prior to demolition. If the contractor's demolition  
42 methods will cause non-friable ACM to become friable, the contractor is responsible for removal and disposal of all Cat-  
43 egory I non-friable ACM in accordance with applicable regulations prior to demolition.

44 3. The asbestos abatement contractor will require sole occupancy of the workspace during asbestos abatement work.  
45 Contractor shall communicate with the asbestos abatement contractor and make adequate allowance for the asbestos  
46 abatement work in the work schedule

47 H. LEAD BASED PAINT: Conform with OSHA and EPA recommended worker safety requirements when removing lead based  
48 paint or material bearing lead based paint or material contaminated with lead by the demolition process. Contractor's at-  
49 tention is directed to the Occupational Safety and Health Act (OSHA) in general and particularly to 29 CFR 1910 (LEAD  
50 STANDARD) and to CFR 1926 (LEAD EXPOSURE IN THE CONSTRUCTION INDUSTRY). For OSHA compliance and regulation in-  
51 terpretations, contractors may contact the area OSHA office for this project. [Milwaukee, telephone (414) 297-3315; Ap-  
52 pleton, telephone (414) 734-4521; Eau Claire, telephone (715) 832-9019]. Dispose of refuse containing lead based paint or  
53 contaminated with lead by the demolition process in conformance with State of Wisconsin Hazardous Waste Regulations  
54 set forth by the Department of Natural Resources and in conformance with OSHA and EPA recommended worker safety re-  
55 quirements.

56 I. PCB'S: Contractor shall assume all ballasts and transformers not specifically labelled as "no PCB" type to contain PCB and to  
57 dispose properly meeting all regulatory requirements

58 J. MERCURY-CONTAINING DEVICES: Mercury containing devices are accumulated in our facilities for eventual recycling  
59 through a contracted vendor. These devices include certain building controls and switches, thermometers, and lamps.  
60 Lamps are stored in accordance with Environmental Protection Agency universal waste regulation 40 CFR part 273 including  
61 storing them in containers with labels describing the contents and the start date of accumulation.

62 K. PAINT AND RELATED PRODUCTS: The oil-based paints are disposed of as hazardous waste

63 L. USED APPLIANCES AND BUILDING EQUIPMENT: Used appliances include microwaves, refrigerators, and ice machines.  
64 Smaller pieces of building equipment include items such as water heaters and variable-drive motors. All of these items are  
65 recycled by a contracted vendor at eh contractor's expense.

1 M. VOC: Volatile Organic Compounds in materials shall be limited to these maximum values:

- 2 1. Adhesives and Sealants:
- 3 2. Wood Glues: 30 g/L.
- 4 3. Metal-to-Metal Adhesives: 30 g/L.
- 5 4. Adhesives for Porous Materials (Except Wood): 50 g/L.
- 6 5. Subfloor Adhesives: 50 g/L.
- 7 6. Plastic Foam Adhesives: 50 g/L.
- 8 7. Carpet Adhesives: 50 g/L.
- 9 8. Carpet Pad Adhesives: 50 g/L.
- 10 9. VCT and Asphalt Tile Adhesives: 50 g/L.
- 11 10. Cove Base Adhesives: 50 g/L.
- 12 11. Gypsum Board and Panel Adhesives: 50 g/L.
- 13 12. Rubber Floor Adhesives: 60 g/L.
- 14 13. Ceramic Tile Adhesives: 65 g/L.
- 15 14. Multipurpose Construction Adhesives: 70 g/L.
- 16 15. Fiberglass Adhesives: 80 g/L.
- 17 16. Contact Adhesive: 80 g/L.
- 18 17. Structural Glazing Adhesives: 100 g/L.
- 19 18. Wood Flooring Adhesive: 100 g/L.
- 20 19. Structural Wood Member Adhesive: 140 g/L.
- 21 20. Single-Ply Roof Membrane Adhesive: 250 g/L.
- 22 21. Special Purpose Contact Adhesive (contact adhesive that is used to bond melamine covered board, metal, unsupported
- 23 vinyl, rubber, or wood veneer 1/16 inch or less in thickness to any surface): 250 g/L.
- 24 22. Top and Trim Adhesive: 250 g/L.
- 25 23. Plastic Cement Welding Compounds: 250 g/L.
- 26 24. ABS Welding Compounds: 325 g/L.
- 27 25. CPVC Welding Compounds: 490 g/L.
- 28 26. PVC Welding Compounds: 510 g/L.
- 29 27. Adhesive Primer for Plastic: 550 g/L.
- 30 28. Sheet Applied Rubber Lining Adhesive: 850 g/L.
- 31 29. Aerosol Adhesive, General Purpose Mist Spray: 65 percent by weight.
- 32 30. Aerosol Adhesive, General Purpose Web Spray: 55 percent by weight.
- 33 31. Special Purpose Aerosol Adhesive (All Types): 70 percent by weight.
- 34 32. Other Adhesives: 250 g/L.
- 35 33. Architectural Sealants: 250 g/L.
- 36 34. Non-membrane Roof Sealants: 300 g/L.
- 37 35. Single-Ply Roof Membrane Sealants: 450 g/L.
- 38 36. Other Sealants: 420 g/L.
- 39 37. Sealant Primers for Nonporous Substrates: 250 g/L.
- 40 38. Sealant Primers for Porous Substrates: 775 g/L.
- 41 39. Modified Bituminous Sealant Primers: 500 g/L.
- 42 40. Other Sealant Primers: 750 g/L.
- 43 41. Inside Paints and Coatings:
- 44 42. Flat Paints, Coatings, and Primers: VOC not more than 50 g/L.
- 45 43. Nonflat Paints and Coatings: VOC not more than 150 g/L.
- 46 44. Dry-Fog Coatings: VOC not more than 400 g/L.
- 47 45. Primers, Sealers, and Undercoaters: VOC not more than 200 g/L.
- 48 46. Anticorrosive and Antirust Paints applied to Ferrous Metals: VOC not more than 250 g/L.
- 49 47. Zinc-Rich Industrial Maintenance Primers: VOC not more than 340 g/L.
- 50 48. Pretreatment Wash Primers: VOC not more than 420 g/L.
- 51 49. Clear Wood Finishes, Varnishes: VOC not 1 more than 350 g/L.
- 52 50. Clear Wood Finishes, Lacquers: VOC not more than 550 g/L.
- 53 51. Floor Coatings: VOC not more than 100 g/L.
- 54 52. Shellacs, Clear: VOC not more than 730 g/L.
- 55 53. Shellacs, Pigmented: VOC not more than 550 g/L.
- 56 54. Stains: VOC not more than 250 g/L.

57  
58 **2.4. BARRICADES, SIGNS, WARNING DEVICES, AND TEMPORARY PLASTIC BARRIERS**

- 59 A. Traffic barricades, traffic signs, and warning devices shall meet the requirements of applicable OSHA standards and the FHA
- 60 Manual of Uniform Traffic Control Devices (MUTCD).
- 61 B. UV stabilized high-density polyethylene barrier fence free of holes tears and other defects. Provide 4' tall fence in diamond
- 62 or rectangular pattern. Fencing shall be "safety orange" color, unless otherwise noted.
- 63 C. Posts for temporary plastic barrier fencing shall be 5' tall, minimum 12 gauge, painted metal posts.

64

1 **2.5. SEALING AND FIRESTOPPING**

- 2 A. Manufacturers: 3M, Hilti, Rectorseal, STI/SpecSeal, Tremco, or approved equal.  
3 B. All firestopping systems shall be provided by the same manufacturer and shall be UL listed.  
4 C. Submittals: Contractor shall submit product data for each firestop system. Submittals shall include product characteristics,  
5 performance and limitation criteria, test data, MSDS sheets, installation details and procedures for each method of instal-  
6 lation applicable to this project. For non-standard conditions where no UL tested system exists, submit manufacturer's  
7 drawings for UL system with known performance for which an engineering judgement can be based upon.  
8 D. Use a product that has a rating not less than the rating of the wall or floor being penetrated.  
9 E. Contractor shall use firestop putty, caulk sealant, intumescent wrapstrips, intumescent firestop collars, firestop blocks,  
10 firestop mortar or a combination of these products to provide a UL listed system for each application required for this pro-  
11 ject. Provide mineral wool backing where specified in manufacturer's application detail.  
12 F. Where shown or specified, pack annular space with fiberglass batt insulation or mineral wool insulation. Provide 4" sheet  
13 metal escutcheon around duct on both sides of partition or floor to cover annular space.  
14 G. Install approved product in accordance with the manufacturer's instructions where an installation penetrates a fire/smoke  
15 rated surface. When pipe is insulated, use a product, which maintains the integrity of the insulation and vapor barrier.  
16 H. Whenever possible, avoid penetrations of fire and smoke rated partitions. When they cannot be avoided, verify that suffi-  
17 cient space is available for the penetration to be effectively fire and smoke stopped.  
18

19 **PART 3 – EXECUTION**

20  
21 **3.1. PROJECT MEETINGS**

- 22 A. Project meetings will be held at the time designated by the owner. If the principal of the firm does not attend meetings, a  
23 responsible representative of the Contractor who can bind the Contractor to a decision at the meetings shall attend. The  
24 contractor will write a report covering all items discussed and decisions reached and copy of such report distributed to all  
25 parties involved within 3 business days. All contractors, sub-contractors and other related parties shall attend. Attendance  
26 especially is required if such contractor is scheduled to perform work within the next 6 weeks.  
27 B. PRE-CONSTRUCTION MEETING: Owner, design representatives and all contractor and sub-contractor representatives at-  
28 tend.  
29 C. PRE-INSTALLATION MEETING: prior installation, layout or other activities related to major systems, separate meetings will  
30 be held to ensure proper coordination. These meetings will be initiated by the contractor. Not initiating these meetings  
31 doesn't relieve the contractor from coordination responsibilities. The owner may set up such meetings as needed  
32

33 **3.2. CONTINUITY OF SERVICE, TRAFFIC, SHUTDOWN AND ACCESS**

- 34 A. BUILDING ACCESS: Unless otherwise shown or directed, maintain existing access and egress to the facility throughout con-  
35 struction. Maintain ANSI A117 compliant access for disabled persons, delivery access, emergency vehicle access, and emer-  
36 gency egress. Do not interrupt access and egress without prior written approval by owner.  
37 B. Contractor shall verify the locations of any water, drainage, gas, sewer, electric, drainage, gas, sewer, electric, tele-  
38 phone/communication, fuel, steam lines or other utilities and site features which may be encountered in any excavations or  
39 other site work. All lines shall be properly underpinned and supported to avoid disruption of service.  
40 C. TRAFFIC:  
41 a. Do not interrupt or change existing traffic, delivery, or parking without prior written approval from owner. When inter-  
42 ruption is required, coordinate schedule with the Owner agency to minimize disruptions. When working in public right-  
43 of-way, obtain all necessary approvals and permits from applicable municipalities and WISDOT.  
44 b. When Contractor's activities impede or obstruct traffic flow, Contractor shall provide traffic control devices, signs and  
45 flaggers in accordance with other Contract Documents and the current version of the MUTCD, or as shown on the  
46 Drawings.  
47 D. UTILITIES:  
48 a. Verify the locations of any water, drainage, gas, sewer, electric, drainage, gas, sewer, electric, tele-  
49 phone/communication, fuel, steam lines or other utilities and site features which may be encountered in any excava-  
50 tions or other site work. All lines shall be properly underpinned and supported to avoid disruption of service.  
51 b. Do not interrupt or change existing utilities without prior written approval from owner, affected utilities and users. No-  
52 tify all users impacted by outages a minimum of 48 hours in advance of outage. Notification shall be provided in writing  
53 and describe the nature and duration of outages and provide the name and number of Contractor's foreman or other  
54 contact.  
55 E. Contractor shall provide and maintain continuous service (power, controls, alarms, communication, elevators, HVAC, roads  
56 etc.) during the entire construction period. No outages shall be permitted on existing systems except at the time and during  
57 the interval specified by the owner. Any outage must be scheduled when the interruption causes the least interference with  
58 normal institutional schedules and business routines and might be scheduled during after-hours if regular business hours  
59 are not acceptable to the owner. No extra costs will be paid to the Contractor for such outages, which must occur outside  
60 of regular weekly working hours. Cost to the utility is paid by Contractor. The Contractor shall provide temporary utility ser-  
61 vices and bypasses for any disruptions not completed within this period. The Contractor shall restore any circuit interrupted  
62 as a result of this work to proper operation as soon as possible.  
63 F. HVAC: If the building is occupied and continues operation during construction, retrofit or demolition, Contractor must  
64 maintain ventilation and air conditioning for as large parts of the building as technically feasible. Where maintaining space  
65 conditioning is not feasible with the existing system, the Contractor shall provide temporary sufficient air conditioning,  
66 heating and ventilation in coordination with the owner. Heating to prevent freeze damage is required for all construction

1 activity regardless of occupancy. All work affecting air conditioning and ventilation must be coordinated with and approved  
2 by the owner. If air conditioning, heating and ventilation has to be taken out of service for longer periods of time in parts of  
3 the building and owner would be affected negatively. All such taking out of service has to be coordinated and approved by  
4 the owner.

5 G. SHUTDOWN:

- 6 a. If the shutdown involves the interface with, or modification of, existing building energy system(s), the Contractor shall  
7 be required to show the reviewed submittal and shop drawings of the proposed modifications. Shutdown schedules  
8 shall have been reviewed and approved by the owner at least 72 hours prior to date of shutdown. Postponement of  
9 scheduled shutdowns by the owner shall not constitute a basis for additional charges to the owner.
- 10 b. Prior to the shutdown of any building energy system(s) the Contractor shall provide the following:
- 11 c. Proof of receipt of all materials required for the shutdown or a written commitment from the responsible suppliers that  
12 the required materials will be available at the time of the shutdown.
- 13 d. A list of the qualified Contractor personnel assigned to perform the work.
- 14 e. Analysis of any affect on the utility or building energy system(s) and the estimated duration of the shutdown.
- 15 f. A twenty-four-hour emergency callback phone number to be used by the owner in the event of any problems or con-  
16 cerns with the modifications made to the building system(s) after the Contractor has left the site.  
17

18 **3.3. DEMOLITION**

- 19 A. Perform all demolition as indicated on the drawings to accomplish new work. Demolition Drawings are based on casual  
20 field observation and/or existing record documents. Verify field measurements and circuiting arrangements as shown on  
21 Drawings, verify that abandoned wiring, piping, ducting and equipment serve only abandoned facilities. Report discrepan-  
22 cies to the owner before disturbing existing installation. Beginning of demolition means installer accepts existing condi-  
23 tions.
- 24 B. Demolition all abandoned services and devices in areas affected by this contract, even if not shown on plans. This includes  
25 but is not limited to wiring, conduits, piping, and equipment.
- 26 C. Before demolition of any load bearing concrete a ground-penetrating radar or concrete X-ray scan needs to be performed  
27 to detect any rebar, conduit or other damageable items. This work shall be performed at least a week before demolition  
28 starts to give A/E the opportunity to resolve any issues by rebar or other obstacles in unexpected locations. Drawings with  
29 existing subsurface obstacles may not be correct and shall not be relied on.
- 30 D. Where pipe or duct is removed and not reconnected with new work, cap ends of existing services as if they were new  
31 work. Coordinate work with owner to minimize disruption to the existing building occupants.
- 32 E. All pipe, wiring and associated conduit, insulation, ductwork, and similar items demolished, abandoned, or deactivated are  
33 to be removed from the site by the Contractor. Maintain the condition of material and/or equipment that is indicated to  
34 be reused equal to that existing before work began.
- 35 F. Patch holes and openings caused by removal of material and equipment, or formerly covered by such, with like material  
36 and texture of surrounding surface. Paint to match surroundings.
- 37 G. Disconnect all services in a manner which allows for future connection to that service. Disconnect services to equipment at  
38 unions, flanges, valves, or fittings wherever possible.
- 39 H. Approval of all Jurisdictions Having Authority shall be obtained prior to disposal of any equipment and materials. All dis-  
40 posal has to be in compliance with all local, county, state and nationwide regulations.
- 41 I. All disconnected wiring shall be removed from all raceway systems, panels, enclosures pull boxes, junction boxes etc. irre-  
42 spective of whether the removal is specified in the construction documents or not. The empty raceway systems shall be  
43 tagged spare on both ends of each termination.
- 44 J. Don't demolition or damage equipment and material that is to stay in place. Replace and repair any equipment and instal-  
45 lations that get damaged during demolition. The Contractor shall restore all disturbed areas in accordance with the draw-  
46 ings and specifications. If plans and specifications do not address restoration of specific areas, these areas will be restored  
47 to pre-construction conditions as approved by owner.
- 48 K. Verify the locations of, and protect, any buildings, structures, utilities, paved surfaces, signs, streetlights, utilities, landscap-  
49 ing and all other such facilities that are intended to remain or be salvaged. Make such explorations and probes as neces-  
50 sary to ascertain any required protection measures that shall be used before proceeding with demolition.
- 51 L. Provide and maintain adequate catch platforms, warning lights, barricades, guards, weather protection, dust protection,  
52 fences, planking, bracing, shoring, piling, signs, and other items required for proper protection.
- 53 M. Report damage of any facilities or items scheduled for salvaging to owner.
- 54 N. Explosives shall not be used for demolition.
- 55 O. Remove all equipment, fixtures and other materials scheduled for salvage prior to beginning demolition operations.
- 56 P. Abandon gas, electric and communication utilities in accordance with local utility company requirements, or applicable  
57 substantive requirements if considered private.
- 58 Q. Carry out vehicle loading as necessary within the project boundaries or as defined or indicated on the drawings, but not in  
59 locations that block vehicular traffic on the streets or pedestrian traffic on adjacent public walks.
- 60 R. Dismantle each structure in an orderly manner to provide complete stability of the structure at all times. Provide bracing  
61 and shoring where necessary to avoid premature collapse of structure.
- 62 S. Conduct demolition operations and the removal of rubbish and debris in such a way that a minimum of nuisance dust is  
63 caused. Constantly sprinkle rubbish and debris with water if necessary to keep nuisance dust to a minimum.
- 64 T. Where necessary to prevent collapse of any construction, install temporary shores, underpinning, struts or bracing. Do not  
65 commence demolition work until all temporary construction is complete.

- 1 U. During the execution of the work, provide, operate, and maintain all pumping equipment, suction and discharge lines in a
- 2 number of capacity as required to keep all cellars and pits free of water from any source whatsoever at all times.
- 3 V. Masonry and concrete shall be demolished in small sections. Use braces and shores as necessary to support the structure
- 4 of the building or structure and protect it from damage. Where limits of demolition are exposed in the finished work, cut-
- 5 ting shall be made with saws, providing an absolutely straight line, plumb, true and square.
- 6 W. Operate equipment so as to cause a minimum of damage to plaster which is to remain, and so as to keep dust and dirt to a
- 7 minimum.
- 8 X. BUILDING DEMOLITION:
- 9 1. Proceed with demolition in a systematic manner, from top of structure to ground. Complete demolition work above
- 10 each floor or tier before disturbing supporting members on lower levels.
- 11 2. Neatly saw or cut joints at the limits of removal; whenever possible, locate cuts at existing joints.
- 12 3. Cut existing plaster with power saws equipped with plaster cutting blades and dust collection system.
- 13 4. Patch or repair any damaged surfaces or structural members at the limits of removal.
- 14 5. Remove structural framing members and lower to ground by hoists, derricks or other suitable means.
- 15 6. Remove all existing flooring in accordance with plans. Leave exposed existing sub flooring or surface in suitable con-
- 16 dition for receiving new finished flooring.
- 17 7. Locate demolition equipment and remove structure so as to not impose excessive loads to supporting walls, floors or
- 18 framing.
- 19 8. Break up and remove concrete slabs-on-grade, unless otherwise shown to remain.
- 20 Y. DEMOLITION BELOW GRADE:
- 21 1. Demolish foundation walls and other below grade features in accordance with the plans. Unless otherwise noted,
- 22 remove all below grade features to a point 4' below adjoining existing grade, or proposed grade, whichever is lower.
- 23 Basement and/or lowest level floors more than 4' below existing grade need not be removed, but must be broken up to
- 24 permit drainage.
- 25 2. Backfill and compact below grade areas and voids resulting from demolition of structures and other abandonment
- 26 and demolition. Backfilling shall not begin until demolition and abandonment has been approved and documented by
- 27 owner. Prior to placement of fill materials, ensure that areas to be filled are free of standing water, frost, frozen ma-
- 28 terials, trash and debris.
- 29 Z. DRAIN TILE:
- 30 1. Carefully protect and/or replace drain tiles encountered during demolition which are necessary to maintain site
- 31 drainage conditions. Immediately repair or replace any drain tiles not scheduled for demolition, but damaged. Re-
- 32 port damage to owner.
- 33 2. Repairs to drain tile or replacement drain tile shall be comparable or better than the existing drain tile system.
- 34 3. Test drain lines with water to assure free flow before covering. Remove all obstructions which may be found, retest
- 35 until satisfactory.

### 37 3.4. TEMPORARY CONSTRUCTION

- 38 A. Temporary construction shall conform to all requirements and laws of state and local authorities, which pertain to opera-
- 39 tion, safety, and fire hazards. Contractor shall furnish and install all items necessary for conformance with such require-
- 40 ments, whether called for under separate sections of these Specifications or not. Contractor shall provide, maintain, and
- 41 remove upon completion of his work:
- 42 B. Provide temporary rigging, scaffolding, shoring, hoisting equipment, and all other temporary work as required for this pro-
- 43 ject.
- 44 C. TEMPORARY ELECTRIC:
- 45 1. Lighting shall be supplied and maintained by the Contractor so that construction work can be safely performed. The
- 46 temporary lighting system shall be sufficient to enable all trades to safely complete their work and to enable owner to
- 47 check all work as it is being done. Illumination shall be 5 foot-candles minimum in all areas and, in addition, shall meet
- 48 or exceed the requirements of 29 CFR 1926.56 Illumination (OSHA regulations) or be higher if the type of work requires
- 49 more lighting for quality control.
- 50 2. All temporary electrical circuits for construction purposes shall be equipped with combination ground fault interrupter
- 51 and circuit breakers meeting the requirements of UL for Class A, Group 1 devices.
- 52 D. TEMPORARY HEATING AND COOLING
- 53 1. Not required on this project. The contractor is required to provide temporary ventilation as required to the boiler room
- 54 once permanent ventilation is disconnected.
- 55 E. TEMPORARY ELECTRICAL SERVICE
- 56 1. Contractor shall provide and maintain electrical services in single phase or multiphase as required by equipment to be
- 57 used. Provide at multiple services to ensure service to run at less than 75% of its capacity at all times and to enable
- 58 short cable runs of less than 300 ft to equipment to be used.
- 59 F. TEMPORARY WATER, SEWER AND PUMPS:
- 60 1. The City shall supply all water required for construction and other purposes.
- 61 2. Waste of water shall be avoided and valves, connections, pumps pipes and hoses shall be provided by Contractor pre-
- 62 vent waste of water.
- 63

1 **3.5. INSTALLATION**

- 2 A. Install in accordance with manufacturer's instructions and all code requirements. Provide the owner with copy of manufac-  
3 turer's instructions prior to installation. Coordinate equipment location with piping, ductwork, conduit and equipment of  
4 other trades to allow sufficient clearances. Locate equipment to provide access space for servicing all components. Install in  
5 accordance with recognized industry practices. The manufacturer's latest recommendations shall be used. It is Contractor's  
6 responsibility to enforce these requirements with all the Contractors. The Contractor shall be responsible for correcting any  
7 infringement on this requirement at no cost to owner.
- 8 B. Startup and test equipment and adjust operating and safety controls for proper operation.
- 9 C. Contractor shall coordinate work with existing equipment so that all systems, equipment and other components will fit the  
10 available space, and will allow proper service and repair. Each location needs to be approved by owner. This also applies to  
11 existing equipment if newly installed equipment interferes with its accessibility. Location of equipment has to fit into exist-  
12 ing panels, decoration or finish. Owner can request position changes of equipment before the work has begun.
- 13 D. The Contractor shall cooperate in reducing objectionable noise or vibration. If noise or vibration is a result of improper  
14 material or installation, these conditions shall be corrected at no cost to owner. Abnormal buzzing in equipment is not ac-  
15 ceptable.
- 16 E. Provide carpentry, cutting, patching, and core drilling required for installation of material and equipment.
- 17 F. WATERPROOF CONSTRUCTION: Maintain waterproof integrity of penetrations of materials intended to be waterproof.  
18 Provide flashings at exterior roof penetrations. Caulk penetrations of foundation walls and floors watertight. Provide  
19 membrane clamps at penetrations of waterproof membranes.
- 20 G. PAINTING OF EQUIPMENT AND HARDWARE: Provide moisture resistant paint for all exterior painting. Colors shall be as  
21 shown on the drawings unless specified. All exposed conduits, raceways and gutters inside (finished spaces) and outside the  
22 building shall be painted to match the wall color.
- 23 H. Lubricate all bearings with lubricant as recommended by the manufacturer before the equipment is operated for any rea-  
24 son. Once the equipment has been run, maintain lubrication in accordance with the manufacturer's instructions until the  
25 work is accepted by owner. Maintain a log of all lubricants used and frequency of lubrication; include this information in the  
26 Operating and Maintenance Manuals at the completion of the project.

27  
28 **3.6. DELIVERY, STORAGE AND HANDLING OF MATERIALS**

- 29 A. Contractor must be present to accept delivery of all equipment and material shipments. Owner will not knowingly accept,  
30 unload or store anything delivered to the site for the Contractor's use. Inadvertent acceptance of delivered items by owner  
31 shall not constitute acceptance or responsibility for any of the materials or equipment. It is the Contractor's responsibility  
32 to assume liability for equipment or material delivered to the job site.
- 33 B. Comply with manufacturer's ordering instructions and lead-time requirements to avoid construction delays. Materials and  
34 equipment shall be delivered to the site in adequate time to ensure uninterrupted progress of the work and inspection of  
35 material by owner. Deliver materials in manufacturer's original, unopened, undamaged containers with identification labels  
36 intact. Packaged units shall be delivered in their original crates.
- 37 C. Store in a clean and dry space. Maintain factory wrapping or provide an additional heavy canvas or heavy plastic cover to  
38 protect units from dirt, water, construction debris, and traffic. Promptly inspect shipments to insure that the material is un-  
39 damaged and complies with specifications. Materials or equipment, which do not conform to the Specifications or are dam-  
40 aged shall not be incorporated in the work and shall be immediately removed from the site.
- 41 D. Arrange for the necessary openings in the building to allow for admittance of all apparatus. When the building access was  
42 not previously arranged and must be provided by this Contractor, restore any opening to its original condition after the ap-  
43 paratus has been brought into the building.
- 44 E. Contractor shall confine equipment, apparatus, storage of materials and operations to limits indicated on the drawings or  
45 by specific direction of owner. Storage of materials within the building shall at no time exceed the design carrying capacity  
46 of the structural system. The Contractor assumes full responsibility for damage due to the storage of materials.
- 47 F. Material shall be stored according to manufacturer's recommendations as a minimum. Provide and maintain watertight  
48 storage sheds on the premises where directed, for storage of materials that might be damaged by weather. Sheds shall  
49 have wood floors raised at least 6" above the ground. Materials, construction sheds, and earth stockpiles shall be located so  
50 as not to interfere with the installation of the utilities nor cause damage to existing lines. Should it be necessary at any time  
51 to move material sheds or storage platforms, the Contractor shall move it at the Contractor's expense, when directed by  
52 owner.
- 53 G. If necessary, material will be stored off site at the Contractor's expense. Offsite storage agreements will not relieve the  
54 Contractor from using proper storage techniques. Storage and protection methods must allow inspection to verify prod-  
55 ucts.
- 56 H. All materials shall be stored in a manner that prevents release of hazardous material to the environment. All hazardous  
57 materials, including motor fuels, shall be properly handled and contained to prevent spills or other releases. The Contractor  
58 shall develop and maintain a contingency plan to provide emergency response, containment, and cleanup of spills of haz-  
59 ardous materials resulting from contract activities. All spills and releases shall be reported to owner immediately

60  
61 **3.7. CONCRETE WORK**

- 62 A. Provide all layout drawings, anchor bolts, metal shapes, and/or templates required to be cast into concrete or used to form  
63 concrete for support or installation of electrical, mechanical, plumbing piping, fixtures, specialties and equipment. This in-  
64 cludes but is not limited to piping thrust restraints, pipe supports, hydrant supports, manholes, catch basins, grease traps,

1 septic tanks, distribution boxes, valve pits, meter pits, cleanout cover pads, yard hydrant pads, etc. Coordinate locations of  
2 equipment, pipe penetrations in wet areas, etc. with other trades.

- 3 B. Unless noted otherwise provide cast in place concrete for equipment pads, manhole bases and thrust blocks. Concrete to  
4 be 3,000 psi at 28 days, 3/4 inch aggregate, five bags cement, three inch slump, air entraining admixture. The ACI 614 Rec-  
5 ommended Practice for Measuring, Mixing and Placing of Concrete shall constitute the execution requirements.  
6

### 7 **3.8. OPENINGS, SLEEVES, CUTTING, STRUCTURAL ATTACHMENT, PATCHING AND PAINTING**

8 A. Before any drilling, cutting or other type of opening the contractor shall verify that no conduits, wires, pipes or other items  
9 are in or near opening area. X-ray or ground-penetrating radar technology shall be employed to survey ceilings, slabs or  
10 walls when potentially damaging opening techniques are employed. Existing available data and records may not be accu-  
11 rate regarding exact location of structural steel, pipes or conduit.

12 B. Openings shall be the responsibility of the Contractor requiring the openings even if such openings are not shown on draw-  
13 ings. The Contractor shall install sleeves for all openings and shall submit to the owner for review and approval, layout  
14 drawings of all such required sleeves and/or openings. Sleeve and opening sizes and locations shall be dimensioned from  
15 column lines and floor elevations or from a point of reference approved by owner.

16 C. All openings shall be made as airtight, watertight, fireproof, smoke-tight, thermally insulated as the wall they are in. Patch  
17 wall around sleeve to match adjacent wall construction and finish. In finished spaces where penetration through wall is ex-  
18 posed to view, sheet metal sleeve shall be installed flush with face of wall. Grout area around sleeve in masonry construc-  
19 tion. Patching includes repairing openings to match adjacent construction and painting the surface to match existing sur-  
20 face including texture.

21 D. For floor pipe and duct penetrations through floors in mechanical rooms and wet locations (all rooms with water tap or  
22 connection, Parking ramps, kitchens, food service areas, pumping stations, swimming pools, chemical storage, storage of  
23 liquids or locations that can get wet by accident or failure of a component etc.), core drill opening and provide 1-1/2" x 1-  
24 1/2" x 1/8" galvanized steel angles fastened to floor surrounding the penetration or group of penetrations to prevent water  
25 from getting to penetration. Provide urethane caulk between angles and floor and fasten angles to floor minimum 8" on  
26 center. Seal corners water tight with urethane caulk. Or, core drill sleeve opening large enough to insert schedule 40  
27 sleeve and grout area around sleeve with hydraulic setting, non-shrink grout. If the pipe penetrating the sleeve is support-  
28 ed by a pipe clamp resting on the sleeve, weld a collar or struts to the sleeve that will transfer weight to existing floor struc-  
29 ture. Size sleeve to allow insulation and paint the sleeve.

#### 30 **E. PIPE SLEEVES:**

31 1. Provide galvanized sheet metal sleeves for pipe penetrations through interior and exterior walls to provide a backing for  
32 sealant or firestopping. Pipe sleeves in new poured concrete construction shall be schedule 40 steel pipe (sized to allow  
33 insulated pipe to run through sleeve), cast in place.

34 2. Pipe sleeves are not required in interior non-rated drywall, plaster or wood partitions and sleeves are not required in  
35 existing poured concrete walls where penetrations are core drilled.

36 3. Pipe sleeves in new poured concrete construction shall be schedule 40 steel pipe (sized to allow insulated pipe to run  
37 through sleeve), cast in place.

38 4. Extend the top of sleeve 2 inch above the adjacent floor in piping floor penetrations located in the mechanical rooms  
39 and wet locations listed below. In finished areas sleeves shall be flush with rough floor.

#### 40 **F. DUCT SLEEVES:**

41 1. Duct sleeves are not required in non-rated partitions or floors.

42 2. Provide sleeve required for fire dampers in fire-rated partitions and floors.

#### 43 **G. NON-RATED PENETRATIONS:**

44 1. Conduit Penetrations Through Below Grade Walls: In exterior wall openings below grade, use a modular mechanical  
45 type seal consisting of interlocking synthetic rubber links shaped to continuously fill the annular space between the un-  
46 insulated conduit and the cored opening or a water-stop type wall sleeve.

47 2. Conduit and Cable Tray Penetrations: At conduit and cable tray penetrations of non-rated interior partitions, floors and  
48 exterior walls above grade, use urethane caulk in annular space between conduit and sleeve, or the core-drilled open-  
49 ing.

50 3. In exterior wall openings below grade, assemble rubber links of mechanical seal to the proper size for the pipe and  
51 tighten in place, in accordance with manufacturer's instructions.

52 H. Do not pierce beams or columns without owner's permission and then only as directed in writing.

53 I. No devices or materials shall be attached to non-structural or structural members or parts of the building without approval  
54 by owner. All items shall be attached to structurally stable building parts only. Provide all supporting devices as required for  
55 the installation of mechanical equipment and materials. All supports and installation procedures are to conform to the lat-  
56 est requirements of the ANSI Code for building piping. Do not hang any mechanical item directly from a metal deck or run  
57 piping so its rests on the bottom chord of any truss or joist. Fasteners depending on soft lead for holding power or requiring  
58 powder actuation will not be accepted. Support apparatus and material under all conditions of operation, variations in in-  
59 stalled and operating weight of equipment and piping, to prevent excess stress, and allow for proper expansion and con-  
60 traction.

61 J. Provide all supporting steel required for the installation of mechanical equipment and materials, including angles, channels,  
62 beams, etc. to suspended or floor supported tanks and equipment. All of this steel may not be specifically indicated on the  
63 drawings.

1  
2 **3.9. IDENTIFICATION**

- 3 A. All labels shall be permanent, and machine generated. NO HANDWRITTEN OR NON-PERMANENT LABELS ARE ALLOWED.  
4 B. Identify all equipment with engraved name plates (White letters on a black background, 1/16 inch thick plastic laminate,  
5 beveled edges, screw mounting, Setonply Style 2060 by Seton Name Plate Company or Emedolite Style EIP by EMED Co., or  
6 equal by W. H. Brady).  
7 C. Identify interior piping with >1" stencils or snap-around pipe marker Equal to Seton Setmark not less than once every 25  
8 feet, not less than once in each room, not less than once per 6' (or larger) section, adjacent to each access door or panel,  
9 and on both side of the partition where accessible piping passes through walls or floors. Place flow directional arrows at  
10 each pipe identification location. Label all pipes with name of loop and arrows for flow direction with permanent label.  
11 Mark pipes based on served system as "hot", "cold", and as "boiler", "chilled", "geothermal" and also as "glycol" or "wa-  
12 ter". All supply water shall be labeled per code as "potable" (green background / white letters) or "non-potable" (yellow  
13 background / black letters). Label all gauges. Use one coat of black enamel against a light background or white enamel  
14 against a dark background.  
15 D. Extend tape to surface at building entrances, meters, hydrants and valves. Where existing underground warning tape is  
16 broken during excavation, replace with new tape identifying appropriate service and securely spliced to ends of existing  
17 tape.  
18 E. All underground non-metallic sewers/mains and water services/mains shall be provided with tracer wire installations. Trac-  
19 er wire installations shall conform with code. Tracer wire shall be continuous solid copper or steel plastic coated with split  
20 bolt or compression-type connectors.  
21 F. Identify valves with brass tags bearing a system identification and a valve sequence number. Use round brass tags with 1/2  
22 inch numbers, 1/4 inch system identification abbreviation, 1-1/4 inch minimum diameter, with brass jack chains, brass "S"  
23 hooks or one piece nylon ties around the valve stem, available from EMED Co., Seton Name Plate Company, or W. H. Brady.  
24 Valve tags are not required at a terminal device unless the valves are greater than ten feet from the device, located in an-  
25 other room or not visible from device. Provide a typewritten valve schedule and pipe identification schedule indicating the  
26 valve number and the equipment or areas supplied by each valve and the symbols used for pipe identification; locate  
27 schedules in mechanical room and in each Operating and Maintenance manual. Schedule in mechanical room to be framed  
28 under clear plastic.  
29 G. Identify balancing valves like valves above and in addition include balancing chart for the specific balancing valve and detail  
30 the setting and flow set at time of balancing.  
31 H. Label fire, smoke and combination fire smoke dampers on the exterior surface of ductwork directly adjacent to access  
32 doors using a minimum of 0.5 inch height lettering reading, "SMOKE DAMPER" or "FIRE DAMPER". Smoke and combination  
33 fire smoke dampers shall also include a second line listing the individual damper tag. The tags must be coordinated with  
34 the mechanical schedules. Utilize stencils or manufactured labels. All other forms of identification are unacceptable. All  
35 labels shall be clearly visible from the ceiling access point.  
36 I. Label all conductors. Size shall be appropriate for the conductor or cable size(s), outlet faceplate layout and patch panel  
37 design. All labels shall be self-laminating, white/transparent vinyl and be wrapped around the cable or sheath. Flag type  
38 labels are not allowed. The labels shall be of adequate size to accommodate the circumference of the cable being labeled  
39 and properly self-laminate over the full extent of the printed area of the label.  
40

41 **3.10. TRAINING AND DEMONSTRATION**

- 42 A. The owner's facility staff (and occupants and service Contractors as needed), shall receive orientation and training on fea-  
43 tures, systems and equipment in this facility requisite with the complexity and criticality of the system and the owner's  
44 needs. Additional training requirements may be found in specific equipment sections. Owner may video-record all training  
45 sessions.  
46 B. Only training on equipment that works as designed and with approved Operations and Maintenance manual is acceptable.  
47 If system fails, training will be repeated.  
48 C. The Contractor shall be responsible for training coordination and scheduling and ultimately for ensuring that training is  
49 completed on all equipment per the Specifications. Unless otherwise required or approved, the training shall be given dur-  
50 ing regular business hours during a regular work week.  
51 D. Owner will be responsible for coordinating and approving the content and adequacy of the training.  
52 E. Training team shall consist of, as needed and at the discretion of the owner, the installing technician, installing Contractor  
53 and the appropriate trade or manufacturer's representative on each major piece of equipment. Practical building operating  
54 expertise as well as in-depth knowledge of all modes of operation of the specific piece of equipment as installed in this pro-  
55 ject is required by the person training. If owner determines training was not adequate, it will be repeated in improved form.  
56 F. Follow the outline in the table of contents of the operation and maintenance manual and illustrate whenever possible the  
57 use of the O&M manuals for reference. Training Shall Include the Following:  
58 1. Use of the printed installation, operation and maintenance instruction material included in the O&M manuals.  
59 2. A review of the written O&M instructions emphasizing safe and proper operating requirements, preventative mainte-  
60 nance, and special tools needed and spare parts inventory suggestions. The training shall include start-up, operation in  
61 all modes possible, shutdown, seasonal changeover, as applicable, and any emergency procedures.  
62 3. Discussion of relevant health and safety issues and concerns.  
63 4. Discussion of warranties and guarantees.  
64 5. Common troubleshooting and maintenance issues, problems and solutions.  
65 6. Explanatory information included in the O&M manuals and the location of all related plans and manuals in the facility.

7. Discussion of any peculiarities of equipment installation or operation.
- G. The format and training agenda in The HVAC Commissioning Process, ASHRAE Guideline 1 is recommended, as applicable.
- H. Hands-on training shall include start-up, operation in all modes possible, including manual, shutdown and any emergency procedures and preventative maintenance for all pieces of equipment.
- I. Training shall occur after functional testing and piping and equipment labeling are complete unless approved otherwise by Owner.
- J. HVAC CONTROL SYSTEMS:
1. For the primary HVAC equipment, the controls Contractor shall provide a short discussion of the control of the equipment during the mechanical or electrical training conducted by others.
  2. The standard operating manual for the system and any special training manuals shall be provided for and retained by each trainee. In addition, the system technical manual shall be demonstrated during training. Manuals shall include detailed description of the subject matter for each session. The manuals shall cover all control sequences and have a definitions section that fully describes all relevant words used in the manuals and in all software displays.
  3. The trainings will be tailored to the needs and skill-level of the trainees and be oriented to the specific system installed in this project.
  4. There shall be two training sessions:
  5. Training I– Control System and Building Systems: The second session shall be actual hands-on training. As a minimum, the session shall include instruction on:
    - a. A review of the as-built drawings and O&M manuals, a walk-through of the facility to identify control panels and device locations.
    - b. Specific hardware configuration of installed systems in this building and specific instruction for operating the installed system, including HVAC systems, lighting controls and any interface with security and communication systems.
    - c. Security levels, alarms, system start-up, shut-down, power outage and restart routines, changing set points and alarms and other typical changed parameters, overrides, freeze protection, manual operation of equipment, optional control strategies that can be considered, energy savings strategies and set points that if changed will adversely affect energy consumption, energy accounting, procedures for obtaining vendor assistance, etc.
    - d. All trending and monitoring features (values, change of state, totalization, etc.), including setting up, executing, downloading, viewing both tabular and graphically and printing trends. Trainees will actually set-up trends in the presence of the trainer.
    - e. Every screen shall be completely discussed, allowing time for questions.
    - f. Use of keypad or plug-in laptop computer at the zone level.
    - g. Use of remote access to the system via phone lines or networks.
    - h. Graphics generation.
    - i. Point database entry and modifications.
  6. Training II - Deferred On-Site: The third training will be conducted on-site 6 months after Training Session I. The session will be structured to address specific topics that trainees need to discuss and to answer questions concerning operation of the systems. The maintenance staff shall sign off on all training. Additional training may be required if the Maintenance staff deems the training as inadequate.
- K. FIRE ALARM SYSTEM:  
Not Applicable.
- L. Testing Adjusting and Balancing: The Contractor shall have the following special training responsibilities relative to the testing, adjusting and balancing (TAB) work:
1. The TAB technician shall meet with facility staff after completion of TAB and instruct them on the following:
    - a. Go over the final TAB report, explaining the layout and meanings of each data type.
    - b. Discuss any outstanding deficient items in control, ducting or design that may affect the proper delivery of air or water.
    - c. Identify and discuss any terminal units, duct runs, diffusers, coils, fans and pumps that are close to or are not meeting their design capacity.
    - d. Discuss any temporary settings and steps to finalize them for any City-furnished, City-installed equipment.
    - e. Other salient information that may be useful for facility operations, relative to TAB.

### 3.11. TESTS, PUNCH LIST AND FINAL ACCEPTANCE

- A. The complete installation consisting of the several parts and systems and all equipment installed according to the requirements of the Contract Documents, shall be ready in all respects for use by owner and shall be subjected to a test at full operating conditions and pressures for normal conditions of use.
- B. Contractor shall make all necessary adjustments and replacements affecting the work, which is necessary to fulfill owner's requirements and to comply with the directions and recommendations of the manufacturer of the several pieces of equipment, and to comply with all codes and regulations, which may apply to the entire installation. Contractor shall also make all required adjustments to comply with all provisions of the drawings and specifications.
- C. Prior to acceptance, all elements of operating equipment, including those of mechanical nature and those that slide, swing, turn, or are intended to move in any way and those of an electrical nature, shall be given an operating test to assure to the satisfaction of owner that such equipment operates as required. Contractor shall make all adjustments, replacements, and such other modifications as needed. If it is necessary to run equipment in order to complete the work, for periods that ex-

ceed the manufacturer's recommended maintenance interval, the Contractor will provide such required maintenance at no additional cost to owner.

- D. Notice that the work is ready for final inspection and acceptance shall be given after the Contractor has carefully inspected all portions of the work, has reviewed in detail the drawings and specifications, and that to the best of the Contractor's knowledge all conditions of the contract documents have been fulfilled. The owner and the Contractor shall make a joint inspection of the work and owner will issue a punchlist.
1. Multiple punch lists can be submitted and neither punchlist may be considered final. Punchlist can be submitted throughout the entire warranty period.
  2. If Contractor fails to perform required corrective work in less than 30 days upon receipt of punch list by Contractor, owner can perform corrections or hire a separate contractor and charge the Contractor the full cost.
  3. Contractor shall advise owner that the necessary work has been performed. If punch list items were not resolved and the work was not performed in less than 30 days upon receipt of punch list by Contractor, the Contractor shall be required to compensate the owner for additional site visits of project manager, design professional and other related staff at a rate of \$ 100/hour plus mileage. The amount shall be paid to the owner prior to processing the final payment. Payment may be processed as deductive change order.
- E. After deficiencies, if any, have been corrected or accounted for, and after all work is satisfactorily complete, the City will accept the work; and Notice of Completion will be filed by owner. The contractor shall test equipment before claiming completion. Prior to final acceptance, filing of the Notice of Completion or processing of final payment, the following shall be done and submitted reviewed and accepted by owner:
1. Certificates of compliance and guarantees required under various Sections
  2. Operating and maintenance manuals
  3. Instruction to City personnel, as required
  4. Test reports (TAB, fire alarm, elevator etc.)
  5. Certifications and registrations (boiler etc.)
  6. All keys
  7. Replacement material as required in specifications
  8. All required operations tests
  9. All documents required by commissioning, LEED certification and other project related documents
  10. Satisfy all commissioning requirements
  11. As-built documents
  12. All punch list items resolved
  13. All training provided (except deferred seasonal training)
  14. All warranty issues brought to Contractor's attention so far resolved
  15. Warranty documents signed by representative of manufacturer, guarantee documents, roofing agreement and other warranty related documents

### 3.12. CLEANING

- A. The construction site shall be kept in clean and safe manner. The Contractor shall clean up and remove from the premises, on a daily basis accumulation of surplus materials, rubbish, debris and scrap and shall repair all damage to new and existing equipment resulting from its work. When job is complete, this Contractor shall remove all tools, excess material and equipment, etc., from the site. Contractors or subcontractors found to be in violation may be required to leave the jobsite until their staff is trained in orderly, clean and safe construction site work. Clean and safe construction site includes but is not limited to:
1. All trades keep a separate and neat area for material, equipment etc.
  2. Equipment and material not needed anymore is removed from the jobsite
  3. Demolition material and equipment is removed from jobsite daily
  4. All material and equipment is sorted and stored properly
- B. Spreading of dirt, dust and other construction related material must be kept to a minimum. Occupied and work areas must be separated by seals. Such seals shall be inspected and repaired frequently as needed to ensure proper sealing at all times.
- C. Keep streets, walks and all other adjacent paved areas clean and swept clear of dirt, mud and debris deposited as a result of this operation. Protect surrounding area from dust. Control rodents, and other vermin associated with demolition operations.
- D. All installed items shall be cleaned at time of installation, and all lens exteriors shall be cleaned just prior to final inspection. Equipment shall be thoroughly cleaned of all stains, paint, spots, dirt and dust. All temporary labels not used for instruction or operation shall be removed. Dust, dirt and other foreign matter shall be removed completely from all internal surfaces of all mechanical and electrical units, cabinets, ducts, pipes, etc. Dirt, soil, fingerprints, stains and the like, shall be completely removed from all exposed finished surfaces.
- E. Contractor shall wash all glass immediately prior to the occupancy of this project. Work shall include the removal of labels, paint splattering, glazing compound and sealant. Surfaces shall include mirrors and both sides of all glass in windows, borrowed lights, partitions, doors and sidelights. In addition to the above, the Contractor shall be responsible for the general "broom" cleaning of the premises and for expediting all of the cleaning, washing, waxing and polishing required within the technical sections of the specifications governing work under this Contract. The Contractor shall also perform "final" cleaning of all exposed surfaces to remove all foreign matter, spots, soil, construction dust, etc., so as to put the project in a complete and finished condition ready for acceptance and use intended.

- 1 F. If rubbish and debris is not removed, or if surfaces are not cleaned as specified above, the owner reserves the right to have
- 2 said work done by others and the related cost(s) will be deducted from monies due the Contractor.

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**END OF SECTION**

**APPENDIX A - WASTE MATERIALS ESTIMATING SHEET**

1  
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Instructions: Use as many sheets as needed.

**PROJECT TITLE:** \_\_\_\_\_  
**COMPANY:** \_\_\_\_\_  
**DATE:** \_\_\_\_\_

|              |             | Total Amount Generated |        | Amount Recycled |        | Amount Salvaged |        | Amount Sent to Landfill |        |
|--------------|-------------|------------------------|--------|-----------------|--------|-----------------|--------|-------------------------|--------|
| Material     | Destination | Tons                   | Cu Yds | Tons            | Cu Yds | Tons            | Cu Yds | Tons                    | Cu Yds |
|              |             |                        |        |                 |        |                 |        |                         |        |
|              |             |                        |        |                 |        |                 |        |                         |        |
|              |             |                        |        |                 |        |                 |        |                         |        |
|              |             |                        |        |                 |        |                 |        |                         |        |
|              |             |                        |        |                 |        |                 |        |                         |        |
|              |             |                        |        |                 |        |                 |        |                         |        |
|              |             |                        |        |                 |        |                 |        |                         |        |
|              |             |                        |        |                 |        |                 |        |                         |        |
|              |             |                        |        |                 |        |                 |        |                         |        |
|              |             |                        |        |                 |        |                 |        |                         |        |
| <b>Total</b> |             |                        |        |                 |        |                 |        |                         |        |

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## SECTION 22 00 00 - GENERAL PLUMBING PROVISIONS

### PART 1 - GENERAL

#### 1.1 DESCRIPTION OF WORK

A. Plumbing work includes:

1. Furnish all labor and materials necessary for the complete installation of plumbing system as shown on the drawings and/or specified herein.
2. Drawings: Refer to P-Series drawings for graphic representations, schedules and notations showing Plumbing work.
3. Specifications: Applicable portions of Division 1 govern all work under this Section. Refer to Division 22 Sections for primary technical specifications of Plumbing work, as listed below:

|          |                               |
|----------|-------------------------------|
| 22 00 00 | General Plumbing Provisions   |
| 22 05 00 | Basic Materials and Methods   |
| 22 25 00 | Pipe Insulation               |
| 22 35 00 | Natural Gas Piping Systems    |
| 22 40 10 | Domestic Water Piping Systems |
| 22 45 10 | Plumbing Equipment            |
4. Control wiring (less than 100 volts) for Plumbing equipment.
5. Equipment structural supports, prime painted. Anchor bolts, metal shapes and templates required to be cast into concrete or to support mechanical equipment.
6. Motors for all Plumbing equipment.
7. Final fuel, waste and water piping connections to Plumbing equipment.
8. Secure and pay all fees necessary for execution and completion of work.
9. Test, adjust and balance Plumbing systems.

#### 1.2 RELATED DOCUMENTS

A. Applicable provisions of Division 1 shall govern work under this section.

B. Related Work by Plumbing Contractor:

1. Field painting of all exposed piping, hangers, supports and related metal work throughout.
2. Field painting of exposed gas piping.
3. Building cutting and patching for all opening, recesses and chases intended as equipment space for piping in existing construction.
4. Lintels and openings for piping through walls, floors and ceilings.
5. All new plumbing openings through existing structural floors will require confirming the location of the reinforcement bars prior to starting and a determination that no reinforcement bars will be cut in the process.

C. Work by Others:

1. Final roof flashings, patching and sealing at roof penetrations shall be provided by the Owner's Roofing Contractor at no cost to the Plumbing Contractor.
2. Line voltage (greater than 100 volts) wiring, conduit and connections by the Electrical Contractor.
3. All equipment starters not furnished as integral part of plumbing equipment shall be provided by the Electrical Contractor.
4. All low-voltage temperature control work shall be provided by the HVAC Temperature Control Contractor at no cost to the Plumbing Contractor.

#### 1.3 QUALITY ASSURANCE

- A. Qualifications of Installers: For the actual fabrication, installation and testing of work under this Section, use only thoroughly trained and experienced workmen completely familiar with the items required and the manufacturer's current recommended methods of installation.
- B. In acceptance or rejection of installed work, the Architect/Engineer will make no allowance for lack of skill on the part of the workmen.
- C. Reference Standards: Specifically, for Plumbing work in addition to standards specified in individual work section, the following standards are imposed, as applicable to work in each instance:
  - 1. American National Standards Institute - ANSI.
  - 2. American Society for Testing and Materials - ASTM.
  - 3. American Water Works Association- AWWA.
  - 4. Manufacturers Standardization Society of the Valve and Fittings Industry - MSS.
  - 5. National Electrical Manufacturers Association - NEMA.
  - 6. National Electrical Code - NEC.
  - 7. National Fire Protection Association - NFPA.
  - 8. National Sanitation Foundation - NSF
  - 9. Cast Iron Soil Pipe Institute - CISPI
  - 10. Underwriters' Laboratories - UL.
  - 11. International Building Code - IBC
  - 12. International Fuel Gas Code - IFC
  - 13. Wisconsin Plumbing Code - SPS 381-391
  - 15. Local and State Building Codes; Plumbing, Mechanical, etc.
  - 16. American Society of Heating, Refrigerating and Air Conditioning Engineers - ASHRAE.

#### **1.4 LAWS, PERMITS AND REGULATIONS**

- A. Obtain and pay for all licenses and permits, pay all fees and/or charges for meters and associated devices, pay all charges for connection to outside services. Comply with all laws, ordinances, regulations and code requirements applicable to this work. It is assumed that the Contractor is familiar with all laws; codes and ordinances governing his work and that all work done by him will be approved by authorities having jurisdiction over his work.
- B. All work shall be performed in compliance with all applicable Laws, Codes and Regulation of the governmental Bodies having jurisdiction over the site.

#### **1.5 MEASUREMENTS**

- A. All measurements must be verified from actual observations at the project site. The Contractor is responsible for all his work fitting into place in approved, satisfactory, and workmanlike manner in every particular.

#### **1.6 SPECIFICATION TERMINOLOGY**

- A. "Provide", as used in these Specifications, means furnish all material labor, sub-contracts, and appurtenances required, including mark-up and install to a complete, operating, finished condition.
- B. "Furnish" means to purchase material as shown and specified, including moving the material to an approved location at the site or elsewhere as noted or agreed, to be installed by supporting trades.
- C. "Install" means to set in place and connect; ready for use and in complete, operating, finished condition, material that has been furnished.

- D. "Rough-in and Connect Only" means provide an appropriate system connection such as supplied with stops, continuous wastes with traps, shut-off valves required and all piping connections, testing, etc., for proper operation, and to install equipment furnished. Equipment furnished is received, assembled and set in place by supporting trades unless they make prior arrangements to hire the Plumbing installer for this work.
- E. "Accessible" means arranged so that a service person may approach the areas in question with the tools and products necessary for the service work intended, and may then position himself to properly perform the task to be accomplished without disassembly or damage to the surrounding installation.
- F. "Serviceable" means arranged so that the component or product in question may be properly removed, and replaced without disassembly, destruction or damage to surrounding installation or piece being serviced.
- G. "Product" is a generic term, which includes materials, equipment, fixtures and any physical items used on the product.
- H. "A/E" means Architect/Engineer.

### **1.7 DIAGRAMMATIC DRAWINGS**

- A. Drawings and specifications are complementary, each to the other; what is shown on one is as binding as if called for both. The Drawings are partly diagrammatic and do not show all offsets in piping or exact location of piping ducts, etc.
  - 1. The drawings do not necessarily show in minute detail all features of the installation; however, provide a complete and satisfactorily working installation.
  - 2. Provide all work shown on the drawings and specified, unless otherwise stated.
  - 3. For additional details, the Contractor is referred to the Architectural, HVAC, Electrical and other trade Drawings.
  - 4. If errors, omissions, or conflicts between the drawings and/or specifications occur, the Contractor shall obtain clarification from the Architect/Engineer prior to bidding.

### **1.8 REVIEW OF MATERIALS AND EQUIPMENT SUBMITTALS**

- A. Submittals: Provide submittals for all products and systems described in Division 15000A and shown on the Drawings to demonstrate compliance with the requirements of the projects.
  - 1. Furnish equipment submittals in the manner described elsewhere in these Specifications
- B. Substitutions: If the Architect/Engineer and Owner approve a substitution, the approval is given with the understanding that the Contractor guarantees the article or material substituted to be equal to or better in every respect than the article or material specified. The Contractor shall also assume complete responsibility that the article or material will fit the job as far as space, access and service requirements.
- C. Data Required for Review: Mark submittal literature and show drawings clearly. Bind 8 1/2" x 11" literature in loose-leaf binders by individual set and include all equipment and material shown on Drawings and specified. Indicate the following:
  - 1. Specification reference and/or drawings reference for which literature is submitted for review with an index following specifications format, and item-by-item identification.
  - 2. Manufacturer's name and address, and supplier's name, address and phone number.
  - 3. Catalog designation or model number.
  - 4. Rough-in data and dimensions.
  - 5. Performance curves and rated capacities.
  - 6. Motor characteristics and wiring diagrams.

7. Operation characteristics.
  8. Complete customized listing of characteristics, equipment, accessories, etc., specified. Indicate whether item is "As Specified" or "Proposed Substitution". Indicate any deviation on submittal. Mark out all non-applicable items. The terminology "As Specified" used without this customized listing is not acceptable.
  9. Wiring diagrams for the specific system operation.
  10. Working construction drawings (Shop Drawings).
  11. Contractor shall submit for approval, six(6) copies of Shop Drawings, Literature and Equipment List, including control wiring diagrams.
  12. Submit prior to fabrication or delivery.
- D. Partial Submittals: If other than a complete submittal is made, the Contractor may make partial submittals separated into complete specification section classifications. Unclear submittals, and submittals not organized by specification section will be returned without review.
- E. Submittal review is for general design and arrangements only and does not relieve the Contractor from any of the requirements of the Contract Documents. Submittals will not be checked for quantity, dimensions, fit or proper technical design or manufacture equipment. Where deviations of substitute product or systems performance have not been specifically noted in the submittals by the Contractor, provision of a complete and satisfactory working installation is the sole responsibility of the Contractor.

#### **1.9 SHOP DRAWINGS**

- A. Prepare and submit working construction drawings as requested, specified, or otherwise necessary to demonstrate proper planning for installation and arrangement or work.
1. Layout drawings to scale and show dimensions where accuracy of location is necessary for coordination of communication purposes.
  2. Show work of all trades, including Architectural, Structural, HVAC and Electrical items, which may be pertinent to proper and accurate coordination.
  3. Provide shop drawings for all products, systems, system components, and special supports, which are not, a standard catalog product, which may be fabricated for the Contractor or by the Contractor.

#### **1.10 PROJECT RECORD DRAWINGS**

- A. Reference requirements stated in Division 1 Requirements.
- B. In addition to other requirements, mark-up a clean set of drawings as the work progresses, to show the dimensioned location and routing of all Mechanical work, which will become permanently concealed.
1. Show routing and location of items cast iron concrete or buried underground.
  2. Show routing of work in permanently concealed blind spaces within the building.
  3. Work located in spaces with access, or above suspended ceilings, is not considered permanently concealed.
  4. Show complete routing and sizing of any significant revisions to the systems shown.
- C. Show the location of all valves and their appropriate tag identification.
- D. At completion of project, deliver record drawings to the Architect/Engineer and obtain written receipt.

#### **1.11 ELECTRICAL WORK**

- A. Related Work Specified Elsewhere:

1. Electrical Specifications: Division 26.
- B. Unless otherwise indicated on the Electrical Drawings or the Electrical Specifications, provide all Plumbing equipment motors, motor starters, disconnect switches, thermal overload switches, control relays, time clocks, thermostats, motor valves, float controls damper motors, electrical-pneumatic and pneumatic electrical switches, electrical components wiring and other miscellaneous Division 26 controls.
  1. All motors, electrical equipment, low voltage controls, line voltage controls for all Plumbing equipment shall be provided complete by the Plumbing Contractor.
  2. The Electrical Section will provide wiring from current source to all starters and from starter to motors, except in the case of factory installed wiring in packaged equipment. The Electrical Section will wire to the line side of pre-wired equipment, to the control panel, and to fuel burning and control equipment. Electrical Section will provide all motor interlock wiring unless otherwise stipulated.
- C. Motors:
  1. Motors up to and including 1/2 HP shall be 120 volt for 60-cycle operation. Motors larger than 1/2 HP shall be 3-phase for 60-cycle operation (Unless otherwise indicated).
  2. Motors shall have sealed ball bearings. Motors shall be designed for fan duty, direct or belt drive and be designed for quiet operation.
  3. Motors on or in equipment on roof or exposed to weather shall be totally enclosed.
- D. Starters and Protection:
  1. Each motor shall be equipped with overload and under-voltage protections.
  2. Provide 3-phase protection.
  3. 120-volt motors shall have thermal protection consisting of manual starter switch, one pole toggle operated with pilot light with thermal overload element.
  4. 3-phase motors shall have across-the-line starter with thermal overload and under voltage protection of each phase.
- E. Carefully coordinate all work with the electrical work shown and specified elsewhere in these documents.
- F. Motors: Furnish electric motors designed for the specific application and duty applied, and to deliver rated horsepower without exceeding temperature ratings when operated on power systems with a combined variation in voltage and frequency not more than plus or minus 10 percent.
- G. Verify from the drawings and specifications the available electrical supply characteristics and furnish equipment that will perform satisfactorily under the conditions shown and specified.
- H. Size motors for 1.15 service, factor, and not to exceed 40 degrees C. temperature rise above ambient.
- I. Provide self-resetting thermal overload switch for fractional horsepower motors.
- J. All motors to be high-efficiency or premium-efficiency motors, as scheduled or noted elsewhere, complying with NEMA test standards MEL-12.53a, (IEEE test procedure 112, method B) using accuracy improvement by segregated loss determination including stray load measurements. Motors shall meet Federal EPACT qualifying standards.

## 1.12 TESTS AND INSPECTIONS

- A. Schedule, obtain, and pay for all fees and/or services required by local authorities and by these specifications, to test the Plumbing systems as specified in these specification.

- B. Request for Tests: Notify the Architect/Engineer a minimum of 24 hours in advance of tests. In the event the inspecting authority does not witness the test, certify in writing that all specified tests have been made in accordance with the specifications.
- C. Deficiencies: Immediately correct all deficiencies, which are evidenced during the tests and repeat tests until system is approved. Do not cover or conceal piping, equipment or other portions of the mechanical installation until satisfactory tests are made and approved.
- D. Operating Tests: Upon request from the inspecting authority, place the entire Plumbing installation and/or any portion thereof, in operation to demonstrate satisfactory operation.
- E. Completion: Upon completion of the Plumbing installation, demonstrate to the Architect/Engineer satisfaction that the systems have been installed in a satisfactory manner in accordance with the plans, specifications, and applicable Codes.
  - 1. Demonstrate dynamic operation of all systems.
  - 2. Show that all controls are operable and are properly adjusted in accordance with the requirements of the final systems balance, that all equipment operates properly, strainers are clean, and that all components of all systems are installed and adjusted for proper operation.

### 1.13 OPERATING INSTRUCTIONS

- A. Prior to final acceptance, instruct an authorized representative of the Owner for 8 hours on the proper operation and maintenance of all Plumbing systems, equipment, and controls under this contract. Make available a qualified technician for each component of the installation for the instruction. Give these operating instructions after the operation and maintenance manuals have been furnished to the Owner. Submit written certifications, signed by the Contractor and an authorized representative of the Owner, that this has been completed.
  - 1. Operating Sequence and Procedures:
    - a. General: Describe the procedures necessary for personnel; to operate the system and equipment covered in that chapter.
    - b. Typewritten Operation Procedures: Write procedures for start-up operation, emergency operation and shutdown.
      - 1) Start-up: Give complete step-by-step instructions for energizing equipment making initial setting and adjustments whenever applicable.
      - 2) Shut-down Procedures: Include instructions for stopping and securing the equipment after operation. If a particular sequence is required, give step-by-step instructions.
  - 2. Maintenance Instructions:
    - a. Provide a schedule of preventive maintenance of each product. Recommend frequency of performance for each preventive maintenance task; i.e., cleaning, inspection, etc.
    - b. Provide instructions and schedules for all routing cleaning, lubrication and inspection with recommended lubricants for all equipment and systems. Schedule times of the year that inspection and maintenance should be performed.
    - c. Provide instructions for minor repairs or adjustments required for preventive maintenance routines, limited to repairs and adjustments which may be performed without special tools or test equipment and which require no extensive special training or skills.
    - d. Special Maintenance: Provide all information of a maintenance nature covering warranty items, etc., which have not been discussed elsewhere.

3. Manufacturer's Brochures: Include manufacturer's descriptive literature covering all appurtenances used in each system, together with illustrations, exploded views and renewal parts lists.
4. Shop Drawings: Provide a copy of all corrected, approved shop drawings covering equipment for the project either with the manufacturer's brochures or properly identified in a separate subsection.
5. Equipment Parts Lists: Include a complete list of all equipment furnished for project, with a tabulation of descriptive data of all the equipment replacement parts proposed for each type of equipment or system. Properly identify each part of part number and manufacturer.
6. Other Items:
  - a. Name Plate Directory: Provide list of all major equipment name plates giving manufacturer's name plate data, name plate designation, location of equipment, area served, switch location, normal position of switch, and equipment label designation specified. Submit directory for review and obtain approval prior to substantial completion of project.
  - b. Label all pages to assure correct placement in manual.
  - c. Mark out all non-applicable items or "Highlight" all applicable items.

#### **1.14 WARRANTY**

- A. Warrant materials and workmanship in accord with the General and Supplementary Conditions.
- B. Provide written guarantees, which exceed one (1) year.
- C. Submit with Maintenance and Operating Manual.
- D. Warrant period to extend from date of Substantial Completion. Refer to General Conditions and Supplementary Conditions.

#### **1.15 COORDINATION OF WORK**

- A. Keep informed about the work of all other trades engaged in the project and execute the work in such a manner as not to delay or interfere with the progress of other contractors. This Contractor shall schedule his work so that no other contractor is delayed in the execution of his work. Complete cooperation of all trades is expected. Employ a competent foreman on job throughout the entire project to ensure that coordination is maintained.
- B. Schedule and coordinate the work of this Division with the schedule of the General Contractor to progress the work expeditiously, and to avoid any unnecessary delays.
- C. Examine fully the Drawings and Specifications for other Contractors for other trades, and coordinate the installation of this work with the work of the other Contractors. The Division 22 Contractor shall participate in the coordination drawing process as specified in Division 1 where coordination drawings are required. The Division 22 Contractor shall prepare the coordination drawings.
- D. Any proposed changes from the systems layout, on the drawings, shall be done in accordance with the design criteria specified in the applicable codes and shall be subject to the review and acceptance of the Architect/Engineer.
- E. Utility installation in congested areas is dependent on the sequence of utility installation as much as it is dependent on the physical size of the utilities. The Contractor shall use the coordination process and the coordination drawings process to properly sequence the installation of utilities as appropriate to ensure the above ceiling and congested area utility installation at satisfactory. All Contractors and subcontractors shall participate in the coordination process and the coordination drawings process.

## **1.16 REMODELING REQUIREMENTS**

- A. Prebid Survey: Plumbing Contractor shall survey the job site before submitting his bid to determine the extent of areas requiring demolition, relocating and remodeling. The extent of equipment and materials to be removed. Routings for existing and new piping services and systems. Examine accessibility, material storage and working space available.
- B. Maintenance of Service: The building will be continuously occupied during the construction period except as noted. Special efforts shall be made to avoid interference with building functions. Consult with the Owner prior to performing work in public areas of building or to turn off services, so that Owner can advise as to most suitable time for the necessary interruptions. All such work and interruptions to services shall be performed at times which are approved by the Owner.
- C. Demolition: Carefully examine the present building site, together with all of the drawings and specifications. Within areas involving remodeling, each Contractor shall be responsible for removal of, relocation of, or revisions to existing equipment, wiring, piping, fixtures and all other existing facilities under appropriate headings of his work, which is necessary to accomplish the final arrangement indicated on the Architect's plans. To assist the Contractor in meeting the above requirement, the drawings note certain of these items, but the absence of such notes shall not limit the responsibility of each Contractor to perform all work as described in this paragraph.
- D. Disposition of Demolition Materials and Equipment: Materials demolished or removed shall become the property of the Contractor and shall be removed from the site, except items, which are to be reused or are specifically noted as remaining the property of the Owner.
- E. Cutting or Patching Existing Facility:
  - 1. Plumbing Contractor will be required to do all remodeling, cutting and/or construction removal and all patching or construction replacement as required for his work except for specific cutting and patching described in the documents as being performed by a specific Contractor.
  - 2. Plumbing Contractor shall not endanger any work by any demolition, cutting, digging or otherwise. Any cost caused by defective or ill-timed work shall be borne by the contractor responsible.
  - 3. Plumbing Contractor requiring cutting and patching shall hire men skilled in such cutting and patching to do the work.
  - 4. All new work in existing areas shall match existing work in material, quality, texture, finish and color unless specifically noted or scheduled otherwise.

## **1.17 DEMOLITION**

- A. The Contractor is responsible for removal and relocation of all existing plumbing equipment and related items affected by the remodeling area.
- B. To assist the Contractor in meeting the above design intent, the drawings note certain of these items, but the absence of such notes shall not limit responsibility of the Contractor to perform all demolition work as required to accomplish new design plan.
- C. Contractor shall coordinate his remodeling efforts with the building functions and avoid interference wherever possible. All such interruptions of existing services shall be performed at times which are approved by the Postmaster.

## **PART 2 - PRODUCTS**

--- NOT USED ---

## **PART 3 - EXECUTIONS**

-- NOT USED --

**END OF SECTION**

## SECTION 22 05 00 - BASIC MATERIALS AND METHODS

### PART 1 - GENERAL

#### 1.1 DESCRIPTION OF WORK

- A. Description: This section describes specific requirements, products and methods of execution, which are typical throughout the Plumbing Work of the project. Additional requirements for the specific systems will be found in the sections specifying those systems, and superseded requirements.
- B. General:
1. Diagrams have been made in certain cases showing pipe connections. Contractor is cautioned that these are diagrammatic only and must not be used for obtaining lineal runs or number and type of fittings.
  2. Offsets in Piping: The Drawings do not show exact details of all piping. No extra payment will be allowed where obstructions in the work of other trades, or work under this contract, require offsets in the piping.
  3. Concealed Piping: Pipe indicated to be furred in or concealed shall be installed in such a manner as to require a minimum amount of furring. All pipes in finished rooms shall be concealed.
  4. Provisions for Pipe Covering: In laying out the piping work, allow space for piping covering. If interferences occur, move the piping.
  5. Interference between Piping and Light Outlets: Wherever piping runs on ceilings, Contractor shall arrange the run of piping in such a manner that it does not interfere with light outlets or light fixtures.
  6. Reaming: Each end of steel or wrought iron pipe for screwed joint connections shall be reamed to the full pipe diameter.
  7. Screwed fitting shall be of Crane, Grinnell, or Walworth manufacture. Fittings other than drainage fittings shall be for 125 psi water pressure. Fitting shall comply with ASA dimensions and shall be galvanized where specified with the respective system. Street elbows shall not be used.
  8. Openings in Pipe: Keep ends of pipe closed during the progress of the work.
  9. Run all piping parallel to building surfaces.
  10. Union shall be provided at each pipe connection to any equipment and at any point where necessary to disconnect piping for repairs; 2" and smaller - ground joint malleable type; 2-1/2" and larger - flange type, Grinnell, Crane or Walworth.
  11. Screwed connections shall have true taper full V-threads on dimensions according to ASA Code B-2.
  12. Pipe joint lubricant shall be used on the male threads on all screwed pipe.
  13. Installation of valves shall be with the stem horizontal or above the horizontal.
  14. Gaskets for flanged connections shall be 1/16" thick.
  15. Close nipples shall not be used. For short pipe connections, use standard short nipples.
  16. Provide insulating couplings where metals of different type join.

#### 1.2 RELATED DOCUMENTS

- A. Applicable provisions of Division 1 shall govern work under this section.

#### 1.3 JOB CONDITIONS

- A. Obtain approval from Architect prior to cutting any structural elements or furring members.
- B. Structural Interferences: Should structural members prevent the installation of piping, duct or equipment, notify the Architect before proceeding.

1. Consider minor changes in position of equipment, piping or duct, if decided upon before any adjacent connections have been made as part of the contract at no additional cost to the Owner.
- C. Coordinate with structural and architectural work to determine acceptable locations for sleeves and supports which are required but may not be specifically shown on the plans. Schedule installation of sleeves and special supports in manner timely to the work of other crafts. Anticipate minor offsets necessary for proper coordination with other work, and reroute systems appropriately.

#### **1.4 DIMENSION AND FIT**

- A. Cut materials accurately from measurements taken on the job site.
- B. Do not spring or bend pipe to fit conditions or make up joints.
- C. All measurements shall be verified at the job site. Locate all equipment and fixtures on the centers of walls, openings, spaces, etc. Check all piping, etc., to clear openings. All piping exposed such as flush valves shall be plumbed straight in both vertical and horizontal planes.

#### **1.5 SERVICEABILITY OF PRODUCTS**

- A. Furnish all products to provide the proper orientation of serviceable components to access space provided.
- B. Coordinate installation of piping, ductwork, equipment, systems components, and other products to allow proper service of all items requiring periodic maintenance or replacement.
- C. Replace or relocate all products incorrectly ordered or installed or provide proper serviceability.

#### **1.6 ACCESSIBILITY OF PRODUCTS**

- A. Arrange all work to provide access to all serviceable and/or operable products. Layout work to optimize net usable access space within confines of space available.
  1. Advise Architect/Engineer in a timely manner, of areas where proper access cannot be maintained.
  2. Furnish layout (1/4"=1'-0") drawings to verify this claim, if requested. Mechanical rooms require layout shop drawing for approval.
- B. Provide access doors in ceilings, walls, floors, etc., for access to traps, valves, dampers, automatic devices, and all serviceable or operable equipment in concealed spaces.

#### **1.7 ROUTING**

- A. Route all pipelines parallel with building lines, and as high as possible, except where underground or shown otherwise on the plans.
- B. Route piping to clear all doors, windows, and other openings and to avoid all other pipes and ducts, light fixtures and similar products.
- C. Conceal all pipes where routed through finished areas, unless indicated on plans.

#### **1.8 PREBID SURVEY**

- A. The Contractor shall survey the job site before submitting his bid to determine the following:
  1. Site conditions such as materials storage, staging areas, parking, etc.

2. The extent of equipment and materials to be removed.
  3. Routing for services and systems.
  4. Problems with work sequence.
- B. Any unusual conditions or discrepancies not shown on the drawings or described in the specification shall be reported to the A/E before bidding.
- C. By submitting a bid, the Contractor acknowledges that he has visited the site and either found no unusual conditions or has notified the A/E of the same.
1. Compensation will not be given for items above if discovered after bids are opened and contracts awarded unless specifically noted otherwise on drawings or elsewhere in these specifications.

## PART 2 - PRODUCTS

### 2.1 PIPE AND FITTINGS

#### A. Black Steel Pipe:

1. Piping 10 inches and smaller: Schedule 40, standard weight conforming to ASTM 120, or ASTM 53, Grade B.
2. Joints and fittings, 2 inches and Smaller: Malleable iron, screwed pattern 125 PSI, conforming to ANSI B.16.3 unless specified otherwise in other Division 15 sections.
3. Joints and Fittings 2-1/2" and larger: Contractor's option of:
  - a. Steel flanges conforming to ANSI B.16.5 or AWWA C207.
  - b. Seamless welded fittings conforming to ANSI BI 6.9, B16.28 and ASTM A234.
  - c. Approved mechanical couplings; Victaulic or approved equal.

#### B. Galvanized Steel Pipe:

1. Standard weight, screwed joint zinc-coated steel pipe conforming to Federal Specification WW-P406b(1). ASTM 120 or ASTM 53 Grade B.
2. Couplings: Same material as pipe.
3. Malleable iron fittings, zinc-coated, screwed pattern conforming to Federal Specification WW-P-521-F.

#### C. Cast Iron Drainage Pipe: Cast-iron drainage pipe ANSI-ASTM A74.

1. Service weight conforming to ANSI-ASTM A74.
2. Fittings: Compatible with pipe.
3. Changes in Pipe Sizes: Made with reduction fittings.
4. Hub and spigot soil pipe with mechanical or compression gasket joints at below grade installations.
5. Hubless soil pipe with mechanical sleeve joints for above grade installation.

#### D. Plastic Pipe:

1. Crosslinked Polyethylene(PEX) plastic piping, ASTM F876 and F877 and installed per ASTM D2774.
2. PEX piping may be used as branch distribution piping from copper manifolds with approved mechanical compression fittings. PEX piping shall meet ASTM standards for potable hot and cold water use and shall be color coded. Manifolds shall be recessed and located at approved locations prior to installations.
3. ABS or PVC - DMW plastic pipe and fittings schedule 40(Not allowed for water piping).

4. Joints in plastic drainage, or vent piping within the building shall be solvent welded, except that threaded or flanged joints may be used with adapter fittings as outlined in paragraph above.
5. The solvent cement shall be specific for the piping material and shall meet the requirements of ASTM Standards D 2564-67 and D 2235-67 or currently applicable revisions thereof.

E. Copper Pipe:

1. Type L copper with sweat or mechanical fittings.
2. Solder joints for water supply systems operating below 180 degrees F with lead-free solders and fluxes.
3. Cast bronze or wrought copper fittings.
4. Approved mechanical couplings, Viega Propress.

## 2.2 VALVES

- A. Select valves of the best quality and type suited for the specific service and piping system used. Minimum working pressure rating 120 psi steam or 150 PSIG W.O.G.
- B. Valves throughout the project shall be by one manufacturer, where possible, or unless otherwise specified.
- C. Manufacturer shall be Conbraco - Apollo, Milwaukee Valve Company, Watts, or Nibco of standard dimensions, comparable to the number listed.
- D. Except as otherwise specified, all valves 2-1/2" and smaller shall be full-port ball valves.
- E. Valves 4" and over shall be butterfly valves unless specified otherwise.
- F. Ball Valves: Shall be of full-port design. Chromium plated bronze or stainless steel ball with reinforced Teflon seats and seals. Ball valves shall be one-piece construction and include blowout proof stem design. Furnish 1-1/4" extended stems. Equal to Apollo 77-100 series.
- G. Stop and Waste Valves: 1" and smaller, bronze body ball valve type, 2 piece, full port, with 1-1/4" extended stem, with threaded drain cap to drain downstream piping equal to Apollo #95-100/200 series or Watts B-6300 series.
- H. Butterfly Valves: Lug type with spring loaded trigger level and locking handle. Provide stainless steel stem with ductile iron disc-coated equal to Crane 12TL/14TL.
- I. Butterfly Valves (Grooved Ends): 4" and over, suitable for mechanical coupling as previously described under interior water piping. Equal to Grinnell "Gruvlok" # GLBF7-6-2-2 or Victaulic series 7000.
- J. Check Valves:
  1. 2-1/2" and smaller: Y-pattern swing check type, bronze body, renewable discs, sweat or threaded, for horizontal or vertical installation. Equal to Crane 76E series.
  2. 3" and larger: Iron body, swing check type, replaceable disc/gasket, flanged or threaded, for horizontal or vertical installation. Equal to Crane #370 series.
- K. Balancing Valves:
  1. Balancing valves for domestic hot water circulating system shall be of bronze construction with brass ball and TFE seat rings. Valves shall have positive shut-off, memory stop indicator, drain/purge connection, integral valved readout ports, complete with molded insulation snap-on section. Sweat or threaded ends as applicable, rated 300 psi W.O.G/350 degrees F pressure/temperature.

2. Balance valves shall be equal to B&G CB series "Circuit Setter". Size as shown on drawings.
  3. Calibrate/balance hot water circulating system. Set memory top indicator on balance valve after final setting.
- L. Gauge Valves: 1/4", Crane 7, Jenkins 106-A, Nibco T-235, Powell 150 or Walworth 95, complete with bronze body, renewable composition disc malleable iron handwheel and rising stem.
- M. Valves Specified Elsewhere: Provide special valves such as motor-operated valves, relief valves, temperature regulating valves, etc., as specified under the individual system or as indicated on the drawings.
- N. Provide shut-off valves at each piece of equipment branch line, or Plumbing Fixture.

### 2.3 UNIONS

- A. Provide unions adjacent to all tank and equipment and where required for disconnect and maintenance of equipment.
- B. Union for Steel Pipe: Ground joints malleable iron.
- C. Union for Copper Pipe: All Brass.
- D. Union Between Dissimilar Metals: Designed and advertised to be unaffected by Heat, Cold or Fluid in pipe. EPCO or approved equal.

### 2.4 THERMOMETERS

- A. Manufacturers: Marsh, Taylor, Trerice, U.S. Gauge, Weksler or Weiss.
- B. Pipeline mounted: Thermometers shall be mercury reading, 9" scale cast aluminum case industrial thermometers with clear acrylic plastic window front and adjustable angle stem to permit easy reading from the floor or operating platform. Furnish with extended necks suitable for insulated piping as required. Thermometers shall be compatible with sockets as specified herein.
1. At each temperature sensor or controller.
  2. At hot water heaters.
  3. At each heat exchanger.
  4. At each hot water storage tank.
- B. Manufacturers: Trerice, Marsh, Weksler, or equal.

### 2.5 MISCELLANEOUS

- A. Escutcheons: Provide for all pipe passing through floors, walls or ceilings.
- B. Access Doors: UL labeled for fire resistance of surrounding construction. Milcor Type "K" with screw driver operated lock. Stainless steel access panels in bathroom tile walls or wet locations.

### 2.6 MECHANICAL SUPPORTING DEVICES

- A. General: Securely fasten all mechanical work to the structure to prevent hazard to human life and limb, and to prevent damage to products of construction under all conditions of operation.
- B. Pipe Supports:

1. Single Pipes:
  - a. Support all horizontal runs of steel, copper pipe under 2" and all cast-iron solid pipe on suitable hangers spaced not more than 5 feet on centers.
  - b. Support all steel, and copper piping 2" and larger not more than 10 feet on centers.
  - c. Support piping in a manner to prevent binding, undue swing and the transmission of vibration to the structure. Provide sway bracing where hanger rods are longer than 24".
  - d. Support single pipes from clevis hangers, or split ring socket and rod hangers equal to Grinnell No. 105.
  - e. Install hangers for hot and cold piping outside the insulation using high-density section (6# per cubic foot) of insulation and 18 ga. sheet metal shield or saddle.
2. Trapeze Hangers: Where pipes are clustered, parallel, and in same plane, they may be supported by trapeze hangers. Provide rods and angle irons sized to suit load imposed.
3. Piping on walls: Secure with hook-plates, clips, or fabricated steel brackets.
4. Supports from Steel and Wood Beams and Similar Construction: Use appropriate beam clamps and brackets.
5. Hangers other than those specified not permitted.
6. Provide pipe supports according to the following schedule:

| <u>Pipe Size - Inches</u> | <u>Rod Size - Inches</u> |
|---------------------------|--------------------------|
| 1/2" thru 2"              | 3/8"                     |
| 2-1/2" thru 3-1/2"        | 1/2"                     |
| 4" thru 5"                | 5/8"                     |
| 6" and over               | 3/4"                     |
7. Manufacturers: Grinnell, C & P, Fee & Masons, Elcen, or Super Strut.

## 2.7 SEALING AND FIRESTOPPING

- A. Fire and/or smoke rated penetrations: Firestop putty, caulk sealant, intumescent wrapstrips and firestop collars, firestop mortar or a combination of these products to provide a UL listed system for each application required for this project.
  1. At beginning of project, Contractor shall meet with the building inspector and review all rated penetrations and related requirements.
- B. Manufacturers: 3M, STI/SpecSeal, Tremco or approved equal.
  1. All firestopping systems shall be provided by the same manufacturer.
  2. Fire stop systems shall be UL listed or tested by an independent testing laboratory.
- C. Use product assembly that has a rating of not less than the rating of the wall or floor penetration. Reference architectural drawings for identification of fire and/or smoke rated walls and floors.

## PART 3 - EXECUTION

### 3.1 EQUIPMENT MOUNTING

- A. Provide mounting accessories, supports, hanger expansion joints, adaptors and any other appurtenances to adapt fixtures and equipment supplied to the condition of use indicated.
- B. Independently support piping at equipment so that no weight is supported by the equipment.
- C. Securely fasten fixtures and equipment to the building structure in accordance with manufacturer's recommendations.

- D. At wall attached fixtures and equipment weighing less than 50 pounds, provide backing plates of at least 1/8 x 10 inch steel. Submit attachment details of heavier equipment for approval.

### 3.2 SLEEVES

- A. Provide sleeves where pipes pass through walls, floors or ceilings. Make sleeves as follows:
1. In bearings walls, foundations, masonry or concrete walls and slabs, use Schedule 40 black steel pipe. Sleeves through floor shall be caulked.
  2. In frame or similar construction, use 10 gauge galvanized sheet metal with edges turned 1/2".
- B. Install sleeves flush with surfaces, except mechanical rooms or any wet floor where seepage may occur install 1" above floor.
- C. Waterproof all sleeves through building exterior skin, including walls, floors and roofs, to prevent leakage.
- D. Size sleeves for cold and hot piping to allow continuous insulation through sleeves.
- E. Pack space between sleeve and pipe, leave no void spaces, as follows:
1. Prevent fire and smoke passage by packing with mineral wool, or other non-combustible, fire-stopping material.
  2. Caulk both sides between pipe and sleeve at wall surface. Use UL listed fire stop sealant, flexible at normal working temperatures, having smoke developed 50, fuel contributed 50, and flame spread 25 rating. Caulking thickness 5/8" minimum.
- F. In walls identified for sound insulation, provide 1/4" space between pipe and sleeve pack with sound sealing annular packing and caulk air-tight.

### 3.3 PLUMBING SYSTEM IDENTIFICATION

- A. General: Provide adequate marking of Plumbing system and control equipment to allow identification and coordination of maintenance activities and maintenance manuals. Tag and label Plumbing equipment located in exposed or in accessible areas to conform to ANSI A13.1-1981. After painting and/or covering are complete, identify all equipment, piping and related by its abbreviated generic name as shown/scheduled/specified.
1. All exposed fuel gas piping shall be field painted yellow with labeling of fuel type and pressure.
- B. Equipment: Identify all major Plumbing equipment with plastic-laminate signs or 2" high painted stencils and contrasting background. Provide text of sufficient clarity and lettering to convey adequate information at each location and mount permanently. Identify control equipment by 1-1/2" x 4" plastic nameplates with 1/2" high lettering.
- C. Piping: Identify piping once every 30 feet at each branch, at termination of lines, minimum one per room, and near valve or equipment connections. Place flow directional arrows at each pipe or duct identification. Provide 2" high letters on wrap-around siphonage, adhesive-backed labels.
- D. Valve Tags: Tag all valves with 1-1/2" dia. brass valve tags engraved with readily legible black lettering 1/4" high indicating fluid in pipe and 1/2" numbers. Securely fasten to the valve stem or bonnet with beaded chain.
1. Provide a framed, typewritten directory under glass, and install where directed.

### **3.4 TYPICAL PIPING**

- A. Provide insulating couplings or unions to prevent electrolysis between dissimilar metal, when use of dissimilar metal cannot be avoided in one system.
- B. Close all openings in pipes with appropriate caps, plugs or covers during storage and progress of the work to preclude introduction and contaminants.
- C. Slope all pipelines and provide low point drains for all piping and equipment.
- D. Provide shut-off valves and unions adjacent to all tanks, risers to Plumbing Fixtures and Equipment for disconnect purposes. Install all valves with stem vertical wherever possible, and in no case with stem below the horizontal.
- E. Ream ends of all pipe to full diameter.
- F. Provide pipe anchors, swing joints, and expansion compensators as required to control the expansion of pipelines.
- G. Reduce pipe sizing using reducing tees or reducing fittings. Bushings not permitted except on tanks and similar equipment.
- H. Provide escutcheons on all pipes passing through walls, floors, and ceilings in finished areas and where piping is in counters, closets, or cabinets, and subject to view when doors are open. Cover the pipe sleeve and secure plate in position.
- I. Test all piping in accordance with accepted trade standards if not specified elsewhere.
- J. Setting of flow measuring devices will be by the balancing contractor. Installation is by the mechanical contractor.

### **3.5 WELDING**

- A. Contractor may weld black steel piping using fusion-welding, gas, or electric arc welding process conforming to American Standard B31.1, Section B.
- B. Change direction and make intersections in piping using long turn welded fittings. Do not miter pipe to form elbows, notch straight runs to form tees, or use any similar short cut construction.
- C. Certification of Welders: Employ only welders qualified for pipe welding. Maintain proof of certification that each welder has passed qualification tests as prescribed by the National Certified Pipe Welding Bureau or by any other accredited testing laboratory using procedures covered by American Society of Mechanical Engineer's Boiler Construction Code, Section IX.

### **3.6 THREADED PIPE**

- A. Cut all threads true and of depth to make up properly without leaks.
- B. Make connections to show at least two (2) threads and not more than four (4) threads when tight.
- C. Make-up joints with teflon tape only, as recommended by tape manufacturer, or as specified in specific piping sections.

### **3.7 PIPE CLEANING, TESTING AND CHLORINATION**

- A. Prior to use, isolate and fill system with potable water. Allow to stand for 24 hours. Flush each outlet proceeding from the service entrance to the furthest outlet until water appears clear.
- B. Fill system with a solution of water and chlorine containing at least 50 parts per million of chlorine and allow to stand for 24 hours. Flush system until no chlorine remains.
- C. Conduct pressure test with test medium of water for all systems. On metal piping systems test medium of air may be used with prior approval of Engineer. If leaks are found, repair the pipe system with new materials and repeat the test; caulking will not be acceptable.
  - 1. Do not insulate or conceal pipe until piping system has been successfully tested.
  - 2. Entire test must be witnessed by the Owner's representative.
- D. Test Pressure and Duration:

| <u>System</u>               | <u>Test Pressure</u> | <u>Duration</u> |
|-----------------------------|----------------------|-----------------|
| Below ground domestic water | 100 psig             | 8 hours         |
| Above ground domestic water | 100 psig             | 8 hours         |
| Sanitary Waste and Vent     | 10 feet              | 2 hours         |
| Storm Drainage              | 10 feet              | 2 hours         |
| Clear Water Waste and Vent  | 10 feet              | 2 hours         |

### 3.8 RACKS

- A. Mechanical Contractor shall provide all racks, stands and supports for his equipment and work as required.
- B. Racks and supports shall be steel angle or channel cut to fit neatly and welded or bolted into a sturdy fit.

### 3.9 BUILDING AND SITE WORK

- A. Visit Site Survey: Before submitting a bid, Contractor shall visit the site and familiarize himself with all the features of existing utilities, site and construction which may affect the execution of his work. No extra payment will be allowed for failure to obtain this information.

### 3.10 EXCAVATION

- A. Plumbing Contractor shall perform all excavation of every description required for his work, and of whatever substances encountered, to the depths indicated on the Drawings or as otherwise specified.
  - 1. Review soil boring information for soil information.
  - 2. During excavation, material suitable for backfilling shall be piled in an orderly manner and sufficient distance from the banks of the trench to avoid overloading and to prevent slides or cave-ins.
  - 3. All excavated materials not required or suitable for backfill shall be removed and wasted as indicated on the drawings or as requested by the Architect/Engineer.
- B. Such grading shall be done as may be necessary to prevent surface water from flowing into trenches or other excavations, and any water accumulating therein shall be removed by pumping or by other approved methods.
- C. Such sheeting or shoring shall be done as may be necessary for the protection of the work and for the safety of personnel.
- D. Unless otherwise indicated, excavation shall be by open cut except that short sections of a trench may be tunneled if, in the opinion of the A/E, the pipe or duct can be safely and

properly installed and backfill can be properly tamped in such tunnel sections. Each excavation shall comprise all materials and shall include clay, silt, sand, rock, muck, gravel, hardpan, loose shale, and loose stone.

- E. Open trench sufficiently ahead of pipe laying to reveal obstructions.
- F. Provide trench crossing as necessary to accommodate public travel.
- G. Contractor shall file written notification with all utility companies at least three (3) days prior to excavating.

### **3.11 TRENCH EXCAVATING**

- A. Trenches shall be of necessary width or the proper laying of the pipe but not more than 16" wider than pipe diameter, and the banks shall be as nearly vertical as practicable.
  - 1. The bottom of the trenches shall be accurately graded to provide uniform bearing and support for each section of the pipe on undisturbed soil at every point along its entire length.
  - 2. Except where rock is encountered, care shall be taken not to excavate below the depths indicated.
- B. Where rock excavations are required, the rock shall be excavated to a minimum over depth of four inches below the trench depths indicated on the Drawings or specified.
  - 1. Over depths in the rock excavations and unauthorized over depths shall be backfilled with loose granular material properly compacted.
- C. Whenever wet or otherwise unstable soil that is incapable of properly supporting the pipe, as determined by the A/E, is encountered in the bottom of the trench, such soil shall be removed to the depth required and the trench backfilled to the proper grade with coarse sand, fine gravel or other suitable material, as hereinafter specified.
- D. Keep trenches free from water while construction is in progress. Pipe or appurtenances shall not be laid in water.
  - 1. Pump or bail water from bell holes to permit proper jointing of pipes.
  - 2. Pipe the discharge from trench dewatering to drains or natural drainage channels.
- E. Grading Trench Bottom: Slope bottom of trench for Class C bedding, except as otherwise noted. Perform final grading of trench bottoms by hand tools. Grade the bottom of trenches evenly to insure bearing for all pipes.
- F. Depth of Cover:
  - 1. Trenches for utilities shall be of a depth that will provide the following minimum depths of cover from existing grade or from indicated finish grade, whichever is lower, unless otherwise specifically shown.
    - a. Four (4) feet minimum cover: Water lines.
  - 2. Where depths cannot be maintained, piping shall be protected from freezing.
    - a. Conform to Plumbing Code requirements for frost proofing.
- G. Excavations for Appurtenances: Excavations for manholes and similar structures shall be sufficient to leave at least 12 inches in the clear between their outer surfaces and the embankment or sheeting and shoring which may be used to hold and protect banks.
  - 1. Any over-depth excavation below such appurtenances that has not been requested by the A/E shall be considered as unauthorized and shall be backfilled with sand, gravel, or concrete as directed by the A/E and at the expense of the Contractor.

- H. Protection of Existing Utilities: Existing utility lines to be retained that are shown on the Drawings or the locations of which are made known to the Contractor prior to excavation, as well as all utility lines uncovered during excavation operations, shall be protected from damage during excavation and backfilling, and if damaged shall be repaired by the Contractor, at his expense.

### 3.12 BACKFILLING OF TRENCHES

- A. Backfill trenches only after piping has been inspected, tested, and locations of pipelines and appurtenances have been recorded.
- B. For a depth of 12 inches above the top of the pipe, backfill by hand with material specified for Compacted Backfill. Tamp this backfill thoroughly in layers not exceeding 6" in thickness, taking care not to disturb the pipe.
- C. For the remaining trench backfill and compact with material as specified in the following paragraphs.
- D. Jetting the backfill with water will not be permitted unless approved in writing by the A/E.
- E. Normal Backfill:
1. Where compacted backfill is not specified, the trenches shall be carefully backfilled with the excavated materials approved for backfilling consisting of earth, loam, sandy clay, sand and gravel, soft shale and other approved materials, free from large clods of earth or stones over 2-1/2" maximum dimension, deposited in 12" layers and compacted.
  2. The surface shall be graded to a reasonable uniformity and the mounding over trenches left in a uniform and neat condition as approved by the A/E.
- F. Compacted Backfill: Compacted backfill shall be used under the slab on grade, slabs within building structure, concrete paving and asphaltic concrete paving. The soils used in the fill shall be granular in nature and shall not contain roots, sod, rubbish or stones over 2-1/2" maximum dimension. The A/E may reject any on-site or borrow materials, which he considers unsuitable for the intended use of the fill.
- G. Compaction Density for Backfill: All fills shall be compacted to a dry density equal to at least 95 percent of the maximum density determined in accordance with the Proctor Test, ASTM D698-66T or modified D1557-66T.
1. The maximum density and optimum moisture content shall be determined by the A/E on the basis of laboratory test conducted on the materials used in the fill.
- H. Control Test: Adequacy of compaction shall be determined on the basis of in-place density determinations that are to be conducted while the fills are being placed.
1. The results of these tests shall be the basis on which satisfactory completion of the backfill work. Should the fills fail to meet the specified densities, the Contractor shall remove and recompact the soils until the specified densities are achieved.

### 3.13 FLASHING OF ROOF

- A. All flashings on the roof shall be closely coordinated. Install flashings as required to insure proper vapor barrier and as directed by the A/E.
- B. Roof drains, relief vents, curbs and plumbing vents through roof shall be flashed and counterflashed to conform with details recommended by the building roof system manufacturer.

1. See roofing specification in Architectural Sections for specified system.
  2. Provide additional sheet lead, membrane layers and sealant as required to insure waterproof installation. Coordinate all required work.
- C. Roof attachments, equipment supports, piping systems and other roof penetrations shall be waterproofed as detailed, or as directed by A/E.
- D. Install premolded fabric boot flashings with vent cap for vents through roof as recommended by the manufacturer. Include roof mastic and elastomer as required.
- E. Four (4) pound premolded flashing with 8 inch skirt, 5 inch high steel reinforced vari-pitch boot, vandal proof hood with counter flashing ring equal to Stoneman Fig. No. S1100-5.
- F. Install fabric boot flashing for all roof drains. Flashing shall extend a minimum of 12 inches from the periphery of the drain. Flashing shall clamp into roof drain body.

### **3.14 SAFING OF FLOOR PENETRATIONS**

- A. Floor drains in suspended floors shall be safed with sheet lead or waterproof plastic membrane, clamped into drain.
1. Recess floor drain depressed in floor for proper drainage.
- B. Extend safing to walls from edge of drain. Safing shall be clamped to floor drain body and pitched to drain to weep holes. Floor drains installed in unexcavated areas do not require safing.
- C. Install safings: The concrete floor shall be smooth and free of dirt. Seal all joints per manufacturer's recommendations and turn up sides a minimum of 6 inches above curb, wall or maximum water level. Safing shall connect and clamp to drain body.
- D. Safings shall be subject to a standing water test to detect leaks and proper drainage to weep holes of floor drain.

### **3.15 DAMAGE TO OTHER WORK**

- A. Plumbing Contractor shall be held responsible for all damages to work of his own or any other trade resulting from execution of his work.

### **3.16 CLEANING UP**

- A. Leave all equipment clean and ready for use.
- B. Remove all labels, paint, plaster, etc., from fixtures, equipment and piping.
- C. Remove all rubbish and waste resulting from the site work.

**END OF SECTION**

**SECTION 22 25 00 - PIPE INSULATION**

**PART 1 - GENERAL**

**1.1 DESCRIPTION OF WORK**

A. Work shall include all labor, equipment, accessories, materials and services required to provide all insulation, fittings and finishes for piping and related mechanical equipment in the Plumbing Systems.

**1.2 RELATED DOCUMENTS**

A. Applicable provisions of Division 1 shall govern work under this section.

**1.3 SUBMITTALS**

A. Submit shop drawings in accordance with Division 1 requirements for all products specified.

**PART 2 - PRODUCTS**

**2.1 ACCEPTABLE MANUFACTURERS**

- A. Acceptable Manufacturers:
1. Owens-Corning
  2. Manville Corporation
  3. Certainteed

**2.2 PIPING INSULATION SCHEDULE**

A. *Service Insulation:*

|    |                       | <i>Insulation Thickness by Pipe Size</i> |                       |                     |                     |                 |           |
|----|-----------------------|--|-----------------------|---------------------|---------------------|-----------------|-----------|
|    |                       | <i>Types</i>                             | <i>1" and smaller</i> | <i>1-1/4" to 2"</i> | <i>2-1/2" to 4"</i> | <i>5" to 6"</i> | <i>8"</i> |
| 1. | Hot Water Supply      | 1,2                                      | 1"                    | 1"                  | 1"                  | 1.5"            | 1.5"      |
| 2. | Hot Water Circulating | 1,2                                      | 1"                    | 1"                  |                     |                 |           |
| 3. | Cold Water            | 1,2                                      | 0.5"                  | 0.5"                | 1"                  | 1"              | 1"        |

B. Types of Insulation:

1. Rigid molded glass fiber pipe insulation with ASJ type factory applied jacketing with a density of 3-4 lbs./cu. ft. and a "k" factor of 0.25 @ 75 degrees F mean. (Flame Spread 25, smoke development 50 per ASTM E84-75, -20 degrees to 500 degrees F usage.)
2. Flexible elastomeric thermal insulation with a "k" factor of 0.26 at 75 degrees F mean density of 5.0 lbs./cu. ft. and a maximum water vapor transmission of 0.17 per inch. Seal joints with manufacturer's standard sealant. (Armaflex AP - Flame Spread 25, smoke development 50 per ASTM E84-75, -40 degrees to 220 degrees F usage.)

**PART 3 - EXECUTION**

**3.1 GENERAL INSTALLATION**

A. Application of insulation materials to piping, equipment and tanks shall be done in accordance with manufacturers written recommendations. Where thickness of insulation is

not specified, use applicable thickness recommended by manufacturer and required by applicable codes.

- B. All insulation shall be continuous through wall and ceiling openings and sleeves. All covered pipe is to be located a sufficient distance from walls, other pipe, ductwork and other obstacles to permit the application of the full thickness of insulation specified. (If necessary, extra fittings and pipe are to be used.)

### 3.2 PIPING INSULATION INSTALLATION

- A. All pipe insulation shall be installed with joints butted firmly together. All valves and fittings shall be insulated with mitered sections of insulation equal in density and thickness to the adjoining insulation, or with insulating cement equal in thickness to the adjoining insulation, or with "Zeston" type, premolded PVC fittings installed in accordance with the manufacturer's instructions.
  - 1. Fittings are to be finished with 8 oz. glass mesh and mastic (use breather mastic on systems operating from 50 degrees F up except where Zeston PVC covers are used).
  - 2. Jackets on pipe insulation may be stapled using outward clinch staples spaced 3" apart at least 1/4" in from the lap edge on systems operating at 60 degrees F and above; below 50 degrees F the laps are to be vapor sealed using self-sealing lap, lap-seal tape gun or adhesive such as Armstrong 520.
  - 3. All insulation ends are to be tapered and sealed regardless of service.
- B. On all piping insulated with vapor barrier covering, use protection shield to cover bottom one-half of insulated pipe.
  - 1. Shield to be a minimum of 12" long and 16 gauge galvanized steel.
  - 2. Provide half-round 12" long, hanger block at the bottom half of the pipe in place of the fiberglass insulation. The hanger blocks shall be molded cork or high density pipe insulation of the same thickness as the adjoining fiberglass pipe insulation.
  - 3. The vapor barrier jacket shall be continuous through the hanger location.
- C. Vapor barrier jackets shall be applied with a continuous, unbroken vapor seal. Pipe hangers on cold lines (under 60 degrees F) are to be sized large enough to be installed over the outer surface of the insulation.
- D. Hot piping 1" and smaller: The hanger shall be secured directly to the pipe and the pipe insulation shall surround the hanger.
- E. Hot piping 1-1/4" and larger: Provide pipe covering protection saddles and hanger blocks at hanger locations.
- F. Cold Piping: Provide pipe covering protection saddles and hanger blocks at hanger locations.
- G. Insulation shall preferably be applied while surfaces are hot. Cold water lines shall be at room temperatures when insulation is applied.
- H. Omit insulation for the following:
  - 1. Screwed unions and flanges for hot piping systems.
  - 2. Vents to atmosphere, discharge from safety and relief valves and drain pipes.
- I. Provide removable insulation system for unions on cold piping systems.
- J. Seal all exposed end sections of pipe covering with Childers CP-30.

K. No covering shall be applied until after piping is cleaned and tested, inspected and approved.

**END OF SECTION**

## SECTION 22 35 00 - NATURAL GAS PIPING

### PART 1 - GENERAL

#### 1.1 DESCRIPTION OF WORK

- A. Extent of natural gas piping system work, is indicated on drawings and schedules and by requirements of this section.
  - 1. Existing 5 psig natural gas piping service and low pressure 1/2 psig natural gas service distribution piping will be modified remove existing equipment and add new equipment.
  - 2. Provide new gas pressure regulator valves as indicated on the Drawings

#### 1.2 RELATED DOCUMENTS

- A. Applicable provisions of Division 1 shall govern work under this section.
- B. Specified Elsewhere:
  - 1. 22 05 00 Basic Materials and Methods

#### 1.3 QUALITY ASSURANCE

- A. Manufacturers: Firms regularly engaged in manufacture of natural gas piping products, of types, materials, and sizes required, whose products have been in satisfactory use in similar service for not less than 5 years.
- B. Installer: A firm with at least 3 years of successful installation experience on projects with natural gas piping system work similar to that required for project.
- C. ANSI Code Compliance: Comply with applicable provisions of ANSI B31.2 "Fuel Gas Piping".
- D. Natural Fuel Gas Code Compliance: Comply with applicable provisions of NFPA 54 (ANSI Z223.1) "National Fuel Gas Code" and International Fuel Gas Code IFC.
- E. Local Utility Compliance: Comply with requirements of local gas utility company.

### PART 2 - PRODUCTS

#### 2.1 NATURAL GAS PIPING MATERIALS AND PRODUCTS

- A. General: Provide piping material and factory-fabricated piping products of sizes, types, pressure ratings, and capacities as indicated. Where not indicated, provide proper selection as determined by Installer to comply with installation requirements.
  - 1. Provide materials and products complying with ANSI B31.2 where applicable, base pressure rating on natural gas piping system maximum design pressures.
  - 2. Provide sizes and types matching piping and equipment connections; provide fittings of materials which match pipe materials used in natural gas piping systems.
  - 3. Where more than one (1) type of materials or products are indicated, selection is installer's option.

#### 2.2 BASIC IDENTIFICATION

- A. General: Provide identification complying with Division 15A Basic Materials and Methods, in accordance with the following listing:

1. Paint all exterior and interior exposed gas piping yellow and identify the use as specified above.

### **2.3 BASIC PIPE, TUBE AND FITTINGS**

- A. General: Provide pipe, tube, and fittings complying with Division 15A Basic Materials and Methods ", in accordance with the following listing:

1. Building Distribution Piping: (Exposed Pipe Only)
  - a. Pipe Size 2-1/2" and smaller: Black steel pipe.
  - b. Pipe Weight: Schedule 40.
  - c. Fittings: Malleable iron threaded.
2. Pipe Size 3" and Larger: Black steel pipe.
  - a. Pipe Weight: Schedule 40.
  - b. Fittings: Wrought-butt welding.

### **2.4 SPECIAL VALVES**

- A. General: Special valves required for natural gas piping systems include the following types:

B. Gas Cocks:

1. Gas Cocks 2" and Smaller: 150 psi non-shock WOG, bronze straightway cock, flat or square head, threaded ends.
2. Gas Cocks 2.5" and Larger: 125 psi non-shock WOG, iron body bronze mounted, straightway cock, square head, flanged ends.

- C. Pressure Regulating Valves: 150psi WOG non-shock, cast iron body, threaded ends, aluminum spring and nitrite diaphragm, vent port.

1. Ventless pressure regulators may be used were approved.

- D. Available Manufacturers: Subject to compliance with requirements, manufacturers offering gas cocks which may be incorporated in the work include, but are not limited to the following:

1. DeZurik;
2. Watts;
3. NIBCO;
4. Maxitrol;

## **PART 3 - EXECUTION**

### **3.1 INSTALLATION OF BASIC IDENTIFICATION**

- A. General: Install mechanical identification in accordance with Division 15A Basic Materials and Methods.

### **3.2 INSTALLATION OF NATURAL GAS PIPING**

- A. General: Install natural gas distribution piping in accordance with Division 15A Basic Materials and Methods, and in accordance with applicable codes and local utility company requirements.

- B. Use sealants on metal gas piping threads, which are chemically resistant to natural gas. Use sealants sparingly, and apply to only male threads of metal joints.
- C. Remove cutting and threading burrs before assembling piping.
- D. Do not install defective piping or fittings. Do not use pipe with threads, which are chipped, stripped or damaged.
- E. Plug each gas outlet, including valves, with threaded plug or cap immediately after installation and retain until continuing piping, or equipment connections are completed.
- F. Install drip-legs in gas piping where required by code or regulation.
- G. Install "Tee" fitting with bottom outlet plugged or capped, at bottom of pipe risers.
- H. Use dielectric unions where dissimilar metals are joined together.
  - 1. Install piping with 1" drop in 60' pipe run (0.14%) in direction of flow.
- I. Vent gas regulators to outside discharge per manufacturer's recommendation and per IFC.

### **3.3 INSTALLATION OF PIPING SPECIALTIES**

- A. Install piping specialties in accordance with Division 15A Basic Materials and Methods.

### **3.4 INSTALLATION OF SUPPORTS, ANCHORS AND SEALS**

- A. Install supports, anchors, and seals in accordance with Division 15A Basic Materials and Methods.

### **3.5 INSTALLATION OF VALVES**

- A. Gas Cocks: Provide at connection to gas train for each gas-fired equipment item, and also on risers and branches, where indicated.
- B. Locate gas cocks where easily accessible, and where they will be protected from possible injury.

### **3.6 EQUIPMENT CONNECTIONS**

- A. General: Connect gas piping to each gas-fired equipment item, with drip leg and shutoff gas cock. Comply with equipment manufacturer's instructions.
- B. Vent pressure-regulating valves to exterior.

### **3.7 PIPING TESTS**

- A. Test natural gas piping in accordance with ANSI B31.2, IFC, and local utility requirements.

**END OF SECTION**

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## SECTION 22 40 10 - DOMESTIC WATER PIPING

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 Specifications sections, apply to work of this section.
- B. Division 22 00 00 Basic Materials and Methods.

#### 1.2 DESCRIPTION OF WORK

- A. Extent of domestic water piping systems work, is indicated on drawings and schedules, and by requirements of this section.
- B. Applications for domestic water piping systems include the following:
  - 1. Domestic cold water piping.
  - 2. Domestic hot and return water piping.
- C. Insulation for domestic water piping is specified in applicable Division 15A sections, and is included as work of this section.
- D. Trenching and backfill required in conjunction with exterior water piping is specified in applicable Division 22 sections, and is included as work of this section.
- E. Trenching and backfill required in conjunction with domestic water piping inside of building foundations is specified in applicable Division 22 sections, and is included as work of this section.
- F. Plumbing Code Compliance: Comply with applicable portions of International Plumbing Code pertaining to plumbing materials, construction and installation of products.
- G. ANSI Compliance: Comply with applicable American National Standards pertaining to products and installation of domestic water piping systems.

### PART 2 - PRODUCTS

#### 2.1 DOMESTIC WATER PIPING MATERIALS AND PRODUCTS

- A. General: Provide pipe, tube and fitting complying with Division 15 Basic Materials and Methods Section "Pipe, Tube and Fittings", in accordance with the following listing:
- B. Domestic Water Piping:
  - 1. Tube Size 2-1/2" and Smaller Above Grade: Copper tube.
    - a. Wall Thickness: Type L, hard-drawn temper.
    - b. Fittings: Wrought-copper, solder-joints.
  - 2. Tube Size 2" and Smaller Below Grade: PEX tubing.
    - a. Crosslinked Polyethylene, ASTM F876 & ASTM F877.
    - b. Fittings: Insert type fittings with cold flaring or brass compression type fittings.
  - 3. Tube Size 2" and Smaller Below Grade: Copper tube.
    - a. Wall Thickness: Type K, soft-drawn temper.
    - b. Fittings: Wrought-copper, solder-joints(above grade).

## 2.2 PIPING SPECIALTIES

A. General: Provide piping specialties complying with Division 15 Basic Materials and Methods.

1. Pipe escutcheons.
2. Dielectric unions.
3. Pipe sleeves.

## 2.3 SPECIAL PIPING SPECIALTIES

A. Water Hammer Arresters: Provide bellows or piston type water hammer arresters, pressure rated for 250 psi, tested and certified in accordance with PDI Standard WH-201. Install water hammer arresters in accessible locations, arresters installed in inaccessible chases will not be allowed.

B. Available Manufacturers: Subject to compliance with requirements, manufacturers offering water hammer arresters which may be incorporated in the work include, but are not limited to the following:

1. Amtrol, Inc.
2. Smith (Jay R.) Mfg. Co.
3. Wade Div., Tyler Pipe
4. Zurn Industries, Inc., Hydromechanics Div.
5. Sioux Chief, Mfg. Co.

## 2.4 BASIC SUPPORTS, ANCHORS AND SEALS

A. General: Provide supports, anchors and seals complying with Division 15A Basic Materials and Methods section.

## 2.5 BASIC VALVES

A. General: Provide valves complying with Division 15A Basic Materials and Methods section, in accordance with the following listing:

1. Section Valves:
  - a. 2" and smaller: Ball Valves.
  - b. 2" and larger: Gate Valves.
2. Shutoff Valves:
  - a. 2" and smaller: Ball Valves.
3. Drain Valves:
  - a. 2" and smaller: Ball Valves.
4. Check Valves:
  - a. All sizes: Swing Check Valves.

B. Available Manufacturers: Subject to compliance with requirements, manufacturers offering balance cocks which may be incorporated in the work include, but are not limited to the following:

1. Hammond Valve;
2. Nibco;
3. Milwaukee Valve Co;
4. Watts.

## 2.6 BASIC EXPANSION COMPENSATION

- A. General: Provide expansion compensation products complying with Division 22 000 Basic Materials and Methods section.

### **PART 3 - EXECUTION**

#### **3.1 SURFACE CONDITIONS**

- A. Examine the areas and conditions under which work of this Section will be performed. Correct conditions detrimental to timely and proper completion of the Work. Do not proceed until unsatisfactory conditions are corrected.

#### **3.2 PLUMBING SYSTEM LAYOUT**

- A. Lay out the plumbing system in careful coordination with the Drawings, determining proper elevations for all components of the system and using only the minimum number of bends to produce a satisfactorily functioning system.
- B. Follow the general layout shown on the Drawings in all cases except where other work may interfere.
- C. Lay out pipes to fall within partition, wall, or roof cavities, and to not require furring other than as shown on the Drawings.
- D. Where work is to connect to existing, Plumbing contractor must field verify all connection points before beginning any rough-in work. Verify all connecting invert elevations and flow lines of new work connected to existing gravity drainage.

#### **3.3 TRENCHING AND BACKFILLING**

- A. Perform trenching and backfilling associated with the work of this Section in strict accordance with the provisions of Division 2 of these Specifications.
- B. Cut bottom of trenches to grade. Make trenches 12" wider than the greatest dimension of the pipe.
- C. Bedding and backfilling:
1. Install piping promptly after trenching. Keep trenches open as short a time as practicable.
  2. Under the building, install pipes on a 6" bed of damp sand. Backfill to bottom of slab with damp sand.
  3. Outside the building, install underground piping on a 6" bed of damp sand. Backfill to within 12" of finish grade with damp sand. Backfill remainder with native soil.
  4. Do not backfill until installation has been approved and until Project Record Documents have been properly annotated.

#### **3.4 INSTALLATION OF PIPING AND EQUIPMENT, GENERAL**

- A. General:
1. Proceed as rapidly as the building construction will permit.
  2. Thoroughly clean items before installation. Cap pipe openings to exclude dirt until fixtures are installed and final connections have been made.
  3. Cut pipe accurately, and work into place without springing or forcing properly clearing window, doors, and other openings. Excessive cutting or other weakening of the building will not be permitted.

4. Show no tool marks or threads on exposed plated, polished, or enameled connections from fixtures. Tape all finished surfaces to prevent damage during construction.
5. Make changes in directions with fittings; make changes in main sizes with eccentric reducing fittings. Unless otherwise noted, install water supply and return piping with straight side of eccentric fittings at top of the pipe.
6. Run horizontal sanitary piping at a uniform grade of 1/4" per ft., unless otherwise noted. Run horizontal water piping with an adequate pitch upwards in direction of flow to allow complete drainage.
7. Provide sufficient swing joint, ball joints, expansion loops, and devices necessary for a flexible piping system, whether or not shown on the Drawings.
8. Support piping independently at pumps, coils, tanks, and similar locations, so that weight of pipe will not be supported by the equipment.
9. Pipe the drains from pump glands, drip pans, relief valves, air vents, and similar locations, to spill an open sight drain, floor drain, or other acceptable discharge point, and terminate with a plain and unthreaded pipe 6" above the drain.
10. Securely bolt all equipment, isolators, hangers, and similar items in place.
11. Support each item independently from other pipes. Do not use wire for hanging or strapping pipes.
12. Provide complete dielectric isolation between ferrous and non-ferrous metals.
13. Provide union and shut off valves suitably located to facilitate maintenance and removal of equipment and apparatus.

B. Equipment access:

1. Install piping, equipment, and accessories to permit access for maintenance. Relocate items as necessary to provide such access, and without additional cost to the Owner.
2. Provide access doors where valves, motors, or equipment requiring access for maintenance are located in wall or chases or above ceilings. Coordinate location of access doors with other trades as required.

**3.5 PIPE JOINTS**

A. Copper tubing:

1. Cut square, remove burrs, and clean inside of female fitting to a bright finish.
  - a. Apply solder flux with brush to tubing.
  - b. Remove internal parts of solder-end valves prior to soldering.
2. Provide dielectric unions at points of connection of copper tubing to ferrous piping and equipment.
3. For joining copper tubing, use the following:
  - a. Water piping 3" and smaller: 95-5 solder;
  - b. Water piping larger than 3": "Sil-fos" brazing;
  - c. Underground: "Sil-fos" brazing.

B. Screwed piping:

1. Deburr cuts.
  - a. Do not ream exceeding internal diameter of the pipe.
  - b. Thread to requirements of ANSI B2.1.
2. Use Teflon tape on male thread prior to joining other services.
3. Use litharge and glycerin on joint prior to cleaning for air and oil piping.

C. PEX Piping: Installed per ASTM F-1807

1. Insert-type fittings with external compression ring and cold flaring.

2. Brass compression type fittings with threaded nut, compression ring and insert.
3. Provide copper type L manifolds, where manifold distribution is used with labeled quarter turn ball valve stops for each service line.
4. Install piping and fittings per manufacturers recommendations.

D. Leaky joints:

1. Remake with new material.
2. Remove leaking section and/or fitting as directed.
3. Do not use thread cement or sealant to tighten joint.

### 3.6 PIPE SUPPORTS

- A. Support suspended piping with clevis or trapeze hangers and rods.
- B. Space hangers and support for horizontal steel pipes according to the following schedule:

| <u>Pipe size:</u>   | <u>Maximum spacing on centers:</u> |
|---------------------|------------------------------------|
| 1-1/4" and smaller: | 8'-0"                              |
| 1-1/2" to 3":       | 10'-0"                             |
| 4" to 5":           | 14'-0"                             |

- C. Space hangers and supports for horizontal copper tubing according to the following schedule:

| <u>Tube size:</u> | <u>Maximum spacing on centers:</u> |
|-------------------|------------------------------------|
| 1" and smaller:   | 6'-0"                              |
| 1-1/2":           | 7'-0"                              |
| 2":               | 8'-0"                              |
| 2-1/2":           | 9'-0"                              |
| 3" and larger:    | 10'-0"                             |

- D. Provide sway bracing on hangers longer than 18".
- E. Support vertical piping with riser clamps secured to the piping and resting on the building structure. Provide at each floor unless otherwise noted.
- F. Provide insulation continuous through hangers and rollers. Protect insulation by galvanized steel shields.
- G. Arrange pipe supports to prevent excessive deflection, and to avoid excessive bending stress.
- H. Hubless piping:
  1. Provide hangers on the piping at each side of, and within 6" of, hubless pipe coupling so the coupling will bear no weight.
  2. Do not provide hangers on couplings.
  3. Provide hangers adequate to maintain alignment and to prevent sagging of the pipe.
  4. Make adequate provision to prevent shearing and twisting of the pipe and the joint.

### 3.7 INSTALLATION OF PIPING SPECIALTIES

- A. Install piping specialties in accordance with Division 22 0000 Basic Materials and Methods.
- B. Water Hammer Arresters: Install in upright position, in locations and of sizes in accordance with PDI Standard WH-201, and at each single fixture or group of fixtures with fast closing valves.

### **3.8 INSTALLATION OF SUPPORTS, ANCHORS AND SEALS**

- A. Install supports, anchors and seals in accordance with Division 22 0000 Basic Materials and Methods.

### **3.9 INSTALLATION OF VALVES**

- A. Install valve in accordance with Division 22 000 Basic Materials and Methods.
- B. Branch/Riser Valves: Install on each branch and riser, close to main, where branch or riser serves 2 or more plumbing fixtures or equipment connections, and elsewhere as indicated.
- C. Drain Valves: Install on each plumbing equipment item located to completely drain equipment for service or repair.
  - 1. Install at base of each riser, at base of each rise or drop piping system, and elsewhere where indicated or required to completely drain domestic water piping system.

### **3.10 INSTALLATION OF METERS AND GAUGES**

- A. Install meters and gauges in accordance with Division 15A Basic Materials and Methods.

### **3.11 MECHANICAL EQUIPMENT CONNECTIONS**

- A. Mechanical Equipment Connections: Connect hot and cold water piping system to mechanical equipment as indicated, and comply with equipment manufacturer's installation instructions.
  - 1. Provide shutoff valve and union for each connection, provide drain valve on drain connection.

**END OF SECTION**

## SECTION 22 45 10 - PLUMBING EQUIPMENT

### PART 1 - GENERAL

#### 1.1 DESCRIPTION OF WORK

- A. Domestic water heating equipment:
  - 1. One(1) sealed-combustion condensing gas-fired commercial water heater with modulating output capacity.
- B. Plumbing Contractor shall provide circulation pumps, valves, piping, thermometers, relief valves, all necessary piping and all related items as indicated or scheduled on the Drawings.

#### 1.2 RELATED DOCUMENTS

- A. Applicable provisions of Division 1 shall govern work under this section.

#### 1.3 SUBMITTALS

- A. Submit shop drawings in accordance with Division 1 requirements for all products specified.

### PART 2 - PRODUCTS

#### 2.1 GAS-FIRED WATER HEATER

- A. Water heaters shall be of the seamless 316L stainless steel tank construction. The condensing flue coil shall be hybrid 90/10 cupernickel/stainless steel designed for use in condensing heaters.
  - 1. The heaters shall be suitable for venting with 2"- 3" diameter PVC pipe for a total equivalent distance of 200 feet and concentric outlet vent.
  - 2. The heater shall be factory assembled and tested.
  - 3. The power burner shall be of a design that requires no special calibrations on start up. The heaters shall be approved for 0" clearances to combustibles.
  - 4. Water heater shall have 3-yr commercial use warranty.
  - 5. Condensate neutralizer cannister.
  - 6. Concentric roof termination kit.
- B. The control shall be an integrated solid-state temperature and ignition control device with integral diagnostics, LED fault display capability and a digital display of temperature settings.
- C. The tanks shall be foam insulated and equipped with ASME rated temperature pressure relief valve. The water heater shall be UL listed and exceed the minimum efficiency requirements of ASHRAE/IES 90.1b-1992.
- D. Ratings:
  - 1. Gas Input: 40 - 199 MBH.
  - 2. Turn down: 5:1
  - 3. Thermal Efficiency: 96%.
  - 4. Storage: 119 gallon.
  - 5. 255 GPH recovery @ 90 deg F rise.
- E. Acceptable Manufacturers:
  - 1. HTP Phoenix PH199-119 or approved equal.

## **PART 3 - EXECUTION**

### **3.1 WATER HEATERS**

- A. Provide piping, unions, valves, thermometers, relief valves, and all necessary hardware.
- B. Install relief valves and extend relief piping to above floor drain.
- C. Water heaters shall be located such that all controls, relief valves, access holes are accessible for service and replacement without moving heaters.
- D. When dual water heater installations call for, water heaters shall be manifolded together with piping to permit equal flow to and from each heater.
- E. Set water heaters on 4" high concrete housekeeping pads by this Contractor.
- F. Extend sealed combustion air and flue vents up to concentric roof termination per manufacturer's recommendations. Coordinate roof/wall penetrations and roof patching with Owner's Roofing Contractor.

**END OF SECTION**

## SECTION 23 05 00 - HVAC GENERAL PROVISIONS

### PART 1 - GENERAL

#### 1.1 DESCRIPTION OF WORK

##### A. HVAC work includes:

1. Furnish all labor and materials necessary for the complete installation of heating, ventilating and air conditioning system as shown on the drawings and/or specified herein.
2. Drawings: Refer to H-Series drawings for graphic representations, schedules and notations showing HVAC work.
3. Specifications: Applicable portions of Division 1 govern all work under this Section. Refer to Division 15000B Sections for primary technical specifications of HVAC work, as listed below:

|          |                                    |
|----------|------------------------------------|
| 23 05 00 | HVAC General Provisions            |
| 23 05 90 | Testing Adjusting and Balancing    |
| 23 06 00 | Pipe and Pipe Fittings             |
| 23 06 30 | Piping Specialties                 |
| 23 09 10 | Supports and Anchors               |
| 23 10 00 | Valves                             |
| 23 14 00 | Pumps                              |
| 23 20 00 | Vibration Isolation                |
| 23 25 00 | Mechanical Insulation              |
| 23 61 10 | Prefabricated Stack and Breechings |
| 23 62 00 | Heating Hot Water Boilers          |
| 23 63 00 | Water Treatment                    |
| 23 82 00 | Fans                               |
| 23 84 00 | Ductwork                           |
| 23 86 00 | Ductwork Accessories               |
| 23 87 00 | Air Outlets and Inlets             |
| 23 96 00 | Starting of Mechanical Systems     |

4. HVAC demolition and remodeling.
5. Concrete pads, bases, curbs and supports for HVAC work.
6. Equipment structural supports, prime painted.
7. Motors for all HVAC equipment.
8. Secure and pay all fee
9. Test, adjust and balance HVAC systems.
10. Cutting and patching existing conditions for HVAC equipment by the HVAC Contractor.

#### 1.2 RELATED DOCUMENTS

##### A. Applicable provisions of Division 1 shall govern work under this section.

1. Refer to Division 1 for special work hours requirements for this project.

##### B. Temperature Control specifications are provided for reference and coordination purposes only; all temperature control work will be the responsibility of a separate prime Temperature Control Contractor. Temperature Control Specifications Sections consist of the following:

|          |                                |
|----------|--------------------------------|
| 23 89 50 | Variable Frequency Drives      |
| 23 90 00 | Controls and Instrumentation   |
| 23 91 00 | Direct Digital Control Systems |
| 23 95 00 | Control Sequence               |
| 23 95 10 | DDC Point List                 |

C. General Work by Lead Contractor - HVAC Contractor :

1. Field painting of all exposed piping, ductwork, hangers, supports and related metal work, unless noted specifically in the Drawings or Specifications herein.
2. Building provisions for all recesses and chases intended as equipment space for ductwork and piping in new construction.
3. Lintels and openings for ducts and piping through existing walls, floors and ceilings.
4. Line voltage (greater than 100 volts) wiring, conduit and connections.
5. All equipment starters not furnished as integral part of HVAC equipment.

D. Coordination of Work:

1. General: Contract Documents are diagrammatic in showing certain physical relationships which must be established within HVAC work, and in its interface with other work including electrical work, and that such establishment is the exclusive responsibility of the Contractor.
2. Arrange HVAC work in neat, well organized manner with piping and similar services running parallel with primary lines of building construction, and with minimum of 7 foot overhead clearance where possible.
3. Give right-of-way to piping which must slope for drainage.
4. Advise other trades of openings required in their work for subsequent move-in of large units of HVAC work.
5. Install all sensor wells, dampers and valves provided by the Temperature Control Contractor.

**1.3 SHOP DRAWINGS AND SAMPLES**

- A. The Contractor shall submit to the Architect for approval, shop drawings, giving details, dimensions, capacities, accessories, wiring diagrams, etc., of all materials as indicated in respective specification sections.
- B. All shop drawings shall include proper identification of equipment by name and/or number, as indicated in the specification and/or shown on the plans.
- C. Shop drawings shall be submitted for approval as soon as practicably possible after award of contract. Shop drawings must be approved before installation of materials and equipment. Drawings shall be submitted in accordance with the requirements outlined in Division 1 of the Specifications.
- D. The examination and approval of shop drawings shall not relieve the Contractor from any obligation to perform the work strictly in accordance with the Contract Drawings and Specifications. The responsibility for errors in shop drawings shall remain with the Contractor.
- E. Electronic shop drawing submittals require file labeling to match specification section contained and all equipment identified properly compatible with construction documents. All shop drawings improperly labeled and identified will be returned for corrections.

**1.4 QUALITY ASSURANCE**

- A. Qualifications of Installers: For the actual fabrication, installation and testing of work under this Section, use only thoroughly trained and experienced workmen completely familiar with the items required and the manufacturer's current recommended methods of installation.
- B. In acceptance or rejection of installed work, the Architect will make no allowance for lack of skill on the part of the workmen.
- C. Reference Standards: Specifically, for HVAC work in addition to standards specified in individual work section, the following standards are imposed, as applicable to work in each instance:

AABC                      Associated Air Balance Council

|        |   |
|--------|---|
| ADC    | Air Diffusion Council   |
| AGA    | American Gas Association  |
| AMCA   | Air Movement and Control Association                                      |
| ANSI   | American National Standard Institute                                      |
| ARI    | Air Conditioning and Refrigeration Institute                              |
| ASHRAE | American Society of Heating, Refrigeration and Air Conditioning Engineers |
| ASME   | American Society of Mechanical Engineers                                  |
| ASTM   | American Society of Testing and Materials                                 |
| AWS    | American Welding Society  |
| IEEE   | Institute of Electrical and Electronics Engineers                         |
| MICA   | Midwest Insulation Contractors Association                                |
| MSS    | Manufacturer's Standardization Society                                    |
| NBS    | National Bureau of Standards  |
| NEBB   | National Environmental Balancing Bureau                                   |
| NEC    | National Electrical Code  |
| NEMA   | National Electric Manufacturer's Association                              |
| NFPA   | National Fire Protection Association                                      |
| SMACNA | Sheet Metal and Air Conditioning Contractor's National Association        |
| UMC    | Uniform Mechanical Code   |
| UL     | Underwriter's Laboratories  |

All federal, state, local codes, ordinances and utility regulations.

D. Environmental design conditions for all occupied areas are as follows:

|          | <u>Winter</u> | <u>Summer</u>           |
|----------|---------------|-------------------------|
| Inside:  | 70 degrees F  | 74 deg. F 50% RH        |
| Outside: | -10 degrees F | 91 deg. dbF/75 deg. wbF |

E. Approval of Materials: Refer to General Conditions, Supplementary General Conditions and other requirements of Division 1 for approval of materials and requirements of substituted equipment.

### 1.5 JOB CONDITIONS

A. Building Access: Arrange for the necessary openings in the building to allow for admittance of all HVAC equipment.

B. Temporary Services: No service shall be interrupted or changed without the prior approval of the Owner. Refer to Division 1 requirements.

C. Compatibility: Provide products which are compatible with other products of HVAC work, and with other work requiring interface with HVAC work. Provide products with proper or correct power characteristics, fuel-burning characteristics and similar adaptation for Project. Coordinate selections from among options for compatibility of products. Design and layout is based on equipment scheduled on drawings or in specifications.

- Contractor shall coordinate installation of equipment supplied by other approved equal manufacturers and shall make necessary field modifications to allow for installation of this equipment at no additional expense to the Owner.

D. Record Drawings: Refer to Division 1 requirements.

### 1.6 REMODELING REQUIREMENTS

A. Prebid Survey: HVAC Contractor shall survey the job site before submitting his bid to determine the extent of areas requiring demolition, relocating and remodeling. The extent of equipment and materials to be removed. Routings for existing and new piping services and systems. Examine accessibility, material storage and working space available.

- B. Maintenance of Service: The building will be continuously occupied during the construction period except as noted. Special efforts shall be made to avoid interference with building functions. Consult with the Owner prior to performing work in public areas of building or to turn off services, so that Owner can advise as to most suitable time for the necessary interruptions. All such work and interruptions to services shall be performed at times, which are approved by the Owner.
- C. Demolition: Carefully examine the present building site, together with all of the drawings and specifications. Within areas involving remodeling, each Contractor shall be responsible for removal of, relocation of, or revisions to existing equipment, wiring, piping, fixtures and all other existing facilities under appropriate headings of his work, which is necessary to accomplish the final arrangement indicated on the Architect's plans. To assist the Contractor in meeting the above requirement, the drawings note certain of these items, but the absence of such notes shall not limit the responsibility of each Contractor to perform all work as described in this paragraph.
- D. Disposition of Demolition Materials and Equipment: Materials demolished or removed shall become the property of the Contractor and shall be removed from the site, except items, which are to be reused or are specifically noted as remaining the property of the Owner.
- E. Cutting or Patching Existing Facility:
  - 1. HVAC Contractor will be required to do all remodeling, cutting and/or construction removal and all patching or construction replacement as required for his work except for specific cutting and patching described in the documents as being performed by a specific Contractor.
  - 2. HVAC Contractor shall not endanger any work by any demolition, cutting, digging or otherwise. Any cost caused by defective or ill-timed work shall be borne by the contractor responsible.
  - 3. HVAC Contractor requiring cutting and patching shall hire men skilled in such cutting and patching to do the work.
  - 4. All new work in existing areas shall match existing work in material, quality, texture, finish and color unless specifically noted or scheduled otherwise.

## **1.7 DEMOLITION**

- A. The Contractor is responsible for removal and relocation of all existing HVAC equipment and related items affected by the remodeling area.
- B. To assist the Contractor in meeting the above design intent, the drawings note certain of these items, but the absence of such notes shall not limit responsibility of the Contractor to perform all demolition work as required to accomplish new design plan.
- C. Contractor shall coordinate his remodeling efforts with the building functions and avoid interference wherever possible. All such interruptions of existing services shall be performed at times which are approved by the Postmaster.
- D. Interruption of domestic water service during the course of demolition and new work shall be minimized. Interruptions of domestic water service shall be coordinated and approved by the Postmaster, prior to disconnecting or turning off.
- E. All existing demolished or removed equipment shall be removed from site and disposed of properly at the cost of the Contractor.

## **PART 2 - PRODUCTS**

### **2.1 ELECTRICAL PROVISIONS OF HVAC WORK**

- A. General: The electrical provisions of HVAC work, where indicated to be furnished integrally with HVAC equipment, can be summarized, but not by way of limitation, to include the following: 1) Motors, 2) Motor starters, 3) Control switch, pilot lights, interlocks, and similar devices, and 4) Drip pans to protect electrical work.
1. Temperature Control Contractor (T.C.C.) shall furnish and install control wiring as part of the Temperature Control Contractor work.
  2. Power wiring, connections to equipment, motor control wiring and related work by Electrical Contractor.
  3. Motor starters, disconnects, relays, pushbuttons, pilot lights and related motor control items not furnished integrally with HVAC equipment shall be furnished by Electrical Contractor.
  4. Provide equipment list, locations and wiring diagrams to Electrical Contractor for all HVAC equipment requiring electrical connections.
- B. Motors:
1. Standards: Where not otherwise indicated, comply with applicable provisions of the NEC, NEMA Standards, and sections of Division 16 of specifications. All motors 1 HP and larger shall be NEMA Premium Efficiency motors meeting or exceeding values tested in accordance with IEEE Standard 112, Method B procedures as stated in NEMA MG 1-12.53a and shall be EPACT approved.
  2. Temperature Rating: Class B insulation for 70 degree C temperature rise, except where otherwise indicated or required for service.
  3. Phases and Current: 1/6 HP and smaller is Contractor's option; up to 1/2 HP, capacitor-start, 120 or 277 volt, 60 cycle single-phase; 1/2 HP and larger, squirrel-cage induction NEMA rated 208 or 477 volt, three-phase, 60 cycle.
  4. Service Factor: 1.15 for motors in drip-proof enclosures, all other enclosures to have minimum 1.0 service factor.
  5. Construction: Select motors for conditions in which they will be required to perform: i.e., general purposes, splash proof, explosion proof, standard duty, high torque or other special type as required by manufacturer's recommendations. Enclosures shall be of the type recommended by manufacturer for the specified application.
  6. Frames: NEMA Standard for horsepower specified.
  7. Bearings: Permanently lubricated and sealed ball bearings, 1/8 HP and less may be shaded pole type permanently oiled unit bearings.
  8. Overload Protection: Built-in thermal; with internal sensing device for stopping motor, and for signaling where required.
- C. Starters, Switches: All starters shall have thermal overload and low voltage protection, and shall comply with Electrical Division 16 sections of specifications.
- D. Wiring Connections:
1. Motors: Wired connections in flexible conduit, except where plug-in electrical cords are indicated and permitted by governing regulations.
  2. General Wiring: Comply with applicable provisions of Electrical Division 16 sections of specifications.
- E. Drip Pans: Furnish drain pans below piping which passes directly above electrical work. Locate pan immediately below piping and extend a minimum of 6 inches on each side of piping and lengthwise 18 inches beyond equipment. Fabricate of galvanized sheet metal or copper with 2 inch deep watertight pan, copper drain piping and drain valve

## 2.2 FLOOR, WALL, ROOF AND CEILING OPENINGS

- A. Provide sleeves for pipes and ducts passing through masonry, concrete or other similar construction. Openings for pipes shall be 1" larger in diameter than pipe passing through, including insulation, where indicated. Openings for ductwork shall be 1/2" larger on all sides than size of duct passing through, including duct insulation, where indicated. Coordinate additional space requirements for fire or smoke damper installation.
1. Pipe sleeves: Standard weight steel pipe.
  2. Duct sleeves: 24 gauge galvanized sheet metal, unless noted otherwise.
- B. Grout openings between sleeves and concrete or masonry walls and floors with sand-cement mortar consisting of one part portland cement and three parts sand, by volume. Add sufficient water to make a stiff placeable mortar.
- C. Close joints between sleeves and non-masonry walls and floors with suitable caulking applied over polyethylene foam backer, compatible with caulking used.
- D. Pack annular space between sleeves and insulation pipe or ducts with glass fiber blanket insulation and seal with Urethane caulking compound.
- E. Where penetrations occur through fire rated walls or floors, fill annular space with fire-resistive insulation similar to U.S. Gypsum Thermafiber batts. Seal annular space through fire rated walls or floors with a UL listed fire resistant sealant.

### **2.3 CUTTING AND PATCHING**

- A. General: Perform all cutting and patching required for complete installation of HVAC systems, unless specifically noted otherwise. Provide all materials required for patching unless otherwise noted. All cutting and patching necessary of structural members to install any HVAC work shall not be done without permission, and then only carefully done under the direction of the Architect.
- B. All new work cut or damaged shall be patched and restored to its original condition.

### **2.4 EQUIPMENT ACCESS**

- A. General: All valves, volume dampers, equipment and accessories shall be installed to permit access to equipment for maintenance, servicing or repairs. Any relocation of piping ductwork, equipment or accessories required to provide maintenance access shall be accomplished by the HVAC Contractor at no additional cost to the Owner.
- B. Provide access doors where equipment is located in chases or generally inaccessible. Access doors used in fire-rated construction must have UL label. Minimum access panel size 12" x 12" or of sufficient size to allow total access for maintenance. Coordinate location with General Contractor.
- C. Access panels shall be furnished and installed by the HVAC Contractor in plaster walls, ceilings and related inaccessible surfaces.
- D. Access Doors: Milcor or approved equal, steel frames and door, prime coated, except stainless steel in areas subject to excessive moistures, such as toilet rooms.

### **2.5 EQUIPMENT SUPPORTS**

- A. General: Provide all supporting steel and related materials not indicated on structural drawings as required for the installation of equipment and materials, including angles, channels, beams and hangers.

### **2.6 EQUIPMENT GUARDS**

- A. General: Provide equipment guards over belt-driven assemblies, pump shafts, exposed fans and elsewhere, as indicated in this specification or required by code.

## **2.7 CONCRETE FOR HVAC WORK**

- A. General: All concrete work for HVAC equipment by the General Contractor.
- B. General Standards: Except as otherwise indicated, comply with applicable provisions of Division 3 for concrete work.
- C. Concrete Equipment Pads: For each piece of HVAC equipment as indicated on the drawings, arrange for the General Contractor to install a 4" concrete housekeeping pad a minimum of 4 inches wider than full size of the respective equipment's base. Equipment pads are required for the following equipment.
  - 1. Exterior Air-cooled Condensing Unit.

## **2.8 PAINTING HVAC WORK**

- A. General: All painting of mechanical equipment will be done by the HVAC Contractor unless equipment is hereinafter specified to be furnished with factory applied finish coats. Coordinate the exterior finish painting and color of exterior HVAC equipment with the General Contractor.
  - 1. Exposed ductwork in finished areas outside mechanical rooms shall be cleaned for accepting a paint finish or have factory-applied paint grip finish.
- B. Prime paint all field fabricated metal work under HVAC work, comply with applicable provisions of Division 9.
- C. All equipment shall be provided with factory applied prime finish, unless otherwise specified.
- D. Interior duct surfaces, dampers and other accessories visible through grilles, registers and diffusers shall be painted with flat black paint.
- E. If factory finish on any equipment is damaged in shipment or during construction of the building, the equipment shall be refinished by the Contractor to the satisfaction of the Architect.

## **2.9 HVAC SYSTEM IDENTIFICATION**

- A. General: Provide adequate marking of HVAC system and control equipment to allow identification and coordination of maintenance activities and maintenance manuals. Tag and label HVAC equipment located in exposed or in accessible areas to conform to ANSI A13.1-1981. After painting and/or covering is complete, identify all equipment, piping and ductwork by its abbreviated generic name as shown/scheduled/specified.
- B. Equipment: Identify all major HVAC equipment with plastic-laminate signs or 2" minimum high painted stencils and contrasting background. Provide text of sufficient clarity and lettering to convey adequate information at each location and mount permanently. Identify control equipment by 1-1/2" x 4" plastic nameplates with 1/2" high lettering.
- C. Piping and Ductwork: Identify piping and ductwork once every 30 feet at each branch, at termination of lines, and near valve or equipment connections. Place flow directional arrows at each pipe or duct identification. Provide 2" minimum high letters on wrap-around siphonage, adhesive-backed or paint stenciled.
  - 1. Within boiler room provide piping identification every 10 feet and at each branch and termination.

- D. Valves: Identify all valves with 1-1/2" minimum polished brass stamp-engraved or plastic laminate tags. Prefix or color-code tags for each generic piping service. Prepare and submit valve tag schedule, listing location, service and tag description, incorporate in Instruction Manual. Mount valve tag schedule behind glass in mechanical room at location determined by Owner.
- E. Operational Tags: Where needed for proper or adequate information on operation and maintenance of HVAC systems, provide tags of plasticized or laminated card stock, typewritten to convey the message.

### **PART 3 - EXECUTION**

#### **3.1 HVAC WORK CLOSEOUT**

- A. Lubrication: Upon completion of the work and before turning over to the Owner clean and lubricate all bearings except sealed and permanently lubricated bearings. Use only lubricant recommended by the manufacturer.
- B. Contractor is responsible for maintaining lubrication of all mechanical equipment under his contract until work is accepted by the Owner.
- C. Cleaning: After installation has been completed, Contractor shall clean all systems. All piping and ductwork shall be cleaned both internally and externally to remove all dirt, plaster dust or other foreign materials. All temporary throwaway or replaceable media air filters used during the construction period shall be replaced by new filters or new filter media after construction has been completed and before the building is turned over to the Owner. Check all strainers for clean screens.
- D. All dirt, plaster dust and other foreign matter shall be blown and/or vacuum cleaned from coils, terminal devices, diffusers, registers and grilles. Equipment shall be thoroughly cleaned of all stains, paint spots, dirt and dust.
- E. Housecleaning and Cleanup: Periodically as work progresses and/or as directed by the Architect, the Contractor shall remove waste materials from the building and leave his area of work broom clean. Upon completion of work, remove all tools, scaffolding, broken and waste materials, etc., from the site.

#### **3.2 INSTRUCTION AND MAINTENANCE MANUALS**

- A. Instruction Manuals: Upon completion of work, but before final acceptance of the system, furnish to the Engineer for approval, three (3) instruction and maintenance manuals in loose leaf binders. One approved copy shall be returned for use during instructional period. Manual shall have an index of contents and tab for each piece of equipment or system, as well as the following:
  - 1. Manufacturer's O&M instructions, parts list and data sheets.
  - 2. Copies of all shop drawings.
  - 3. Wiring diagrams.
  - 4. Start-up and shutdown procedures.
  - 5. Composite electrical diagrams, and flow diagrams.
  - 6. Test records.
- C. Equipment Parts Lists: Include a complete list of all equipment furnished for project, with a tabulation of descriptive data of all the equipment replacement parts proposed for each type of equipment or system. Properly identify each part of part number and manufacturer.

- D. Instruct Owner's maintenance personnel in the operation and maintenance of all equipment, including composite operating cycle of all equipment. Include not less than 8 hours of instruction, using the O&M manuals during this instruction. Demonstrate startup and shutdown procedures for all equipment.
- E. Service Organizations: At time of substantial completion, Contractor shall provide Owner with listing of qualified service organizations, including addresses and telephone numbers for each piece of major equipment.

### **3.3 RECORD DRAWINGS**

- A. Refer to Division 1 for further requirements.
- B. Maintain a record set of as-built drawings for all HVAC work performed. As-built drawings shall be continuously updated as the project progresses and be available for periodic inspection by the A/E.

### **3.4 GUARANTEE PERIOD**

- A. Guarantee all equipment, materials, and workmanship to be free from defects for one year after acceptance by the Owner. Repair, replace or alter systems found defective at no extra cost to the Owner.
- B. At the time of substantial completion, turn over the prime responsibility for operation of HVAC equipment and systems to the Owner's operating personnel. During guarantee period, provide one operating engineer, familiar with the work, to consult with and continue training Owner's personnel on an as-need basis.

**END OF SECTION**

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## SECTION 23 05 00 - TESTING, ADJUSTING AND BALANCING

### PART 1 - GENERAL

#### 1.1 DESCRIPTION OF WORK

- A. General Requirements: Contractor shall be responsible for providing complete test-adjust-balance (TAB) work of all hydronic and air systems including distribution systems and the equipment and apparatus connected.
- B. Work Included:
1. The extent of TAB work is indicated by the requirements of this section, and also by drawings and schedules, and is defined to include, but is not necessarily limited to, hydronic and air distribution systems, and associated equipment and apparatus of HVAC work.
  2. The work consists of setting speed and volume (flow) adjusting facilities provided for the systems, recording data, conducting tests, preparing and submitting reports, and recommending modifications to the work as required by the Contract Documents.
  3. The component types of testing, adjusting and balancing specified in this section include but are not limited to the following HVAC equipment:
    - a. Air handling units.
    - b. Hydronic distribution.
    - c. Air diffuser distribution.

#### 1.2 RELATED DOCUMENTS

- A. Applicable provisions of Division 1 shall govern work under this section.
- B. Specified Elsewhere:
- |    |          |                                |
|----|----------|--------------------------------|
| 1. | 23 06 00 | Piping Specialties             |
| 2. | 23 14 00 | Pumps                          |
| 3. | 23 82 00 | Fans                           |
| 4. | 23 90 00 | Controls and Instrumentation   |
| 5. | 23 95 10 | Control Sequence               |
| 6. | 23 96 00 | Starting of Mechanical Systems |

#### 1.3 QUALITY ASSURANCE

- A. Tester: Performed by an Independent Trade who is specifically and actively engaged in the balancing business and regularly does such work. Certified by the NEBB (National Environmental Balancing Bureau), AABC (Associated Air Balance Council) or approved equal in those testing and balanced disciplines similar to those required for this project.
- B. Reference Standards: Comply with AABC's Pub. No. 12173, "National Standards for Field Measurements and Instrumentation, Total System Balance", as applicable to HVAC air and hydronic distribution system and associated equipment and apparatus.
- C. Industry Standards: Comply with ASHRAE recommendations pertaining to measurements, instruments and testing, adjusting and balancing, except as otherwise indicated.
- D. Submittals:
1. Submit certified test reports and types of instruments used and their most recent calibration data with submission of final test report.
  2. Final test report shall bear the name of the person who recorded the data and the seal of the supervisor of the balancing trade.

- E. Guarantee: Guarantee that all TAB work be performed in accordance with NEBB or AABC standards and that all air systems operate within plus or minus 10 percent of the design flow rates as shown on the plans and/or as scheduled.

#### 1.4 JOB CONDITIONS

- A. Do not proceed with testing, adjusting and balancing work until the work to be TAB'ed has been completed and is operable. Ensure that there is no latent residual work still to be completed.
1. Do not proceed until the work scheduled for TAB'ing is clean and free from debris, dirt and discarded building materials.

### PART 2 - PRODUCTS

#### 2.1 MATERIALS

- A. Patching Materials:
1. Except as otherwise indicated, use same products as used by original Installer for patching holes in insulation, ductwork and housing which have been cut or drilled for test purposes, including access for test instruments, attaching jigs, and similar purposes.
  2. At Tester's option, plastic plugs with retainers may be used to patch drilled holes in ductwork and housing.
- B. Test Instruments: Utilize test instruments and equipment for the TAB work required, of the type, precision and capacity as recommended for the following TAB standards: AABC's National Standards for Field Measurements and Instrumentation, Total Balance System.

### PART 3 - EXECUTION

#### 3.1 ADJUSTMENT AND TESTING

- A. Tester must examine the installed work and conditions under which testing is to be done to ensure that work has been completed, cleaned and is operable. Notify the Contractor in writing of conditions detrimental to the proper completion of the test-adjust-balance work. Do not proceed with the TAB work until unsatisfactory conditions have been corrected in a manner acceptable to the Tester.
- B. Test, adjust and balance the environmental systems and components, as indicated, in accordance with the procedures outlined in the applicable standards.
- C. Prepare report of the test results including instrumentation calibration reports in format recommended by the applicable standards.
- D. Patch holes in insulation, ductwork and housings, which have been cut or drilled for test purposes, in a manner recommended by the original Installer.
- E. Mark equipment settings, including damper control positions, valve indicators, fan speed control levers, and similar controls and devices, to show final settings at completion of TAB work. Provide markings with paint or other suitable permanent identification materials.

#### 3.2 AIR SYSTEMS

- A. Test, adjust and balance systems in accordance with the following procedure:
1. Preliminary:
    - a. Identify and list size, type and manufacturer of all equipment to be tested, including air terminals; check all system components for proper installation and operation.

- b. Use manufacturer's ratings for all equipment to make required calculations except where field test shows ratings to be impractical.
  - c. Verify that all instruments are accurately calibrated and maintained.
  - d. Install clean filters furnished by the mechanical contractor in all equipment.
2. Central System:
- a. Test, adjust and record supply fan RPM design requirements within limits of mechanical equipment provided.
  - b. Test and record motor voltage and running amperes including motor nameplate data and starter heater ratings.
  - c. Make Pitot tube traverse of main supply, return and fresh air return ducts, determine and record CFM at fan and adjust fan to design CFM.
  - d. Test and record total system static pressure and suction and discharge static pressure across coils, filters and related air handling sections.
  - e. Test and adjust systems for design recirculated air; CFM.
  - f. Test and record cooling apparatus entering air temperatures; dry bulb and wet bulb.
  - g. Test and record heating apparatus entering and leaving air temperatures; dry bulb.
3. Each Fan:
- a. Each outlet and inlet average velocity, area, CFM.
  - b. Test and record total system static pressure at suction and discharge of fan coils.
  - c. Fan RPM motor RPM.
  - d. Motor name plate current testing.
  - e. Motor current draw.
4. Distribution: Adjust zones or branch ducts to proper design CFM, supply; return and exhaust.
5. Air Terminals:
- a. Identify each air terminal from reports as to location and determine required flow reading.
  - b. Test, adjust and balance each air terminal to within 10% of design requirement. Record readings.
  - c. Set minimum and maximum flow rates for VAV terminals at specified supply duct pressures and 90% system diversity(10% terminal units at minimum flow rate).
6. Verification:
- a. Prepare summation of reading of observed CFM for each system, compare with required CFM and verify that values are within 10% of specified quantities. Determine final coil and filter static pressure drops.
  - b. Verify design CFM at fans as described above.

### 3.3 HYDRONIC SYSTEMS

A. Test, adjust and balance system in accordance with following procedures:

- 1. Preliminary:
  - a. List all mechanical specifications of tested equipment verify against contract documents. Check all system components for proper installation and operations. Clean all screens.
  - b. Open all line valves to full open position. Close coil bypass stop valves, then set mixing control valve to full coil flow.
  - c. For each pump, verify rotation, test and record pump shut-off head and test and record pump wide-open head.
  - d. Verify proper water level in expansion tanks and in the system.
  - e. Verify that air vents in high points of water systems are installed and operating freely.
  - f. Verify that all instruments are accurately calibrated and maintained.
- 2. Central Equipment:
  - a. Set and record hot water pumps to proper flow quantity.
  - b. Adjust and record flow of hot and chilled water through boilers and chiller equipment to design quantities.
  - c. Observe and record leaving water temperature and return water temperatures at boiler, chiller equipment and zone water distribution loops. Reset to correct design temperatures.

- d. Record pump operating suction and discharge pressures. Determine final dynamic head.
- 3. Distribution:
  - a. Balance and record flow to each hot and chilled water hydronic zone and terminal unit. For heating mode and cooling mode (chiller).
  - b. Adjust and record terminal unit flow rates and pressure drops.
  - c. Adjust and record coil flow rates and pressure drops. Verify entering and leaving water temperatures at coil terminals.

### **3.4 AUTOMATIC CONTROL SYSTEM**

- A. Temperature control manufacturer's representative sets and adjusts automatically operated devices to achieve required sequence of operations.
- B. Testing organization verifies all controls for proper calibration and list those controls requiring adjustment by temperature control system installer.

**END OF SECTION**

## SECTION 23 06 00 - PIPE AND PIPE FITTINGS

### PART 1 - GENERAL

#### 1.1 DESCRIPTION OF WORK

- A. Extent of pipe and pipe fitting work is indicated on drawings and by the requirements of this section.
- B. Types of pipe and pipe fittings required for this project include the following:
  - 1. Heating hot water
  - 2. Make-up water
  - 3. Condensate and drainage

#### 1.2 RELATED DOCUMENTS

- A. Applicable provisions of Division 1 shall govern work under this section.
- B. Specified Elsewhere:
  - 1. 23 05 00 HVAC General Provisions
  - 2. 23 06 30 Piping Specialties
  - 3. 23 09 10 Supports and Anchors
  - 4. 23 10 00 Valves
  - 5. 23 63 00 Water Treatment

#### 1.3 QUALITY ASSURANCE

- A. American National Standards Institute, ANSI:
  - 1. B31.1: Power Piping.
- B. Welder Qualifications:
  - 1. Prior to starting any metallic welding, Contractor shall submit his Standard Welding Procedure Specification together with the Procedure Qualification Record as required by Section IX of the ASME Boiler and Pressure Vessel Code and/or the National Certified Pipe Welding Bureau.
- C. Employ piping materials meeting the latest revision of ASTM specifications as listed in this specification.

#### 1.4 PRODUCT DELIVERY, STORAGE AND HANDLING

- A. Where possible, store pipe and tube inside and protected from weather. When necessary to store outside, elevate well above grade and enclose with durable, waterproof wrapping.
- B. Prevent dirt and construction debris from accumulating inside the pipe and pipe fittings, cap open ends whenever possible. Store plastic pipe out of direct exposure to sunlight and support to prevent sagging and bending.

#### 1.5 SUBMITTALS

- A. Submit schedule of pipe and pipe fittings showing manufacturer and catalog number.
- B. Submittal may be in the form of a typewritten list, with proper references, indicating service and pipe or pipe fitting specifications.

## **PART 2 - PRODUCTS**

### **2.1 HOT WATER SYSTEM**

#### **A. 2" and smaller:**

1. ASTM A-53 Type F, standard weight, schedule 40, black steel pipe with class 125, standard weight cast iron threaded fittings.
2. ASTM B88 seamless, Type L, hard temper copper tube with wrought copper 95-5 solder-joint fittings.
3. Mechanical compression type fittings with integral o-ring seal, Viega ProPress or approved equal.

#### **B. 3" and larger:**

1. ASTM A-53, standard weight, schedule 40, black steel pipe with standard weight, class 150, seamless, carbon steel weld fittings.

### **2.2 MAKE-UP WATER**

- A. ASTM B88 seamless, Type L, hard temper copper tube with wrought copper 95-5 solder-joint fittings.

### **2.3 CONDENSATE AND DRAINAGE**

- A. 1" or less: Schedule 40 PVC piping; protect from foot traffic and physical damage. Solvent weld drainage pattern fittings.

### **2.4 WELDED FITTINGS**

- A. Weld-o-lets will be permitted in lieu of welding tees where the branch line is at least two sizes smaller than the main line. Field installations of Weld-o-lets are permitted only where inside of pipes are cleaned after welding.
- B. Pipe ends for welding shall be carefully prepared, in accordance with ANSI Standards, to insure proper weld preparation.
- C. Long radius, butt-welding elbows shall be used at all changes in direction.

### **2.7 DIELECTRIC UNIONS**

- A. 1" and smaller: ASTM A197/ANSI B16.3 WOG malleable insulating unions with vulcanized fiber insulating sleeve and neoprene gasket, equal to Stockam Figure 693-1/2, or EPCO model FX or FB dielectric unions with Epconite No. 2 gasket, 250 PSIG at 210 degrees F.
- B. 1-1/2" and larger: EPCO model GX dielectric flange with Epconite No. 2 gasket, 175 PSIG at 210 degrees F.
- C. Clear flow dielectric fittings may be used in lieu of dielectric unions for pipe sizes 2" and smaller.

### **2.8 UNIONS AND FLANGES**

#### **A. 2" and smaller:**

1. ASTM A197/ANSI B16.3 malleable iron unions with brass seats. Use black malleable iron on black steel piping and galvanized malleable iron on galvanized steel piping. Copper unions with all copper piping. Stainless steel unions with all stainless steel piping.
2. Use unions of a pressure class equal to or higher than specified for the fittings of the respective piping service.

B. 2-1/2" and larger:

1. ASTM A181 or A105, grade 1 hot forged steel flanges of threaded welded neck, or slip-on pattern. Use raised face flanges ANSI B16.5 for mating with other raised face flanges or equipment with flat ring or full face gaskets.
2. Use ANSIN B16.1 flat face flanges with full face gaskets for mating with other flat face flanges on equipment.
3. Use pressure class compatible with that specified for valves, piping specialties and fittings of the respective piping service. Gasket material to be suitable for pressures and temperatures of the piping system.
4. ASTM A516 grade 60/ANSI B16.5 cold formed steel flanges will be acceptable.

### **PART 3 - EXECUTION**

#### **3.1 PREPARATION**

- A. Set pipe on end and hammer sides to remove foreign materials before erection. Ream ends of all piping to remove burrs.

#### **3.2 ERECTION**

- A. Install all piping parallel to building walls and ceilings and at such heights not to obstruct any portion of window, doorway, stairway, or passageway. Where interferences develop in the field, offset or reroute piping as required to clear such interferences. In all cases, consult drawings for exact location of pipe spaces, ceiling heights, door and window openings or other architectural details before installing piping.
- B. Provide anchors, expansion joints, swing joints and expansion loops so that piping may expand and contract without damage to itself, equipment or building.
- C. Mitered ells, notches tees and "orange peel" reducers are not acceptable. On threaded piping, bushings are not acceptable.
- D. "Weld-o-lets" and "Thread-o-lets" may be used for branch takeoff up to one half (1/2) the diameter of the main.
- E. Install drains throughout the systems to permit complete drainage of the entire system.
- F. Do not install piping through dedicated electrical rooms or spaces unless the piping is serving this room or space.
- G. Install 2" deep galvanized sheet metal drain pans below piping which passes over electrical switching apparatus. Pipe drain pans to an accessible location with a drain valve and hose bibb adapter such that the system may be drained without damage to other equipment, insulation or finished spaces.
- H. Install all valves, control valves and piping specialties, including items furnished by others, as specified and/or detailed. Make connections to all equipment installed by others where that equipment requires the piping services indicated in this section.

#### **3.3 INSTALLATION OF PIPE**

- A. Run pipe lines straight and true, parallel to building lines with minimum use of offsets and couplings.
- B. Provide only such offsets as may be required to provide necessary head room or clearance and to provide necessary flexibility in pipe lines.
- C. Changes:

1. Changes in direction of pipe lines made only with fittings or pipe bends.
2. Changes in size shall be made only with fittings.
3. Do not use miter fittings, face of flush bushings or street elbows.
4. All fittings of long radius type, unless otherwise indicated.

D. Use full and double lengths wherever possible:

1. Cut pipe to exact measurement and install without springing or forcing except in case of expansion loops where cold springing is indicated.
2. Take particular care to avoid creating, even temporarily, undue loads, forces, or strains on valves, equipment or building elements either piping connections or piping supports.

E. Install piping to allow for expansion and contraction without stressing pipe or equipment connected.

F. Provide clearance for installation of insulation and for access to valves, air vents, drains, and unions.

G. Sizing:

1. Unless otherwise indicated, install all supply piping, including shut-off valves and strainers, to coils, pumps, and other equipment at line size with reduction in size being made only at inlet to control valve or pump.
2. Install supply piping from outlet of control valve at full size connection in equipment served.
3. Install outlet piping including dirt pockets or mud legs from equipment full size of connection in equipment served.
4. Install piping, check valves, strainers, and shut-off valves in these equipment outlet or return lines beyond dirt pockets size of tapping in trap or if no trap, size of equipment connection.

H. Make reductions in water pipes with eccentric reducing fittings installed to provide drainage and venting.

I. Branch Take-Offs:

1. Liquids: From top, bottom, or side of mains or headers at either 45 degrees or 90 degrees from horizontal plane.
2. Use main sized saddle type branch connections or directly connecting branch lines to mains in steel piping if main is at least 1 pipe size larger than branch for up to 6 inch mains.
3. Do not project branch pipes inside main pipe.
4. Provide flanges or unions at all final connections to equipment, traps and valves to facilitate dismantling.
5. Arrange piping and piping connections so that equipment being served may be serviced or totally removed without disturbing piping beyond final connections and associated shut-off valves.

J. Pipe Drainage Provision:

1. Slope water piping .1 inch in 40 feet and arrange to drain at low points.
2. Closed Systems:
  - a. Equip low points with 3/4 inch valves and hose nipples.
  - b. At high points, provide collecting chambers and high capacity float-operated automatic air vents or manual air vents.

### 3.4 WELDED PIPE JOINTS

A. Make all welded joints by fusion welding in accordance with ASME Code, ANSI B31 and the State Codes where applicable.

B. Electrodes shall be Lincoln, or similar, with coating and diameter as recommended by the manufacturer for the type and thickness of work being done.

### **3.5 THREADED PIPE JOINTS**

- A. Cut threads so that no more than three threads remain exposed after the joint is made. Ream all pipe ends after cutting and clean before erection. Use a thread lubricant when making joints; no hard setting pipe thread cement or caulking will be allowed.

### **3.6 COPPER PIPE JOINTS**

- A. Remove all slivers and burrs remaining from the tube cut by reaming and filing both pipe surfaces. Clean fitting and tube with emery or sand cloth. Remove residue from the cleaning operation, apply flux and assemble joint. Use solder or brazing to secure joint as specified for the specific piping service.

### **3.7. MECHANICAL GROOVED PIPE CONNECTIONS**

- A. Use pipe factory grooved in accordance with the coupling manufacturer's specifications or field grooved pipe in accordance with the same specifications using specially designed tools specially designed for the application.
- B. Lubricate pipe and coupling gasket, align pipe, and secure joint in accordance with the coupling manufacturer's specifications.

### **3.8 WATER SYSTEMS**

- A. Pitch horizontal mains up at 1 inch in 40 feet in the direction of flow. Install manual air vents at all high points where air may collect. If vent is not in an accessible location, extend air vent piping to the nearest code acceptable drain location with vent valve located at the drain.
- B. Main branches and runouts to terminal equipment may be made at the top, side or bottom of the main provided that there are drain valves suitably located for complete system drainage and manual air vents are located as described above.
- C. Use top connection to main for upfeed risers and bottom connection to main for downfeed risers. Connections at a main may be made with a tee and a 45 degree elbow.
- D. Use a minimum of two elbows in each pipe line to a piece of terminal equipment to provide flexibility for expansion and contraction of the piping system. Offset pipe connections at equipment to allow for service, such as removal of the terminal device.
- E. Use eccentric fittings for changes in horizontal pipe sizes with the fittings installed for proper air venting. Concentric fittings may be used for changes in vertical pipe sizes.
- F. When other specification sections or piping details do not require a strainer upstream of each control valve, install bottom connections to a main with a capped dirt leg.
- G. Where copper piping is allowed for heating hot water or solar hot water systems, secure all joints and fittings with 95-5 tin-antimony solder or brazing alloys.
- H. Where mechanically formed tee fittings are allowed, form mechanically extracted collars in a continuous operation, consisting of drilling a pilot hole and drawing out the tube surface to form a collar having a height of not less than three times the thickness of the tube wall. The collaring device shall be adjustable.
- I. Notch and dimple the branch tube. Braze the joint. Apply heat properly so that pipe and tee does not distort. Remove distorted connections.

### **3.9 WATER MAKE-UP**

- A. Install all raw water make-up piping where indicated on the drawings and in the specifications, including all valves, piping specialties and dielectric unions required for a functional system.
- B. Raw water make-up piping for this section is defined as all piping from the air separation device to the expansion tank, including the fill line containing the pressure reducing valve for water systems and all piping associated with glycol-water system make-up pumps.
- C. Where copper piping is allowed, secure all joints and fittings with 95-5 tin-antimony solder or brazing alloys.

**3.10 CHEMICAL TREATMENT**

- A. Install chemical treatment piping as indicated on the drawings, as detailed, and as recommended by the supplier of the chemical treatment equipment.

**3.11 VENTS AND RELIEF VENTS**

- A. Install vent line and relief valve discharge lines as indicated on the drawings, as detailed, and as specified for each specific valve or piping specialty item.

**3.12 DIELECTRIC UNIONS**

- A. Install insulating or dielectric unions or flanges at each point where a copper to steel pipe connection is required in the following systems.

- 1. Cold water or non-potable make-up water lines.
- 2. Hot water system.
- 3. Dielectric unions shall not be used at terminal heating/cooling devices.

**3.13 UNIONS AND FLANGES**

- A. Install a union or flange, as required, at each automatic control valve and at each piping specialty or piece of equipment which may require removal for maintenance, repair or replacement. Where a valve is located at a piece of equipment, locate the flange or union connection on the equipment side of the valve.

- 1. Concealed unions or flanges are not acceptable.

**3.14 PIPE SYSTEM LEAK TESTS**

- A. Conduct pressure test with test medium of air or water unless specifically indicated. If leaks are found, repair the area with new materials and repeat the test; caulking will not be acceptable.
- B. No systems to be insulated until it has been successfully tested. If required for the additional pressure load under test, provide temporary restraints at expansion joints or isolate them during the test. Minimum test time shall be as scheduled below plus such additional time as may be necessary to conduct the examination for leakage.
- C. For hydrostatic tests, use clean water and remove all air from the piping being tested by means of air vents or loosening of flanges. Measure and record test pressure at the high point in the system.
- D. For air tests, gradually increase the pressure to not more than one half of the test pressure; then increase the pressure in steps of approximately one-tenth of the test pressure until the required test pressure is reached. Examine all joints and connections with a soap bubble solution or equivalent method. The piping system exclusive of possible localized instances at pump or valve packing shall show no evidence of leaking. Perform the leak tests as follows:

| System     | Test Pressure | Medium | Duration |
|------------|---------------|--------|----------|
| Heat Water | 100 PSIG      | Water  | 8 hours  |

### **3.15 PIPE CLEANING**

- A. Flush all water and condensate systems clear of all dirt and foreign matter with all pumps bypassed and all strainers removed from strainer bodies. Provide circulation by means of Trade Supplied portable pumping apparatus.
- B. After initial flushing of a system, use portable pumping apparatus for a continuous 24 hour circulation of a cold water detergent equal to Nalco 2567 cleaner. Flush detergent clear with continuous draining and raw water fill for an additional 12 hours or until all cleaner is removed from the system. Replace strainers and reconnect permanent pumping apparatus.

### **3.16 INITIAL SYSTEM FILL AND VENT**

- A. Fill and vent all systems with proper working fluids.
- B. Fluids to be chemically treated as specified in Water Treatment Section 23 63 00.

**END OF SECTION**

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## SECTION 23 06 30 - PIPING SPECIALTIES

### PART 1 - GENERAL

#### 1.1 DESCRIPTION OF WORK

- A. Thermometers, sockets and test wells.
- B. Pressure gauges.
- C. Pipeline strainers.
- D. Air separators.
- E. Manual and automatic air vents.
- F. Calibrated Balance Valves.

#### 1.2 RELATED DOCUMENTS

- A. Applicable provisions of Division 1 shall govern work under this section.
- B. Specified Elsewhere:
  - 1. 23 05 90 Testing, Adjusting and Balancing
  - 2. 23 06 00 Pipe and Pipe Fittings

#### 1.3 QUALITY ASSURANCE

- A. Standards:
  - 1. American National Standards Institute, ANSI: B31.1: Power Piping.
  - 2. ANSI/ASHRAE 15, "Safety Code for Mechanical Refrigeration".

#### 1.4 SUBMITTALS

- A. Submit shop drawings for all items including all data concerning dimensions, capacities, materials of construction, ratings, ranges, pressure drop and appropriate identification.

### PART 2 - PRODUCTS

#### 2.1 MATERIALS

- A. Construct devices for the highest pressures and temperatures existing in the respective systems in accordance with ANSI specifications.

#### 2.2 THERMOMETERS

- A. Manufacturers: Marsh, Taylor, Trerice, U.S. Gauge, Weksler or Weiss.
- B. Pipeline mounted: Thermometers shall be mercury reading, 9" scale cast aluminum case industrial thermometers with clear acrylic plastic window front and adjustable angle stem to permit easy reading from the floor or operating platform. Furnish with extended necks suitable for insulated piping as required. Thermometers shall be compatible with sockets as specified herein.
- C. Panel or remote mounted: Thermometers shall be mercury vapor actuated dial type with remote bulb. Casing shall be 3-1/2" minimum diameter cast metal with double front. Sensing bulbs shall be

of length to suit pipe diameter with extended necks as required for insulated piping, suitable for insertion in separable brass sockets as specified herein.

D. The range of thermometers shall be:

| <u>Service</u> | <u>Scale Range</u>      | <u>Increment</u> |
|----------------|-------------------------|------------------|
| Hot Water      | 30 deg. F to 240 deg. F | 2 deg. F         |

E. Thermometers by the temperature control manufacturer meeting the above specification will be acceptable.

### 2.3 THERMOMETER SOCKETS AND TEST WELLS

A. Sockets and test wells shall be brass with threaded connections suitable for thermometer bulbs and control sensing devices. Socket and test wells length shall be suitable for pipe diameter with extended necks as required to suit pipe insulation.

### 2.4 PRESSURE GAUGES

A. Manufacturers: Ashcroft, U.S. Gauge, Marsh, Taylor, Trerice, Weksler or Weiss.

B. All gauges shall be suitable for the pressure service intended, with minimum 4-1/2" diameter dial cast aluminum case, double strength glass window, phosphor bronze bourdon tube with bronze bushed brass movement, and recalibration from the front of the gauge dial, 99% accuracy over the middle half of the scale.

1. Gauges shall meet ANSI grade A specifications.
2. Gauges by the temperature control manufacturer meeting these specifications will be acceptable.
3. The range of pressure gauges shall be:

|           | <u>Scale Range</u> | <u>Decrement</u> |
|-----------|--------------------|------------------|
| Hot Water | 0 PSIG to 100 PSIG | 1 PSIG           |

C. Pressure snubbers shall be 1/4" size and of all bronze construction, 300 PSIG working pressure. Coil siphons shall be 1/4" size and of bronze construction, 150 PSIG working pressure.

D. Brass needle type gauge valves, Trerice model 735-2 or other approved product.

### 2.5 PIPELINE STRAINERS

A. Manufacturers: Metraflex, Mueller Steam Specialty, Hoffman, Armstrong, Trane, Sarco, Keckley, Illinois.

B. Strainers 2" and smaller: Full pipeline size, "Y" type, 250 psi W.P. steam, cast iron, with screwed ends. Furnish stainless steel strainer with a removable plug type screen retainer unless otherwise indicated on the drawings.

C. Strainers 2-1/2" and larger: Full pipeline size, "Y" type, 125 psi W.P. steam, cast iron, with flanged ends. Furnish stainless steel strainer with a bolted screen retainer and an off-center blowdown connection piped and valved.

D. Liquid service: Screens to be brass or stainless steel with 1/32" diameter perforation for sizes thru 2" and 1/16" diameter perforation for sizes over 2" for closed piping systems and 1/8" diameter perforation for open piping systems. Maximum pressure drop to be 4 feet W.G. in clean strainer.

### 2.6 AIR SEPARATORS

A. Approved Manufacturers: Spirovent.

1. Micro bubble tube screen.
- B. 2-1/2" and Smaller: Cast iron construction with steel diffuser tube, bottom and side threaded inlet connections, bottom and top threaded outlet connections, threaded top connection for air elimination, designed for a maximum working pressure of 125 PSIG.
- C. 3" and Larger: Cast iron or welded steel construction, flanged connections, perforated stainless steel air collector tube to direct air toward the air elimination connection at the top of the unit, tangential water inlet and outlet connections, bottom blow down connection, constructed in accordance with ASME boiler and pressure vessel code and stamped for 125 PSIG design pressure.
- D. Unless indicated otherwise, provide each unit with a removable galvanized steel system strainer with 3/16" diameter perforations and a free area not less than five times the cross sectional area of the connecting pipe.

## 2.7 AIR VENTS

- A. Manual air vents for components and pipe, Bell & Gossett Model 4V or other approved product, 125 PSIG at 210 deg. F. Use 1/2" gate valve for main pipes.
- B. Automatic air vents shall be pilot operated. Spirovent model spirotop, Thrush-Amtrol model 720, Watson McDaniel model 830, B&G model 107 or other approved product.
  1. Cast iron or bronze body with non-ferrous internal parts, designed to vent air automatically with float control.
- C. Vents shall be constructed of metal for maximum operating pressure of 150 psi and maximum operating temperature of 250 deg. F and all working parts shall be noncorrosive.
- D. Vents shall have minimum air elimination rate of 36 CFM at 80 PSIG and shall be fully open for the removal of air at all pressures in the operating range from 2 to 150 psi. It shall be tightly sealed against loss of system water and prevent entrance of air in negative pressure situations.

## 2.8 CALIBRATED BALANCE VALVES

- A. Calibrated Balancing Valves:
  1. Construct valves of all bronze with threaded connections for sizes 2" and below and for 125 PSIG working pressure at a maximum temperature of 250 deg. F. Provide valve with quick disconnect taps with built-in check valve for pressure differential measurement and integral valve setting index.
  2. Select valves for size and pressure drop shown on the drawing and/or schedules and tagged for mark number, flow and pressure drop as specified.
  3. Manufacturers: B&G CB+ calibrated balance valves or approved equal.

## PART 3 - EXECUTION

### 3.1 PIPELINE STRAINERS

- A. Install strainers in steam and water systems on the entering side of all automatic valves and as shown on the drawings and details.
- B. Install strainers in water systems on the suction side of all pumps and elsewhere as indicated on the plans and/or as scheduled.
- C. Install drain valve with hose adapter in each blow off connection and extend drain piping to nearest floor drain.

### **3.2 THERMOMETERS**

- A. Install thermometers in thermometer sockets in locations indicated on the drawings and details.
- B. Install sockets at each point where a temperature sensing device is required under Section 15900B - Controls and Instrumentation, and a thermometer location as shown on the piping drawings and details.

### **3.3 PRESSURE GAUGES**

- A. Install pressure gauges where indicated on the drawings and details.
- B. Install gauges for water service with pressure snubbers and gauge valves.

### **3.4 PRESSURE GAUGE TAPPING**

- A. Install tapings at each point where sensing device is required under Section 15900B - Controls and Instrumentation and at gauge locations as shown on the drawings and details.
- B. Install tapings for water service with pressure snubbers and gauge valves.

### **3.5 AIR SEPARATORS**

- A. Install air separators in the locations as shown on the plans, details and/or schedules.
- B. Provide valved blow down connections and extend drain piping to nearest floor drain.

### **3.6 AIR VENTS**

- A. Install manual air vents where indicated on the drawings, details and at all high points in water systems where air may collect.
- B. Install automatic air vent at the top of the air separator and where shown on drawings with a shut-off valve between air separator and air vent.

### **3.7 CALIBRATED BALANCE VALVES**

- A. Install calibrated balance valves as indicated on the drawings and/or schedules and in accordance with the manufacturer's recommendations.

**END OF SECTION**

## SECTION 23 09 10 - SUPPORTS AND ANCHORS

### PART 1 - GENERAL

#### 1.1 DESCRIPTION OF WORK

- A. Pipe hangers and supports for mechanical system piping.

#### 1.2 RELATED DOCUMENTS

- A. Applicable provisions of Division 1 govern work under this section.
- B. Specified Elsewhere:
  - 1. 23 06 30 Piping Specialties
  - 2. 23 20 00 Vibration Isolation
  - 3. 23 25 00 Mechanical Insulation

#### 1.3 QUALITY ASSURANCE

- A. Standards:
  - 1. ANSI B31.1: Power Piping
  - 2. MSS SP58 & SP69

#### 1.4 SUBMITTALS

- A. Submit shop drawings for the following:
  - 1. Schedule of all manufactured hanger and support devices, indicating type of device for each pipe size range and type of service, including shielding devices as specified.

#### 1.5 MANUFACTURERS

- A. Grinnell, Fee and Mason, Michigan Hanger, B-Line or Elcen, or approved equal.
- B. Grinnell figures listed as reference only.

### PART 2 - PRODUCTS

#### 2.1 GENERAL

- A. Materials and application of pipe hangers and supports shall be in accordance with MSS Standard Practice SP-58 and SP-69 unless otherwise specified.
- B. Design supports of strength and rigidity to suit loading, service, and in manner, which will not unduly stress the building construction. Where support is from concrete construction, take care not to weaken concrete or penetrate waterproofing. Fasten supports and hangers to building steel framing whenever practical. Do not use perforated iron, chain or wire as hangers.
- C. Where piping can be conveniently grouped to allow the use of trapeze type supports, the supporting steel shall be by means of standard structural shapes or continuous insert channels. Where continuous insert channels are used, pipe-supporting devices made specifically for use with the channels may be substituted for the specified supporting devices provided that similar types are used and all data is submitted for approval.

#### 2.2 EQUIPMENT SUPPORTS

- A. Provide all supporting steel, not indicated on the structural drawings, that is required for the installation of mechanical equipment and materials, including angles, channels, beams, etc. to suspend or floor support tanks and equipment.
- B. Refer to HVAC Drawing details for further requirements.

**2.3 PIPE HANGERS AND SUPPORTS**

- A. Manufacturers: Grinnell, Fee and Mason, Michigan Hanger, B-Line or Elcen similar to the Grinnell figures listed.
- B. Pipe Hangers Application:
  - 1. 2" and smaller: Adjustable, swivel split ring type Grinnell Fig. 104 or lightweight, adjustable clevis type Grinnell Fig. 65.
  - 2. 2-1/2" and larger: Adjustable clevis type Grinnell Fig 260.
- C. Hangers for copper pipe without insulation shall be either copper plated or PVC coated.
- D. Hot piping 2" and smaller: Hanger may be secured directly to the pipe with insulation system around hanger.

**2.4 INSULATION PROTECTION SHIELDS**

- A. Application: Insulation protection shields are required on the following piping systems:
  - 1. Cold piping (under 60 deg. F): All sizes.
  - 2. Hot piping (over 120 deg. F): 2-1/2" and larger piping.
- B. Insulation Protection Shields: Grinnell Fig. 167, Fee & Mason or Elcen or other approved product, constructed of galvanized carbon steel. Select shield to accommodate outer diameter of insulation. Shield lengths and gauge shall be as follows:

| <u>Pipe Size</u> | <u>Length</u> | <u>Gauge</u> |
|------------------|---------------|--------------|
| 1/2" thru 2-1/2" | 12"           | 18           |
| 3" thru 6"       | 18"           | 16           |
| 8" thru 12"      | 24"           | 14           |

**2.5 HANGER SUPPORT INSULATION**

- A. Application: Piping 2-1/2" diameter and larger in conjunction with insulation protection shields to resist compression of insulation system.
- B. Hanger insulation system shall cover bottom half of pipe at the same thickness as pipe insulation system.

**2.6 PIPE HANGER RODS**

- A. Support rods shall conform to the latest MSS standards except as modified herein.
- B. Size rods for individual hangers and trapeze support as indicated in the following schedule:

| <u>Pipe size</u> | <u>Maximum Rod Diameter</u> | <u>Load (lbs.)</u> |
|------------------|-----------------------------|--------------------|
| Up to 2"         | 3/8"                        | 610                |
| 2-1/2" and 3"    | 1/2"                        | 1130               |
| 4" and 5"        | 5/8"                        | 1810               |
| 6"               | 3/4"                        | 2710               |
| 8" thru 12"      | 7/8"                        | 3770               |

- C. Furnish rods complete with adjusting and lock nuts.

- D. In piping 4 inches and larger, each valve shall be supported.

## 2.7 HANGERS AND SUPPORT SPACING

- A. Space pipe hangers and supports in accordance with the following schedule, with exceptions as indicated herein:

| <u>Pipe size</u> | <u>Steel</u> | <u>Copper</u> |
|------------------|--------------|---------------|
| Up thru 1-1/4"   | 8'-0"        | 6'-0"         |
| 1-1/2" and 2"    | 10'-0"       | 8'-0"         |
| 2-1/2" and 3"    | 12'-0"       | 10'-0"        |
| 4" and 5"        | 14'-0"       | 10'-0"        |
| 6" to 12"        | 14'-0"       | 10'-0"        |

- B. Place hangers to meet the requirements of the piping section of this specification, with regard to pitch for drainage and venting, and clearance between services.
- C. Place hangers within one foot of each elbow and at each valve and strainer for piping 4" and above.

## 2.8 BEAM CLAMPS

- A. Grinnell Fig. 87 Series beam clamps with retaining clip for hanger rods to 5/8". Maximum load 440 lbs.
- B. Grinnell Fig. 228 beam clamps with links for hanger rods 3/4" and above.

## 2.9 RISER CLAMPS

- A. Grinnell Fig. 261 for steel pipe, CT-121 for copper tubing.

## 2.10 CONCRETE INSERTS

- A. Grinnell Fig. 285, 281 or 282, poured concrete ceiling insert, suitable for rod diameter and weight supported.
- B. Inserts drilled and placed after concrete pour shall have steel shell with expander plug, not depending on soft lead for holding power.

## PART 3 - EXECUTION

### 3.1 INSTALLATION

- A. Install supports to provide for free expansion of the pipe. Support all piping from the structure using concrete inserts, beam clamps, ceiling plates, wall brackets, or floor stands. Fasten ceiling plates and wall brackets securely to the structure and test to demonstrate the adequacy of the fastening.
- B. Coordinate hanger and support installation to properly group piping of all trades.

### 3.2 INSULATION PROTECTION SHIELDS

- A. Install insulation protection shields at support points for insulated piping as scheduled herein.
- B. Spacing shall be 10'-0" maximum based on insulation with a compressive strength of 15 psi. For insulation with compressive strengths greater than 15 psi, span may be increased proportionally up to a maximum allowable as listed under hanger and support spacing in this section.

**END OF SECTION**

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## SECTION 23 10 00 - VALVES

### PART 1 - GENERAL

#### 1.1 DESCRIPTION OF WORK

- A. Valves for mechanical system piping.

#### 1.2 RELATED DOCUMENTS

- A. Applicable provisions of Division 1 govern work under this section.

B. Specified Elsewhere:

- |    |          |                                  |
|----|----------|----------------------------------|
| 1. | 23 05 90 | Testing, Adjusting and Balancing |
| 2. | 23 06 00 | Pipe and Pipe Fittings           |
| 3. | 23 06 30 | Piping Specialties               |

#### 1.3 SUBMITTALS

- A. Submit shop drawings for all valves including all data concerning dimensions, materials of construction and pressure/temperature ratings.
- B. Mark shop drawings clearly for each system and note with the correct cross reference number.

### PART 2 - PRODUCTS

#### 2.1 MANUFACTURERS

- A. Acceptable manufacturers: Powell, Crane, Nibco, Hammond, Stockham, Lunkenheimer, Milwaukee.

1. Valves shall be of same manufacturer, unless otherwise approved by A/E.

- B. Acceptable manufacturer and Fig. No. are listed under each valve type as the standard for equal quality from approved manufacturers.

- C. Manufacturer's name and pressure ratings clearly mounted on outside of valve body.

- D. All valve packing to be non-asbestos and flexitallic type.

#### 2.2 WATER SYSTEMS VALVES

A. Globe Valves:

1. Valves 2-1/2" and smaller: Bronze body, screwed pattern, renewable composition disc, union or screw-over bonnet, malleable iron hand wheel, 300 psi W.O.G., Mueller Fig. 203-AP or Metraflex No. 700.
2. Valves 3" and larger: Iron body, bronze mounted O.S. & Y., flanged, renewable bronze seat and disc, 200 psi W.O.G., Nibco Fig. F-718.

B. Check Valves:

1. 2-1/2" and smaller: Bronze body, screwed, regrinding type, horizontal swing, renewable seat and disc, 150 SWP - 200 WOG rated. Nibco Fig. T-413-Y.
2. 3" and larger: Iron body, flanged, bronze-mounted, horizontal swing, bronze disc and seat, 150 SWP - 200 WOG rated. Nibco Fig. F-918-B or Milwaukee F2974.

C. Spring Loaded Check Valves:

1. Valves 2-1/2" and smaller: Bronze or iron body, bronze trim, stainless steel spring, screwed, 250 psi WOG, Nibco Fig. T-480Y, Mueller Fig. 203-AP or Metraflex No. 700.
2. Valves 3" and larger: Iron body, wafer type, bronze trim, stainless steel spring, Buna-N seat, 200 psi W.O.G., Nibco Fig. W-960, Metraflex No. 700, Mueller Sure Check Model No. 71, or Milwaukee 1800 series.

D. Balancing Valves(non-calibrated):

1. Valves 2-1/2" and smaller: Use eccentric plug valves or ball valves with memory stops.
2. Valves 3" and larger: Use eccentric plug valves or butterfly valves with locking memory stops.

E. Balancing Valves(calibrated):

1. Valves 2-1/2" and smaller: Refer to Section 23 06 30, Piping Specialties, under Flow Sensors and Meters.
2. Valves 3" and larger: Use butterfly valves with locking memory stops together with flow meters as specified in Section 23 06 30, Piping Specialties, under Flow Sensors and Meters.

F. Eccentric Plug Valves:

1. Valves 2-1/2" and smaller: Semi-steel body, screwed, bronze bearings, bronze or electroless nickel plated semi-steel plugs, adjustable memory stop, isobutene-isoprene resilient seat, 175 psi WOG, DeZurik Fig. 499.
2. Valves 3" and larger: Iron body, flanged, stainless steel bearings, resilient faced plugs, adjustable memory stop, isobutene-isoprene resilient seat, 175 psi WOG, DeZurik Fig. 118.
3. Provide at least three (3) handles for each valve size thru 2". Provide all valves over 2" with permanent handles. Provide all valves 6" and larger with gear operator.

G. Butterfly Valves:

1. Valves 3" and larger: Iron body, stainless steel shaft, bronze, aluminum-bronze, ductile iron nickel plated or cast iron with welded nickel edge disc, bronze bearings, bubble tight resilient EPDM seat, adjustable memory stop, minimum 175 psi WOG pressure differential in the closed position and suitable for continuous operation at temperature up to 250 degrees F.
2. Valve necks to be sufficient length to allow for insulation where insulation is specified.
3. Valves shall be lug type, permitting removal of down stream piping without removing valve.
4. Provide valves 5" and smaller with infinite position lever actuators and 6" and larger with worm gear wheel operators.
5. Manufacturers: DeZurik Fig. 632, Keystone Fig. 228, Nibco LD 2000 or Centerline LT series, Milwaukee M or C series..

H. Ball Valves:

1. Valves 2-1/2" and smaller: Bronze body, screwed, brass or stainless steel ball, full or conventional port, Teflon seat rings, blowout-proof stem, two-piece construction, 600 psi WOG, Apollo No. 70 Series, Milwaukee BA 100/150, Nibco T/S 585-70.
2. Provide valve neck extensions with sufficient length to allow for insulation where insulation is specified.

I. Drain Valves:

1. Bronze, screwed, Buna-N seat discs, hose thread adapter, 125 psi WOG, Nibco Fig 74, or ball valve as specified above with hose thread adaptor.
2. Minimum drain valve size - 3/4" except where strainer blowdown valves are indicated, drain valve same as blowdown connection size.

J. Combination Shut-off, Check and Balancing Valves:

1. 2" and smaller: Provide check valve and balance valve in series at pump discharge.
2. 2-1/2" and larger: Cast iron or semi-steel body, flanged, spring loaded disc, calibrated balancing adjustment with memory bank, valve stem, maximum working pressure of 175 PSIG, maximum operating temperature of 300 deg. F.
3. Design valves to permit repacking under full line pressure.

K. Shut-off and Check Valves: Provide spring-loaded check valve and shut-off (ball or butterfly) valve in series at pump discharge.

**2.3 WATER PRESSURE REDUCING VALVES**

- A. Manufacturers: Thrush, Watts, Cash-Acme, Taco, or B&G valves.
- B. Valves shall be diaphragm operated and pressure adjustable with anti-siphon check valve and inlet strainer designed for a maximum working pressure of 125 PSIG at 240 deg F.
- C. Set the valves for pressures required, or as scheduled.

**2.4 WATER RELIEF VALVES**

- A. Manufacturers: Kunkle, Consolidated, Thrush, Watts, Cash-Acme, or B&G. Valves shall be iron or bronze body, diaphragm operated, with non-ferrous seat and designed for a maximum working pressure of 125 PSIG.
- B. Relief valves shall conform to State requirements and each valve shall have an ASME stamp.

**2.5 GAUGE VALVES**

- A. Terrice Fig. 735, 1/4" brass needle valve, threaded ends, 300 WOG rated.

**PART 3 - EXECUTION**

**3.1 GENERAL**

- A. Install valves as shown on plans, details and according to the valve manufacturer's installation recommendations. Install valves with stems upright or horizontal.
- B. Install all temperature control valves furnished under Section 15900B - Controls and Instrumentation.

**3.2 SHUT-OFF VALVES**

- A. Install shut-off valves at all equipment, at each branch take-off from mains, and at each automatic valve for servicing.

**3.3 THROTTLING VALVES**

- A. Install globe or angle valves for throttling service and control device or PRV station bypass.
- B. Install gate valves for throttling in steam systems sizes 8 inches and larger.

**3.4 BALL AND BUTTERFLY VALVES**

- A. Ball and butterfly valves shall be used for water system shut-off valves.

**3.5 BALANCING VALVES**

- A. Provide balancing valves for complete balancing of water systems. Furnish calibrated balance valves and flow meters as specified in Section 23 06 30, Piping Specialties, under Flow Meters.

**3.6 DRAIN VALVES**

- A. Provide drain valves where specified, detailed and at all low points of piping systems for complete drainage of the systems.

**3.7 WATER RELIEF VALVES**

- A. Install relief valves as shown on drawings.
- B. Unless otherwise indicated, provide one relief valve in each closed water system in the pump inlet piping.

**3.8 SPRING LOADED CHECK VALVES**

- A. Provide a spring loaded check valve in each pump discharge line.

**3.9 COMBINATION SHUT-OFF, CHECK AND BALANCING VALVES**

- A. Install combination or triple-duty (shut-off, check and balancing) valve in lieu of providing separate shut-off valve, check valve and balancing valve at water circulation pump discharge line.

**3.10 WATER RELIEF VALVES**

- A. Install water relief valves on closed system hydronic heating systems to relief rated system input capacity. Extend relief outlet to safe location near floor drain.

**END OF SECTION**

## SECTION 23 14 00 - PUMPS

### PART 1 - GENERAL

#### 1.1 DESCRIPTION OF WORK

A. Types of pumps specified in this section include the following:

1. Base-mounted Pumps

#### 1.2 RELATED DOCUMENTS

A. Applicable provisions of Division 1 govern work under this section.

B. Specified Elsewhere:

1. 23 05 90 Testing, Adjusting and Balancing
2. 23 06 30 Piping Specialties
3. 23 10 00 Valves
4. 23 20 00 Vibration Isolation

#### 1.3 QUALITY ASSURANCE

A. UL and NEMA Compliance: Provide electric motors and products which have been listed and labeled by Underwriters Laboratories and comply with NEMA Standards.

#### 1.4 SUBMITTALS

A. Submit certified pump curves showing pump performance characteristics with pump and system operating point plotted. Include NPSH curve, when applicable.

B. Submit all data concerning dimensions, materials of construction, ratings, and other relevant product data.

### PART 2 - PRODUCTS

#### 2.1 GENERAL REQUIREMENTS

A. Provide factory tested pumps, thoroughly cleaned, and painted with one coat of machinery enamel prior to shipment. Type, size, and capacity of each pump are listed on pump schedule. Provide pumps of same type by same manufacturer.

B. Pump shall meet or exceed the operating efficiencies scheduled.

C. Select motor with sufficient horsepower rating for non-overloading operation over the entire pump curve.

D. All pumps shall operate without objectionable noise or vibration.

#### 2.2 BASE MOUNTED PUMPS

A. General: Provide base-mounted, single suction, single stage, direct-connected, bronze-fitted pumps where indicated, and of capacities as scheduled. Pump shall be the pull-out design to service pump internals with disconnecting piping or motor.

B. Acceptable Manufacturers:

1. Bell and Gossett
- C. Casing: Cast iron, solid convolute casing, rated for greater of 150 psi or 1.25 times actual working discharge pressure, and operating temperature of 225 degrees F continuous, 250 degrees F intermittent. Renewable bronze wear rings, flanged suction and discharge.
  1. Provide tapped and plugged openings for vent, drain, suction and discharge gauge connections.
- D. Shaft: High-grade alloy steel with copper, bronze or stainless steel shaft sleeves.
- E. Bearings: Grease lubricated roller or ball bearings with oil seal and integral dirt and water seal at each end of reservation.
- F. Seal: Mechanical single balanced type with Buna-N N/carbon rotating element and ceramic stationary seat.
- G. Drive: Flexible coupling with coupling guard.
- H. Impeller: Bronze, fully enclosed, hydraulically and dynamically balanced and keyed to shaft.
- I. Baseplate: High grade heat treated cast iron or reinforced heavy steel with integral drain rim grout base.
- J. Motor: NEMA drip-proof type JM or JP and shall be non-overloading over the entire pump curve.
  1. Premium efficiency motor per IEEE Standard 112, Method B. Premium efficiency motor per IEEE Standard 112, Method B and EPCACT requirements.
  2. Motor shall be VFD compatible, where applicable.
- K. Nameplate: Each pump and motor shall be provided with a nameplate displaying the manufacturer's name, serial number of pump, capacity in GPM, and head in feet at design, horsepower, voltage, frequency, speed and full load current.
  1. Permanently identify exact impeller size of pump on nameplate.

### **PART 3 - EXECUTION**

#### **3.1 INSTALLATION OF PUMPS**

- A. Install pumps where indicated, in accordance with manufacturer's published installation instructions, with recommended clearance provided for service and maintenance.
  1. Install all floor-mounted pumps on a concrete housekeeping pad.
- B. Install in-line pumps supported from piping system, located for access to oil cups, service and maintenance. Pipe to be free of all movement.
- C. Base-Mounted Pumps: Pumps shall be anchored to concrete base with proper bolt anchor insert per manufacturer's recommendations.
- D. Provide piping, accessories, hangers, supports, and anchors, valves, meters and gauges, vibration isolation, and equipment supports, as indicated for completion installation. All valves and piping specialties are to be full line sizes as indicated on drawings.
  1. Install a full line size silent spring loaded check valve and balancing valve in the pump discharge piping.
  2. Provide line size ball or butterfly valve and strainer on suction piping.

3. Provide supports under elbows on pump suction sizes 4 inches and over.
- E. Lubricate pump before start-up. Start-up in accordance with manufacturer's instructions.
- F. Ensure that pump units are wired properly, with rotation in correct direction, and that pump and motor grounding have been provided.
- G. Start-Up Services and Inspection Report: Manufacturer's representative shall inspect pump installation and start-up pump to verify proper installation, pump shaft alignment and operation, and submit report to Engineer.

**END OF SECTION**

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## **SECTION 23 20 00 - VIBRATION ISOLATION**

### **PART 1 - GENERAL**

#### **1.1 DESCRIPTION OF WORK**

- A. Extent of vibration isolation work required by this section is indicated on drawings and schedules, and/or specified in other Division 15 sections.
- B. Types of vibration isolation products specified in this section include the following:
  - 1. Vibration Isolation Springs.
  - 2. Flexible Duct Connectors.
  - 3. Flexible Pipe Connectors.

#### **1.2 RELATED DOCUMENTS**

- A. Applicable provisions of Division 1 shall govern work under this section.
- B. Specified Elsewhere:
  - 1. 23 86 00 Ductwork Accessories

#### **1.3 DESIGN CRITERIA**

- A. Isolate all motor driven mechanical, unless otherwise noted, from the building structure, and from the systems which they serve, to prevent equipment vibrations from being transmitted to the structure.
- B. Consider equipment weight distribution to provide uniform deflections.
- C. For equipment with variable speed capability, select vibration isolation devices based on the lowest speed.

#### **1.4 SUBMITTALS**

- A. Submit shop drawings of isolation devices indicating isolation materials, isolator heights both free & operating, isolator dimensions, deflections, and isolation efficiency based on lowest operating speed.

#### **1.5 SUPERVISION AND INSPECTION**

- A. Vibration isolation manufacturer or his qualified representative to provide supervision to assure correct installation and adjustment of the isolators.

### **PART 2 - PRODUCTS**

#### **2.1 MATERIALS**

- A. All isolation devices shall be designed for the equipment with which they will be used. Materials used shall retain their isolation characteristics for the life of the equipment served. All elastomeric materials shall be industrial grade neoprene.
- B. Isolation devices subject to weather shall have hot-dipped galvanized finish and be furnished with limit stops to resist wind.
- C. Coordinate the selection of devices with the isolator and equipment manufacturer.

#### **2.2 MANUFACTURERS**

- A. Products and methods of fabrication shall be as manufactured by Mason Industries, Korfund Co., Amber/Booth Co., Vibration Mounting & Controls, or Kinetics, similar to the manufacturers model listed.

### **2.3 TYPE FD FLEXIBLE DUCT CONNECTORS**

- A. Laminated flexible sheet of cotton duct and sheet elastomer (butyl, neoprene or vinyl), reinforced with steel wire mesh where required for strength to withstand duct pressure indicated. Form connectors with full-faced flanges and accordion bellows to perform as flexible isolation units. Equip each unit with galvanized steel retaining rings for airtight connection with ductwork.

### **2.4 TYPE B MOUNTS**

- A. Mason type SLF, combination spring and neoprene with rib-molded base. Spring type isolator shall be free standing and laterally stable without any housing and complete with 1/2" neoprene acoustical friction pads between the baseplate and the support.
- B. All mounting shall have leveling bolts that must be rigidly bolted to the equipment. Springs shall have a minimum additional travel to solid equal to 50% of the rated deflection. Spring diameters shall be no less than 0.8 of the compressed height of the spring at rated load.

### **2.5 TYPE C MOUNTS**

- A. Mason type SLR, combination spring and neoprene with rib-molded base. Isolator housing shall have vertical limit stops with 1/2" minimum clearance. Housing shall be free hot-dipped galvanized with 1/2" neoprene acoustical friction pads between the baseplate and the support.
- B. All mounting shall have leveling bolts that must be rigidly bolted to the equipment. Springs shall have a minimum additional travel to solid equal to 50% of the rated deflection. Spring diameters shall be no less than 0.8 of the compressed height of the spring at rated load.

### **2.6 TYPE D HANGERS**

- A. Mason type 30N, vibration hangers with steel spring and 0.3" deflection neoprene element in series. Neoprene element shall be molded with a rod isolation bushing that passes through the hanger box. Spring diameters and hanger box shall permit hanger rod to swing 30 deg. arc before contacting the hole and short circuiting the spring.
- B. Springs shall have a minimum additional travel to solid equal to 50% of the rated deflection.

### **2.7 TYPE K FLEXIBLE PIPING CONNECTIONS**

- A. Provide flexible connections for all piping to equipment mounted on vibration isolators and all piping connected to rotating or reciprocating equipment.
- B. Flexible connection shall be suitable for pressure, temperature and fluid involved.
- C. Minimum line length of flexible hose shall be 12" or length required to absorb 3/4" lateral movement, whichever is longer.
- D. Piping connected to a coil which is in an assembly mounted on vibration isolators is to have flexible piping connections and piping vibration hangers as specified below. Piping connected to a coil which is in an assembly where the fan is separately isolated by means of vibration isolators and duct flexible connections does not require flexible piping connectors or piping vibration hangers.
- E. Water System:
  - 1. Metraflex, Mason or other approved product similar to Mason Safeflex SFEJ series.
  - 2. Connections shall consist of multiple plies of nylon tire cord fabric reinforced with an EPDM cover and liner. No steel wire or rings shall be used as internal pressure reinforcement. 2-

1/2" and smaller may have threaded connections; 3" and larger shall have floating steel flanges recessed to lock the bead wire in the raised face of the EPDM flange.

3. Construct all straight through connections with twin spheres with control rod assemblies as recommended by the manufacturer.

## 2.8 PERFORMANCE

- A. Select all vibration isolation devices to provide minimum 95% isolation efficiency or based on the minimum static deflection and mounting criteria listed below, whichever greater.

|                               | Floor Span       |       |                  |       |                  |       |
|-------------------------------|------------------|-------|------------------|-------|------------------|-------|
|                               | On Grade         |       | 20 feet          |       | 30 feet          |       |
|                               | Min. Static Type | Defl. | Min. Static Type | Defl. | Min. Static Type | Defl. |
| 1. <u>Pumps:</u>              |                  |       |                  |       |                  |       |
| Base-Mounted                  | K                | 0.75" | --               | --    | --               | --    |
| 2. <u>Suspended Fans:</u>     |                  |       |                  |       |                  |       |
| FD-D                          | FD-D             | 1.5"  | FD-D             | 1.5"  | FD-D             | 1.5"  |
| 3. <u>Floor-mounted Fans:</u> |                  |       |                  |       |                  |       |
| FD-C                          | --               | --    | FD-C             | 0.75" | FD-C             | 0.75" |

## PART 3 - EXECUTION

### 3.1 GENERAL

- A. Except as otherwise indicated, apply the following types of vibration isolators at indicated locations or for the following indicated items of equipment. Selection is Installer's option where more than one type is indicated.
- B. Neoprene/Spring Isolators:
  1. Suspended Fans.
  2. Floor-mounted Fans.
- C. Flexible Duct Connectors:
  1. Duct connections with air handling equipment mounted on vibration isolators.
- D. Flexible Pipe Connectors:
  1. Circulation Pumps.

### 3.2 INSTALLATION

- A. General: Except as otherwise indicated, comply with manufacturer's instructions for installation and load application to vibration isolation materials and units. Adjust to ensure that units do not exceed rated operating deflections or bottom out under loading, and are not short-circuited by other contact or bearing points.
- B. Anchor and attach units to substrate and equipment as required for secure operation and to prevent displacement by normal forces, and as indicated.
- C. Install vibration isolation devices as specified, as shown on the drawings and according to the manufacturer's installation instructions.
- D. In no case shall the installation short circuit the isolation device. Flexible piping connections are to be installed on the equipment side of shut-off valves.

**END OF SECTION**

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## SECTION 23 25 00 - MECHANICAL INSULATION

### PART 1 - GENERAL

#### 1.1 DESCRIPTION OF WORK

- A. Extent of mechanical insulation required by this section is indicated on drawings, and by requirements of this section.
- B. Work shall include all labor, equipment, accessories, materials and services required to furnish and install all insulation, fittings and finishes for piping, ducts and related mechanical equipment in the Heating, Ventilating and Air Conditioning Systems.
- C. The following types of insulation are specified in this section:
  - 1. Pipe insulation.
  - 2. Duct insulation.
  - 3. Equipment insulation.

#### 1.2 RELATED DOCUMENTS

- A. Applicable provisions of Division 1 shall govern work under this section.
- B. Specified Elsewhere:
  - 1. 23 09 10 Support and Anchors
  - 2. 23 84 00 Ductwork

#### 1.3 QUALITY ASSURANCE

- A. Acceptable Manufacturers:
  - 1. Owens-Corning
  - 2. Schuller
  - 3. Certainteed
- B. All insulating products delivered to the construction site shall be labeled with the manufacturer's name and description of materials.
- C. All insulation installation methods shall be performed in accordance with the latest edition of MICA (Midwest Insulation Contractors Association) Standard and manufacturer's installation instructions, except as modified in this section of specifications.

#### 1.4 DEFINITIONS

- A. Concealed Ductwork: Concealed areas, where indicated in this section, shall apply to shafts, furred spaces, space above finished ceilings, low tunnels and crawl spaces.
- B. Exposed Ductwork: Exposed ductwork, include mechanical rooms, walk-through tunnels, and similar installations subjecting ductwork insulation to physical damage and tearing.

#### 1.5 SUBMITTALS

- A. Submit shop drawings for insulation systems, including a schedule for all insulating materials, including adhesives, fastening methods, fitting materials, installed thickness and intended use of each material.
- B. Submittal shall include catalog sheets indicating density, thermal characteristics, jacket, and

installation instructions.

## PART 2 - PRODUCTS

### 2.1 MATERIALS

- A. All products including vapor barriers and adhesives shall conform to NFPA Section 90A. All products except pipe insulation shall possess a flame spread rating of not over 25, without evidence of continued progressive combustion, and a smoke developed rating no higher than 50.

### 2.2 PIPING INSULATION SCHEDULE

- A. Insulation Thickness Pipe Size Schedule:

| Type of System                 | Fluid Temp. Range Deg F | *Run-outs Up to 2" | 1" and Less | 1-1/4" -2" | 2-1/2" -4" | 5&6 inch | 8" & Up |
|--------------------------------|-------------------------|--------------------|-------------|------------|------------|----------|---------|
| <u>Hot Water:</u><br>Low Temp. | 141-200                 | 0.5                | 1.0         | 1.0        | 1.5        | 1.5      | 1.5     |

\*Runouts are extensions to individual terminal units not exceeding 12 ft. in length.

- B. Insulation thickness shown in schedule are based on products having a maximum "k" factor of 0.26 at a mean temperature of 75 degrees F. These thicknesses can be reduced for products having significantly lower "k" values and shall be increased for products having higher "k" values in order to produce equivalent or greater thermal resistance. ("R" value of products equals the thickness of the insulation divided by the "k" factor.)

- C. Insulation Application Schedule:

| Type of System                      | Fluid Temp. Range (deg. F) | Type of Insulation |
|-------------------------------------|----------------------------|--------------------|
| <u>Hot Water:</u><br>Low Temp/HWS&R | 141-200                    | Glass Fiber        |

### 2.3 PIPE INSULATION

- A. Rigid molded glass fiber pipe insulation with ASJ type factory applied jacketing with a density of 3-4 lbs./cubic feet and a "k" factor of 0.25 @ 75 degrees F. mean. (Flame Spread 25, smoke development 50 per ASTM E 84-75, -20 degrees to 500 degrees F. usage.)
1. Jacket shall be glass fiber reinforced foil kraft laminate, factory applied, with white finish. Permeance shall not exceed 0.02 perms. Beach puncture resistance shall be 50 units minimum.
  2. Provide Aluminum or UV-resistant PVC jacket for all exposed exterior piping insulation.
- B. Flexible elastomeric thermal insulation with a "k" factor of 0.26 at 75 degrees F mean density of 5.0 lbs./cu. ft. and a maximum water vapor transmission of 0.17 per inch. Seal joints with manufacturers standard sealant. (Armaflex AP-Flame Spread 25, smoke development 50 per ASTM E 84-75, -40 degrees to 220 degrees F usage.)

### 2.4 CONCEALED DUCTWORK INSULATION

- A. Material: Flexible Glass Fiber Wrap: Flexible glass fiber insulation shall have a minimum density of 0.75 PCF with thermal conductivity of not more than 0.31 at 75 degrees F mean temperature and

suitable for 240 degrees F with FSK aluminum foil reinforced vapor barrier jacket. Material shall meet NFPA 90A and 90B.

1. Jacket shall be glass fiber reinforced foil kraft laminate factory applied with paintable white finish. Permeance shall not exceed 0.04 perms. Beach puncture resistance shall be 15 units minimum.

## 2.5 EXPOSED DUCTWORK INSULATION

- A. Material: Rigid Glass Fiber Board: Rigid or semi-rigid glass fiber insulating board shall have a minimum density of 3.0 PCF with thermal conductivity of not more than 0.23 at 75 degrees F mean temperature and suitable for 450 degrees F with ASJ white facing complying with ASTM E-136 and C612 Class 3 for flat surfaces and semi-rigid flexible board. Attached with mastic bands and mechanical weld pins with washers.
1. Jacket shall be of heavy duty fire retardant material with glass fiber reinforcing kraft laminate factory applied with white finish. Permeance shall not exceed 0.02 perms. Beach puncture resistance shall be 25 units minimum.

## 2.6 DUCTWORK INSULATION SCHEDULE

A. Concealed - Supply Air Ducts:

1. Type Insulation: 1-1/2" Flexible Wrap (Concealed).

B. Exposed - Supply Air Ducts:

1. Type Insulation: 1" Rigid Board (Unconditioned spaces - Mech. Rms.).  
*Note:* Insulation not required if supply duct is lined. Refer to Section 15840B.
2. Exposed ducts in conditioned spaces do not require external insulation.

D. Exhaust Air Ducts - General Exhaust:

1. Automatic Control Damper (ACD) to Ambient Outlet (Louver):  
1-1/2" Flexible Wrap (Concealed).
2. Exhaust Registers to Fan Inlet: None.

F. Fresh Air Ducts:

1. Fresh Air: 1" Rigid Board (exposed) or 1-1/2" Flexible Wrap (concealed).

## 2.7 EQUIPMENT INSULATION

- A. Materials: Rigid or semi-rigid glass fiber insulating board shall have a thermal conductivity of not more than 0.23 at 75 deg. F mean temperature and suitable for 450 degrees F with heavy duty FSK jacket complying with ASTM E-136 and C-612 Class 3 for flat surfaces and semi-rigid flexible board. Attach with mastic bands and mechanical weld pins with washers.
1. Finish: Brush on mastic coating over factory jacket with two layers of glass cloth mesh and smooth, seal final coat with vapor barrier mastic equal to Benjamin foster 30-36 Sealfas. Paint white.
- B. Optional Materials: Flexible elastomeric thermal insulation with a "k" factor of 0.26 at 75 degrees F mean density of 5.0 lbs./cu. ft. and a maximum water vapor transmission of 0.17 per inch. Seal joints with manufacturers standard sealant. (Armaflex AP-Flame Spread 25, smoke development 50 per ASTM E 84-75, -40 degrees to 220 degrees F usage.)
- C. Coverage:

1. Air Separator: 1" thickness.

### **PART 3 - EXECUTION**

#### **3.1 GENERAL INSTALLATION**

- A. Application of insulation materials to piping, equipment, tanks and ductwork shall be done in accordance with manufacturer's written recommendations. Where thickness of insulation is not specified, use applicable thickness recommended by manufacturer and required by applicable codes.
- B. All insulation shall be continuous through wall and ceiling openings and sleeves. All covered pipe and ductwork is to be located a sufficient distance from walls, other pipe, ductwork and other obstacles to permit the application of the full thickness of insulation specified. (If necessary, extra fittings and pipe are to be used.)

#### **3.2 PIPING INSTALLATION**

- A. All pipe installation shall be installed with joints butted firmly together. All valves and fittings shall be insulated with mitered sections of insulation equal in density and thickness to the adjoining insulation by one of the following methods:
  1. Premolded PVC fittings installed in accordance with the manufacturer's instructions.
  2. Jackets on pipe insulation laps are to be vapor sealed using self-sealing lap, lap-seal tape gun or adhesive such as Armstrong 520. All insulation ends are to be tapered and sealed regardless of service.
- B. Provide removable insulation sections to permit easy access where inspection, service and/or repairs are required.
  1. Insulation for valves, unions (cold only), strainers, flexible connections and expansion joints shall be removable for inspection and repair.
- C. On all cold piping insulated with vapor barrier covering, use protection shield to over bottom one-half of insulated pipe. Provide half-round, 12" long, hanger block at the bottom half of the pipe in place of the fiberglass pipe insulation. The hanger blocks shall be molded cork or calcium silicate pipe insulation of the same thickness as the adjoining fiberglass pipe insulation. The vapor barrier jacket shall be continuous through the hanger location.
  1. Provide removable elastomeric insulation wraps over cold piping unions.
- D. Vapor barrier jackets shall be applied with a continuous, unbroken vapor seal. Pipe hangers on cold lines (dual temperature piping) are to be sized large enough to be installed over the outer surface of the insulation.
- E. On hot piping 2" and smaller, the hanger shall be secured directly to the pipe and the pipe insulation shall surround the hanger. Provide pipe covering protection saddles and hanger blocks at hanger locations on hot piping 4" and larger.
- F. Insulation shall preferably be applied while surfaces are hot. Chilled water lines shall be at room temperatures when insulation is applied.
- G. Omit insulation for the following:
  1. Discharges piping from safety and relief valves to outlets.
  2. Piping unions on hot only (HWS&R) systems.
  3. Provide removable insulation jackets over unions and valves for hot/chilled water systems.
  4. Hot water piping inside convactor, wall fin radiation and cabinet heater enclosures.

- H. Seal all exposed end sections of pipe covering with a coat of vapor barrier mastic. Childers CP-30 or equal.
- I. No covering shall be applied until after piping is cleaned and tested, inspected and approved.

### **3.3 DUCTWORK INSULATION INSTALLATION**

- A. Insulation shall be installed per manufacturer recommendations with mechanical fasteners. Seal all joints and fasteners with UL labeled vapor proof tape.
- B. Provide finished edges at all access doors and ends.

### **3.4 INSTALLATION OF EQUIPMENT INSULATION**

- A. General: Install insulation products in accordance with manufacturer's written instructions and in accordance with recognized industry practices to ensure that insulation serves its intended purpose.
- B. Install insulation materials with smooth and even surfaces.
- C. Clean and dry ductwork surfaces prior to insulating, Butt insulation joints firmly together to ensure complete and tight fit over surfaces to be covered.
- D. Do not insulate over equipment nameplates or ASME stamps. Bevel and seal insulation at these locations.
- E. Do not insulate factory insulated equipment.

### **3.5 PROTECTION AND REPLACEMENT**

- A. Replace damaged insulation which cannot be repaired satisfactorily, including units with vapor barrier damage and moisture saturated units.
- B. Protection: Insulation installer shall advise Contractor of required protection for insulation work during remainder of construction; period, to avoid damage and deterioration.

**END OF SECTION**

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## SECTION 23 61 10 - PREFABRICATED STACK AND BREECHINGS

### PART 1 - GENERAL

#### 1.1 DESCRIPTION OF WORK

- A. Extent of stack and breechings work is shown on drawings and by the requirements of this section.
- B. Types of stacks and breechings required for this project:
  - 1. Prefabricated positive-pressure condensing stack and breeching – Category IV.

#### 1.2 RELATED DOCUMENTS

- A. Applicable provisions of Division 1 shall govern work under this section.
- B. Specified Elsewhere:
  - 1. 23 62 00 Heating Hot Water Boilers

#### 1.3 SUBMITTALS

- A. Submit shop drawings for all equipment including all data concerning dimensions, materials, thermal characteristics, erection and supporting methods and appropriate identifications.

#### 1.4 DESIGN CRITERIA

- A. All products, fabrication and installation shall comply with the requirements of NFPA 211 together with state and local codes.

### PART 2 - PRODUCTS

#### 2.1 PREFABRICATED POSITIVE-PRESSURE STACKS AND BREECHING

- A. General: Gas vent stack shall be AGA and UL 103 Listed positive-pressure double wall stack for use with high-efficiency, condensing boilers with 1" air space between casings and UL listed for continuous operation at 600 deg F under 1-1/2" positive pressure rating. Provide all necessary accessories including bird and waterproof top, discharge support assembly, elbows, base tee with cleanout, flashing and storm collars and sleeve for rated enclosure, complete for the installation.
- B. Acceptable Manufacturers: Schebler PAL series, Heat Fab Saf-T Vent or approved equal.
- C. Outer Jacket: 20-gauge 304 stainless steel.
- D. Inner Pipe: 20-gauge AL 29-4C stainless steel alloy.
- E. Joints: Field assembled with drawbands, gas-tight, rated up to temperatures less than 600 deg F with RTV silicone sealant or equivalent system.

### PART 3 - EXECUTION

#### 3.1 INSTALLATION

- A. Install vents as shown on the drawings, details and in accordance with the manufacturer's recommendations. Coordinate carefully with the General Trade.
- B. Support vents adequately from the building structure with provisions for expansion and contraction.
- C. Provide all connections, breeching and stack material between equipment and stack.
- D. Breeching shall be pitched one-fourth (1/4) inch per foot upward in direction of flow for condensate to drain back to boiler.
- E. Maintain minimum clearance to combustibles per NEC, AGA and local codes.
- F. Vent stacks and chimneys shall be installed per manufacturers instructions, NFC and local code requirements.
- G. Coordinate final breeching layout and sizing with Boiler Manufacturer's requirements and approval prior to submitting for approval and ordering.

**END OF SECTION**

## SECTION 23 62 00 - HEATING HOT WATER BOILERS

### PART 1 - GENERAL

#### 1.1 DESCRIPTION OF WORK

- A. Extent of heating hot water boiler work required by this section is indicated on drawings and schedules, and by requirements of this section.
- B. Types of heating hot water boiler specified in this section include the following:
  - 1. Gas-fired hot water high-efficiency condensing boilers.

#### 1.2 RELATED DOCUMENTS

- A. Applicable provisions of Division 1 shall govern work under this section.

#### 1.3 QUALITY ASSURANCE

- A. Installers: Contractors certified Contractors for installation of boilers, of types and capacities required, with similar installations in satisfactory use in similar service for not less than 3 years.
- B. Regulatory Requirements:
  - 1. AGA Compliance: Provide heating hot water boilers that have been tested and rated in accordance with American Gas Association.
  - 2. NFPA Compliance: Install gas-fired hot water boilers in accordance with National Fire Protection Association (NFPA) Code 54 "National Fuel Gas Code".
  - 3. ASME Compliance: Construct hot water boilers in accordance with American Society of Mechanical Engineers (ASME) Boiler and Pressure Vessel Code, Section IV.
  - 4. UL Labels: Provide heating hot water boiler ancillary electrical components which have been listed and labeled by Underwriters Laboratories (UL).
- C. Manufacturers: Subject to compliance with requirements, manufacturers offering sealed combustion type boilers which may be incorporated in the work, include the following:
  - 1. AERCO BMK 3.0 series.
- D. Warranty:
  - 1. Heat exchanger/combustion chamber assembly: 3 years.
  - 2. Pressure vessel and exhaust manifold: 10 years.
- E. Start-Up Services: Contractor shall provide factory authorized supervision of all phases of equipment start-up.
  - 1. Manufacturer-approved start-up technician shall commission startup of boilers and boiler plant controller.
  - 2. Startup Technician shall document operational parameters and submit report itemizing measured parameters and approving the boiler installation.
  - 3. Provide a startup report and Manufacturer's letter of compliance with all factory recommendations and installation instructions.

#### 1.4 SUBMITTALS

- A. Shop drawings of product data and manufacturer's installation and maintenance manual.

## PART 2 - PRODUCTS

### 2.1 HOT WATER BOILERS

A. General: Provide as indicated, modular units of capacity as scheduled. Provide net ratings approved by AGA, and construct in accordance with requirements of ASME Boiler and Pressure Vessel Code. Boilers shall be gas-fired sealed combustion complete with all accessories.

1. AGA Design certified input = 3,000,000 BTU/HR.
2. Heating capacity = 2,670,000 BTU/HR.
3. Conversion efficiency = 89% at 100% load and 120 deg F HWR temp.

B. Boiler:

1. The entire assembled heat exchanger shall be hydrostatically tested, approved and stamped for 150 psi ASME operation – B & PV code section IV stamp H. Units shall be factory assembled for operation with natural gas; delivery pressure to gas valve of 8.5" W.C.
2. Each boiler assembly shall include the following standard components:
  - a. Condensing fire tube design.
  - b. Modulating power burner; 15:1 turn-down.
  - c. Positive pressure discharge.
  - d. Helical fire tube heat exchanger/combustion chamber.
  - e. Exhaust manifold: Corrosion resistant porcelain enameled cast iron.
  - f. Flame monitoring system with UL combustion safeguard system utilizing interrupted spark, ignition and rectifier type flame sensor.
  - g. Four inch N.P.S. tappings for supply and return water on heat exchanger connections.
  - h. Low water cut-off electric probe.
  - i. Dual over-temperature protection.
  - j. Electrohydraulic double-seated safety shut-off gas valve.
  - k. Temperature/pressure relief valve.
  - l. Remote fault alarm, sensor failure detection and auxiliary equipment contacts.
3. Boiler shall be ordered for 3-phase 208-volt electrical service.
4. Boiler shall be set-up for natural gas delivery.
5. Jeavons J48 gas pressure regulators with shut off valves.
6. Condensate traps and neutralizer tank.
7. Motorized butterfly valve with Belimo 24volt actuator and end switch.

C. Operation:

1. Outlet temperature accuracy:  $\pm 2$  degrees F.
2. Firing range 7% to 100% over 50 degrees F to 220 degrees F.
3. Adjustable outdoor air temperature reset of hot water supply. Reset ratio of 0.6 to 2.4:1.

D. Boiler Controls:

1. Boiler manufacturer shall supply a microprocessor-based, factory tested and wired boiler management control system to control boiler operation sequence, HWS temperature and vary input capacity to each boiler. Control system shall provide automatic adjustable heating system start a contact closure for auxiliary equipment such as pumps and combustion air dampers. NEMA 13 grade enclosure.
2. External Signal: 4-20 vma.
3. Accuracy:  $\pm 2$  degrees F.

4. Display: LCD.
5. Memory: Non-volatile.
6. Fault alarm surveillance.
7. Adjustable set point, minimum and maximum temperatures, proportional band, reset ratio control.
8. ProtoNode Gateway for MODbus interface.
9. Provide C-more control system.

## **PART 3 - EXECUTION**

### **3.1 INSPECTION**

- A. Examine areas and conditions under which boilers are to be installed. Do not proceed with work until unsatisfactory conditions have been corrected.

### **3.2 INSTALLATION OF BOILERS**

- A. General: Comply with boiler manufacturer's instructions for installation, except as otherwise indicated.
- B. Comply with installation requirements of local and state boiler codes, and applicable provisions of NFPA and ASME boiler code standards.
- C. Install boilers on 4" high concrete pad where indicated, maintain manufacturer's recommended clearances around and over top of boilers.
- D. Install boiler trim not installed at factory.
- E. Connect water, fuel, piping, and venting as indicated.
- F. Furnish to Electrical installer, manufacturer's wiring diagram and electrical requirements for installation of field-wiring required for heating hot water boilers, not work of this section.
- G. Flush and clean heating hot water boiler upon completion of installation, in accordance with manufacturer's start-up instructions.
- H. Start-up heating hot water boilers, in accordance with manufacturer's start-up instructions, and in presence of boiler manufacturer's representative. Test controls and demonstrate compliance with requirements. Replace damaged or malfunctioning control and equipment.
- I. Hydrostatically test assembled boiler and piping in accordance with applicable sections of ASME Boiler and Pressure Vessel Code.
- J. Arrange with National Board of Boiler and Pressure Vessel Inspectors of inspection of boiler piping, observation of hydrostatic testing, and for certification for completed boiler unit.
- K. Install a drain valve at low point to boiler assembly.
- L. Each boiler is to have a butterfly valve for isolation and maintenance, along with a calibrated balance valve for flow balancing between boilers.

### **3.3 TRAINING OF OWNER'S PERSONNEL**

- A. Certified Installation: The HVAC Contractor shall be a certified to install and start-up AERCO boilers or shall retain a certified AERCO boiler installer for this work.
- B. Start-Up Services: Contractor shall provide factory-certified supervision of all phases of boiler installation and start-up services.

1. Furnish factory-certified installation compliance and start-up report at completion of project.
  2. Provide factory training for Owner's maintenance personnel on the operation and maintenance of the boiler system.
- C. Schedule training with Owner, provide at least 7-day notice of Owner and Architect of training date.

**END OF SECTION**

## SECTION 23 63 00 - WATER TREATMENT

### PART 1 - GENERAL

#### 1.1 DESCRIPTION OF WORK

- A. This section includes requirements for water treatment related to the following:
1. Closed Loop Treatment System
  2. Pipe Cleaning and Inhibiting Treatment
- B. Specification of an item in this section shall not relieve the HVAC Contractor from providing all items, materials, operations, methods, labor, equipment and incidentals necessary for a complete and functional system.
- C. All services will be performed by a qualified, full-time representative of the water treatment company.
1. Coordinate water treatment with Owner's current water treatment program for compatible chemicals and treatment methods.
  2. Approved Water Treatment Contractor/Supplier for this Project:  
  
Lakeland Chemical Specialties Inc.  
W140N5080 Lilly Road  
Menomonee Falls, WI 53051-7017  
Attn: Scott Olson cell phone: 414-254-9987  
email: scott63052lcsi@sbcglobal.net

#### 1.2 RELATED DOCUMENTS

- A. Applicable provisions of Division 1 shall govern work under this section.
- B. Specified Elsewhere:
1. 23 06 00 Pipe and Pipe Fittings

#### 1.3 SUBMITTALS

- A. Submit product data, installation and operating instructions.

#### 1.4 SUPERVISION AND INSPECTION

- A. Water treatment manufacturer or his qualified representative to provide supervision and final inspection upon completion of installation and adjustment, shall submit report in writing, certifying the correctness of the installation in compliance with the specifications and proper operation.

### PART 2 - PRODUCTS

#### 2.1 CLOSED LOOP TREATMENT SYSTEM

- A. Water treatment consists of initial chemical type treatment to clean piping and prevent rust and scale in final fill treated water.
1. Sequestering agent to reduce deposits and adjust pH.
  2. Corrosion inhibitors.

3. Conductivity enhances.

B. Bypass Feeder: Water treatment consists of bypass pot feeder and initial chemical type treatment to prevent rust and scale. Bypass feeder shall be 5 gallon for each hot and chilled water system with filter sock(5 micron) and support cage.

### **PART 3 - EXECUTION**

#### **3.1 INSTALLATION**

- A. Heating Contractor will provide initial fill treatment to each closed-loop system. After this initial treatment, the Owner shall be responsible for all future service requirements.
- B. Install in a bypass arrangement at pump discharge as indicated.
- C. Furnish start-up chemical treatment chemicals, procedures and certification after installation is complete.
- D. After start-up treatment, the treatment company shall be responsible for all water treatment service requirements for one year, to include the following treatment services performed by qualified, full time representatives of the treatment company.
1. Initial water analysis and recommendations.
  2. Initial equipment clean-up chemicals, procedures and certification after clean-up is complete.
  3. Assistance during start-up of the treatment program.
  4. Instructions of operating personnel on proper feeding and control techniques.
  5. Periodic service and consultation meetings.
  6. Any necessary record forms and log sheets.
  7. Any required laboratory and technical assistance.

#### **3.2 WATER TREATMENT SERVICE PROGRAM**

- A. After start-up treatment, the treatment company shall be responsible for all water treatment service requirements for one year, to include the following treatment services performed by qualified, full time representatives of the treatment company.
1. Initial water analysis and recommendations.
  2. Initial equipment clean-up chemicals, procedures and certification after clean up is complete.
  3. Assistance during start-up of the treatment program.
  4. Instructions of operating personnel on proper feeding and control techniques.
  5. Periodic service and consultation meetings.
  6. Any necessary record forms and log sheets.
  7. Any required laboratory and technical assistance.

#### **3.3 PIPE CLEANING AND INHIBITING GUIDELINES**

- A. Cleaning: Hydronic water piping system shall be cleaned by using a solution consisting of a blend of organic alkaline penetrants, emulsifiers, surfactants and corrosion inhibitors and containing propylene glycol, methyl ether, phosphonates, sodium-meta-silicate-hydrate and sodium hydroxide.
1. The material shall not contain tri-sodium phosphate.
  2. The piping system shall be filled, vented and circulated employing the chemical cleaner solution for a period of at least 24 hours or more in accordance with the manufacturer's recommendations and job site chemical tests. Water filters shall be removed from the system for this cleaning. The concentration shall be brought to a

level which raises the M Alkalinity to a value of 250 above that for the existing water used for the fill.

3. Chemical tests shall be made to verify these levels and submitted to the A/E. The system should be circulated, drained and flushed to achieve the original M Alkalinity level.

B. Inhibitor:

1. The inhibitor shall be added to the system after it is acceptably cleaned and flushed and refilled. The inhibitor shall consist of a boron nitrite, benzol thiazol, benzotriazole, mercapto-benzo-thiazole, tolyltriazone silicates and color trace all producing a scale and corrosion inhibitor system. The inhibitor shall be chemically installed to a concentration of 700 to 1000 parts per million and the solution shall be tested to indicate that it falls within this range.
2. Test results shall be submitted to the A/E.
3. The strainer baskets may be remounted before the system is inhibited.

C. Supervision:

1. The chemical supplier shall supervise the addition, the testing of the flushing and draining of all chemical scale and inhibitor solutions for all systems. Three copies of the chemical water status shall be submitted to the A/E for final approval.
2. Cleaning, inhibiting and testing of the piping systems shall be carried out in the presence of the owner's representative.

**END OF SECTION**

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## SECTION 15820B - FANS

### PART 1 - GENERAL

#### 1.1 DESCRIPTION OF WORK

- A. Extent of fan work is shown on drawings and schedules, and by requirements of this section.
- B. Types of fans required for project include the following:
  - 1. Centrifugal Inline Fans.

#### 1.2 RELATED DOCUMENTS

- A. Applicable provisions of Division 1 shall govern work under this section.
- B. Specified Elsewhere:
  - 1. 23 05 90 Testing, Adjusting and Balancing
  - 2. 23 20 00 Vibration Isolation
  - 3. 23 90 00 Controls and Instrumentation

#### 1.3 QUALITY ASSURANCE

- A. Manufacturers:
  - 1. Greenheck
  - 2. Carnes
  - 3. Cook
- B. AMCA Compliance: Provide fans bearing the Air Movement and Control Association, Inc. (AMCA) Certified Rating Seal.
- C. UL Compliance: Provide power roof ventilator electrical components which have been listed and labeled by Underwriters Laboratories (UL).

#### 1.4 SUBMITTALS

- A. Submittals shall include all product data, performance, materials of construction, and installation instructions.

### PART 2 - PRODUCTS

#### 2.1 CENTRIFUGAL IN-LINE FANS

- A. Centrifugal in-line fans shall be the belt or direct-driven, centrifugal type, as schedule.
- B. The fan wheel shall be centrifugal with backward inclined, airfoil, or forward curved blades, as scheduled. The fan wheel shall be statistically and dynamically balanced. The fan shall be quiet operating and vibration free. Fan performance shall be certified by an AMCA ratings seal.
- C. The fan shaft shall be mounted in lubricated ball bearing pillow blocks. Bearings shall be provided with grease fittings and caps. Bearings shall be rated for 200,000 hours.
- D. The fan housing shall be steel construction with 1/2" thick, 1-1/2" lb. density fiberglass lining. Belt drives shall have a sliding or pivoting motor plate for belt tensioning, and the belt shall be totally enclosed by a belt guard with tachometer holes. The fan motor shall be a NEMA approved, ball

bearing type. Provide casing access for checking fan speeds. Provide variable-speed control switch when scheduled.

E. Accessories: As specified herein and indicated on drawings schedules:

1. Neoprene vibration isolation supports.
2. ECM motor with local 0-10VDC potentiometer for balancing.
3. Flexible duct connections.

### **PART 3 - EXECUTION**

#### **3.1 INSPECTION**

A. General: Examine areas and conditions under which fans are to be installed. Do not proceed with work until unsatisfactory conditions have been corrected.

#### **3.2 INSTALLATION OF FANS**

A. General: Except as otherwise indicated or specified, install ventilators in accordance with manufacturer's installation instructions and recognized industry practices to insure that ventilators serve their intended function.

B. Coordinate ventilator work with work of roofing, walls and ceilings, as necessary for proper interfacing.

C. Electrical Wiring: Install electrical devices furnished by manufacturer but not specified to be factory-mounted. Furnish copy of manufacturer's wiring diagram submittal to Electrical installer.

1. Verify that electrical wiring installation is in accordance with manufacturer's submittal and installation requirements of Division 16 sections. Verify proper rotation direction of fan wheels. Do not proceed with equipment start-up until wiring installation is acceptable to equipment installer.

D. Install vibration isolation as scheduled and specified in Section 15200B.

#### **3.3 FIELD QUALITY CONTROL**

A. Testing: After installation of ventilators has been completed, test each ventilator to demonstrate proper operation of units at performance requirements specified. When possible, field correct malfunctioning units, then retest to demonstrate compliance. Replace units which cannot be satisfactorily corrected.

#### **3.4 SPARE PARTS**

A. General: Furnish to Owner, with receipt, one spare set of belts for each belt drive power ventilator.

**END OF SECTION**

## SECTION 23 84 00 - DUCTWORK

### PART 1 - GENERAL

#### 1.1 DESCRIPTION OF WORK

- A. Extent of ductwork requirements is indicated on the Drawings and by requirements of this section.
- B. The ductwork requirements for this project include the following:
  - 1. Low-Pressure Ductwork
  - 2. Plenums

#### 1.2 RELATED DOCUMENTS

- A. Applicable provisions of Division 1 shall govern work under this section.
- B. Specified Elsewhere:
  - 1. 23 25 00 Mechanical Insulation
  - 2. 23 86 00 Ductwork Accessories

#### 1.3 QUALITY ASSURANCE

- A. SMACNA Standards: Comply with SMACNA "HVAC Duct Construction Standards" first edition 1985 for fabrication and installation of metal and flexible ductwork.
- B. ASHRAE Standards: Comply with ASHRAE Handbook and Product Directory, 1979 Equipment Volume, Chapter 1 "Duct Construction", for fabrication and installation of ductwork.
- C. NFPA Compliance: Comply with ANSI/NFPA 90A "Standard for the Installation of Air Conditioning and Ventilating Systems" and ANSI/NFPA 90B "Standard for the Installation of Warm Air Heating and Air Conditioning Systems."
- D. ACIGH Industrial Ventilation 24<sup>th</sup> Edition 2001.

#### 1.4 SUBMITTALS

- A. Submit product data and specifications for ductwork materials.
- B. Indicate duct fittings, particulars such as gages, sizes, welds, and configuration prior to start of work for low and high-pressure and exhaust ductwork systems.

### PART 2 - PRODUCTS

#### 2.1 DUCTWORK MATERIALS

- A. Above ground, general ductwork: Galvanized steel, lock-forming quality, ASTM A527; 1.25 oz. zinc coating each side, mill phosphatized, ASTM A525.
  - 1. Round – Spiral wound ductwork.
- B. Steel Ducts: Galvanized steel, lock-forming quality, ASTM A527; 1.25 oz. zinc coating each side(G90), mill phosphatized, ASTM A525.
- C. Stainless Steel Ducts: ASTM A167, Type 304.

D. Flexible Duct:

1. Spiral wire Reinforced Fabric: Spiral wire reinforced fabric type flexible duct shall be made of a corrosion-resistant reinforcing wire helix bonded to a continuous layer of fabric. Class I Air Duct Material, UL Standard 181.

E. Insulated Flexible Duct: Insulation shall be cellular glass, 1-1/2" nominal thickness of 1-1/2 pound density per cubic foot. The insulation shall encase the flexible duct and shall be sheathed with vapor barrier having a permeability of not over 2.0 perm. Insulation and vapor barrier shall be factory installed.

F. Flexible Fiberglass Duct Liner: Flexible coated glass fiber duct liner; ANSI/ASTM C553; 'K' value of 0.26 at 75 degrees F; 1-1/2 lbs./cu. ft. minimum density; coated air side for maximum 4,000 ft./min. air velocity.

1. Lagging Adhesives: Fire resistive to ASTM E84, NFPA 255.
2. Impale Anchors: Galvanized steel, 12 gage self-adhesive pad or mechanical fastener type as recommended, insulation manufacturer.

G. Duct Sealant: Non-hardening, non-migrating mastic or liquid elastic sealant gaskets and tapes as compounded and recommended by the manufacturer specifically for sealing joints and seams in ductwork.

H. Ductwork Support Materials: Except as otherwise indicated, provide hot-dipped galvanized steel fasteners, anchors, rods, straps, trim and angles for support of ductwork.

I. Drive Screws and Clamps: As recommended by SMACNA.

J. Factory Made Joints: Ductmate system as manufactured by Ductmate Industries, Inc., Nexus system as manufactured by Exanno, or other approved product may be used.

## 2.2 DUCTWORK PRESSURE-VELOCITY CLASSIFICATION

A. General: Construct ductwork in conformance to SMACNA "HVAC Duct Construction Standards" 1st edition 1985.

B. Low Pressure Ductwork:

1. Static Pressure Class: +2" W.G.
2. Maximum Velocity Level: 2500 FPM.

## 2.3 DUCTWORK SEALING CLASSIFICATION

A. General: Construct ductwork in conformance to SMACNA "HVAC Duct Construction Standards" 1st edition 1985.

B. Low Pressure Ductwork:

1. Seal Class: B seal transverse joists and longitudinal seams.

## 2.4 FABRICATION

A. Shop fabricate ductwork in 4, 8, 10, or 12 foot lengths, unless otherwise indicated or required to complete runs. Pre-assemble work in shop to greatest extent possible, so as to minimize field assembly of systems. Disassemble systems only to extent necessary for shipping and handling. Match-mark sections for reassembling and coordinated installation.

B. All dimensions indicated on drawings are free area ductwork requirements. Increase ductwork dimensions to accommodate ductwork lining requirements.

C. Accessories:

1. Fabricate ductwork with accessories such as air turns, extractors, and volume dampers, installed during fabrication to greatest extent possible.
2. Fabricate ductwork with duct liner in each section of duct where required.

D. Variation: No variation of duct configuration or sizes permitted except by written permission.

E. Directional Change:

1. Construct tees, bends, and elbows with radius minimum 1-1/2 times width of duct on center lines.
2. Where not possible and where rectangular elbows used, provide airfoil type turning vanes.
3. Where acoustical lining is required, provide turning vanes of perforated metal type with fiberglass inside.

F. Size Change:

1. Increase duct sizes gradually, not exceeding 15 deg. divergence wherever possible.
2. Maximum divergence upstream of equipment to be 30 deg. and 45 deg. convergence downstream.

G. Seams and Joints:

1. Seams and joints fabricated in accordance with SMACNA standards.
2. Rigidly construct metal ducts with joints mechanically tight, substantially airtight, braced and stiffened so not to breathe, rattle, vibrate, or sag.

**2.5 LOW PRESSURE DUCTWORK**

A. Fabricate and support in accordance with SMACNA Low Pressure Duct Construction Standards and ASHRAE handbooks, except as indicated. Provide duct material, gages, reinforcing, and sealing for operating pressures indicated.

B. Size round ducts installed in place of rectangular ducts in accordance with ASHRAE table of equivalent rectangular and round ducts. No variation of duct configuration or sizes permitted except by written permission.

C. Construct T's, bends, and elbows with radius of not less than 1-1/2 times width of duct on center line. Where not possible and where rectangular elbows are used, provide airfoil turning vanes. Where acoustical lining is indicated, provide turning vanes of perforated metal with glass fiber insulation.

1. Where acoustic lining is indicated, provide turning vanes of perforated metal with glass fiber insulation.

D. Increase duct sizes gradually, not exceeding 15 degrees divergence wherever possible. Divergence upstream of equipment shall not exceed 30 degrees; convergence downstream shall not exceed 45 degrees.

E. Provide easements where low pressure ductwork conflicts with piping and structure. Where easements exceed 10 percent duct area, split into two ducts maintaining original duct area.

F. Connect flexible ducts to metal ducts with adhesive and draw bands.

G. Round Duct Take-Offs: Provide conical or bellmouth low-pressure fittings.

H. Square Duct Take-Offs: Provide 45 degree leading edge at square take-off with 4: minimum depth.

## 2.6 DUCTWORK APPLICATION SCHEDULE

|    | <u>Air System</u> | <u>Classification</u> | <u>Material</u> |
|----|-------------------|-----------------------|-----------------|
| A. | Supply air:       | Low Press             | Steel           |
| B. | Exhaust air:      | Low Press             | Steel           |
| C. | Fresh air:        | Low Press             | Steel           |

## PART 3 - EXECUTION

### 3.1 INSTALLATION

- A. Assemble and install ductwork in accordance with SMACNA standards, and which will achieve airtight and noiseless systems, capable of performing each indicated service.
1. Align ductwork accurately at connections.
  2. Support ducts rigidly with suitable ties, braces, hangers and anchors of type, which will hold ducts straight, plumb and free of sags and vibration.
- B. Electrical Equipment Spaces: Do not run ductwork through transformer vaults and other electrical equipment spaces and enclosures.
- C. Metal Duct Support:
1. Support ductwork from building structure as required and, where not otherwise indicated, anchor with bolts, concrete inserts, steel expansion anchors, welded studs, C-clamps or special beam clamps.
  2. Support vertical ducts, at 12 foot spacing, by attachment to adjacent vertical structural surfaces or by direct bearing at floor penetrations and similar locations.
  3. Support horizontal ducts located against structural walls and other similar adjacent vertical surfaces, at 8 foot spacing for ducts up to 40 inches horizontal dimension and 4 foot spacing for larger ducts.
  4. Hang horizontal rectangular ducts from overhead structure, at 10 feet spacing for duct widths up to 60 inches and 8 foot spacing for larger ducts.
  5. Arrange hangers, supports and duct rests to permit free, unrestrained and noiseless expansion and contraction of duct.
  6. Where duct lining not used, vertical members may be fastened to duct sides with sheet metal screws.
  7. Where duct lining is used, do not puncture sheet metal.
- D. Provide openings in ductwork where required to accommodate thermometers and controllers. Provide pilot tube openings where required for testing of systems, complete with metal can with spring device or screw to ensure against air leakage. Where openings are provided in insulated ductwork, install insulation material inside a metal ring.
- E. Locate ducts with sufficient space around equipment to allow normal operating and maintenance activities.
- F. Slope underground ducts to plenums or low pumpout points at 1:100 feet. Provide access doors for inspection.
- G. Connect terminal units to high-pressure ducts directly with three-foot maximum length of flexible duct. Do not use flexible duct to change direction.
- H. Provide residue traps in kitchen hood exhaust ducts at base of vertical risers with provisions for cleanout.
- I. During construction provide temporary closures of metal or taped polyethylene on open ductwork to prevent construction dust from entering ductwork system.

- J. Provide sleeved opening where ducts pass through smoke, fire and sound walls.
  - 1. Seal space between duct and sleeve airtight with mineral wool or approved fire stopping material.
  - 2. Provide duct flange to cover and retain fire-stopping material.

K. Connections:

- 1. Connect duct to equipment with flexible fabric, sheet metal clips, screws and washers.
- 2. Connect branch take-offs to include prefabricated air scoops formed of same material as associated duct system.
- 3. Connect diffusers or plenum boots to low-pressure ducts with 10-foot maximum length of flexible duct, held in place with strap or clamp.

### 3.2 ADJUSTING AND CLEANING DUCTWORK

- A. Clean duct system and force air at high velocity through duct to remove accumulated dust. To obtain sufficient air, clean half the system at a time. Protect equipment, which may be harmed by excessive dirt with temporary filters, or bypass during cleaning.
- B. Clean duct systems with high power vacuum machines. Protect equipment, which may be harmed by excessive dirt with filters, or bypass during cleaning. Provide adequate access into ductwork for cleaning purposes.

### 3.3 DUCT LEAKAGE

- A. Inspect all ductwork for leak sources and repair.
- B. Do not insulate ductwork until it has been accepted for duct leakage.
- C. Refer to Section 23 05 90 for Testing, Adjusting, and Balancing requirements of ductwork system.
- D. Low pressure ductwork leakage rate shall not exceed 5%.

**END OF SECTION**

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## SECTION 23 86 00 - DUCTWORK ACCESSORIES

### PART 1 - GENERAL

#### 1.1 DESCRIPTION OF WORK

- A. Extent of duct accessories work is indicated on drawings and in schedules, and by requirements of this section.
- B. Types of duct accessories required for this project include the following:
  - 1. Dampers:
    - a. Manual dampers
    - b. Control dampers
  - 2. Fire dampers
  - 3. Turning vanes
  - 4. Duct hardware
  - 5. Duct access panels
  - 6. Flexible connections

#### 1.2 RELATED DOCUMENTS

- A. Applicable provisions of Division 1 shall govern work under this section.
- B. Specified Elsewhere:
  - 1. 23 20 00 Vibration Isolation
  - 2. 23 25 00 Mechanical Insulation
  - 3. 23 84 00 Ductwork
  - 4. 23 90 00 Controls and Instrumentation

#### 1.3 QUALITY ASSURANCE

- A. SMACNA Compliance: Comply with applicable portions of Sheet Metal and Air Conditioning Contractor's National Association SMACNA "HVAC Duct Construction Standards" 1st edition, 1985.
- B. Industry Standards: Comply with American Society of Heating, Refrigerating and Air Conditioning Engineers Inc. (ASHRAE) recommendations pertaining to construction of duct accessories, except as otherwise indicated.
- C. UL Compliance: Construct, test, and label fire dampers in accordance with Underwriters Laboratories (UL) Standard 555 "Fire Dampers and Ceiling Dampers".
- D. NFPA Compliance: Comply with applicable provisions of ANSI/NFPA 90A "Air Conditioning and Ventilating Systems", pertaining to installation of duct accessories.

### PART 2 - PRODUCTS

#### 2.1 DAMPERS

- A. Manual Dampers: Provide dampers of single blade type (up to 6" height) or multiblade type (over 6" height), constructed in accordance with SMACNA Standards. Provide damper operator with locking devices and damper position indicator.
- B. Automatic Control Dampers (ACD): Refer to Division 15900C section "Controls and Instrumentation" for automatic control damper requirements. Furnished by Temperature Controls Contractor.

C. Available Manufacturers: Subject to compliance with requirements, manufacturers offering dampers which may be incorporated in the work include, but are not limited to the following:

1. Honeywell.
2. Vent Products
3. Ruskin Mfg. Co.

## 2.2 FIRE DAMPERS

A. Fire Dampers: Provide 1-1/2 hour, Type 'B' UL listed fire dampers, of sizes indicated, unless indicated otherwise. Construct casing of 16 ga. galvanized steel with bonded red acrylic enamel finish. Provide fusible link as required. Provide damper with positive lock in closed position, and with the following additional features:

1. U.L. Listed Fire Rating: 1-1/2 hour
2. Damper Blade Assembly: Curtain type.
3. Blade Material: Steel, match casing.

B. Available Manufacturers: Subject to compliance with requirements, manufacturers offering fire and smoke dampers which may be incorporated in the work include, but are not limited to the following:

1. Air Balance Inc.
2. Safe Air Inc.
3. Ruskin Mfg. Co.

## 2.3 TURNING VANES

A. Manufactured Turning Vanes: Provide turning vanes constructed of 1.5" wide curved blades set at 1.5" spacing O.C., supported with bars perpendicular to blade set at 2" O.C., and set into side strips suitable for mounting in ductwork. Double wall type turning vanes shall be 2" radius, 2-1/8" spacing O.C.

1. Ducts over 24-inch dimension shall use double-wall airfoil type turning vane.
2. Ducts with air velocity over 2500 FPM shall use double-wall airfoil type turning vane.

B. Acoustic Turning Vanes: Provide acoustic turning vanes constructed of airfoil shaped aluminum extrusions with perforated faces and fiberglass fill.

1. Provide where acoustic duct liner is required.

## 2.4 DUCT HARDWARE

A. General: Provide duct hardware, manufactured by one manufacturer for all items on project, for the following:

1. Quadrant Locks: Provide for each damper, quadrant lock device on one end of shaft; and end bearing plate on other end for damper lengths over 12". Provide extended quadrant locks and end extended bearing plates for externally insulated ductwork.

B. Available Manufacturers: Subject to compliance with requirements, manufacturers offering duct hardware which may be incorporated in the work include, but are not limited to the following:

1. Ventfabrics, Inc.
2. Young Regulator Co.

## 2.5 DUCT ACCESS PANELS

- A. General: Provide where indicated, duct access panels of size indicated. Minimum size 12" x 12". Access panels are required at the following equipment, but are not limited to these locations:
1. Upstream and downstream of reheat or duct-mounted coils.
  2. Fire Dampers.
  3. Backdraft and motorized dampers.
  4. Automatic Control Dampers - internally mounted.
  5. Louvers.
- B. Construction: Construct of same or greater gauge as ductwork served, provide insulated doors for insulated ductwork. Provide flush frames for uninsulated ductwork, extended frames for externally insulated duct. Provide one size hinged, other side with one (1) handle-type latch for doors 1/2" high and smaller, 2 handle-type latched for larger doors.
- C. Available Manufacturers: Subject to compliance with requirements, manufacturers offering duct access door which may be incorporated in the work include, but are not limited to the following:
- 1 Air Balance Inc.
  - 2 Duro Dyne Corp.
  - 3 Ruskin Mfg. Co.
  - 4 Ventfabrics Inc.

## 2.6 FLEXIBLE CONNECTIONS

- A. General: Provide flexible duct connections, wherever ductwork connects to vibration-isolated equipment. Construct flexible connections of neoprene-coated flameproof fabric crimped into duct flanges for attachment to duct and equipment. Make airtight joint. Provide adequate joint flexibility to allow for thermal, axial, transverse, and torsional movement, and also capable of absorbing vibrations of connected equipment.
- B. Refer to Section 23 20 00 Vibration Isolation.

## PART 3 - EXECUTION

### 3.1 INSPECTION

- A. Examine areas and conditions under which duct accessories will be installed. Do not proceed with work until unsatisfactory conditions have been corrected.

### 3.2 INSTALLATION

- A. Install duct accessories in accordance with manufacturer's installation instructions, with applicable portions of details of construction as shown in SMACNA Standards, and in accordance with recognized industry practices to ensure that products serve intended function.
- B. Install turning vanes in square or rectangular 90 deg. elbows in supply and exhaust air systems, and elsewhere as indicated.
- C. Install access doors to open against systems air pressure, with latches operable from either side, except outside only where duct is too small for person to enter.
- D. Coordinate with other work, including ductwork as necessary to interface installation of duct accessories properly with other work.
1. Install control dampers provided by Temperature Control Contractor.

- E. Field Quality Control: Operate installed duct accessories to demonstrate compliance with requirements. Test for air leakage while system is operating. Repair or replace faulty accessories, as required to obtain proper operation and leak proof performance.

**END OF SECTION**

## SECTION 23 87 00 - AIR OUTLETS AND INLETS

### PART 1 - GENERAL

#### 1.1 DESCRIPTION OF WORK

- A. Extent of outlets and inlets work is indicated by drawings and schedules, and by requirements of this section.
- B. Types of outlets and inlets required for project include the following:
  - 1. Supply and Exhaust Registers.

#### 1.2 RELATED DOCUMENTS

- A. Applicable provisions of Division 1 shall govern work under this section.
- B. Specified Elsewhere:
  - 1. 23 84 00 Ductwork
  - 2. 23 86 00 Ductwork Accessories

#### 1.3 QUALITY CONTROL

- A. Manufacturers: Firms regularly engaged in manufacturer of outlets and inlets of types and capacities required, whose products have been in satisfactory use in similar service for not less than 5 years. Acceptable manufacturers are listed as follows:
  - 1. Carnes
  - 2. Titus
  - 3. Krueger
  - 4. Price.
- B. ARI Standards: Comply with Air Conditioning and Refrigeration Institute (ARI) Standard 650 "Air Outlets and Inlets".
- C. ADC Standards: Comply with Air Diffusion Council standards.
- D. MCA Standards: Comply with Air Moving and Conditioning Association standards.

#### 1.4 SUBMITTALS

- A. Submit shop drawings covering each item together with schedule of outlets and inlets.
- B. Submit manufacturer's air diffusion performance data and installation instructions.

### PART 2 - PRODUCTS

#### 2.1 GENERAL

- A. Except as otherwise indicated, provide manufacturers standard outlet and inlet products where shown, of size, shape, capacity and type indicated on schedules, constructed of materials and components as indicated, and as required for complete installation.
- B. Performance: Provide outlet and inlet products that have, as minimum, temperature and velocity traverses, throw and drop, and noise criteria ratings for each size device as listed in manufacturers current data and schedule for application.

- C. Ceiling Compatibility: Provide outlet and inlet products with border styles that are compatible with adjacent ceiling systems, and that are specifically manufactured to fit into ceiling module with accurate fit and adequate support. Refer to general construction drawings and specifications for types of ceiling systems, which will contain each type of ceiling air diffuser.

## 2.2 SUPPLY REGISTERS

- A. Square and Rectangular: Extruded aluminum construction, adjustable vertical face blades, surface-mounted.
1. Opposed blade damper, as scheduled.
  2. Finish: White.

## 2.3 SUPPLY AND EXHAUST REGISTERS

- A. Square and Rectangular: Extruded aluminum construction, 40 degrees fixed deflection, surface-mounted.
1. Opposed blade damper, as scheduled.
  2. Finish: White.

## PART 3 - EXECUTION

### 3.1 INSTALLATION

- A. Coordinate with other work, including ceiling layout, ductwork and ductwork accessories, as necessary to interface installation of air diffusers properly with other work.
- B. Install items in accordance with manufacturer's printed instructions.
- C. Paint ductwork visible behind air outlets matt black.
- D. Grilles and Registers:
1. Secure overlapping frame of register or grille to screen, flange, or angle of ductwork with countersunk screws.
  2. Locate wall registers and grilles minimum 6 inches below ceiling, unless otherwise indicated.
  3. Locate separate accessible balancing volume damper at each register or grille in addition to control damper integral with register or grille.
  4. Adjust registers and grilles to provide draft less uniform air distribution.

### 3.2 FIELD QUALITY CONTROL

- A. Test and operate installed outlets and inlets to demonstrate compliance with requirements.

**END OF SECTION**

## SECTION 23 96 00 - STARTING OF MECHANICAL SYSTEMS

### PART 1 - GENERAL

#### 1.1 DESCRIPTION OF WORK

##### A. Contractor:

1. Provide material and labor required for start up of all equipment and systems installed under general contract.
2. Coordinate start-up work with pipe cleaning, pipe system leak tests, and initial system fill and venting.
3. Provide all information and assistance required for cooperation with testing, adjusting and balancing services.
4. Contractor shall coordinate start-up of mechanical equipment with manufacturer's representative to be present for supervision and certification of correct operating procedures.

#### 1.2 RELATED DOCUMENTS

A. Applicable provisions of Division 1 shall govern work under this section.

##### B. Specified Elsewhere:

- |    |          |                                  |
|----|----------|----------------------------------|
| 1. | 23 05 90 | Testing, Adjusting and Balancing |
| 2. | 23 06 00 | Pipe and Pipe Fitting            |
| 3. | 23 63 00 | Water Treatment                  |
| 4. | 23 90 00 | Controls and Instrumentation     |

#### 1.3 START-UP PROCEDURES

##### A. Bearings:

1. Inspect for cleanliness, clean and remove foreign materials.
2. Verify alignment.
3. Replace defective bearing and those which run rough or noisy.
4. Lubricate as necessary in accordance with manufacturer's recommendations.

##### B. Motors:

1. Check each motor for amperage comparison to nameplate value.
2. Correct conditions, which produce excessive current flow, which exist due to equipment malfunction.

##### C. Drives:

1. Adjust tension in V-belt drives, and adjust vari-pitch sheaves and drives for proper equipment speed.
2. Adjust drives for alignment of sheaves and V-belts.
3. Clean and remove foreign materials before starting operation.

##### D. Pumps:

1. Check mechanical seals for cleanliness and adjustment before running pump.
2. Inspect shaft sleeves for scoring.
3. Inspect mechanical faces, chambers and seal rings; replace if defective.
4. Verify that piping system is free of dirt and scale before circulating liquid through pump.
5. Clean suction strainers.

E. Control Valves:

1. Inspect hand and automatic control valves, clean bonnets and stems.
2. Tighten packing glands to assure no leakage, but permit valve stems to operate without galling.
3. Replace packing on any valve, which continues to leak.
4. Remove and repair bonnets, which leak.
5. Coat packing gland threads and valve stems with surface preparation after cleaning.
6. Verify that control valve seats are free from foreign materials and are properly positioned for intended service.

F. Water Systems:

1. Tighten flanges after system has been placed in operation. Replace flange gaskets, which show signs of leakage after tightening.
2. Inspect screwed joints for leakage. Promptly remake each joint, which appears to be faulty; do not wait for rust to form.
3. After water system has been placed in operation, clean strainers, dirt pockets, orifices, valve seats and headers in fluid systems to assure being free of foreign materials.
4. Remove rust, scale and foreign materials from equipment and renew defaced surfaces.
5. Inspect each electrical control circuit to assure that operation complies with specifications and requirements to provide desired performance.
6. Inspect each pressure gauge and thermometer for calibration. Replace items defaced, broken or read incorrectly.
7. Repair damaged insulation.

G. Air Systems:

1. Set and calibrate draft gages of air filters and other equipment.
2. Replace filter media with new clean units.
3. Inspect fan wheels for clearance and balance. Provide factory-authorized personnel for adjustment when needed.
4. Check each electrical control circuit to assure that operation complies with specifications and requirements to provide desired performance.

H. Adjustments:

1. Provide such periodic continuing adjustment services as necessary to insure proper functioning of mechanical systems after occupancy of the Project, and for a period of one year after Date of Substantial Completion.
2. Note: Adjustment services are not maintenance services.

**PART 2 - PRODUCTS**

--- NOT USED ---

**PART 3 - EXECUTIONS**

--- NOT USED ---

**END OF SECTION**

## SECTION 23 89 50 - VARIABLE FREQUENCY DRIVES

### PART 1 - GENERAL

#### 1.1 DESCRIPTION OF WORK

- A. Extent of variable frequency drive (VFD) equipment work is indicated by the Drawings and schedules, and by requirements of this section.
- B. Types of variable frequency drives required for this project include the following:
  - 1. HWP-1 20 HP 208-volt 3-phase.
  - 2. HWP-2 20 HP 208-volt 3-phase.
- C. Variable Frequency Drives(VFD) shall be provided by the Temperature Control Contractor(T.C.C.).
  - 1. The Variable Frequency Drives shall be mounted and wired by the Electrical Contractor.
  - 2. The HVAC Contractor will not be responsible for any VFD work, except for providing VFD-compatible HVAC motors, where applicable.

#### 1.2 RELATED DOCUMENTS

- A. Applicable provisions of Division 1 shall govern work under this section.
- B. Specified Elsewhere:
  - 1. 23 05 00 HVAC General Provisions
  - 2. 23 90 00 Controls and Instrumentation

#### 1.3 QUALITY ASSURANCE

- A. UL and NEMA Compliance: Provide products which have been listed and labeled by Underwriters Laboratories and comply with NEMA Standards.
  - 1. ANSI/UL Standard 508.
- B. IEEE and ANSI Compliance: VFD shall comply with applicable standards of IEEE, ANSI and NEC.
- C. Power Line Noise: Power line noise shall be limited to a voltage distortion factor and line notch depth as defined in IEEE Standard 519-1981, Guide for Harmonic Control and Reactive Compensation of Static Power Converters. Distortion shall not exceed 5%.
- D. Radiated Noise: VFD shall not emit either conducted or radiated RFI in excess of limitations set forth in the FCC Rules and Regulations, Part 15, Subpart J.
- E. Installation and Start-Up Services: VFD manufacturer shall provide a factory trained engineer to approve the installation; start-up operations, test and adjust for proper operations and instruct Owner's representative in the proper operation and maintenance of the units.
- F. Warranty: Manufacturer shall provide standard 18-month warranty for VFD system parts and labor against defects in workmanship and material.
- G. Acceptable Manufacturers:
  - 1. Danfoss.

2. ABB.

**1.4 SUBMITTALS**

- A. Submit shop drawings for all VFD and associated system components as herein specified including all data concerning dimensions, capacities and performance, wiring diagrams and appropriate identification.
- B. Submit certified efficiency versus load and speed curves for VFD.
- C. Submit certified electrical noise generation data in accordance with IEEE 519 standard. Submit electrical noise attenuation equipment required to meet criteria specified.
- D. Operation and Maintenance Manual.

**PART 2 - PRODUCTS**

**2.1 GENERAL REQUIREMENTS**

- A. Furnish complete variable frequency drives as specified herein for the fans and pumps, designated on the drawing schedules to be variable speed. All standard and optional features shall be included within the VFD enclosure, unless otherwise specified. VFD enclosure shall be NEMA 1, freestanding or wall mounted.
- B. The VFD shall convert three-phase, 60-Hz utility power to adjustable-voltage and frequency, three-phase power for stepless motor speed control from 5% to 100% of the motor's 60-Hz speed. Input voltage shall be as specified on the Drawing schedules.
- C. The VFD shall include a converter and an inverter section. the converter section shall convert fixed frequency and voltage AC utility power to DC voltage. All VFDs shall include input line reactors.
- D. The inverter section of the VFD shall invert the DC voltage into a quality output waveform, with adjustable voltage and frequency for stepless motor speed control.
- E. The VFD and options shall be tested to ANSI/UL Standard 508. The Complete system, including all specified options, shall be listed by a nationally recognized testing agency such as UL or BTL.
- F. Power line noise shall be limited to a voltage distortion factor and line notch depth as defined in IEEE Standard 519-1981, Guide for Harmonic Control and Reactive Compensation of Static Power Converters. The total voltage distortion shall not exceed 5%.
- G. The VFD shall not emit radiated RFI in excess of the limitations set forth in the FCC Rules and Regulations, Part 15 for Class A computing devices. The VFD shall carry a FCC compliance label. PWM type drives shall include RFI filters.
- H. The VFD shall not cause objectionable acoustical motor noise. Motor noise as a result of the VFD shall be limited to three dB-over across-the-line operation, measured at three feet from the motors centerline.
- I. The VFD's full load AMP rating shall meet or exceed NEC Table 430-150.
- J. Motors and variable frequency drives shall be provided by the drive manufacturer and selected to accommodate additional motor heating when driven by a VFD, while maintaining full nameplate horsepower at specified service factor.

- K. VFD system shall modulate the speed of its respective motor in response to a 0-10 VDC or 4-20 mA control signal provided by the Temperature Control Sub-contractor.
- L. VFD system shall consist of the following components:
  - 1. Variable frequency drive.
  - 2. Bypass motor contactor and bypass switch for VFD.
  - 3. Input disconnect switch.
  - 4. Electrical noise filters.

## 2.2 VFD UNIT

- A. General: VFD shall be variable torque, solid state transistorized control with diode bridge rectifier and manual transfer switch. The unit shall be U.L. listed, solid state, micro processor-based with a pulse width modulated (PWM) output wave form (none others are acceptable).
  - 1. The VFD shall employ a full wave bridge rectifier, to prevent line notching, with DC output bus choke, capacitors to minimize the ripple of the rectified voltage to maintain near constant DC voltage. Insulated gate bipolar transistors (IGBT's) shall be employed as the output switching device.
  - 2. VFD shall be factory tested at maximum HP and 40 deg. C for 100 hours.
- B. Performance:
  - 1. Input Voltage: 208 volts, 3-phase, 60 Hertz.
  - 2. Output Voltage: 208 volts, 3-phase, 3 to 60 Hertz.
  - 3. Speed Range: 20:1 maximum.
  - 4. Enclosure: NEMA 1 with lock, wall mount.
  - 5. Minimum Efficiency: 92% @ 50%; 99% @ 100% speed.
  - 6. Power Factor: 0.95 thru speed range.
  - 7. Adjustments: Minimum and maximum speed acceleration-deceleration 30 to 50 seconds.
  - 8. Power Line Noise: Voltage distortion factor of 5% or less and a line notch depth of 25% or less.
- C. Standard Features:
  - 1. Run/stop selector switch, auto/manual selector switch, fault light, manual speed potentiometer, power on light, ready light.
  - 2. Speed/power/load digital display and selector switch.
  - 3. Automatic under voltage reset with adjustable time delay.
  - 4. 0-10 VDC or 4-20 mA common input signal follower.
  - 5. Motor overload protection.
  - 6. Over temperature protection.
  - 7. Under voltage/over voltage protection.
  - 8. Adjustable current limit.
  - 9. Door interlock disconnect.
- D. Special Features:
  - 1. Drive/Off/Line manual bypass switch with bypass contactor and motor overload protection.
  - 2. VFD input disconnect switch.
  - 3. Two N.C. and N.O. auxiliary contacts.
- E. Provide partitioning within drive enclosures to separate and isolate bypass section from VFD section of drive, to house bypass wiring, contactors, relays, automatic or manual transfer

switch. Devices within the convertor/inverter compartment must be able to be maintained with power completely off in the convertor/inverter section.

- F. Provide an automatic transfer switch/bypass starter to allow operation in bypass mode in the event of convertor/inverter failure or shutdown. Drive shall also be provided with capability to manually switch from drive to bypass operation.
  - 1. Provide a manual switch and bypass contactors to transfer from VFD operation to bypass operation.
  - 2. Provide a fixed or adjustable current limiting control device.
- G. Provided devices to permit field adjustment of minimum and maximum output frequency.
- H. Drives shall be equipped with devices allowing field adjustment of acceleration rate. Capability shall exist to allow motor speed to increase from start to full speed in a field adjustable period of time.
- I. Provide one normally open and one normally closed auxiliary contact in each drive. These contacts shall be activated upon drive failure of any kind, including safety shutdowns. Contacts are intended to be used for remote monitoring of drive operation by the central energy management system.
- J. Field performance testing of adjustable speed drive assemblies to determine compliance with specified performance requirements will be performed at the Owner's discretion. Performance testing may include any specified feature, including operation of protective devices (through simulated fault). The cost of initial testing will be borne by the owner. Should drive be found to be deficient in any performance category, drive manufacturer will be required to make any and all changes necessary to bring units into compliance with performance guidelines as specified. The cost of changes, and the cost of retest, will be borne by mechanical contractor.

### **PART 3 - EXECUTION**

#### **3.1 INSTALLATION OF VFD SYSTEM**

- A. Install VFD system in accordance with details, shop drawings and manufacturer's instructions.
- B. VFD system components shall be turned over to the Electrical Trade for mounting and wiring under the supervision of the HVAC Trade.
  - 1. Field electrical wiring of line voltage components between transformer, VFD and motors shall be by the Electrical Trade.
  - 2. Control wiring (100 volts or less) shall be by the Temperature Control Contractor.
- C. Start-up, Operation and Maintenance:
  - 1. Manufacturer shall provide the services of a factory-trained engineer to approve the installation, start-up, test and adjust VFD units for proper operation, and instruct and train the owner's maintenance personnel in the operation and maintenance of the units.
  - 2. Manufacturer's representative shall demonstrate operational capability of units during instruction and training period.
  - 3. Upon completion of this service, submit to the Engineer a complete diagnostic report, including start-up and test log, signed by the manufacturer's representative.

**END OF SECTION**

## SECTION 23 90 00 - CONTROLS AND INSTRUMENTATION

### PART 1 - GENERAL

#### 1.1 DESCRIPTION

##### A. Work Includes:

1. Complete system of XL5000 Direct Digital Automatic Controls System.
2. Complete Integration into existing Honeywell SymmetrE Network.
3. Electrical Control system.
4. Control devices, components, wiring and material.
5. Instructions for users.

##### B. Existing Honeywell DDC controls at the Olbrich Gardens Mechanical Room shall be reused to fullest extent.

1. Existing Honeywell boiler plant controller and control panel may be reused with new controls.
2. Existing sensors may be reused; as indicated on drawings.

#### 1.2 DESCRIPTION OF WORK

##### A. Extent of controls and instrumentation work is indicated on drawings and schedules and by requirements of this section.

##### B. Control system for air handler units and heating plant operation shall be electronic (DDC) to control HVAC systems as specified herein. Electronic controlled devices such as valve and damper actuators shall be employed. Control loop logic and sequencing of HVAC operations shall be accomplished by DDC controls with electronic input devices as temperature and pressure sensors.

##### C. Control systems shall be electronic DDC to control valve and damper actuators for terminal units, as specified herein.

##### D. Instruction of Owner's personnel.

#### 1.3 RELATED WORK

##### A. Applicable provisions of Division 1 shall govern work under this section.

##### B. Specified Elsewhere:

- |    |          |                                |
|----|----------|--------------------------------|
| 1. | 23 91 00 | Direct Digital Control Systems |
| 2. | 23 95 00 | Control Sequence               |
| 3. | 23 95 10 | DDC Point List                 |

#### 1.4 QUALITY ASSURANCE

##### A. Regulatory Requirements:

1. National Electrical Code, NEC
2. National Electrical Manufacturers Association, NEMA
3. Underwriter's Laboratories, UL

##### B. All equipment provided, including control panels, dampers, valves, controllers, transmitters, sensors and other control devices shall bear the manufacturer's nameplate.

- C. Entire control system including piping and wiring shall be installed by mechanics specifically authorized by the Temperature Control equipment manufacturer for the installation and having acceptable experience installing and servicing similar control equipment.
- D. Acceptable Manufacturers/Contractor:
1. Honeywell XL5000/SymmetrE Network
- E. Authorized Controls Integrator: The control contractor shall be a Honeywell ACI – Authorized Integrator.
- F. Guarantee: Guarantee the controls and instrumentation to maintain the temperature within one degree of the setpoint and further guarantee all work, materials, equipment, and controls against defects in workmanship and material, and provide service for a period of one (1) year from date of final acceptance.

## 1.5 SUBMITTALS

- A. Shop Drawings:
1. Schematic control diagrams giving specific data on all settings, ranges, action, adjustments, and normal positions.
  2. Wiring diagrams detailed adequately for field construction and include all related wiring.
  3. Control valve and damper schedules with complete sizing data giving required design flow and temperature or pressure, and any other pertinent data.
  4. Sequence of operation for each system corresponding to control schematics.
  5. Panel drawings including complete internal wiring and piping schematics and complete data on all mounted components.
  6. Damper operator schedule, listing quantity, size of operators and mounting arrangement.
  7. Space thermostat sensor schedule indicating types of covers and adjustment means for each space.
- B. Control Diagrams:
1. Furnish and mount in each equipment room or space prints of schematic control diagrams and corresponding sequences of operation for all systems located therein.
  2. Diagrams and sequences mounted in frames under clear plastic and located in easily visible location or as directed by A/E.
- C. Product Data:
1. Submit published descriptive data on each item of equipment and accessories.
  2. Submit manufacturer's installation instructions.
- D. Report:
1. At completion of work, submit report of check-out of automatic control system.
  2. Report actual setpoints with record drawings.

## 1.6 CALIBRATION AND ADJUSTMENTS

- A. After completion of the installation, perform final calibrations and adjustments of the control equipment provided under this contract and supply services incidental to the proper performance of the automatic control system under warranty.
- B. Submit letter to Engineer indicating all controls are calibrated and operating per sequence of control.

## **1.7 SYSTEM START-UP AND ACCEPTANCE PROCEDURE**

- A. Upon completion of the calibration, the Control Contractor shall start up the system and perform all necessary testing and run diagnostic tests to ensure proper operation. Control Contractor shall be responsible for generating all software and entering all database necessary to perform the sequence of control and specified software routines. An acceptance test in the presence of the Owner's representative or engineer shall be performed.

## **1.8 OWNER TRAINING**

- A. Provide sufficient but not less than 8 hours of training to the Owner's representatives, concerning the proper operation and maintenance of all control systems, sensing, monitoring and control equipment. Training sessions shall be conducted during normal business hours after system start-up and acceptance by the Owner.
- B. Submit operating and maintenance manuals to Owner a minimum of five (5) working days prior to training session. Use these manuals as the basis for instruction at all training sessions.
- C. Provide two follow-up visits for troubleshooting and instruction, one six months after substantial completion and the other at the end of the warranty period. Length of each visit to be not less than four (4) hours or the time necessary to provide required information and complete troubleshooting and inspection activity.

## **1.9 DELIVERY, STORAGE AND HANDLING**

- A. Factory shipping cartons for each piece of equipment.
- B. Factory-applied plastic end caps on each length of pipe and tube.
- C. Maintain cartons and end caps through shipping, storage and handling as required to prevent equipment and pipe-end damage, and to eliminate dirt and moisture from equipment and inside of pipe and tube.
- D. Where possible, store equipment and materials inside and protected from weather.
- E. When necessary to store outside, elevate well above grade and enclose with durable waterproof wrapping.

## **PART 2 - PRODUCTS**

### **2.1 SYSTEM REQUIREMENTS**

- A. Provide complete control systems consisting of thermostats, sensors, control valves, dampers, operators, indicating devices, interface equipment, and other apparatus required to operate mechanical system and to perform functions specified and in compliance with the sequence of operations described herein.
- B. Provide necessary materials, labor and field work necessary to connect control components factory supplied as part of equipment controlled.

### **2.2 COORDINATION OF TEMPERATURE CONTROL WORK**

- A. Electric Wiring: All electric wiring in connection with the automatic temperature control system shall be furnished and installed by the Controls Trade, except for equipment starter interlocks, which are the responsibility of the Electrical Trade.

1. All 120 (line) volt or larger electrical service wiring and connections to equipment and motor starters is the responsibility of the Electrical Trade.
2. All additional line voltage power requirements beyond which is indicated on the Drawings and Specifications for the temperature control system shall be the responsibility of the Controls Trade.

B. Valves and Piping Wells: Furnish by Controls Trade, installed by HVAC Trade under supervision.

C. Dampers, Valves, Actuators and related Controlled Devices: Furnished by Controls Trade, installed by HVAC Trade under supervision.

### 2.3 CONTROL PANELS

- A. Provide local panels of unitized cabinet type for each system under automatic control. Mount relays, switches, and controllers with control point adjustment in cabinet and temperature indicators, pressure gages, pilot lights, push buttons, and clocks and switches flush on cabinet panel face. All components within the control panels shall be prewired to numbered terminal strips, ready for field connection to field-mounted control components.
- B. Control panels shall be constructed of steel or extruded aluminum with hinged door and keyed lock, with baked enamel finish of manufacturer's standard color.
- C. Panel mounted indicators or thermometers shall indicate the temperature sensed by each remote built sensor as shown or as required. Indicators or thermometers shall be 3-1/2" in diameter and have an accuracy of 1% of scale range.
- D. Mount panels adjacent to associated equipment on vibration free walls or free standing steel angle supports. One cabinet may accommodate more than system in same equipment room. Provide engraved plastic name plates for instruments and controls inside cabinet and on cabinet face.

### 2.4 ELECTRICAL EQUIPMENT REQUIREMENTS

- A. Provide electrical devices and relays that are UL listed and of a type meeting current and voltage characteristics of the project.

### 2.5 THERMOSTATS

A. Room Thermostats(Sensors):

1. Electronic Sensors: Provide space sensors with dual setpoint settings, LCD readout, local face temperature adjustment with actual space temperature readout and local override switch. Removable cover shall be smooth hard plastic ivory or off-white color.
2. Provide tamperproof locking covers in all public areas.

B. Immersion Thermostats: For remote bulb elements use either averaging type or suitable length for air or rigid bulb type for liquids.

1. In liquids, use separable wells.
2. Duct thermostat sensing element shall be remote bulb or minimum 8 foot averaging element.
3. Thermostats shall be one or two-pipe, proportioning type, direct or reverse acting as required. Thermostat shall have adjustable setpoint and throttling ranges adequate for the application.

C. Outdoor Bulbs for Thermostats and Thermometers:

1. Locate on north side, with sun shield at least 10 feet above grade and at least 5 feet from openings.
2. Non-ferrous type securely fastened to construction.

## 2.6 FREEZESTATS (LOW-LIMIT CUT-OFF)

- A. Freezestats shall be of the electric 2 position type with temperature sensing element and manual reset. Stats shall be capable of opening the stat circuit if any one foot length of the sensing element is subject to a temperature below the stat setting.
- B. Sensing element shall not be less than one lineal foot per square foot of coil surface area, minimum length 12 feet. Unless otherwise indicated, set freezestats at 38 deg. F.

## 2.7 SENSORS/TRANSMITTERS

- A. Temperature Sensors (Room): Use a surface mount zone temperature sensor housed in a durable, ventilated plastic wall-mount enclosure, with broad aluminum faceplate. The sensing element to be a 1,000 ohm RTD (nickel or silicon) 0-10 VDC, or 4-20 MA accuracy +/- 1/2% span.
  - 1. Tamperproof locking covers and concealed adjustment in public areas.
- B. Temperature Sensors (Discharge and Return Duct): Use a surface mount duct temperature sensor housed onto a standard metal handibox. The sensing element to be a 10,000 ohm RTD (nickel or silicon) 0-10 VDC, or 4-20 MA. House sensor in a 8-1/2" stainless steel probe. Accuracy +/- 1/2% span.
- C. Temperature Sensor (Mixed Air - Averaging): Select an averaging capillary type sensor housed on a standard metal handibox. The capillary type sensor to house no less than five sensing elements which will return an average of the five or more sensor elements. The sensing elements are to be a 1,000 ohm RTD (nickel or silicon) 0-10 VDC, or 4-20 MA. Accuracy +/- 1/2% span.
- D. Immersion type temperature sensors: Rod and tube type with linear output. Provide separable thermowells with heat conductive fluid for installation in pipeline. Units shall be factory calibrated.
- E. Ambient Static Pressure Sensor(reference): Equal to BAPI model ZPS-ACC-10 outside air pickup port or approved equal.

## 2.8 CONTROL VALVES

- A. Water Valves:
  - 1. Furnish all modulating straight-through water valves with equal-percentage contoured throttling plugs. Furnish all three-way valves with linear throttling plugs such that the total flow through the valve shall remain constant regardless of the valve's position.
  - 2. Size 3-way control valves for a pressure drop equal to the unit they serve but not to exceed 5 psi.
- B. Valves 2" and smaller shall be screwed type, forged or cast brass, 125 PSIG rated, stainless steel stems, synthetic elastomeric or teflon packing.
- C. 2-1/2" and larger valves shall be iron body, bronze mounted, stainless steel stems, PTFE teflon packing.

## 2.3 ELECTRIC CONTROL ACTUATORS

- A. Electronic Actuators shall be sized to operate their appropriate dampers or valves with sufficient reserve power to provide smooth proportional action or two-position action as specified.
  - 1. Modulating Valves: Valve actuators shall accept proportional 0-10 VDC or 0-20 mA signals for modulating action. Provide at air handling unit water coils and reheat coils at VAV boxes.

2. Two-Position Valves: May be provided at radiation valves or convectors.
  3. Three-way Valves: Air handling unit water coils.
- B. Provide positive position sequencing relays for accuracy and non-overlapping operation of two or more actuators where required system design function.
- C. Actuators shall be designed to allow replacement of seal glands without draining the piping system.
- D. Acceptable Manufacturers: Belimo or approved equal.

## 2.4 NORMAL POSITIONS

- A. Regardless of type of system, each device shall assume specified normal positions on power failure.
- B. Normal positions shall be safe positions and as follows:
1. Outside and Relief/Exhaust Air Dampers: Normally closed.
  2. Return Air Damper: Normally open.
  3. Automatic Control Valves: Normally open - full flow thru heat transfer device.
  4. Terminal Heating Valves: Normally open valve position; spring-return to full flow thru heat transfer device.

## 2.5 CONTROL DAMPERS

- A. The control trade shall furnish all control dampers as shown on the plans and/or as required to perform the control sequence specified except those furnished with fan equipment.
- B. All modulating dampers shall be sized by the control trade to meet flow requirements of the application in accordance with his recommendation. All two position dampers to be sized as close as possible to duct size, but in no case is damper size to be less than 90% of duct area.
- C. Unless otherwise indicated, all control dampers shall be opposed blade type. Two position dampers may be parallel blade type.
- D. All dampers shall be factory fabricated and shall be standard products of the control manufacturer.
- E. Damper frames shall not be less than 13 gauge galvanized steel or extruded aluminum of 12 gauge. Blades shall not be less than 16 gauge galvanized steel or 14 gauge aluminum, not over 8 inch width with steel trunnions mounted in a bronze sleeve or ball bearings.
- F. All blade linkage hardware shall have corrosion-resistant finish and be readily accessible for maintenance.
- G. Fresh and Relief Air Dampers: Furnish low-leakage type dampers with replaceable neoprene edging seals installed at all four sides of the frame and each blade.
1. Dampers and seals shall be suitable for maximum temperature and air velocities to be encountered in the system with the minimum temperature ranges of -40 degrees F to 200 degrees F.
  2. Submit leakage and flow characteristic data for all control dampers along with shop drawings.
  3. Dampers when closed, shall be guaranteed by the control manufacturer not to leak air in excess of 1/2% at 4 inches static pressure water gauge.

## PART 3 - EXECUTION

### 3.1 GENERAL

- A. Install all control equipment, wiring and air piping in a neat and workmanlike manner.
- B. All immersion wells, pressure tapings and any associated shut-off valves, flow switches, level switches and other such items furnished by the control manufacturer shall be installed by the mechanical contractor under the coordinating control and supervision of the control contractor.
- C. Install all control devices in an accessible location.
- D. Electrical Wiring: All electrical wiring for the automatic control system, excluding line voltage power to control panels, as indicated on the Drawings, shall be furnished and installed by the Temperature Control Contractor in accordance with this specification section. All the electrical sections of this specification and all applicable electric codes shall apply to the required work.
  - 1. Sensor and/or control wiring shall be provided with conduit independent of those used for high voltage, switches AC or other signals which may create interference or cause induced voltages which promote signal drift or reduced accuracy. Sensor and high voltage wiring may not be run in the same conduit.

### 3.2 INSTALLATION

- A. Check and verify location of thermostats, room sensors and other exposed control sensors with plans and piping details before installation. Locate thermostats and sensors 60 inches above floor.
  - 1. Isolated from exterior walls as recommended by manufacturer.
  - 2. Located where not exposed to direct rays of sun, and where not influenced by concealed or adjacent heating, domestic hot water piping or warm air currents.
- B. Valve tops, inserts or bonnets, sensors, thermostats, thermometers, gauges, and damper motors of all types:
  - 1. Provide with access doors and/or access panels, in building construction so that they may be readily removed, replaced and serviced.
  - 2. Access doors and access panels by HVAC Contractor.
- C. Control Wiring of all Kinds:
  - 1. All control wiring to be labeled at both ends identifying termination and origination point.
  - 2. In conduit and included with temperature control system.
  - 3. Concealed low voltage control wiring may be routed as cabling.
  - 4. Exposed control wiring shall be in EMT conduit.
  - 5. Conforming to all requirements of Electrical Specifications, Division 16.
- D. Locate controls, relays, instruments, switches, valves, devices and accessories so they are readily accessible for adjustment, service, and replacement or as indicated on the drawings.
- E. Install control valves horizontal with power unit up unless otherwise indicated. Maximum variation from vertical is 45 degrees.
- F. Locate, size and support temperature sensing elements in water streams to properly sense the representative temperature.
  - 1. For controlling, transmitting and indicating elements, sensing device located, sized and of the type to sense the average condition.
  - 2. Wells shall not obstruct the flow of the fluid being measure.
  - 3. Pipes 1" and smaller shall be increased at least one pipe size at point of insertion.

- G. Where insulation on piping, ductwork or equipment is punctured or penetrated due to the installation of sensing elements or tubing, reseal the openings air and vapor tight.
- H. Where control devices are to be located on insulated surfaces, provide brackets to clear the finished surface of the insulation avoiding punctures of the vapor seal.
- I. Locate support, enclose and install control devices and equipment so that they will not be subject to:
  - 1. Vibration
  - 2. Excessive temperatures
  - 3. Dirt, moisture or other harmful effects.
  - 4. Conditions beyond their rated limitations.
- J. Conceal all piping except piping in mechanical rooms and other areas where mechanical system piping may be exposed.
- K. Install all exposed piping and conduit parallel to or at right angles to the building structure and support adequately at uniform intervals. Use only tool made bends.
- L. Make tests on piping from time to time during the progress of installation to insure against leaks.

### **3.3 TESTING, ADJUSTING AND PERFORMANCE DEMONSTRATIONS**

- A. All controlling devices which are a part of the automatic temperature control system, shall be tested and adjusted by the Contractor before system is offered for final acceptance.
  - 1. All associated devices, valves, operators and dampers adjusted.
  - 2. All operating and positioning of all dampers verified.
- B. After all calibrations, adjustment and checking have been completed and all systems are operational:
  - 1. Demonstrate to User's representative, the complete and correct functioning of all control systems and equipment.
  - 2. Demonstrations shall consist of operating the controls through their normal full ranges and sequences.
  - 3. Simulate abnormal conditions to demonstrate proper functioning of safety devices.
  - 4. Readjust all settings to their correct design values and after sufficient time, observe ability of controls to establish the desired conditions, noting any abnormal deviations.
  - 5. Make any necessary repairs, replacements or adjustments on all items which fail to perform satisfactorily, all to the satisfaction of the Owner's representative.
- C. Upon completion of the work and testing, but prior to final acceptance:
  - 1. A representative of the control system manufacturer shall spend such length of time as necessary to instruct the Owner's personnel in proper operation, adjustment and maintenance of the control equipment and systems.
  - 2. Instruction shall be performed by competent, trained, full-time employees of the control system manufacturer who have a complete working knowledge of the systems and equipment installed in this job.

**END OF SECTION**

## SECTION 23 91 00 - DIRECT DIGITAL CONTROL SYSTEMS

### PART 1 - GENERAL

#### 1.1 SCOPE

- A. The DDC control work associated with this section shall be bid as part of the Temperature Control Contract scope of the Work.
- B. The Building Automation System (BAS) shall be capable of integrating multiple building functions, including equipment supervision and control, alarm management, energy management, and trend data collection.
- C. The BAS shall consist of the following:
  - 1. Direct Digital Control Panels.
  - 2. Standalone Application Specific Controllers (ASCs).
  - 3. Network wiring.
- D. The system shall be modular in nature, and shall permit expansion of both capacity and functionality through the addition of sensors, actuators, ASCs, and operator devices.
- E. The failure of any single component or network connection shall not interrupt the execution of control strategies at other operational devices.

#### 1.2 RELATED WORK

- A. Applicable provisions of Division 1 shall govern work under this section.
- B. Specified elsewhere:
  - 1. 23 90 00 Controls and Instrumentation
  - 2. 23 95 00 Control Sequences
  - 3. 23 95 10 DDC Point List
  - 4. Division 23 HVAC Specifications
  - 5. Division 26 Electrical Specifications

#### 1.3 QUALITY ASSURANCE

- A. Acceptable Manufacturer/Installer: A firm regularly engaged in manufacture of DDC control equipment similar to the specified equipment and has been in satisfactory similar service for not less than five (5) years. Subject to compliance with requirements, provide DDC control system from the following manufacturers:
  - 1. Manufacturer: Honeywell
  - 2. Installer Qualifications: A firm specializing and experienced in DDC control system installation with a local service office within 60 miles of Madison metropolitan area and experience with a minimum of five(5) similar installations for no less than five(5) years experience with Honeywell Control installations. All work to be done by qualified mechanics in the direct employ of this manufacturer.
- B. Electrical Standards: Provide electrical products which have been tested, listed and labeled by Underwriters' Laboratories (UL) and comply with NEMA standards.

- C. DDC Standards: DDC manufacturer shall provide written proof with shop drawings that the equipment being provided is in compliance with F.C.C. rules governing the control of interference caused by Digital Electronic Equipment to Radio Communications (1979 Amendment to Part 15, Subpart J).

#### 1.4 SUBMITTALS

A. Product Data:

1. Submit manufacturer's specifications for each control device furnished, including installation instructions and startup instructions. General catalog sheets showing a series of the same device is not acceptable unless the specific model is clearly marked.
2. Annotated software program documentation shall be submitted for system sequenced, along with descriptive narratives of the sequence of operation of the entire system involved.
3. Submit wiring diagram for each electrical control device with other details required to demonstrate that the system has been coordinated and will function as a systems.

- B. Maintenance Data: Submit maintenance data and spare parts lists for each control device. Include this data in maintenance manual.

- C. Record Drawings: Prior to request for final payment, provide complete composite record drawings to incorporate the DDC and Pneumatic/Electric field work

#### 1.5 MATERIAL DELIVERY AND STORAGE

- A. Provide factory shipping cartons for each piece of equipment and control device. This contractor is responsible for storage of equipment and materials inside and protected from the weather.

### PART 2 - PRODUCTS

#### 2.1 NETWORKING/COMMUNICATIONS

- A. The design of the BAS shall be networked as shown on the attached system configuration drawing. Inherent in the system's design shall be the ability to expand or modify the network either via a local network, auto-dial telephone line modem connections, or a combination of the two networking schemes.

- B. Building Operator's Station: Owner will provide CPU, monitor, keypad, mouse, printer, desk and chair.

C. Local Network:

1. Building Operator's Station /Panel Support: The Building Operator's Station or Digital Panel shall directly oversee a local network such that communications may be executed directly to and between ASCs. The Operator's Terminal version or Digital Panel version shall be referred to as the "Digital Panel(s)" throughout this document.
2. Data Access: All operator devices either network resident or connected via dial-up modems, shall have the ability to access all point status and application data on the network. Access to system data shall not be restricted by the hardware configuration of the facility management system.
3. Global Data Sharing: global Data Sharing or Global point broadcasting shall allow point data to be shared between ASCs, when it would be inefficient or impractical to locate multiple sensors.
4. General Network Design: Network design shall include the following provisions:
  - a. Data transfer rates for alarm reporting and quick point status from multiple ASCs. The minimum baud rate shall be 9600 baud.

- b. Support of any combination of ASCs. A minimum of 100 ASCs shall be supported on a single local network. The bus shall be addressable for up to 255 ASCs.
- c. Detection of single or multiple failures of the ASCs or the network media.
- d. Error detection, correction, and retransmission to guarantee data integrity.
- e. Commonly available, multiple sourced, networking components shall be used.
- f. Use of an industry standard protocol, such as Optomux, and IEEE RS-485 communications interface.

## 2.2 DIGITAL PANELS

- A. General: Digital Panels shall be microprocessor-based, multi-tasking, multi-user, digital control processors.
- B. Memory: Each Digital Panel shall have sufficient memory to support its own operating system and databases including:
  - 1. Control Processes
  - 2. Energy Management Applications
  - 3. Alarm Management
  - 4. Trend Data
  - 5. Maintenance Support Applications
  - 6. Operator I/O
  - 7. Dial-Up Communications
  - 8. Manual Override Monitoring
- C. Expandability: The system shall be modular in nature, and shall permit easy expansion through the addition of field controllers, sensors, and actuators.
- D. Serial Communication Ports: Digital Panels shall provide at least two RS-232C serial data communication ports for simultaneous operation of multiple operator I/O devices such as laptop computers, Personal Computers, and Video Display terminals.
- E. Hardware Override Monitoring: Digital Panels shall monitor the status of all overrides, and include this information in logs and summaries to inform the operator that automatic control has been inhibited.
- F. Integrated On-Line Diagnostics: Each Digital Panel shall continuously perform self-diagnostics, communication diagnosis and diagnosis of all subsidiary equipment. The Digital Panels shall provide both local and remote annunciation of any detected component failures, or repeated failure to establish communication. Indication of the diagnostic results shall be provided at each Digital Panel.
- G. Surge and Transient Protection: Isolation shall be provided at all network terminations, as well as all field point terminations to suppress induced voltage transients consistent with IEEE Standard 587-1980. Isolation levels shall be sufficiently high as to allow all signal wiring to be run in the same conduit as high voltage wiring where acceptable by electrical code.
- H. Powerfail Restart: In the event of the loss of normal power, there shall be an orderly shutdown of the Digital Panels to prevent the loss of database or operating system software. Non-volatile memory shall be incorporated for all critical controller configuration data, and battery back-up shall be provided to support the real-time clock and all volatile memory for a minimum of 72 hours.

Upon restoration of normal power, the Digital Panels shall automatically resume full operation without manual intervention.

## 2.3 SYSTEM SOFTWARE FEATURES

- A. General

1. All necessary software to form a complete operating system as described in this specification shall be provided.
2. The software programs specified in this section shall be provided as an integral part of the Digital Panel and shall not be dependent upon any higher level computer for execution.

B. Graphic Requirements: Provide color graphic backgrounds with operational information interface for the following systems:

1. Air handling system with AH-2 and ERV-2
2. Each VAV terminal.
3. Building Floor Plan graphic for temperature sensor informational and terminal unit service designations.

C. Control Software Description:

1. Equipment Cycling Protection: Control software shall include a provision for limiting the number of times each piece of equipment may be cycled within any one-hour period.
2. Heavy Equipment Delays: The system shall provide protection against excessive demand situations during start-up periods by automatically introducing time delays between successive start commands to heavy electrical loads.
3. Powerfail Motor Restart: Upon the resumption of normal power, the DDC panel shall analyze the status of all controlled equipment, compare it with normal occupancy scheduling, and turn equipment on or off as necessary to resume normal operation.

D. Energy Management Applications: Digital Panels shall have the ability to perform any or all of the following energy management routines:

1. Time of Day Scheduling
2. Calendar Based Scheduling
3. Holiday Scheduling
4. Temporary Schedule Overrides
5. Optimal Start
6. Optimal Stop
7. Demand Limiting
8. Load Rolling
9. Heating/Cooling Interlock
10. Average/High/Low Signal Select and Reset

All programs shall be executed automatically without the need for operator intervention, and shall be flexible enough to allow user customization. Programs shall be applied to building equipment as described in the "Execution" portion of this specification.

E. Programming Capability: Digital Panels shall be able to execute configured processes defined by the user, to automatically perform calculations and control routines.

1. Process Inputs and Variables: It shall be possible to use any of the following in a custom process:
  - a. Any system-measured point data or status
  - b. Any calculated data
  - c. Any results from other processes
  - d. Boolean logic operators (and, or,)
2. Process Triggers: Configured processes may be triggered based on any combination of the following:
  - a. Time of Day
  - b. Calendar Date
  - c. Other Processes

- d. Events (e.g., point alarms)
3. Data Access: A single process shall be able to incorporate measured or calculated data from any and all other ASCs.

In addition, a single process shall be able to issue commands to points in any and all other NCUs on ASCs local network.

- F. Alarm Management: Alarm management shall be provided to monitor, buffer, and direct alarm reports to operator devices and memory files. Each Digital Panel shall perform distributed, independent alarm analysis and filtering to minimize operator interruptions due to non-critical alarms, minimize network traffic, and prevent alarms from being lost. At no time shall the Digital Panel's ability to report alarms be affected by either operator activity at the local I/O device, or communications with other ASCs on the network.

1. Alarm Messages: In addition to the point's descriptor and the time and date, the user shall be able to print, display or store a 60-character alarm message to more fully describe the alarm condition or direct operator response.
2. Each Digital Panel shall be capable of storing a library of at least 100 Alarm Messages. Each message may be assignable to any number of points in the panel.
3. Auto-Dial Alarm Management: In dial-up applications, only critical alarms shall initiate a call to a remote operator device. In all other cases, call activity shall be minimized by time-stamping and saving reports until an operator scheduled time, a manual request, or until the buffer space is full. The alarm buffer must store a minimum of 50 alarms.

- G. Trend Analysis: A data collection utility shall be provided to automatically sample, store and display system data.

Measured and calculated analog and binary data shall be assignable to user-definable trends for the purpose of collecting operator-specified performance data over extended periods of time. Sample intervals of 5 seconds to 24 hours, in one-minute or one-hour intervals, shall be provided. Each Digital Panel shall have a dedicated buffer for trend data, and shall be capable of storing 32 trend logs. Each trend log shall have up to 4 points trended at 168 data samples each. data shall be stored at the Digital Panel.

Trending: The BAS will be capable of trending all data points for 5 years with logging intervals of 15 minutes, and be available to trend all data points with an interval of 5 seconds or less for up to at least two hours. The format of the trending data will be in a format acceptable by MS Excel-2003 or newer.

The trend data shall be in a table with date and time in the first column(s) and the trending data in consecutive columns. All columns shall have the heading on the first row(s) and the data for that heading in the same column in the following rows. All headings will be explained in detail such that there is no uncertainty as to what was measured and the location of that sensor. All columns headings shall include the units for the trended data.

The trending data files shall not contain more than 200 columns and 65,000 rows each.

- H. Runtime Totalization: Digital Panels shall automatically accumulate and store runtime hours for binary input and output points as specified in the "Execution" portion of this specification.

1. The Totalization routine shall have a sampling resolution of one minute.
2. The user shall have the ability to define a warning limit for Runtime Totalization. Unique, user-specified messages shall be generated when the limit is reached.

- I. Event Totalization: Digital Panels shall have the ability to count events such as the number of times a pump or fan system is cycled on and off. Event totalization shall be performed on a daily, weekly, or monthly basis.

1. The Event Totalization feature shall be able to store the records associated with a minimum of 9,999,999 events before reset.
2. The user shall have the ability to define a warning limit. Unique, user-specified messages shall be generated when the limit is reached.

## 2.4 APPLICATION SPECIFIC CONTROLLERS - HVAC APPLICATIONS

- A. Each Digital Panel shall be able to extend its performance and capacity through the use of standalone Application Specific Controllers (ASCs).
- B. Each ASC shall operate as a standalone controller capable of performing its specific control responsibilities independently of other controllers in the network. Each ASC shall be of microprocessor-based, multi-tasking, real-time digital control processor.
- C. Each ASC shall have sufficient memory to support its own operating system and data bases including:
  1. Control Processes
  2. Energy Management Applications
  3. Operator I/O (Portable Service Terminal)
- D. The operator interface to any ASC point data or programs shall be through the Digital Panel or portable operator's terminal connected to any ASC on the network.
- E. ASCs shall directly support the temporary use of a portable service terminal that can be connected to the ASC via zone temperature or directly at the controller. The capabilities of the portable service terminal shall include, but not be limited to, the following:
  1. Display temperatures
  2. Display status
  3. Display setpoints
  4. Display control parameters
  5. Override binary output control
  6. Override analog setpoints
  7. Modification of gain and offset constants
- F. Powerfail Protection: All system setpoints, proportional bands, control algorithms, and any other programmable parameters shall be stored such that a power failure of any duration does not necessitate reprogramming the ASC.
- G. Application Descriptions:
  1. VAV Terminal Unit Controllers:
    - a. VAV Terminal Unit Controller shall support, but not be limited to, the control of the following configurations of VAV boxes to address current requirements described in the "Execution" portion of this specification, for future expansion.
      - 1.) Single Duct Only (Cooling Only, or Cooling with Reheat)
      - 2.) Fan Powered (Parallel/Side Pocket, Series On/Off Logic Series/Proportional Fan)
      - 3.) Dual Duct (Constant Volume, Variable Volume)
      - 4.) Supply/Exhaust.
    - b. VAV Terminal Unit Controller shall support the following types of point inputs and outputs:
      - 1.) Proportional Cooling Outputs
      - 2.) Box and Baseboard Heating Outputs: (Proportional or 1 to 3 Stages)
      - 3.) Fan Control Output: (On/Off Logic, or Proportional Series Fan Logic)

- c. VAV Terminal Unit Controllers shall support the following library of control strategies to address the requirements of the sequences described in the "Execution" portion of this specification, and for future expansion:
  - 1.) Daily Schedules
  - 2.) Comfort/Occupancy Mode
  - 3.) Economy Mode
    - Standby Mode
    - Unoccupied
    - Shutdown
  - 4.) Lighting Logic Interlock to Economy Mode
  - 5.) Temporary Override Mode
  
- c. Alarm Management: Each VAV Terminal Unit Controller shall perform its own limit and status monitoring and analysis to maximize network performance by reducing unnecessary communications.

2. Unitary Controllers:

- a. Unitary Controllers shall support, but not be limited to, the following types of systems to address specific applications described in the "Execution" portion of this specification, and for future expansion:
  - 1.) Unit Vents (ASHRAE Cycle I, II, III, or W)
  - 2.) Heat Pumps (Air-to-Air, Water-to-Air)
  - 3.) Packaged Rooftops
  - 4.) Fan Coils (Two-Pipe, Four-Pipe)
  - 5.) Generic Point Multiplexing
  
- b. Unitary Controllers shall support the following types of point inputs and outputs:
  - 1.) Economizer Switchover Inputs
    - a.) Drybulb
    - b.) Outdoor Air Enthalpy
    - c.) Differential Temperature
    - d.) Binary Input from a separate controller
  - 2.) Economizer Outputs
    - a.) Integrated Analog with minimum position
    - b.) Binary Output to enable self-contained
    - c.) Economizer Actuator
  - 3.) Heating and Cooling Outputs
    - a.) 1 to 3 Stages
    - b.) Analog Output with two-pipe logic
    - c.) Reversing valve logic for Heat Pumps
  - 4.) Fan Output
    - a.) On/Off Logic Control
  
- c. Unitary controllers shall support the following library of control strategies to address the requirements of the sequences described in the "Execution" portion of this specification, and for future expansion:
  - 1.) Daily Schedules
  - 2.) Comfort/Occupancy Mode
  - 3.) Economy Mode:
    - Standby Mode/Economizer Available
    - Unoccupied/Economizer Not Available
    - Shutdown
  - 4.) Lighting Logic Interlock to Economy Mode
  - 5.) Temporary Override Mode:
    - Temporary Comfort Mode (Occupancy-Based Control)

## Boost (Occupant Warmer/Cooler Control)

- d. Alarm Management: Each VAV Terminal Unit Controller shall perform its own limit and status monitoring and analysis to maximize network performance by reducing unnecessary communications.

### 3. AHU Controllers

- a. AHU Controllers shall support, but not be limited to the following configurations of systems to address current requirements as described in the "Execution" portion of this specification, and for future expansion:
  - 1.) Air Handling Units
    - Mixed Air-Single Path
    - Mixed Air-Dual Path
    - 100% Single Path
    - 100% Dual Path
    - Generic Point Multiplexing
- b. AHU Controllers shall support all the necessary point inputs and outputs to perform the specified control sequences in a totally standalone fashion.
- c. AHU controllers shall have a library of control routines and program logic to perform the sequence of operation as specified in the "Execution" portion of this specification.
- d. Continuous Zone Temperature Histories: Each AHU Controller shall automatically and continuously, maintain a history of the associated zone temperature to allow users to quickly analyze space comfort and equipment performance for the past 24 hours. A minimum of two samples per hour shall be stored.
- e. Alarm Management: Each AHU Controller shall perform its own limit and status monitoring and analysis to maximize network performance by reducing unnecessary communications.
- f. Each AHU Controller shall come with a hand-held Zone Terminal permanently mounted at the controller to allow interface with the controller. This device will allow the user to monitor or adjust set points and time scheduling within a specific zone.

### 4. Lab and Central Plant (LCP) Controllers:

- a. LCP controllers shall support, but not be limited to, the following configurations of systems to address current requirements described in the "Execution" portion of this specification, and for future expansion.
  - 1.) Single boiler or chiller plants with pump logic
  - 2.) Cooling towers
  - 3.) Zone pressurization of labs
  - 4.) Air Handling Units and Roof-top units with complex controls sequences
  - 5.) Plant Heating and Cooling circuits
  - 6.) Heat exchangers
- b. LCP controllers shall support all the necessary point inputs and outputs to perform the specified control sequences in a totally standalone fashion. A minimum of 30 I/O points expandable to 94 shall be supported by the LCP.

## 2.5 OPERATOR INTERFACE

### A. Basic Interface Description:

1. Command Entry/Menu Selection Process: Operator interface software shall minimize operator training through the use of English language prompting, English language point identification.

The operator interface shall have the option of using a mouse or similar pointing device for a "point and click" approach to facilities management. Users shall be able to start and stop equipment or change setpoints from graphical displays through the use of a mouse or similar pointing device.

2. Password Protection: Multiple-level password access protection shall be provided to allow the user/manager to limit control, display and database manipulation capabilities as he deems appropriate for each user, based upon an assigned password.
  - a. Passwords shall be exactly the same for all operator devices.
  - b. A minimum of four (4) levels of access shall be supported:
    - 1.) Level 1 = Data Access and Display
    - 2.) Level 2 = Level 1 + Operator Overrides and Commands
    - 3.) Level 3 = Level 2 + Operator Management
    - 4.) Level 4 = Level 3 + Database Generation and Modification
  - c. A minimum of eight (8) passwords shall be supported at each Digital Panel.
  - d. Operators will be able to perform only those commands available for their respective passwords. Menu selections displayed at any operator device, shall be limited to only those items defined for the access level of the password used to log-on.
  - e. User-definable, automatic log-off timers of from 1 to 60 minutes shall be provided to prevent operators from inadvertently leaving devices logged on.
  
4. Operator Commands: The operator interface shall allow the operator to perform commands including, but not limited to, the following:
  - a. Start-up or shutdown selected equipment
  - b. Adjust setpoints
  - c. Add/Modify/Delete time programming
  - d. Enable/Disable process execution
  - e. Lock/Unlock alarm reporting for each point
  - f. Enable/Disable Totalization for each point
  - g. Enable/Disable Trending
  - h. Enter temporary override schedules
  - i. Define Holiday Schedules
  - j. Change time/date
  - k. Enter/Modify analog alarm limits
  - l. Enable/Disable demand limiting
  - m. Enable/Disable duty cycle
  - n. Enable/Disable average/high/low signal select and reset
  
5. Logs and Summaries: Reports shall be generated manually, and directed to the displays. As a minimum, the system shall allow the user to easily obtain the following types of reports:
  - a. A general listing of all points in the network shall include, but not be limited to, the following:
    - 1.) Points currently in alarm
    - 2.) Off-line points
    - 3.) Points currently in override status
    - 4.) Points in Weekly Schedules
    - 5.) Holiday Programming
  - b. Summaries shall be provide for specific points, for a logical point group, for a user-selected group of groups, or for the entire facility without restriction due to the hardware configuration of the facility management system. Under no conditions shall the operator need to specify the address of hardware controller to obtain system information.
  
- B. System Configuration and Definition: All temperature and equipment control strategies and energy management routines shall be definable by the operator. System definition and modification procedures shall not interfere with normal system operation and control.

1. The system shall be provided complete with all equipment and documentation necessary to allow an operator to independently perform the following functions:
  - a. Add/Delete/Modify Application Specific Controllers
  - b. Add/Delete/Modify points of any type, and all associated point parameters, and tuning constants
  - c. Add/Delete/Modify alarm reporting definition for each point
  - d. Add/Delete/Modify energy management applications
  - e. Add/Delete/Modify time- and calendar-based programming
  - f. Add/Delete/Modify Totalization for every point
  - g. Add/Delete/Modify Historical Data Trending for every point
  - h. Add/Delete/Modify configured control processes
  - i. Add/Delete/Modify dial-up telecommunication definition
  - j. Add/Delete/Modify all operator passwords
  - k. Add/Delete/Modify Alarm Messages
2. Programming Description: Definition of operator device characteristics, ASCs, individual points, applications and control sequences shall be performed through fill-in-the-blank templates.
3. System Definition/Control Sequence Documentation: All portions of system definition shall be self-documenting to provide hardcopy printouts of all configuration and application data.
4. Database Save/Restore/Back-Up: Back-up copies of all ASC and Digital Panel databases shall be stored in at least one personal computer or laptop. Users shall also have the ability to manually execute downloads of an ASC or Digital Panel data base.

### **PART 3 - EXECUTION**

#### **3.1 INSTALLATION**

- A. Install the control system in accordance with manufacturer's instructions.

#### **3.2 DEMONSTRATION**

- A. The system manufacturer or his representative shall provide start-up and adjustment service for the control system.
- B. The system manufacturer or his representative shall provide a minimum four (4) hours of training for the Owner's personnel on the operation and maintenance of the packaged control system.

**END OF SECTION**

## SECTION 23 95 00 - CONTROL SEQUENCE

### PART 1 - GENERAL

#### 1.1 DESCRIPTION

- A. Provide control sequences as outlined in this specification section herein.

#### 1.2 RELATED DOCUMENTS

- A. Applicable provisions of Division 1 shall govern work under this section.
- B. Refer to schematic layout of control and HVAC equipment on HVAC drawings.
- C. Specified Elsewhere:
- |    |          |                                |
|----|----------|--------------------------------|
| 1. | 23 90 00 | Controls and Instrumentation   |
| 2. | 23 91 00 | Direct Digital Control Systems |
| 3. | 23 95 10 | DDC Point List                 |

### PART 2 - PRODUCTS

#### 2.1 MATERIALS

- A. Refer to Section 23 90 00 - Controls and Instrumentation.

### PART 3 - EXECUTION

#### 3.1 CONTROL SEQUENCE

- A. Systems shall perform in accordance with the following descriptions of the control strategy intent.
- B. BAS = Building Automation System (DDC Controls).

#### 3.2 HOT WATER CIRCULATION PUMPS HWP-1 & 2

- A. Lead pump shall be started by the BAS (Building Automation System) and shall operate continuously during the heating season. Pumps shall be switched for lead/lag operation automatically by the BAS, or by pumps failure, as sensed by differential pressure switches across the piping of the respective pump.
- B. Pump lead operation shall be manually rotated for equal run time by the BAS.
- C. Pump Capacity Control: Static pressure controller shall modulate pump capacity through signal to VFD motor speed controls to maintain minimum pressure differential between HWS and HWR piping at one(1) sensor locations. (See Drawings.)
1. Initial Set Point: 20 feet differential (adjustable).

#### 3.3 HOT WATER HEATING SYSTEM

- A. Boiler manufacturer(AERCO) shall provide for the following control, as part of the integral boiler management system(BMS) at each boiler control panel.

- B. Hot water supply to the system shall be reset by outside air temperature with one sensor in the hot water supply to maintain a building hot water supply temperature and one sensor outside measuring ambient conditions as dictated by the following reset schedule:

Outdoor Air Temperature

-10 degrees F  
60 degrees F

Hot Water Supply Temperature

160 degrees F  
90 degrees F

- C. Three(3) modular boilers shall be staged and modulated into operation on a first-on/first-off basis to maintain a hot water supply temperature as scheduled. Lead boiler selection shall be automatically rotated for equal run time on both boilers. Boiler sequencing to be programmed from boiler C-more control panel.
- D. HWS high limit alarm set at 200 degree F.
- E. The BAS controls shall be provided by the Temperature Control Contractor(TCC), the C-More networked controller at each boiler shall be provided by the boiler equipment supplier(AERCO) as part of the boiler equipment package. The DDC control systems shall interface with the C-More controllers through the MODbus interface. The C-more boiler controls shall enable and disable boilers, sequence boilers, control each boiler capacity, optimize boiler plant efficiency, monitor and control hot water supply and return temperatures, monitor boiler status and outdoor air temperature through each boiler control communication interface.
- F. Temperature Control Contractor shall be responsible for mounting all Boiler Control Panel sensors and interfacing with the AERCO boiler representative upon boiler startup and control panel setup.

### 3.4 BOILER ROOM VENTILATION

- A. Supply Fan SF-1 & Exhaust Fan EF-14: Start and stop ventilation fans upon a rise in temperature above setpoint in the Boiler Room 30.
1. Provide relay to control 115 volt fans.
  2. Provide automatic dampers at exhaust and fresh air duct to open with ventilation fans.

**END OF SECTION**

## **SECTION 23 95 10 - DDC POINT LIST**

### **PART 1 - GENERAL**

#### **1.1 DESCRIPTION**

- A. Direct Digital Control (DDC) Point List.

#### **1.2 RELATED DOCUMENTS**

- A. Applicable provisions of Division 1 shall govern work under this section.
- B. Refer to schematic layout of control and HVAC equipment on HVAC drawings.
- C. Specified Elsewhere:
  - 1. 23 90 00 - Controls and Instrumentation
  - 2. 23 91 00 - Direct Digital Control Systems
  - 3. 23 95 00 - Control Sequence

### **PART 2 - PRODUCTS**

#### **2.1 MATERIALS**

- A. Refer to Section 23 90 00 - Controls and Instrumentation.
- B. Refer to Section 23 91 00 - Direct Digital Control Systems.

### **PART 3 - EXECUTION**

#### **3.1 DDC POINT LIST**

- A. Controls systems shall provide the DDC input/output control points and related as scheduled on the attached sheet 23 95 10 - 2.

**END OF SECTION**

**DDC POINT LIST**

| <u>POINT DESCRIPTION</u>              | <u>TYPE</u>    | <u>OPERATION SCHEDULE</u> | <u>ALARM</u> | <u>HISTORY</u> | <u>FIELD DEVICE</u>       |
|---------------------------------------|----------------|---------------------------|--------------|----------------|---------------------------|
| <i><u>BOILER HEATING PLANT</u></i>    |                |                           |              |                |                           |
| PUMP HWP-1                            | BINARY OUTPUT  | START/STOP                | --           | RUNTIME        | CONTACTS @ VFD            |
| PUMP HWP-2                            | BINARY OUTPUT  | START/STOP                | --           | RUNTIME        | CONTACTS @ VFD            |
| PUMP HWP-1                            | BINARY INPUT   | STATUS                    | FLOW FAIL    | --             | CURRENT SWITCH            |
| PUMP HWP-2                            | BINARY INPUT   | STATUS                    | FLOW FAIL    | --             | CURRENT SWITCH            |
| PUMP HWP-1 VFD                        | ANALOG OUTPUT  | --                        | --           | 15 MIN.        | 0-10VDC SIGNAL            |
| PUMP HWP-2 VFD                        | ANALOG OUTPUT  | --                        | --           | 15 MIN.        | 0-10VDC SIGNAL            |
| HWS & R PRESS. DIFF.                  | ANALOG OUTPUT  | DIFF. PRESS               | H/L PRESS    | 15 MIN.        | PIPE DIFF PRESS SENSOR(1) |
| HWS FLOW                              | ANALOG INPUT   | GPM                       | LOW FLOW     | 15 MIN.        | FLOW METER SENSOR         |
| HWS TEMP                              | ANALOG INPUT   | TEMP.                     | H/L TEMP.    | 15 MIN.        | IMMERSION SENSOR - PIPE   |
| HWR TEMP                              | ANALOG INPUT   | TEMP.                     | H/L TEMP.    | 15 MIN.        | IMMERSION SENSOR - PIPE   |
| BOILER B-1                            | ANALOG INPUT   | MODbus Interface          | --           | 15 MIN         | NETWORK INTERFACE         |
| BOILER B-2                            | ANALOG INPUT   | MODbus Interface          | --           | 15 MIN         | NETWORK INTERFACE         |
| BOILER B-3                            | ANALOG INPUT   | MODbus Interface          | --           | 15 MIN         | NETWORK INTERFACE         |
| <i><u>BOILER ROOM VENTILATION</u></i> |                |                           |              |                |                           |
| SPACE TEMP                            | ANALOG INPUT   | TEMP.                     | H/L TEMP.    | 15 MIN.        | SPACE SENSOR              |
| SF-1 SUPPLY FAN                       | DIGITAL OUTPUT | START/STOP                | --           | RUNTIME        | RELAY @ FAN               |
| SF-1 SUPPLY FAN                       | DIGITAL INPUT  | STATUS                    | FLOW FAIL    | --             | CURRENT SWITCH            |
| FA DAMPER                             | DIGITAL OUTPUT | OPEN/CLOSE                | --           | 15 MIN.        | DAMPER ACTUATOR           |
| EF-14 EXHAUST FAN                     | DIGITAL OUTPUT | START/STOP                | --           | RUNTIME        | RELAY @ FAN               |
| EF-14 EXHAUST FAN                     | DIGITAL INPUT  | STATUS                    | FLOW FAIL    | --             | CURRENT SWITCH            |
| EA DAMPER                             | DIGITAL OUTPUT | OPEN/CLOSE                | --           | 15 MIN.        | DAMPER ACTUATOR           |

**END OF SECTION**

## SECTION 26 05 00 - ELECTRICAL GENERAL PROVISIONS

### PART 1 - GENERAL

#### 1.1 DESCRIPTION OF WORK

- A. Applicable provisions of Division 1 shall govern Work under this Section.
- B. Furnish all labor, materials, equipment and accessories required to complete all electrical work as shown on the Drawings and specified herein, and shall include, but is not necessarily limited to:

26 05 00 Electrical General Provisions  
26 10 00 Electrical Demolition and Alterations  
26 11 00 Raceways and Boxes  
26 12 00 Low Voltage Conductors and Cables  
26 14 00 Wiring Devices  
26 15 10 Motors and Motor Wiring  
26 15 50 Motor Starters  
26 19 00 Supporting Devices  
26 45 00 Grounding and Bonding

C. Work Included in Division 16:

1. General: The mention hereinafter of article, operation, material, equipment or method requires that the E.C. shall provide such article of quality noted, in the quantity required, shall perform each operation, and use such method, material or equipment prescribed, all in complete accordance with the conditions stated. The E.C. shall provide all materials, labor, tools, equipment and transportation as necessary to complete the project in conformity with the drawings, the specifications, and other Contract Documents. In general, this work includes everything essential for a complete electrical system in operating order as shown or implied on the drawings or hereinafter specified.
2. All work shall be in accordance with all Local & State Inspection Authorities having jurisdiction together with the recommendations of the manufacturer whose equipment is to be supplied and connected by the E.C. All materials shall bear a UL label where a UL Standard and/or test exists.
3. Before submitting his bid, each bidder shall examine the drawings relating to this work and shall become fully informed as to the extent and character of the work required and its relation to other work in the building. No consideration will be granted for any alleged misunderstanding of materials to be furnished or work to be done, it being understood that the tender of a proposal carries with it the agreement to all items and conditions referred to herein or indicated on the accompanying drawings.
4. The E.C., in conjunction with the Engineer's representative, shall establish exact location of all materials and equipment to be installed in consideration of construction features, equipment of other trades and requirements and purpose of equipment installed by the E.C.

D. Summary of Electrical Work:

1. Drawings and Specifications: Electrical drawings are schematic. Minor relocations of these items may be made by the Engineer prior to rough in at no expense to the Owner.
2. Any conflict between the drawings and specifications shall be brought to the attention of the Engineer.
3. Note that the electrical drawings are only a portion of the complete set of plans. The complete set of plans shall be used to define the electrical work.
4. The complete specifications will be utilized to define the electrical work.

5. General Outline: The facilities and systems of the electrical work can be described (but not by way of limitation) as follows:
  - a. Demolish and remove existing equipment in boiler room.
  - b. Remodel existing boiler plant for new equipment from existing panelboards.
  - c. Relocate existing light fixtures.

E. Coordination of Electrical Work:

1. General: The Contractor shall confer with the other trades and the Engineer so that all concerned will be thoroughly familiar with the specific items and areas of the coordination.
2. Conflicts of any type shall be immediately reported to the Engineer.
3. The Contractor shall furnish and be responsible for the proper installation of all reinforcement required for wall or ceiling attached equipment.
4. Arrange electrical work in a neat, well organized manner with conduit and similar services running parallel with primary lines of the building construction.
5. Locate operating and control equipment properly to provide easy access, and arrange entire electrical work with adequate access for operation and maintenance.
6. All conduit shall be concealed except in mechanical and electrical rooms.

**1.2 RELATED DOCUMENTS**

- A. Applicable provisions of Division 1 shall govern work under this section.

**1.3 DEFINITIONS**

- A. Provide: Furnish and install, complete and ready for service.
- B. Exposed: Exposed to view in any room, corridor or stairway.
- C. E.C.: Electrical Contractor.
- D. The Engineer: HEIN Engineering Group.
- E. The Owner: City of Madison / Olbrich Botanical Gardens
- F. A/E: Architect/Engineer.
- G. ANSI: American National Standards Institute
- H. NEC: National Electric Code
- I. NEMA: National Electric Manufacturers Association
- J. NFPA: National Fire Protection Association
- K. UL: Underwriters Laboratories, Inc.

**1.4 PERMITS AND LICENSES**

- A. Prepare and submit to all authorities having jurisdiction, for their approval, all applications and working drawings required by them. Secure and pay for all licenses and permits required.

**1.5 QUALITY ASSURANCE, STANDARDS AND SYMBOLS**

- A. General: Specifically, for the electrical work (in addition to standards specified in individual work section), the following standards are imposed, as applicable to the work in each instance:

1. Standards for Materials and Workmanship: All materials shall conform to the standard of the UL in every case where the UL has established a standard of such materials. In addition, these materials shall bear the UL label to show their conformance. Materials not covered by UL standards shall be processed, supplied or manufactured to NEMA, IEEE, or other accepted industry standards for these materials and shall also be labeled or properly identified as being in conformance with the appropriate standards. Substitute standards for those listed are not acceptable. Materials and equipment shall be protected during delivery and handling to prevent damage; and shall be stored in a clean dry area to prevent contamination. Damaged materials shall not be used.
2. All materials and work shall conform to the applicable portions of the latest issues of the following standards:
  - a. UL
  - b. NEMA
  - c. NEC
  - d. NECA
  - e. ANSI
  - f. IEEE
  - g. ASTM
  - h. NFPA
  - i. IPCEA
  - j. FM
  - k. ETL
3. All work shall be installed in accordance with National and State laws, ordinances and regulations. Comply with all applicable OSHA regulations.
  - a. IBC
  - b. IECC
4. All materials shall have a UL label where a UL Standard and/or test exists.
5. All work shall be executed in a neat and workmanlike manner by workers thoroughly qualified in the trade of duties they are to perform. A rough or unworkmanlike installation will be cause for removal and replacement of said installation.

**B. Substitution of Materials:**

1. All requests for substitution shall be in writing and shall include sufficient product information to permit the Architect/Engineer to evaluate the request.
2. The Architect/Engineer specifically reserves the right to reject or approve any and all substitute materials or equipment in order to insure compliance with the minimum standards of quality established for the project herein specified, and also to insure that any substitute materials or equipment maintains the trends of style and appearances established for this project.
3. When an item is approved as an equal, either by specification or by approved substitution, this item shall give the same end results, to the Architect/Engineer's satisfaction, as the item it has replaced from the specification. Any modification, additional fittings or change to the approved item or to concomitant items to accomplish these results shall be at the expense of the Contractor.
4. The Contractor shall choose from the listed manufacturers for specific items or a substitute manufacturer if approved, but once a manufacturer has been chosen all similar items shall be by the same manufacturer.

**1.6 JOB CONDITIONS**

**A. Job Site:**

1. The Contractor shall be familiar with conditions which will affect his work, and locations where the work will be performed and other pertinent factors.
2. The Contractor shall furnish all labor and materials to complete each installation ready for use.

3. No additional allowances will be granted because the Contractor's knowledge of job site conditions was incomplete.

**B. Products, Electrical Work:**

1. Product Listing: Prepare the product listing for electrical work. Include listing of each significant item of equipment and material used in the work; and indicate the generic name, product name, manufacturer, model number, related specification number(s).
  - a. Submit list to the Architect/Engineer for approval.
2. Compatibility: Provide products which are compatible with other products of the electrical work, and with other work requiring interface with the electrical work, including electrical connections and control devices. For exposed electrical work, coordinate colors and finishes with the other work.

**1.7 WORK SEQUENCE**

- A. The Contractor shall review the work sequence and determine if any dates of completion can not be met for his work. Any conflicts with completion dates shall be brought to the Engineer's attention prior to submitting a bid. No time extensions will be granted after contracts are awarded unless permitted in other parts of these specifications.

**1.8 DIMENSIONS AND DEFINITE LOCATIONS**

- A. The drawings depicting electrical work are diagrammatic and depict, in their approximate location, symbols representing electrical equipment. The exact location shall be established in the field in accordance with instructions from the Architect.
- B. Unless specifically stated to the contrary, no measurement of an electric drawing by scale shall be used as a dimension to work by. Dimensions noted on the electric drawings are subject, in each case, to measurements of adjacent or previously completed work and all such measurements necessary shall be taken before undertaking any work dependent upon time.

**1.9 DRAWINGS**

- A. The E.C. shall prepare, at his expense, complete field installation drawings necessary for the proper installation of his work. These drawings shall be submitted to the Engineer when requested for review and such copies of same as are necessary shall be provided for others as directed.
- B. The E.C. shall keep a detailed record, up-to-date, of the manner and location in which all installations are actually made, properly indexing each feeder, pull box and protective device.
- C. As Built Drawings: See General Requirements - Division 1.
- D. In the event of a conflict between the drawings and specifications the E.C. shall base his bid on the greater quantity, cost or quality of the item in question, unless such conflict is resolved by addenda.

**1.10 MATERIALS AND EQUIPMENT**

- A. Provide all new materials and equipment to form a complete installation, unless otherwise specified.
- B. All equipment supplied shall be based on materials and equipment of manufacturers specified. No substitutions will be allowed except as provided in Instructions to Bidders.
- C. All items specified shall be the latest type or model produced by the manufacturer specified. If descriptive specification or model number is obsolete, substitute current product.

### **1.11 FLOOR, WALL AND CEILING OPENINGS**

- A. Pipe sleeves must be set for all pipes passing through new masonry construction. Coordinate with G.C. as to size and location of openings.
- B. Coordinate the location of sleeves, openings, chases, furred spaces, etc., with the other Contractors. Provide all sleeves, hangers and inserts that are to be built into the structure during the progress of construction.
- C. Pipe sleeves shall be Schedule 40 galvanized steel pipe and shall extend completely through the construction.
- D. Sleeves for pipe 4" and smaller shall be at least two pipe sizes larger than the pipe passing through.
- E. Sleeves shall extend 3/8" above the finished floor. In mechanical rooms and other areas where water may accumulate, sleeves shall extend 2" above the finished floor.
- F. Pack annular space between sleeves and insulation or pipe with fiberglass. Where penetrations occur through mechanical rooms or fire rated walls, floors, fill with Dow-Corning 3-6548 Silicone RTV Foam.

### **1.12 SHOP DRAWINGS**

- A. Submit to Engineer for review, in accordance with Division 1, shop drawings and/or equipment brochures for the following:
  - 1. Raceways and Boxes.
  - 2. Low Voltage Conductors and Cables.
  - 3. Wiring Devices.
  - 4. Starters and EPO switches.
- B. Submit in advance of construction requirements and as to cause no delay in the E.C.'s work and to allow the Engineer reasonable time to review them to make necessary corrections.
- C. All data submitted for Engineer's review shall be numbered consecutively, shall be noted to correlate with the electrical drawings and shall bear the name and location of the project, the name of the E.C., the date of submittal, the date of the drawings and the date of each correction and revision. If more than one type of lighting fixture (or other materials) are on submitted sheet, the one specified shall be conspicuously checked with red pencil by the E.C.

### **1.13 DELIVERY STORAGE AND HANDLING**

- A. All materials shall be suitably stored and protected prior to installation and all work shall be protected after installation, during construction and all work prior to acceptance.
- B. The E.C. shall furnish and remove upon completion of the project, all scaffolding, rigging, hoisting and services necessary for delivery, erection and installation of all equipment and apparatus required to be installed by the E.C.

### **1.14 MAINTENANCE MANUALS**

- A. The E.C. shall assemble and submit to the Architect for subsequent submission to the Architect/Engineer, in accordance with Division 1, complete sets of a Manual of Operation and Maintenance for each of the separate systems furnished as a part of the electrical subcontractor.

- B. Each manual shall consist of an approved loose-leaf type bound volume instructing the Architect/Engineer's personnel in the use, operation and maintenance of the system in question. The manual shall cover all phases of operation of the equipment and it shall be illustrated with photographs, drawings, wiring diagrams, etc., as required to accurately and adequately describe the operation, construction and adjustable features of the complete system and each component part. The manual shall be complete with an equipment parts listing to facilitate the ordering of spare and replacement parts.
- C. Each manual shall contain two sets of final shop drawings depicting equipment as installed.
  - 1. Equipment Parts Lists: Include a complete list of all equipment furnished for project, with a tabulation of descriptive data of all the equipment replacement parts proposed for each type of equipment or system. Properly identify each part of part number and manufacturer.

#### **1.15 CLEANING AND PAINTING**

- A. All rubbish resulting from this work shall be removed and disposed of on a daily basis and in such manner as to be acceptable to the Architect.
- B. The E.C. shall clean all exposed ironwork, interior and exterior of panels and pull boxes, etc., and remove all rubbish and debris resulting from the work.
- C. Where painted surfaces of equipment have been abused, removed, or rusted during construction, the E.C. shall paint same to match original factory or surrounding finish.

#### **1.16 TESTS AND ACCEPTANCE**

- A. The operation of the equipment and electrical installations done does not constitute an acceptance of the work by the Architect/Engineer. The final acceptance is to be made after the E.C. has adjusted his equipment and demonstrated that it fulfills the requirements of the drawings and the specifications.
- B. After the work is completed and prior to acceptance, the E.C. shall conduct the following tests, tabulate data, date, sign and submit to the Engineer: clamp ammeter test on each feeder conductor with all utilization equipment energized. The load current in each phase conductor of the feeder of the portion thereof supplying the panel shall not differ from the average connected load currents in the several conductors by more than 10%. If the load current does differ by more than 10%, the E.C. shall change phase loading to same or receive written approval from the Engineer that this is not required due to the nature of the load.
- C. At the time of connection, or energizing, check all motors for proper rotation, conferring with contractor furnishing equipment, if necessary, to determine proper direction.
- D. Upon completion of the installation, the E.C. shall furnish certificates of approval from all authorities having jurisdiction. He shall demonstrate that all work is complete and in perfect operating condition, with raceway and conduit system properly grounded, all wiring free from grounds, shorts, and that the entire installation is free from any physical defects. In the presence of the Engineer and the Architect/Engineer, the E.C. shall demonstrate the proper operation of all miscellaneous systems.
- E. All materials and workmanship is subject to inspection, examination and tests by the Architect/Engineer at any time.

#### **1.17 EXTRA STOCK/SPARE PARTS**

- A. None anticipated for electrical work.

## 1.18 DEFECTS

- A. Should it be found by the Engineer that the fixtures, equipment or any portion thereof furnished and installed under this subcontract fail to comply with the specifications and drawings, with respect or regard to the quality, amount of value of material, appliances or labor used in the work, it shall be rejected and replaced by the E.C. and all work disturbed by changed necessitated in consequence of said defects or imperfections shall be made good at the E.C.'s expenses.

## 1.19 WARRANTY

- A. The Contractor shall warranty: All materials furnished to be perfect in every respect; and, if not, replace same immediately. Replace any material or part showing defects within a minimum of one year of acceptance, or within warranty period of the item if greater than one year. This one-year warranty period shall be binding even though it may exceed the product warranty period normally furnished by some manufacturers. Repair or replacement shall bear an additional 12 months warranty as called for, dated from final acceptance of the repairs or replacement. The apparatus to be installed in strict accordance with these specifications and the various codes covering this work. Neither the final acceptance nor any provisions in the Contract Documents shall relieve this Contractor of the responsibility for negligence, faulty materials or workmanship within the extent and period provided by this contract.

## 1.20 IDENTIFICATION

- A. General:
1. Materials and equipment shall be clearly identified as listed below.
  2. Locate identification conspicuously.
  3. Terminology to be approved by Architect.
  4. See plans for any additional items to be identified.
  5. Loads such as motors shall be described by function rather than by the system of arbitrary number as shown on electrical plans.
  6. Use abbreviations sparingly.
- B. All panels and cabinets shall be stenciled with 2" letters indicating usage, plan designation and voltage. In Equipment and Mechanical Rooms this identification may be on the exterior of unit; in other areas identification shall be inside door or cover.
- C. Junction and pull boxes shall be stenciled utilizing a coded identification system. The following junction and pull boxes shall be identified using a coded system. Coding shall be submitted to Engineer for approval.
1. Light and Power - 120/208V.
  2. Fire Alarm.
- D. On all 3-phase systems, each phase shall be identified at all terminals using code markers.
- E. Laminated Bakelite Plates: Engraved plastic nameplate shall be securely fastened to the following equipment. Size 1" x 4" with 3/8" high letters unless space available dictates differently.
1. Each section of main distribution switchboards and panelboards. Mount one next to each protection device to identify load served by each circuit breaker.
  2. Each contractor, time switch, metering cabinet, starter, motor disconnect switch. In Equipment and Mechanical Rooms this identification may be on the exterior of unit, in other areas identification shall be inside door or cover.
  3. Each feeder at all accessible locations, i.e., panels, junction boxes, pull boxes, etc. (strap plate to feeder conductors in junction boxes or pull boxes).

4. Each end of empty conduit runs to indicate the intended use of the conduit and the location of opposite end. Use room numbers that are permanently assigned.
- F. Typewritten Directory: Each panelboard shall be provided with a typewritten directory in a steel frame with plastic cover contained on the inside of panel door. These directories shall indicate load served and rooms served by each protective device in the respective panel.
- G. Conductor Identification:
1. Identify each conductor at each conductor or splice point with permanently attached wrap around adhesive markers as manufactured by Brady Company.
  2. This identification shall include branch circuit number, control circuit number, or any other appropriate number or lettering that will expedite future tracing and "trouble shooting".
  3. All wire shall be color-coded per the NEC. In addition, color-coding shall be used to identify phases, neutral, ground and voltages. Coding shall be:  
  
120/208V      - Phase A - Black  
                  - Phase B - Red  
                  - Phase C - Blue  
                  - Neutral - White  
                  - Ground - Green

#### **1.21 ACCESS PANEL**

- A. Access panels required by code or otherwise to electrical equipment shall be provided by Electrical Contractor. Access panels shall be in accordance with Division 1 complete with master cylinder lock.

#### **PART 2 - PRODUCTS**

--- Not Used ---

#### **PART 3 - EXECUTION**

--- Not Used ---

**END OF SECTION**

## **SECTION 26 10 00 - ELECTRICAL DEMOLITION AND ALTERATIONS**

### **PART 1 - GENERAL**

#### **1.1 RELATED REQUIREMENTS**

A. Applicable requirements of Division 1 shall govern work in this section.

#### **1.2 JOB CONDITIONS**

- A. It is the responsibility of Electrical Contractor for demolition of any interior boiler room electrical equipment. The Electrical Contractor shall verify for HVAC contractor that all HVAC equipment is de-energized prior to HVAC demolition.
- B. Prior to demolition or alteration of structures, the following shall be accomplished:
- Disconnection of electrical power to equipment and circuits removed or affected by demolition work.
  - Coordinate sequencing with Owner and other Contractors.
  - Survey and record condition of existing facilities to remain in place that may be affected by demolition operations. After demolition operations are completed, survey conditions again and restore existing facilities to their predemolition condition.
- C. Notify utilities prior to razing operations to permit them to disconnect and remove and/or relocate any equipment that served existing facilities.
- D. Contractor shall dispose of all obsolete material.
- E. Contractor shall notify the Engineer of any existing code violations observed during the course of performing his work. The Engineer will decide if corrective action needs to be taken. Corrective actions that change the scope of the work will be considered a change order and will be processed accordingly.

### **PART 2 - PRODUCTS**

Not used.

### **PART 3 - EXECUTION**

#### **3.1 ELECTRIC SERVICE**

A. De-energize existing electric service is not applicable to this project.

#### **3.2 REMOVAL**

- A. Remove or relocate conduit, wire, boxes, and fixtures.
- B. Remove electrical equipment released from service as a result of construction or as indicated on drawings.
- C. Do not reuse removed electrical equipment, unless specifically called out in the drawing documents.
- D. Where existing equipment is being removed, removal shall include all equipment associated with the device. Associated equipment shall include but not be limited to coverplates,

backboxes, conduit, fittings, de-energized conductors, etc. When boxes are removed from existing walls which will remain, it shall be the Electrical Contractor's responsibility to fill in openings and sand as required flush with adjacent surfaces. The General Contractor shall be responsible for final finish work unless specifically indicated otherwise on the plans.

### **3.3 DISPOSAL**

- A. Dispose of equipment that is removed unless specifically indicated on the drawings.
- B. Raceway, conductors, boxes, cabinets and supporting devices shall become the property of the Contractor and shall be removed from the site and disposed of by the Contractor.
- C. The Contractor shall tour demolition areas with the Owner to determine the status of all other equipment to be removed during demolition. All equipment that is to be salvaged for reuse by the Owner shall be removed by the Contractor and transported to an owner designated storage area on the site. The Owner shall be responsible for removal of salvaged equipment from the storage area.

### **3.4 ASBESTOS REMOVAL**

- A. Any work involved with asbestos removal, disposal or abatement shall not be considered as part of this project. All work in this regard shall be the responsibility of the Owner. If this Contractor shall discover the presence of any asbestos material he shall cease work immediately and notify Owner and Engineer of condition.

**END OF SECTION**

## SECTION 26 11 00 - RACEWAY AND BOXES

### PART 1 - GENERAL

#### 1.1 DESCRIPTION

- A. Provide complete raceway system as specified for power distribution systems.
  - 1. Conduit, box and raceway systems.

#### 1.2 RELATED DOCUMENTS

- A. Applicable provisions of Division 1 shall govern work under this section.
- B. Specified Elsewhere:
  - 1. 26 05 00 Electrical General Provisions
  - 2. 26 12 00 Low Voltage Conductors and Cables
  - 3. 26 19 00 Supporting Devices
  - 4. 26 45 00 Grounding and Bonding

#### 1.3 QUALITY ASSURANCE

- A. Regulatory Requirements:
  - 1. National Electrical Code, NEC: Comply with NEC/NFPA No. 71 as applicable to construction and installation of electrical conduit.
  - 2. National Electrical Manufacturer's Association, NEMA: Comply with applicable portions of NEMA standards pertaining to non-metallic duct and fittings for underground installation.
  - 3. Underwriters Laboratories: Provide electrical conduit listed and labeled by UL.

#### 1.4 DELIVERY, STORAGE AND HANDLING

- A. Provide color-coded end-cap thread protectors on exposed threads of threaded metal conduit.
- B. Storage:
  - 1. Store pipe and tubing inside and protect from weather.
  - 2. When necessary to store outdoors, elevate well above grade and enclose with durable, watertight wrapping.
- C. Handle conduit and tubing carefully to prevent bending and end damage and to avoid scarring the finish.

### PART 2 - PRODUCTS

#### 2.1 APPROVED MANUFACTURERS

- A. Conduit:
  - 1. Allied Tube and Conduit Corporation.
  - 2. Wheatland Tube Company.
  - 3. Steelduct Conduit Products.

B. Couplings:

1. Appleton Electric Company.
2. Crouse-Hinds Company.
3. Killark Electric Manufacturing Company.

C. Flexible Conduit:

1. Anaconda Metal Hose.
2. I.B.C. Corporation.
3. Electri-Flex Company.

D. Boxes:

1. Appleton Electric Company.
2. Crouse-Hinds Company.
3. General Electric Company.
4. Killark Electric Manufacturing Company.
6. Lew Electric Fitting Company.
7. O.Z./Gedney Company.
8. Raco, Inc.
9. Square D Company.
10. Steel City Division.
11. Thomas and Betts Company, Inc.
12. Wiremold/Walker.

**2.2 CONDUIT MATERIAL**

A. RIGID METAL CONDUIT AND FITTINGS

1. Conduit: Heavy wall, galvanized steel, schedule 40, threaded.
2. Fittings and Conduit Bodies: Use all steel threaded fittings and conduit bodies.

B. INTERMEDIATE METAL CONDUIT (IMC) AND FITTINGS

1. Conduit: Galvanized steel, threaded.
2. Fittings and Conduit Bodies: Use all steel threaded fittings and conduit bodies.

C. ELECTRICAL METALLIC TUBING (EMT) AND FITTINGS

1. Conduit: Steel, galvanized tubing.
2. Fittings: All steel, set screw, concrete tight. No push-on or indenter types permitted.  
Conduit Bodies: All steel threaded conduit bodies.

D. FLEXIBLE METAL CONDUIT AND FITTINGS

1. Conduit: steel, galvanized, spiral strip.
2. Fittings and Conduit Bodies: All steel, galvanized, or malleable iron.

E. LIQUIDTIGHT FLEXIBLE METAL CONDUIT AND FITTINGS

1. Conduit: flexible, steel, galvanized, spiral strip with an outer Liquidtight, nonmetallic, sunlight-resistant jacket.
2. Fittings and Conduit Bodies: ANSI/NEMA FB 1, compression type. There shall be a metallic cover/insert on the end of the conduit inside the connector housing to seal the cut conduit end.

F. CONDUIT

1. Rigid Threaded: Steel, ANSI C80.1
2. Electrical Metallic Tubing: ANSI C80.3
3. Rigid Nonmetallic Tubing: Schedule 40 PVC; NEMA TC-2 & WC-1094

## 2.3 BOXES MATERIAL

### A. OUTLET BOXES

1. Sheet Metal Outlet Boxes: galvanized steel, with stamped knockouts.
2. Luminaire and Equipment Supporting Boxes: Rated for weight of equipment supported; include 3/8 inch male fixture studs where required.
3. Concrete Ceiling Boxes: Concrete type.
4. Cast Boxes: Cast ferrous alloy, or aluminum type deep type, gasketed cover, threaded hubs.
5. Boxes:
  - a. Metallic hot-dipped galvanized, 1.25 oz. per square foot or cadmium plated.
  - b. Non-metallic, PVC thermoplastic or thermoset polyester.
6. Interior Boxes:
  - a. Pressed sheet steel, blanked for conduit.
  - b. Provide attached lugs for locating.
7. Exterior Boxes: Cast aluminum, deep type, corrosion proof fasteners, water tight, gasketed with threaded hubs.
8. For Ceiling: 4-inch octagon boxes for 1 fixture, including fixture studs and maximum 2 connecting conduits.
9. For Flush Mounting in Walls:
  - a. Boxes with matching plaster cover for single or two gang outlets.
  - b. Two-gang box or larger or deep masonry box for conductors, conductor joints, conduit terminations and wiring devices.
10. Surface Mounted: 4 inches square.

### B. PULL AND JUNCTION BOXES

Pull boxes and junction boxes shall be minimum 4 inch square by 2-1/8th inches deep for use with 1 inch conduit and smaller. On conduit systems using 1-1/4 inch conduit or larger, pull and junction boxes shall be sized per NEC but not less than 4-11/16 inch square.

1. Sheet Metal Boxes: code gauge galvanized steel, screw covers, flanged and spot welded joints and corners.
2. Sheet Metal Boxes Larger Than 12 Inches (300 mm) in any dimension shall have a hinged cover or a chain installed between box and cover.
3. Cast Metal Boxes for Outdoor and Wet Location Installations: Type 4 and Type 6, flat-flanged, surface-mounted junction box, UL listed as raintight. Galvanized cast iron or aluminum box and cover with ground flange, neoprene gasket, and stainless steel cover screws.
4. Box extensions and adjacent boxes within 48" of each other are not allowed for the purpose of creating more wire capacity.
5. Junction boxes 6" x 6" or larger size shall be without stamped knock-outs.
6. Wireways shall not be used in lieu of junction boxes.
1. Pull Boxes and Junction Boxes: NEC metal construction with screw or hinged cover.

### C. CONDUIT BODIES:

1. Galvanized or aluminum cast-metal of type, shape and size to fit each respective location.
2. Constructed with threaded conduit ends, removable cover and corrosion-resistant screws.

### D. BUSHINGS, KNOCKOUT CLOSURES AND LOCKNUTS: Provide corrosion-resistance punched-steel box knockout closures, conduit locknuts and malleable iron conduit bushing, type and size to suit respective use.

## PART 3 - EXECUTION

### 3.1 CONDUIT INSTALLATION

- A. Wiring: All wiring shall be installed in raceways as herein specified. All raceway runs shown on the drawings are diagrammatic; exact locations shall be determined in the field.
1. Conceal all conduit in finished areas.
  2. Concealed raceways shall be installed in the walls, above ceilings, below floors or in furred out spaces so as to be completely concealed from view by occupants during their normal activities in use of the space.
  3. Exposed raceways shall be run in straight lines at right angles or parallel with walls, beams and columns.
  4. Provide raceways as required by the access control equipment controls for door operating and monitoring.
- B. Raceway Installation: All raceways, which are not buried or embedded in concrete shall be supported by straps, suitable clamps or hangers to provide a rigid installation. Perforated strap or wire hangers will not be acceptable. In no case shall raceways be supported or fastened to other pipe. No raceway smaller than 1/2" shall be used, except that light fixture switch legs may be 3/8".
1. Bends: Not more than three 90 degree bends will be allowed in one raceway run. Where more bends are necessary, a conduit or pull box shall be installed. All bends in 1" and smaller conduit or electrical metallic tubing shall be made with proper bender. All other bends shall be machine made.
  2. Joints: Joints in rigid metal shall be threaded type made up watertight with white lead or compound applied to male threads only and all field joints shall be cut square, reamed smooth and properly threaded to receive couplings. Electrical metallic tubing systems shall utilize watertight compression type fittings throughout. No indenter type fittings or running threads will be permitted.
  3. Locknuts: Double locknuts shall be provided on all conduit terminations with the exception of conduits terminating in threaded hubs and couplings. Locknuts shall be of a type that have sharp beveled teeth that dig into the metal when tightened and will not loosen through vibration.
  4. Bushing: Bushing shall be provided on all conduits with the exception of conduits terminating in hubs and couplings. Insulating bushings consisting of insulating inserts in metal housing shall be provided on all installations. Insulating bushings shall be grounding type where required by the National Electrical Code.
  5. Heating Ducts and Pipes: Care shall be used to avoid proximity to heating duct and hot water lines. Where such crossings are unavoidable, raceway shall clear covering or line by at least 6".
- C. Utilize rigid steel conduit or rigid nonmetallic conduit where exposed to moisture, buried in earth or in concrete.
- D. Utilize electrical metallic tubing(EMT) or intermediate metal conduit in other above-grade locations.
- E. For underground conduit: use PVC-coated rigid conduit or rigid non-metallic conduit.
- F. Connections:
1. Motors and equipment: Minimum 1/2" size; PVC jacketed flexible conduit and liquid-tight connectors.
  2. Flexible conduit sufficient length to avoid vibration transmission.
  3. Use 3/8" flexible conduit only for light fixture whips(72" max.)and control wiring.
  4. Coordinate service conduit connections with location of service transformers.
- G. Install conduit and tubing products as indicated, in accordance with manufacturers written instructions and applicable requirements of NEC and NEMA Standard and Installation.

- H. Install conduit concealed in all areas excluding mechanical, electrical and other unfinished rooms, connections to motors and connections to surface cabinets.
- I. Coordinate installation of conduit in masonry work.
- J. Do not install conduit larger than 1" in concrete slabs.
- K. Install conduit free from dents and bruises.
- L. Plug conduit end to prevent entry of dirt or moisture.
- M. Clean out conduit before installation of conductor.
- N. Alter conduit routing to avoid structural obstructions, minimizing cross-overs.
- O. Seal conduit with oakum or fiberglass where conduits leave heated area and enter unheated area.
- P. Roof Penetrations: Provide flashing and pitchpockets making watertight joints where conduits pass through roof or waterproofing membrane.
- Q. Building Expansion Joints:
  - 1. Install UL listed expansion fittings complete with grounding jumpers where conduits cross building expansion joints.
  - 2. Provide bends or offsets in conduits adjacent to building expansion joints where conduit is installed above suspended ceiling.
- R. Route all exposed conduits parallel or perpendicular to building lines.
- S. Allow minimum 6" clearance at flues, steam pipes and heat source.
- T. Underground Conduit: Direct burial minimum.
  - 1. Support multiple runs vertically and horizontally with plastic spacers 8' on center.
  - 2. Slope conduit to drainage point.
  - 3. Adjust final layout to coordinate with existing utilities.
  - 4. Trench and backfill as detailed on drawings.
  - 5. Encase conduit with 3" concrete cover under driveways.
- U. Cap all spare conduits.
- V. Provide all empty raceways with a heavy duty nylon cord, full length of raceway. Tag cord for identification.
- W. Maintain safe clearances from hazardous adjacent equipment, hot water piping, flues, high temperature piping, ductwork, etc.

### **3.2 CONDUIT INSTALLATION SCHEDULE**

- A. Concealed in Concrete and Block Walls: Rigid steel conduit. Electrical metallic tubing. Schedule 40 PVC conduit. Electrical Nonmetallic Tubing (ENT).
- B. Within Concrete Slab: Rigid steel conduit. Schedule 40 PVC conduit. Electrical Nonmetallic Tubing (ENT).
- C. Wet Interior Locations: Rigid steel conduit. Schedule 40 PVC conduit.
- D. Concealed Dry Interior Locations: Rigid steel conduit. Intermediate metal conduit. Electrical metallic tubing.

- E. Exposed Dry Interior Locations: Rigid steel conduit. Intermediate metal conduit. Electrical metallic tubing.
- F. Motor and equipment connections: Flexible PVC coated metal conduit (all locations). Minimum length shall be one foot (300 mm), maximum length shall be three feet (900 mm). Conduit must be installed perpendicular to direction of equipment vibration to allow conduit to freely flex.
- G. Light fixtures: Direct box or conduit connection for surface mounted and recessed fixtures. Flexible metal conduit from a J-box for recessed lay-in light fixtures. Conduit size shall be 3/8" minimum diameter and six foot (1.8 M) maximum length. Conduit length shall allow movement of fixture for maintenance purposes.
- F. In areas where the walls cannot be fished, the station cable serving these outlets shall be covered with raceways. No exposed wire shall be permitted within offices, laboratories, and conference rooms or like facilities.
- G. The non-metallic raceway shall have a screw applied base. Both the base and cover shall be manufactured of rigid PVC materials.
- H. The raceway shall originate from a surface mounted box mounted adjacent to and at the same height as existing electrical boxes in the room, be attached to the wall and terminate above the ceiling.
- I. All fittings including, but not limited to, extension boxes, elbows, tees, fixture bodies shall match the color of the raceway.
- J. The raceway and all systems devices shall be UL listed and exhibit nonflammable self extinguishing characteristics, tested to specifications of UL94V-0.
- K. The raceway and all systems devices shall adhere to the EIA/TIA Category 5e bend radius standard.

### 3.3 BOX INSTALLATION

- A. Pull Boxes and Junction Boxes: Locate pull boxes and junction boxes above removable ceilings or in electrical rooms, utility rooms or storage areas.
- B. Outlet Boxes:
  - 1. Mount outlet boxes flush in area other than mechanical rooms, electrical rooms and above removable ceilings.
  - 2. Adjust position of outlets in finished masonry walls to suit masonry course lines.
  - 3. Do not install boxes back-to-back in same wall.
  - 4. Masonry Walls:
    - a. Coordinate cutting of masonry walls to achieve neat openings for boxes.
    - b. Locate boxes in masonry walls so that only corner need be cut from masonry walls.
  - 5. Do not use sectional or handy boxes unless specifically requested.
  - 6. For boxes mounted in exterior walls, make sure that there is insulation behind outlet boxes.
  - 7. For outlets mounted above counters, benches or splashbacks, coordinate locations and mounting heights with built-in units.
  - 8. Adjust outlet mounting height to agree with required location for equipment served.
- C. Boxes supplied by others: Verify exact mounting location and type of mounting.
- D. Provide knockout closures to cap unused knockout holes where blanks have been removed.
- E. Support all boxes independently of conduit.

### 3.4 COORDINATION OF BOX LOCATIONS

- A. Provide electrical boxes as shown on Drawings, and as required for splices, taps, wire pulling, equipment connections, and code compliance.
  - 1. Electrical box locations shown on Contract Drawings are approximate unless dimensioned. Verify location of floor boxes and outlets in offices and work areas prior to rough-in.
  - 2. No outlet, junction, or pull boxes shall be located where it will be obstructed by other equipment, piping, lockers, benches, counters, etc.
  - 3. Boxes shall not be fastened to the metal roof deck.
- B. It shall be the Contractor's responsibility to study drawings pertaining to other trades, to discuss location of outlets with workmen installing other piping and equipment and to fit all electrical outlets to job conditions.
  - 1. In case of any question or argument over the location of an outlet, the Contractor shall refer the matter to the Architect/Engineer and install outlet as instructed by the Architect/Engineer.
  - 2. The proper location of each outlet is considered a part of this contract and no additional compensation will be paid to the Contractor for moving outlets which were improperly located.
- C. Locate and install boxes to allow access to them. Where installation is inaccessible, coordinate locations and provide 12 inch by 12 inch access doors.
- D. Locate and install to maintain headroom and to present a neat appearance.
- E. Install boxes to preserve fire resistance rating of partitions and other elements, using approved materials and methods.

### **3.5 PULL AND JUNCTION BOX INSTALLATION**

- A. Locate pull boxes and junction boxes above accessible ceilings, in unfinished areas or furnish and install approved access panels in non-accessible ceilings where boxes are installed. All boxes are to be readily-accessible.
- B. Support pull and junction boxes independent of conduit.

**END OF SECTION**

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## SECTION 26 12 00 - LOW VOLTAGE CONDUCTORS AND CABLES

### PART 1 - GENERAL

#### 1.1 WORK INCLUDES

- A. Provide all wires and cables required for a complete electrical system.

#### 1.2 RELATED WORK

- A. Applicable provisions of Division 1 shall govern work under this section.

- B. Specified Elsewhere:

- 1. 26 11 00 Raceways and Boxes

#### 1.3 QUALITY ASSURANCE

- A. Regulatory Requirements:

- 1. National Electrical Code, NEC: Comply with NEC/NFPA No. 70, as applicable to construction and installation of electrical cable, wire and connectors.
  - 2. Underwriter Laboratories, UL: Electrical cable, wire and connectors listed and labeled by UL.

- B. References: National Electrical Manufacturers Association/Insulated Power Cable Engineer's Association, NEMA/IPCEA.

#### 1.4 PROJECT CONDITIONS

- A. Verify that field measurements are as shown on Drawings.
- B. Conductor sizes are based on copper.
- C. Wire and cable routing shown on Drawings is approximate unless dimensioned. Route wire and cable as required to meet project conditions.
- D. Where wire and cable routing is not shown, and destination only is indicated, determine exact routing and lengths required.

#### 1.5 DELIVERY, STORAGE AND HANDLING

- A. Provide factory-wrapped waterproof flexible barrier material for covering wire and cable on wood reels, where applicable; and weather-resistant fiberboard containers for factory-packaging of cable, wire and connections to protect against physical damage in transit.
- B. Store cable, wire and connectors in factory-installed coverings in clean, dry indoor space which provides protection against weather.
- C. Do not install damaged cable, wire and connectors; remove from project site.

### PART 2 - PRODUCTS

#### 2.1 ACCEPTABLE MANUFACTURERS

- A. Wire and Cable:

- 1. Anaconda Wire and Cable Company.
  - 2. Collyer Insulated Wire Company, Division.

3. Electrical Cable Division.
4. General Cable Corporation.
5. General Electric Company.
6. Phelps Dodge Cable and Wire Company.

B. Connectors:

1. AMP, Inc.
2. Burndy Corporation.
3. General Electric Company.
4. Ideal Industries, Inc.
5. 3M Company.
6. O.Z./Gedney Company.
7. Thomas and Betts Company.
8. Buchanon.

**2.2 MATERIALS**

A. Wire and Cable:

1. 98% conductivity copper.
2. 600 volt insulation.
3. Branch circuit wiring #10 and smaller shall be solid or stranded THWN or THHN. Sizes #8 and larger stranded type THWN or THHN. Stranded wire shall be used for all motor connections regardless of size. Lighting fixture wiring shall be 90 deg C THHN.
4. Stranded conductors may only be terminated with UL OR ETL Listed type terminations or methods.
5. Conductors smaller than No. 12 AWG gauge not permitted except for alarm and signal circuits which may be #14 AWG minimum.
6. Color code and identify all wiring as specified in Section 16050.

B. Insulation: Type THHN/THWN, XHHW-2 insulation for feeders and branch circuits. Type XHHW-2 insulation for feeders with aluminum conductors.

C. Exterior Wiring: Comply with NEC for wet location wiring.

D. Wiring for systems other than power:

1. Conform to system manufacturer standards as to size, type and coding, subject to specified minimums.
2. Size conduit as required by system manufacturer, but no smaller than shown.
3. Provide copper XHHW for exterior services.

**2.3 WIRING CONNECTORS**

- A. Solderless Pressure Connectors: High copper alloy terminal. May be used only for cable termination to equipment pads or terminals. Not approved for splicing.
- B. Spring Wire Connectors: Solderless spring type pressure connector with insulating covers or copper wire splices and taps. Use for conductor sizes 10 AWG and smaller.
- C. All wire connectors used in underground or exterior pull boxes shall be gel filled twist connectors or a connector designed for damp and wet locations.
- D. Mechanical Connectors: Bolted type tin-plated; high conductivity copper alloy; spacer between conductors; beveled cable entrances.
- E. Split Bolt Connectors: Not acceptable.

- F. Compression (crimp) Connectors: Long barrel; seamless, tin-plated electrolytic copper tubing; internally beveled barrel ends. Connector shall be clearly marked with the wire size and type and proper number and location of crimps.
- G. Splices: Splices and taps for No. 10 or smaller shall be with twist-on insulated connectors. Splices in wire No. 8 and larger shall be made with split-bolt or compression connectors equal to Burndy Hydent requiring a tool and die application. Tape all non-insulated compression connectors to achieve full 600V insulation.

### **PART 3 - EXECUTION**

#### **3.1 GENERAL WIRING METHODS**

- A. All wire and cable shall be installed in conduit, unless specified
- B. Do not use wire smaller than 12 AWG for power and lighting circuits.
- C. Conductors size indicated on drawings indicates ampacity requirements using copper conductors and type THHN insulation unless otherwise noted.
  1. Provide XHHW for exterior services.
- D. All conductors shall be sized to prevent excessive voltage drop at rated circuit ampacity. As a minimum use 10 AWG conductor for 20 ampere, 120 volt branch circuit home runs longer than 100 feet (30 m), and for 20 ampere, 277 volt branch circuit home runs longer than 200 feet (61 m).

#### **3.2 INSTALLATION**

- A. Make conductor length for parallel feeders identical.
- B. Lace or clip groups of feeder conductors at new panel board.
- C. Install wire and cable in NEC Code conforming raceway.
- D. Pulling:
  1. Use wire pulling lubricant for pulling No. 4 AWG and larger wire. Use special care to avoid overstraining of conductors.
  2. Pull conductors together where more than one is being installed in raceway.
  3. Do not use pulling means, including fish tape, cable or rope which can damage raceway.
  4. All raceways shall be thoroughly swabbed out with a dry swab to remove moisture and debris before conductors are drawn into place. All ends of raceways shall be tightly plugged with tapered plugs or capped bushings until the conduits are pulled to prevent water and debris from entering conduits. All conduits stubbed up through floors shall be capped and aligned during construction by the use of spacers and caps.
- E. Install wire in conduit runs after concrete and masonry work is complete, conduit shall be clean and dry.
- F. Splicing:
  1. Splice only in accessible junction boxes.
  2. Install splices and taps which have equivalent or better mechanical strength and insulation as conductor.
  3. Use splice and tap connectors which are compatible with conductor material.
  4. No. 10 and smaller joints: Utilize connectors as hereinafter specified with PVC or nylon covers.

5. No. 8 and larger joints: Clean and join with tool and die compression type fitting.

### **3.3 WIRING INSTALLATION IN RACEWAYS**

- A. Pull all conductors into a raceway at the same time. Use Listed wire pulling lubricant for pulling 4 AWG and larger wires and for other conditions when necessary.
- 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. Completely and thoroughly swab raceway system before installing conductors.
- D. Place all conductors of a given circuit (this includes phase wires, neutral (if any), and ground conductor) in the same raceway. If parallel phase and/or neutral wires are used, then place an equal number of phase and neutral conductors in same raceway or cable.

### **3.4 WIRING CONNECTIONS AND TERMINATIONS**

- A. Splice only in accessible junction boxes.
- B. Wire splices and taps shall be made firm, and adequate to carry the full current rating of the respective wire without soldering and without perceptible temperature rise.
- C. Use solderless spring type pressure connectors with insulating covers for wire splices and taps, 10 AWG and smaller.
- D. Use mechanical or compression connectors for wire splices and taps, 8 AWG and larger. Tape uninsulated conductors and connectors with electrical tape to 150 percent of the insulation value of conductor.
- E. Thoroughly clean wires before installing lugs and connectors.
- F. At all splices and terminations, leave tails long enough to cut splice out and completely re-splice.

**END OF SECTION**

## SECTION 26 14 00 - WIRING DEVICES

### PART 1 - GENERAL

#### 1.1 DESCRIPTION OF WORK

- A. Applicable provisions of Division 1 shall govern work under this section.
- B. Furnish and install all devices such as switches, receptacles, plates, etc., as shown on the drawings.

#### 1.2 RELATED DOCUMENTS

- A. Applicable provisions of Division 1 shall govern work under this section.
- B. Specified Elsewhere:
  - 1. 26 11 00 Raceways and Boxes
  - 2. 26 18 50 Equipment Connections
  - 3. 26 45 00 Grounding and Bonding

#### 1.3 SUBMITTALS

- A. Submit products and technical data per Division 1 and Section 26 0500.
- B. Wiring Device and plate color to be selected by Architect.

### PART 2 - PRODUCTS

#### 2.1 WALL SWITCHES

- A. Wall Switches for Lighting Circuits and Motor Loads Under 1/2 HP: Heavy duty use toggle switch, rated 20 amperes and 120/277 volts AC. Switches shall be UL20 Listed and meet Federal Specification WS-896. All switches shall be heavy duty Specification Grade with separate green ground screw.
- B. All switches shall be back and side wired, screw clamp type, suitable for solid or stranded wire up to #10 AWG. Switches shall be Leviton model 1221-S, Hubbell model CS1221, Pass & Seymour model CSB20, Cooper model CSB120, or approved equal.
- C. Handle: made of nylon or high impact resistant material.

#### 2.2 RECEPTACLES

- A. Convenience and Straight-blade Receptacles: NEMA Type 5-15R or 5-20R, nylon impact resistant face. Receptacles shall be UL498 Listed and meet Federal Specification WC-596.
- B. All duplex receptacles shall be heavy duty Specification Grade, 15 or 20-amp rated, as scheduled or shown on drawings. All receptacles shall be back and side wired, screw clamp type, suitable for solid or stranded wire up to #10 AWG, with a separate green ground screw. Receptacles shall be Leviton model 5362-S, Hubbell model CR5362, Pass & Seymour model CRB5362, Pass & Seymour model PT5362 with 90° connector, Cooper model 5362C, or approved equal.
  - 1. Provide tamperproof receptacles where required by local code.
- C. Generally, all receptacles shall be duplex convenience type unless otherwise noted.

- D. Receptacles installed in damp or wet locations shall be UL listed weather resistant.
- E. All receptacles installed in outdoor locations, in garages, within 6 feet of the outside edge of sinks, and in other damp or wet locations shall be GFCI type.
- F. GFCI Receptacles: Duplex convenience receptacle, Specification Grade, with integral ground fault current interrupter meeting the requirements of UL standard 943 Class A and UL standard 498. GFCI receptacles shall be Leviton model 8899, Hubbell model GRF5352, Pass & Seymour model 2095 or approved equal.
- G. All receptacles on emergency circuits shall have a red face.
- H. All receptacles designated as isolated ground shall have an isolated ground triangle imprint on the face of the receptacle.
- I. Locking-Blade Receptacles: As indicated on drawings.

### **2.3 DEVICE PLATES AND BOX COVERS**

- A. Switch and Receptacle Cover Plates: Specification Grade 302/304 smooth stainless steel construction.
- B. Weatherproof Cover Plate: Gasketed metal with hinged device covers.
- C. Surface Cover Plate: Raised galvanized steel.
- D. Receptacles installed in damp or wet locations shall be UL listed weather resistant.
  - 1. Provide as required for each outlet, single or multiple gang.
  - 2. Provide blank covers on all empty boxes or outlets.
  - 3. Galvanized steel box covers shall be used in unfinished areas. Cover shall be 1/2" raised with no sharp edges.
  - 4. Provide single gang, die-cast, weather-resistant covers equal to Leviton #6196-V on receptacles in damp areas and exterior for in-use per NEC.
- E. Any device switches or receptacles necessary for completion of the work, but not called for in the Contract Documents shall be furnished and installed by the Contractor as needed at no additional cost to the Owner. Such devices shall meet the intended standards described in this Section.

## **PART 3 - EXECUTION**

### **3.1 GENERAL**

- A. Receptacles above counters shall be mounted vertically 6" above counter or high enough to miss backsplash if provided.
- B. Receptacles required for equipment shall be located within 2 feet of that equipment if possible.
  - 1. Receptacles for refrigerators, freezers and vending machines shall be mounted at 36" AFF.
  - 2. Verify final mounting height required for electric water cooler with Plumbing Contractor.
- C. Verify all device locations with General Contractor before rough in.

### **3.2 WIRING DEVICE INSTALLATION**

- A. Install wall switches 48 inches above floor, OFF position down.
- B. Install convenience receptacles 18 inches above floor, grounding pole on bottom.
- C. Install box for information outlet 18 inches above finished floor. Install box for telephone jack for wall telephone 54 inches above finished floor.
- D. Install specific-use receptacles at heights shown on Contract Drawings.
- E. Drill opening for poke-through fitting installation in accordance with manufacturer's instructions.
- F. Install device plates on switch, receptacle, and blank outlets in finished areas.
- G. Install galvanized steel plates on outlet boxes and junction boxes in unfinished areas, above accessible ceilings, and on surface-mounted outlets.
- H. Install devices and wall plates flush and level.
- I. Receptacles shall have a bonding conductor from grounding terminal to the metal conduit system. Self-grounding receptacles using mounting screws as bonding means are not approved.

**END OF SECTION**

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## SECTION 16 15 10 - MOTORS AND MOTOR WIRING

### PART 1 - GENERAL

#### 1.1 DESCRIPTION OF WORK

- A. Provide motor branch circuit wiring, motor starters, and disconnect switches to make a complete code complying motor branch circuit for each motor on project.
- B. Mounting of all equipment under this contract.

#### 1.2 RELATED DOCUMENTS

- A. Applicable provisions of Division 1 shall govern work under this section.
- B. Specified Elsewhere:
  - 1. 26 11 00 Raceways and Boxes
  - 2. 26 15 50 Motor Starters
  - 3. 26 17 00 Motor and Circuit Disconnects
  - 4. 26 18 50 Equipment Connections
  - 5. Division 22 Plumbing Equipment
  - 6. Division 23 HVAC Equipment
- C. Each motor shall have an individual means of disconnect within equipment cabinet in finished area. Adjacent to motor in sight of and within 25'-0" of motor in all other areas.
- D. Disconnect shall be heavy-duty, horsepower-rated fused switch for three phase motors and fused toggle switch or manual fractional motor starter switch for single phase motors, unless noted otherwise in Motor Schedules or otherwise.
- E. Enclosures for outdoor locations and those marked "WP" shall be NEMA Type 3R elsewhere, unless otherwise noted, enclosures shall be NEMA Type 1.
- F. All controls shall be 120 volt or less. Control wiring shall have all controls wired in hot line (fused for three or more control devices and all fuel burners) with other side grounded. Control panel protected per NEC 430 and 440. Control wiring by contractor furnishing motor except as noted.
- G. Contractor who furnished and installed motor or other current using equipment shall furnish to Electrical Contractor all line voltage(greater than 100 volts) control devices for installation.
  - 1. Specified manual, automatic, local and remote motor and other control devices and switches, including thermostats, pressurestats, aquastats and other devices when specified as supplied by others.
  - 2. Detailed wiring diagrams, installation and operating instructions in form of reviewed shop drawings for complete wiring installations of above equipment.
  - 3. Motors will be set and aligned by contractor furnishing motor.

#### 1.3 QUALITY ASSURANCE

- A. Motor and related equipment shall conform to NEMA standards for the type and application.

### PART 2 - PRODUCTS

#### 2.1 MOTORS

- A. Motors smaller than 1/2 HP: 120 V, single phase, 60-cycle current.
- B. Motors 1/2 HP and larger:
  - 1. In accordance with NEMA Standards, unless otherwise indicated.
  - 2. 460V or 208V, 3-phases, 60-cycle current.
- C. Characteristics: Quiet, non-overloading under operating conditions, 1.15 series factor, suitable for intended services, accessible for servicing and with oiling devices arranged for easy access.
- D. Motor Protection:
  - 1. Motor protection integral with motor starter, thermal overload type, including manual reset.
  - 2. Automatic reset type overloads or built-in overload not acceptable.
  - 3. Provide motor protection for each speed of multiple speed motors.
- E. Factory Wired Panels:
  - 1. Factory wired panels supplied as integral part of equipment provided by Division 22 & 23 Contractor.
  - 2. Factory wired panel includes responsibility for totally wired control system as indicated on control drawings by Division 15 Contractor.
    - a. Furnished with completely integrated control panel, including switches, starters, certain disconnects, protective devices and control transformers mounted on associated mechanical equipment.
    - b. "Factory wired panel" does not mean wired at factory, but does mean provided by the Heating, Ventilating or Plumbing Contractor specified in Division 22 & 23.
    - c. In certain cases, as indicated, Electrical Contractor provides disconnect switch ahead of factory wired panel.
- G. Temperature Control Panels: Electrical Contractor shall provide line voltage power to control panels as indicated on the Drawings and Schedules. Additional line voltage wiring requirements shall be the responsibility of the Temperature Control Contractor to retain an electrical trade to complete temperature control power requirements.

**2.2 STARTERS - See Section 26 15 50 Motor Starters.**

**PART 3 - EXECUTION**

**3.1 INSTALLATION**

- A. Provide wiring, disconnect devices, final connection to all equipment noted.
- B. Furnish, install and wire all such electrical devices, controls, interlocks, including main, control and interlocking wiring, final connections and testing in full compliance with all requirements of contract.
- C. Perform all such work under direct supervision of Contractor who provided motor or equipment. Latter Contractor shall have full responsibility for complete motor, current using device, controls and wiring installations, including all work done by Electrical Contractor and shall guarantee all such work as if he had installed it.
- D. All conductors shall be stranded for motor feeders.
- E. Provide liquid tight flexible conduits at motors and other vibrating equipment.

- F. Grounding wire shall be provided in all flexible conduits. All motors shall be grounded per NEC 250.
- G. When a motor box serves more than one motor and motor branch wire size is smaller than wire size in motor outlet box, motor branch shall be protected as required by NEC.
- H. Examine the drawings and specifications covering all contracts to ascertain what equipment is furnished by others. Furnish the necessary labor and materials to wire said equipment unless material and wiring is called for under the specifications.
- I. Locate and install control devices, as indicated. Coordinate requirements with all other trades.
- J. In finished areas, mount motor protection switches flush and install suitable coverplates.
- K. Install overload heater or related with full load current of motors provided. Provide actual field measurements of equipment operating under normal loads to verify proper heater selection.
- L. Set all protective devices to suit motors provided.
- M. Mount and wire all controlling equipment furnished in Division 22 & 23.
- N. Verify motor sizes for starters, including verification of required number of auxiliary contacts.
- O. Install all power and control wiring including conduit to and from starters to motors and to all remote devices required for complete system operation as indicated on drawings.
- P. Install all motor starter, pilot lights, pushbuttons, selector switches, thermal overloads and local disconnect switches at motors, except those devices specified as part of integral factory wired panels or as provided under Division 22 & 23.
- Q. E.C. is responsible for connections, proper phase relationships and motor rotation.

**END OF SECTION**

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## SECTION 26 15 50 - MOTOR STARTERS

### PART 1 - GENERAL

#### 1.1 DESCRIPTION OF WORK

- A. Provide and install motor starters where indicated on plans and elsewhere in these specifications.
- B. Submittals: Provide submittal as required in 26 05 00.

### PART 2 - EQUIPMENT

#### 2.1 MOTOR STARTERS

- A. All motor starters shall be furnished by the Electrical Contractor unless otherwise noted. Starters shall be Siemens, Square D, or Cutler Hammer.
- B. Magnetic starters shall be non-reversing, full voltage across-the-line type in a NEMA-1 enclosure; where located exterior provide NEMA 3R enclosure.
  - 1. Starters shall have external manual reset thermal overload relays, undervoltage protection, 120V holding coil voltage, "reset" push button, green "run" pilot light.
  - 2. Each starter shall have 3 melting alloy overload protectors. See Drawings for size and voltage.
  - 3. Auxiliary contacts required for interconnection of controlled equipment shall be furnished by the Electrical Contractor after consultation with the temperature control and other mechanical contractors.
  - 4. When interlocking or automatic control of single-phase motors is required, motors shall have magnetic across-the-line starters.
  - 5. Each starter shall be complete with magnetic circuit breaker and front operated position - indicating handle. Each circuit breaker shall have means of padlocking external operating handle in the off position.
  - 6. The starter door shall be interlocked so that the circuit breaker must be "off" before the door can be opened. Each starter shall be equipped with a control transformer 208 or 480 volt, 2-wire primary and 120 volt, wire secondary.
  - 7. Each control transformer shall be equipped with a Bussman type KTK fuse on the secondary side.
  - 8. Provide combination starter-disconnects where scheduled.
- C. Accessories.
  - 1. EPO(emergency power off) switch: Momentary N.C.120 volt with red mushroom push button. Remote to boiler starters. Label for service. Provide latching mechanical relay for momentary control of contactor.
- D. Manual starter shall have melting alloy type trip-free thermal overload relays furnished in NEMA- enclosure with toggle switch disconnect and pilot light. Refer to Motor Schedule for sizes and voltage requirements.
- D. Nameplates: Each switch and/or pilot light shall have individual engraved nameplates describing its function.

### PART 3 - EXECUTION

#### 3.1 GENERAL

- A. Install motor starters where shown on plans and as indicated on Motor Equipment Schedule.
- B. Verify all overload heaters are correctly sized.
- C. Coordinate all motor line voltage control wiring for starters with other Trades
- D. Torque all conductor and busbar connections to manufacturer's recommendations.

**END OF SECTION**

## SECTION 26 18 50 - EQUIPMENT CONNECTIONS

### PART 1 - GENERAL

#### 1.1 DESCRIPTION OF WORK

- A. Power and selected control wiring for all equipment including, but not limited to:
  - 1. HVAC motors and control panels.
  - 2. Plumbing motors and control panels.
- B. Coordinate all equipment requirements with the various contractors and the Owner. Review the complete set of drawings and specifications to determine the extent of wiring, starters, devices, etc., required.

#### 1.2 RELATED DOCUMENTS

- A. Applicable provisions of Division 1 shall govern work under this section.
- B. Specified Elsewhere:
  - 1. Div. 22 Plumbing
  - 2. Div. 23 HVAC
  - 2. 26 05 00 Basic Materials and Methods
  - 3. 26 11 00 Raceways and Boxes
  - 4. 26 12 00 Low Voltage Conductors and Cables
  - 5. 26 15 10 Motors and Motor Wiring
  - 6. 26 15 50 Motor Starters
  - 7. 26 17 00 Motor and Circuit Disconnects

### PART 2 - PRODUCTS

- 2.1 SEE 1.2 ABOVE AND DRAWINGS.

### PART 3 - EXECUTION

#### 3.1 HVAC AND PLUMBING CONNECTIONS

- A. Provide all power wiring including all circuitry carrying electrical energy from panelboard or other source through starters and disconnects to motors or to packaged control panels.
  - 1. Packaged control panels may include disconnects and starters and overcurrent protection. Provide all wiring between packaged control panels and motors.
  - 2. Include starters disconnects and overload protection if not included in packaged control panels.
- B. Provide 120 volts circuits to each temperature control panel as indicated on the Drawings.
  - 1. Line voltage wiring requirements for temperature control beyond the requirements shown on the drawings and schedules shall be the responsibility of the Temperature Control Contractor to retain the electrical trade and pay for such work.
- C. Unless otherwise specified, all electrical motors and control devices such as aquastats, float and pressure fan powered VAV boxes, switches, electropneumatic switches, solenoid valves and damper motors requiring mechanical connections shall be furnished and installed and

wired for low-voltage connections (less than 100volts) by the Contractor supplying the devices or the Temperature Control Contractor, as specified elsewhere.

- D. Each motor terminal box shall be connected with a maximum 36" piece of flexible conduit to a fixed junction box. A green wire run through the flexible conduit shall interconnect the motor frame and the rigid conduit system. Use Liquid tight flexible metal conduit for all motor connections.
- E. Check for proper rotation of each motor.

**END OF SECTION**

## SECTION 26 19 00 - SUPPORTING DEVICES

### PART 1 - GENERAL

#### 1.1 DESCRIPTION OF WORK

- A. Conduit and equipment supports.

#### 1.2 RELATED DOCUMENTS

- A. Applicable provisions of Division 1 shall govern work under this section.

B. Specified Elsewhere:

1. 26 11 00 Raceways and Boxes

#### 1.3 QUALITY ASSURANCE

A. Regulatory Requirements:

1. National Electrical Code, NEC: Comply with NEC/NFPA No. 70, as applicable to supports.
2. Underwriters Laboratories, UL: Supports listed and labeled by UL.

### PART 2 - PRODUCTS

#### 2.1 MATERIAL

- A. Support Channel: Steel, Galvanized, Enameled or other corrosion resistant.
- B. Hardware: Corrosion resistant.
- C. Minimum sized threaded rod for supports shall be 3/8" for trapezes and single conduits 1-1/4" and larger, and 1/4" for single conduits 1" and smaller.
- D. Conduit clamps, straps, supports, etc., shall be steel or malleable iron. One-hole straps shall be heavy duty type. All straps shall have steel or malleable backing plates when rigid steel conduit is installed on the interior or exterior surface of any exterior building wall.

#### 2.2 CONDUIT SUPPORTS

A. Material:

1. Single Runs:
  - a. Galvanized two-hole conduit straps or ring-bolt type hangers with specialty spring clips.
  - b. *Do not use plumber's perforated straps.*
2. Multiple Runs: Conduit rack with 25% spare capacity.
3. Vertical Runs: Channel support with conduit fittings.
  - a. 25-ft intervals.

B. Anchor Methods:

1. Hollow Masonry: Toggle bolts or spike type expansion anchors.
2. Solid Masonry: Lead expansion anchors or preset inserts.
3. Metal Surfaces: Machine screws, bolts or welded studs.
4. Wood Surfaces: Wood screws.
5. Concrete Surfaces: Self-drilling anchors or power driven studs.

- C. Light Fixtures:
  - 1. Provide grid troffer clips in accordance with NEC 410-16.
- D. Mounting Racks and Supports:
  - 1. Provide rack and supports of galvanized or painted steel channel sections with bolted or welded fittings.
  - 2. Provide exterior treated 3/4" plywood mounting surface with gray paint finish on both sides and edges.

### **PART 3 - EXECUTION**

#### **3.1 GENERAL**

- A. Maintain headroom, neat mechanical appearance and to support equipment loads.
- B. Suspend, support from and attach only to the structural elements at intervals required by code, with threaded rod, channels, "stand-off" and other clips and NECA approved devices.
- C. To the fullest extent possible, group several conduits together and run parallel, supporting with rod and channel.

#### **3.2 INSTALLATION**

- A. Fasten hanger rods, conduit clamps, outlet, junction and pull boxes to building structure using pre-cast insert system, preset inserts, beam clamps, expansion anchors, or spring steel clips (interior metal stud walls only).
  - 1. Do not use "stand-off" clips for attachment to walls and partitions.
  - 2. Install raceways tight to walls.
- 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 anchors on concrete surfaces; sheet metal screws in sheet metal studs and wood screws in wood construction. If nail-in anchors are used, they must be removable type anchors.
- C. Do not fasten supports to piping, ductwork, mechanical equipment, cable tray or conduit. Do not fasten to suspended ceiling grid system.
- D. Fabricate supports from galvanized 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.
- E. In wet locations, mechanical rooms and electrical rooms install free-standing electrical equipment on 3.5 inch (89 mm) concrete pads.
- F. Install surface-mounted cabinets and panelboards with minimum of four anchors. Provide steel channel supports to stand cabinet one inch (25 mm) off wall (7/8" Uni-strut or 3/4" painted, fire-retardant plywood is acceptable).
- G. Bridge studs top and bottom with channels to support flush-mounted cabinets and panelboards in stud walls.
- H. Furnish and install all supports as required to fasten all electrical components required for the project, including free standing supports required for those items remotely mounted from the building structure, catwalks, walkways etc.

**END OF SECTION**

## SECTION 26 45 00 - GROUNDING AND BONDING

### PART 1 - GENERAL

#### 1.1 DESCRIPTION OF WORK

- A. Provide and install materials for a complete grounding system integral with the power distribution in accordance with the National Electrical Code.
- B. Distribution grounding system.
- C. Equipment grounding system.

#### 1.2 RELATED DOCUMENTS

- A. Applicable provisions of Division 1 shall govern work under this section.
- B. Specified Elsewhere:
  - 1. 26 11 00 Raceways and Boxes
  - 2. 26 12 00 Low Voltage Conductors and Cables

#### 1.3 QUALITY ASSURANCE

- A. Regulatory Requirements:
  - 1. ANSI/IEEE 142 (Latest edition) - Recommended Practice for Grounding of Industrial and Commercial Power Systems.
  - 2. National Electrical Code, NEC: Comply with NEC/NFPA No. 70, as applicable to materials and installation of electrical grounding systems and associated equipment and wiring.
  - 3. Underwriters Laboratories:
    - a. Comply with UL Standards pertaining to electrical grounding and bonding.
    - b. UL 467: Grounding and Bonding Equipment.

### PART 2 - PRODUCTS

#### 2.1 MATERIALS

- A. Materials used for grounding conductors shall be as called for in National Electrical Code Article #250-81.
- B. Ground Fittings:
  - 1. OZ Company:
    - a. Type BF
    - b. Type OG
    - c. Type LG
    - d. Type MG

#### 2.2 MECHANICAL CONNECTORS

- A. The mechanical connector bodies shall be manufactured from high strength, high conductivity cast copper alloy material. Bolts, nuts, washers and lockwashers shall be made of Silicon Bronze and supplied as a part of the connector body and shall be of the two bolt type.

- B. Split bolt connector types are NOT allowed. Exception: the use of split bolts is acceptable for grounding of wire-basket type cable tray, and for cable shields/straps of medium voltage cable.
- C. The connectors shall meet or exceed UL 467 and be clearly marked with the catalog number, conductor size and manufacturer.

### **2.3 COMPRESSION CONNECTORS**

- A. The compression connectors shall be manufactured from pure wrought copper. The conductivity of this material shall be no less than 99% by IACS standards.
- B. The connectors shall meet or exceed the performance requirements of IEEE 837, latest revision.
- C. The installation of the connectors shall be made with a compression, tool and die system, as recommended by the manufacturer of the connectors.
- D. The connectors shall be clearly marked with the manufacturer, catalog number, conductor size and the required compression tool settings.
- E. Each connector shall be factory filled with an oxide-inhibiting compound.

### **2.4 WIRE**

- A. Material: Stranded copper (aluminum not permitted).
- B. Feeder and Branch Circuit Equipment Ground: Size as shown on drawings, specifications or as required by NFPA 70, whichever is larger. Differentiate between the normal ground and the isolated ground when both are used on the same facility.

## **PART 3 - EXECUTION**

### **2.1 GENERAL**

- A. Install Products in accordance with manufacturer's instructions.
- B. Mechanical connections shall be accessible for inspection and checking. No insulation shall be installed over mechanical ground connections.
- C. Ground connection surfaces shall be cleaned and all connections shall be made so that it is impossible to move them.
- D. Attach grounds permanently before permanent building service is energized.

### **2.2 LESS THAN 600 VOLT SYSTEM GROUNDING**

- A. Bond together system neutrals, service equipment enclosures, exposed non-current carrying metal parts of electrical equipment, metal raceway systems, grounding conductor in raceways and cables, receptacle ground connectors, and plumbing systems.
- B. Equipment Grounding Conductor: Provide separate, insulated equipment grounding conductor within each raceway. Terminate each end on suitable lug, bus, enclosure or bushing. Provide a ground wire from each device to the respective enclosure.

### **3.3 INSTALLATION**

- A. Electrical service, electrical equipment enclosures and associated metallic raceway system shall be permanently grounded and bonded together by a grounding electrode conductor as per NEC requirements with a ground clamp to a 1-1/4 inch or larger cold water metallic pipe on street side of water meter and ground rod electrodes.
  - 1. Provide water meter shunt; cable to pipe connections copper cable shunt.

- B. Bond main switches, ground rods, foundation reinforcement rebar and water service entrance together with ground electrodes sized per code.
1. Ground connection surfaces shall be clean.
  2. Bond structural steel frame to grounding electrode conductor.
- C. Damp Locations: All convenience outlets, switches, fixtures, boxes and plates in damp locations or outdoors shall be fully grounded by a separate green grounding conductor.
- D. Panelboard Grounding: Install grounding conductor from main service to each panelboard and ground bar as indicated on Drawings:
1. Provide separate circuit grounding conductors to dedicated ground circuits, surge suppression receptacles (computers), and GFI receptacles.
- E. Bonding Jumpers:
1. Maintain ground continuity by separate insulated green ground wire in fixture cords, flexible connections or similar location where raceway system is interrupted.
  2. Light Fixtures: Provide separate green wire grounded from fixture housing to nearest conduit system box, where flexible conduit is used.
  3. Receptacles: Provide green wire bonding jumper from all new receptacles to metal back box.
- F. Motors: Provide insulated grounding conductor from motor connection to distribution panel grounding bus for all motors.
1. Where motors are connected to conduit systems with flexible conduit section, install greenfield grounding conductor in flexible conduit section.
- G. Equipment Grounding Conductors: Provide separate, insulated grounding conductor within each feeder raceway.
1. Ground cable tray at intervals not exceeding 100 feet.
- H. Device Boxes: Provide new green wire ground from panel ground bar to all new devices located in the raceway systems.
1. Provide dedicated ground wire to GFI and surge suppression receptacles.

**END OF SECTION**

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SECTION E: BIDDERS ACKNOWLEDGEMENT

CONTRACT TITLE

CONTRACT NO.

Bidder must state a Unit Price and Total Bid for each item. The Total Bid for each item must be the product of quantity, by Unit Price. The Grand Total must be the sum of the Total Bids for the various items. In case of multiplication errors or addition errors, the Grand Total with corrected multiplication and/or addition shall determine the Grand Total bid for each contract. The Unit Price and Total Bid must be entered numerically in the spaces provided. All words and numbers shall be written in ink.

- The undersigned having familiarized himself/herself with the Contract documents, including Advertisement for Bids, Instructions to Bidders, Form of Proposal, City of Madison Standard Specifications for Public Works Construction - 2015 Edition thereto, Form of Agreement, Form of Bond, and Addenda issued and attached to the plans and specifications on file in the office of the City Engineer, hereby proposes to provide and furnish all the labor, materials, tools, and expendable equipment necessary to perform and complete in a workmanlike manner the specified construction on this project for the City of Madison; all in accordance with the plans and specifications as prepared by the City Engineer, including Addenda to the Contract Nos. n/a through n/a issued thereto, at the prices for said work as contained in this proposal. (Electronic bids submittals shall acknowledge addendum under Section E and shall not acknowledge here)
- If awarded the Contract, we will initiate action within seven (7) days after notification or in accordance with the date specified in the contract to begin work and will proceed with diligence to bring the project to full completion within the number of work days allowed in the Contract or by the calendar date stated in the Contract.
- The undersigned Bidder or Contractor certifies that he/she is not a party to any contract, combination in form of trust or otherwise, or conspiracy in restraint of trade or commerce or any other violation of the anti-trust laws of the State of Wisconsin or of the United States, with respect to this bid or contract or otherwise.
- I hereby certify that I have met the Bid Bond Requirements as specified in Section 102.5. (IF BID BOND IS USED, IT SHALL BE SUBMITTED ON THE FORMS PROVIDED BY THE CITY. FAILURE TO DO SO MAY RESULT IN REJECTION OF THE BID).
- I hereby certify that all statements herein are made on behalf of BACHMANN Construction Co (name of corporation, partnership, or person submitting bid) a corporation organized and existing under the laws of the State of WI a partnership consisting of \_\_\_\_\_; an individual trading as \_\_\_\_\_; of the City of \_\_\_\_\_ State of \_\_\_\_\_; that I have examined and carefully prepared this Proposal, from the plans and specifications and have checked the same in detail before submitting this Proposal; that I have fully authority to make such statements and submit this Proposal in (its, their) behalf; and that the said statements are true and correct.

[Signature]  
SIGNATURE

Asst Project Manager  
TITLE, IF ANY

Sworn and subscribed to before me this 27 day of Mar, 20 15.

[Signature]  
 (Notary Public or other officer authorized to administer oaths)  
 My Commission Expires 10-12-17  
 Bidders shall not add any conditions or qualifying statements to this Proposal.



# SECTION F: DISCLOSURE OF OWNERSHIP & BEST VALUE CONTRACTING

## BID TITLE CONTRACT NO. CONTRACT NUMBER

State of Wisconsin  
Department of Workforce Development  
Equal Rights Division  
Labor Standards Bureau

### Disclosure of Ownership

**Notice required under Section 15.04(1)(m), Wisconsin Statutes.** The statutory authority for the use of this form is prescribed in Sections 66.0903(12)(d) and 103.49(7)(d), Wisconsin Statutes. The use of this form is mandatory. The penalty for failing to complete this form is prescribed in Section 103.005(12), Wisconsin Statutes. Personal information you provide may be used for secondary purposes.

- (1) On the date a contractor submits a bid to or completes negotiations with a state agency or local governmental unit, on a project subject to Section 66.0903 or 103.49, Wisconsin Statutes, the contractor shall disclose to such state agency or local governmental unit the name of any "other construction business", which the contractor, or a shareholder, officer or partner of the contractor, owns or has owned within the preceding three (3) years.
- (2) The term "other construction business" means any business engaged in the erection, construction, remodeling, repairing, demolition, altering or painting and decorating of buildings, structures or facilities. It also means any business engaged in supplying mineral aggregate, or hauling excavated material or spoil as provided by Sections 66.0903(3), 103.49(2) and 103.50(2), Wisconsin Statutes.
- (3) This form must **ONLY** be filed, with the state agency or local governmental unit that will be awarding the contract, if **both (A) and (B) are met.**
  - (A) The contractor, or a shareholder, officer or partner of the contractor:
    - (1) Owns at least a 25% interest in the "other construction business", indicated below, on the date the contractor submits a bid or completes negotiations.
    - (2) Or has owned at least a 25% interest in the "other construction business" at any time within the preceding three (3) years.
  - (B) The Wisconsin Department of Workforce Development (DWD) has determined that the "other construction business" has failed to pay the prevailing wage rate or time and one-half the required hourly basic rate of pay, for hours worked in excess of the prevailing hours of labor, to any employee at any time within the preceding three (3) years.

#### Other Construction Business

Not Applicable

Name of Business

Street Address or P O Box

City

State

Zip Code

Name of Business

Street Address or P O Box

City

State

Zip Code

Name of Business

Street Address or P O Box

City

State

Zip Code

**I hereby state under penalty of perjury that the information, contained in this document, is true and accurate according to my knowledge and belief.**

Print the Name of Authorized Officer

*Edward A. Enalus*

Signature of Authorized Officer

*Edward A. Enalus*

Date Signed

27 MAR 15

Name of Corporation, Partnership or Sole Proprietorship

*BALTMANN CONSTRUCTION CO INC*

Street Address or P O Box

*1201 S. STOUGHTON RD*

City

*MADISON*

State

*WI*

Zip Code

*53716*

**If you have any questions call (608) 266-0028**

ERD-7777-E (R. 09/2003)



**BID TITLE**  
**CONTRACT NO. CONTRACT NUMBER**

**Best Value Contracting**

1. The Contractor shall indicate the non-apprenticeable trades used on this contract.

2. Madison General Ordinance (M.G.O.), 33.07(7), does provide for some exemptions from the active apprentice requirement. Apprenticeable trades are those trades considered apprenticeable by the State of Wisconsin. Please check applicable box if you are seeking an exemption.

- Contractor has a total skilled workforce of four or less individuals in all apprenticeable trades combined.
- No available trade training program; The Contractor has been rejected by the only available trade training program, or there is no trade training program within 90 miles.
- Contractor is not using an apprentice due to having a journey worker on layoff status, provided the journey worker was employed by the contractor in the past six months.
- First-time Contractor on City of Madison Public Works contract requests a onetime exemption but intends to comply on all future contracts and is taking steps typical of a "good faith" effort.
- Contractor has been in business less than one year.
- Contractor doesn't have enough journeyman trade workers to qualify for a trade training program in that respective trade

3. The Contractor shall indicate on the following section which apprenticeable trades are to be used on this contract. Compliance with active apprenticeship, to the extent required by M.G.O. 33.07(7), shall be satisfied by documentation from an applicable trade training body; an apprenticeship contract with the Wisconsin Department of Workforce Development or a similar agency in another state; or the U.S Department of Labor. This documentation is required prior to the Contractor beginning work on the project site.

- The Contractor has reviewed the list and shall not use any apprenticeable trades on this project.



**LIST APPRENTICABLE TRADES** (check all that apply to your work to be performed on this contract)

- BRICKLAYER
- CARPENTER
- CEMENT MASON / CONCRETE FINISHER
- CEMENT MASON (HEAVY HIGHWAY)
- CONSTRUCTION CRAFT LABORER
- DATA COMMUNICATION INSTALLER
- ELECTRICIAN
- ENVIRONMENTAL SYSTEMS TECHNICIAN / HVAC SERVICE TECH/HVAC INSTALL / SERVICE
- GLAZIER
- HEAVY EQUIPMENT OPERATOR / OPERATING ENGINEER
- INSULATION WORKER (HEAT & FROST)
- IRON WORKER
- IRON WORKER (ASSEMBLER, METAL BLDGS)
- PAINTER & DECORATOR
- PLASTERER
- PLUMBER
- RESIDENTIAL ELECTRICIAN
- ROOFER & WATER PROOFER
- SHEET METAL WORKER
- SPRINKLER FITTER
- STEAMFITTER
- STEAMFITTER (REFRIGERATION)
- STEAMFITTER (SERVICE)
- TAPER & FINISHER
- TELECOMMUNICATIONS (VOICE, DATA & VIDEO) INSTALLER-TECHNICIAN
- TILE SETTER



**CONTRACT NO.**

**Small Business Enterprise Compliance Report**

This information may be submitted electronically through Bid Express or submitted with bid in sealed envelope.

**Cover Sheet**

Prime Bidder Information

|                       |                                       |
|-----------------------|---------------------------------------|
| Company:              | BACHMANN CONSTRUCTION Co INC          |
| Address:              | 1201 S. SToughton RD MADISON WI 53716 |
| Telephone Number:     | (608) 222-8809                        |
| Fax Number:           | (608) 222-8618                        |
| Contact Person/Title: | ED ENGLER ASST. PROJECT MANAGER       |

Prime Bidder Certification

|          |                       |
|----------|-----------------------|
| Name:    | ED ENGLER             |
| Title:   | ASST. PROJECT MANAGER |
| Company: | BACHMANN CONSTRUCTION |

I certify that the information contained in this SBE Compliance Report is true and correct to the best of my knowledge and belief.

  
\_\_\_\_\_  
Witness' Signature

  
\_\_\_\_\_  
Bidder's Signature

3/27/15  
\_\_\_\_\_  
Date









Quality Through Teamwork Since 1954

---

To:

27 March 2015

City Of Madison Engineering  
1692 Emil St  
Madison WI 53713

BID

Olbrich Botanical Gardens HVAC Upgrade – Phase 1  
Contact No. 7383

**LUMP SUM BID: \$412,900.00**

A handwritten signature in black ink, appearing to read "E. Engler", is written over the printed name.

Edward A Engler  
Assistant Project Manager  
Bachmann Construction



## SECTION G: BID BOND

KNOW ALL MEN BY THESE PRESENT, THAT Bachmann Construction Company, Inc. (a corporation of the State of Wisconsin) (Individual), (partnership), hereinafter referred to as the "Principal") and \*\*\* a corporation of the State of Wisconsin (hereinafter referred to as the "Surety") and licensed to do business in the State of Wisconsin, are held and firmly bound unto the City of Madison, (hereinafter referred to as the "Obligee"), in the sum of five per cent (5%) of the amount of the total bid or bids of the Principal herein accepted by the Obligee, for the payment of which the Principal and the Surety bind themselves, their heirs, executors, administrators, successors and assigns, jointly and severally, firmly by these presents.

\*\*\* Old Republic Surety Company

The conditions of this obligation are such that, whereas the Principal has submitted, to the City of Madison a certain bid, including the related alternate, and substitute bids attached hereto and hereby made a part hereof, to enter into a contract in writing for the construction of:

### HVAC UPGRADE FOR OLBRICH BOTANICAL GARDENS – PHASE 1 CONTRACT NO. 7383

1. If said bid is rejected by the Obligee, then this obligation shall be void.
2. If said bid is accepted by the Obligee and the Principal shall execute and deliver a contract in the form specified by the Obligee (properly completed in accordance with said bid) and shall furnish a bond for his/her faithful performance of said contract, and for the payment of all persons performing labor or furnishing materials in connection therewith, and shall in all other respects perform the agreement created by the acceptance of said bid, then this obligation shall be void.

If said bid is accepted by the Obligee and the Principal shall fail to execute and deliver the contract and the performance and payment bond noted in 2. above executed by this Surety, or other Surety approved by the City of Madison, all within the time specified or any extension thereof, the Principal and Surety agree jointly and severally to forfeit to the Obligee as liquidated damages the sum mentioned above, it being understood that the liability of the Surety for any and all claims hereunder shall in no event exceed the sum of this obligation as stated, and it is further understood that the Principal and Surety reserve the right to recover from the Obligee that portion of the forfeited sum which exceed the actual liquidated damages incurred by the Obligee.

The Surety, for value received, hereby stipulates and agrees that the obligations of said Surety and its bond shall be in no way impaired or affected by an extension of the time within which the Obligee may accept such bid, and said Surety does hereby waive notice of any such extension.



IN WITNESS WHEREOF, the Principal and the Surety have hereunto set their hands and seals, and such of them as are corporations have caused their corporate seals to be hereto affixed and these presents to be signed by their proper officers, on the day and year set forth below

Seal Bachmann Construction Company, Inc. 3-20-15  
Principal Date

By: 

Old Republic Surety Company  
Name of Surety  
By:  3/20/2015  
Elizabeth Mosca, Attorney-in-Fact Date

This certifies that I have been duly licensed as an agent for the above company in Wisconsin under License No. 2530156 for the year 2015, and appointed as attorney in fact with authority to execute this bid bond and the payment and performance bond referred to above, which power of attorney has not been revoked.

3/20/2015  
Date

Elizabeth Mosca  
Agent



6609 University Ave  
Address

Middleton, WI 53562  
City, State and Zip Code

608-644-8668  
Telephone Number

**NOTE TO SURETY & PRINCIPAL**

The bid submitted which this bond guarantees may be rejected if the following instrument is not attached to this bond:

Power of Attorney showing that the agent of Surety is currently authorized to execute bonds on behalf of the Surety, and in the amounts referenced above.



**OLD REPUBLIC SURETY COMPANY**

**POWER OF ATTORNEY**

KNOW ALL MEN BY THESE PRESENTS: That OLD REPUBLIC SURETY COMPANY, a Wisconsin stock insurance corporation, does make, constitute and appoint:

ANN P. MAY, RANA R HUGHEY, JANICE F. CLOOTEN, MICHELE A. HOLZ, ELIZABETH MOSCA, OF MIDDLETON, WI

its true and lawful Attorney(s)-in-Fact, with full power and authority, not exceeding \$20,000,000, for and on behalf of the company as surety, to execute and deliver and affix the seal of the company thereto (if a seal is required), bonds, undertakings, recognizances or other written obligations in the nature thereof, (other than bail bonds, bank depository bonds, mortgage deficiency bonds, mortgage guaranty bonds, guarantees of installment paper and note guaranty bonds, self-insurance workers compensation bonds guaranteeing payment of benefits, asbestos abatement contract bonds, waste management bonds, hazardous waste remediation bonds or black lung bonds), as follows:

ALL WRITTEN INSTRUMENTS IN AN AMOUNT NOT TO EXCEED AN AGGREGATE OF FIVE MILLION DOLLARS(\$5,000,000)----- FOR ANY SINGLE OBLIGATION, REGARDLESS OF THE NUMBER OF INSTRUMENTS ISSUED FOR THE OBLIGATION.

and to bind OLD REPUBLIC SURETY COMPANY thereby, and all of the acts of said Attorneys-in-Fact, pursuant to these presents, are ratified and confirmed. This document is not valid unless printed on colored background and is multi-colored. This appointment is made under and by authority of the board of directors at a special meeting held on February 18, 1982. This Power of Attorney is signed and sealed by facsimile under and by the authority of the following resolutions adopted by the board of directors of the OLD REPUBLIC SURETY COMPANY on February 18, 1982.

RESOLVED that, the president, any vice-president, or assistant vice president, in conjunction with the secretary or any assistant secretary, may appoint attorneys-in-fact or agents with authority as defined or limited in the instrument evidencing the appointment in each case, for and on behalf of the company to execute and deliver and affix the seal of the company to bonds, undertakings, recognizances, and suretyship obligations of all kinds; and said officers may remove any such attorney-in-fact or agent and revoke any Power of Attorney previously granted to such person.

RESOLVED FURTHER, that any bond, undertaking, recognizance, or suretyship obligation shall be valid and binding upon the Company (i) when signed by the president, any vice-president or assistant vice president, and attested and sealed (if a seal be required) by any secretary or assistant secretary; or (ii) when signed by the president, any vice president or assistant vice president, secretary or assistant secretary, and countersigned and sealed (if a seal be required) by a duly authorized attorney-in-fact or agent; or (iii) when duly executed and sealed (if a seal be required) by one or more attorneys-in-fact or agents pursuant to and within the limits of the authority evidenced by the Power of Attorney issued by the company to such person or persons.

RESOLVED FURTHER, that the signature of any authorized officer and the seal of the company may be affixed by facsimile to any Power of Attorney or certification thereof authorizing the execution and delivery of any bond, undertaking, recognizance, or other suretyship obligations of the company; and such signature and seal when so used shall have the same force and effect as though manually affixed.

IN WITNESS WHEREOF, OLD REPUBLIC SURETY COMPANY has caused these presents to be signed by its proper officer, and its corporate seal to be affixed this 29TH day of APRIL, 2014.

OLD REPUBLIC SURETY COMPANY

*Phyllis M. Johnson*  
Assistant Secretary



*Alan Pavlic*  
President

STATE OF WISCONSIN, COUNTY OF WAUKESHA-SS

On this 29TH day of APRIL, 2014, personally came before me, Alan Pavlic and Phyllis M. Johnson, to me known to be the individuals and officers of the OLD REPUBLIC SURETY COMPANY who executed the above instrument, and they each acknowledged the execution of the same, and being by me duly sworn, did severally depose and say; that they are the said officers of the corporation aforesaid, and that the seal affixed to the above instrument is the seal of the corporation, and that said corporate seal and their signatures as such officers were duly affixed and subscribed to the said instrument by the authority of the board of directors of said corporation.



*Kathryn R. Pearson*  
Notary Public  
My commission expires: 9/28/2014

(Expiration of notary commission does not invalidate this instrument)

CERTIFICATE

I, the undersigned, assistant secretary of the OLD REPUBLIC SURETY COMPANY, a Wisconsin corporation, CERTIFY that the foregoing and attached Power of Attorney remains in full force and has not been revoked; and furthermore, that the Resolutions of the board of directors set forth in the Power of Attorney, are now in force.

24-5330

Signed and sealed at the City of Brookfield, WI this 20 day of March, 2015



*Janice F. Clooten*  
Assistant Secretary

SCHWARZ INSURANCE AGENCY INC

THIS DOCUMENT HAS A COLORED BACKGROUND AND IS MULTI-COLORED ON THE FACE. THE COMPANY LOGO APPEARS ON THE BACK OF THIS DOCUMENT AS A WATERMARK. IF THESE FEATURES ARE ABSENT, THIS DOCUMENT IS VOID.



## SECTION H: AGREEMENT

THIS AGREEMENT made this 22 day of April in the year Two Thousand and Fifteen between **BACHMANN CONSTRUCTION COMPANY, INC.**, hereinafter called the Contractor, and the City of Madison, Wisconsin, hereinafter called the City.

WHEREAS, the Common Council of the said City of Madison under the provisions of a resolution adopted **APRIL 21, 2015**, and by virtue of authority vested in the said Council, has awarded to the Contractor the work of performing certain construction.

NOW, THEREFORE, the Contractor and the City, for the consideration hereinafter named, agree as follows:

1. **Scope of Work.** The Contractor shall, perform the construction, execution and completion of the following listed complete work or improvement in full compliance with the Plans, Specifications, Standard Specifications, Supplemental Specifications, Special Provisions and contract; perform all items of work covered or stipulated in the proposal; perform all altered or extra work; and shall furnish, unless otherwise provided in the contract, all materials, implements, machinery, equipment, tools, supplies, transportation, and labor necessary to the prosecution and completion of the work or improvements:

### **HVAC UPGRADE FOR OLBRICH BOTANICAL GARDENS- PHASE I CONTRACT NO. 7383**

2. **Completion Date/Contract Time.** Construction work must begin within seven (7) calendar days after the date appearing on mailed written notice to do so shall have been sent to the Contractor and shall be carried on at a rate so as to secure full completion SEE SPECIAL PROVISIONS, the rate of progress and the time of completion being essential conditions of this Agreement.
3. **Contract Price.** The City shall pay to the Contractor at the times, in the manner and on the conditions set forth in said specifications, the sum of **FOUR HUNDRED TWELVE THOUSAND NINE HUNDRED (\$412,900.00)** Dollars being the amount bid by such Contractor and which was awarded to him/her as provided by law.
4. **Wage Rates for Employees of Public Works Contractors**

**General and Authorization.** The Contractor shall compensate its employees at the prevailing wage rate in accordance with section 66.0903, Wis. Stats., DWD 290 of the Wisconsin Administrative Code and as hereinafter provided unless otherwise noted in Section D: Special Provisions, Subsection 102.10 – Minimum Rate of Wage Scale.

“Public Works” shall include building or work involving the erection, construction, remodeling, repairing or demolition of buildings, parking lots, highways, streets, bridges, sidewalks, street lighting, traffic signals, sanitary sewers, water mains and appurtenances, storm sewers, and the grading and landscaping of public lands.

“Building or work” includes construction activity as distinguished from manufacturing, furnishing of materials, or servicing and maintenance work, except for the delivery of mineral aggregate such as sand, gravel, bituminous asphaltic concrete or stone which is incorporated into the work under contract with the City by depositing the material directly in final place from transporting vehicle.

“Erection, construction, remodeling, repairing” means all types of work done on a particular building or work at the site thereof in the construction or development of the project, including without limitation, erecting, construction, remodeling, repairing, altering, painting, and decorating, the transporting of materials and supplies to or from the building or work done by the employees of the Contractor, Subcontractor, or Agent thereof, and the manufacturing or furnishing of

materials, articles, supplies or equipment on the site of the building or work, by persons employed by the Contractor, Subcontractor, or Agent thereof.

"Employees working on the project" means laborers, workers, and mechanics employed directly upon the site of work.

"Laborers, Workers, and Mechanics" include pre-apprentices, helpers, trainees, learners and properly registered and indentured apprentices but exclude clerical, supervisory, and other personnel not performing manual labor.

**Establishment of Wage Rates.** The Department of Public Works shall periodically obtain a current schedule of prevailing wage rates from DWD. The schedule shall be used to establish the City of Madison Prevailing Wage Rate Schedule for Public Works Construction (prevailing wage rate). The Department of Public Works may include known increases to the prevailing wage rate which can be documented and are to occur on a future specific date. The prevailing wage rate shall be included in public works contracts subsequently negotiated or solicited by the City. Except for known increases contained within the schedule, the prevailing wage rate shall not change during the contract. The approved wage rate is attached hereto.

**Workforce Profile.** The Contractor shall, at the time of signature of the contract, notify the City Engineer in writing of the names and classifications of all the employees of the Contractor, Subcontractors, and Agents proposed for the work. In the alternative, the Contractor shall submit in writing the classifications of all the employees of the Contractor, Subcontractors and Agents and the total number of hours estimated in each classification for the work. This workforce profile(s) shall be reviewed by the City Engineer who may, within ten (10) days, object to the workforce profile(s) as not being reflective of that which would be required for the work. The Contractor may request that the workforce profile, or a portion of the workforce profile, be submitted after the signature of the contract but at least ten (10) days prior to the work commencing. Any costs or time loss resulting from modifications to the workforce profile as a result of the City Engineer's objections shall be the responsibility of the Contractor.

**Payrolls and Records.** The Contractor shall keep weekly payroll records setting forth the name, address, telephone number, classification, wage rate and fringe benefit package of all the employees who work on the contract, including the employees of the Contractor's subcontractors and agents. Such weekly payroll records must include the required information for all City contracts and all other contracts on which the employee worked during the week in which the employee worked on the contract. The Contractor shall also keep records of the individual time each employee worked on the project and for each day of the project. Such records shall also set forth the total number of hours of overtime credited to each such employee for each day and week and the amount of overtime pay received in that week. The records shall set forth the full weekly wages earned by each employee and the actual hourly wage paid to the employee.

The Contractor shall submit the weekly payroll records, including the records of the Contractor's subcontractors and agents, to the City Engineer for every week that work is being done on the contract. The submittal shall be within twenty-one (21) calendar days of the end of the Contractor's weekly pay period.

Employees shall receive the full amounts accrued at the time of the payment, computed at rates not less than those stated in the prevailing wage rate and each employee's rate shall be determined by the work that is done within the trade or occupation classification which should be properly assigned to the employee.

An employee's classification shall not be changed to a classification of a lesser rate during the contract. If, during the term of the contract, an employee works in a higher pay classification than the one which was previously properly assigned to the employee, then that employee shall be considered to be in the higher pay classification for the balance of the contract, receive the appropriate higher rate of pay, and she/he shall not receive a lesser rate during the balance of the

contract. For purposes of clarification, it is noted that there is a distinct difference between working in a different classification with higher pay and doing work within a classification that has varying rates of pay which are determined by the type of work that is done within the classification. For example, the classification "Operating Engineer" provides for different rates of pay for various classes of work and the Employer shall compensate an employee classified as an "Operating Engineer" based on the highest class of work that is done in one day. Therefore, an "Operating Engineer's" rate may vary on a day to day basis depending on the type of work that is done, but it will never be less than the base rate of an "Operating Engineer". Also, as a matter of clarification, it is recognized that an employee may work in a higher paying classification merely by chance and without prior intention, calculation or design. If such is the case and the performance of the work is truly incidental and the occurrence is infrequent, inconsequential and does not serve to undermine the single classification principle herein, then it may not be required that the employee be considered to be in the higher pay classification and receive the higher rate of pay for the duration of the contract. However, the Contractor is not precluded or prevented from paying the higher rate for the limited time that an employee performs work that is outside of the employee's proper classification.

Questions regarding an employee's classification, rate of pay or rate of pay within a classification, shall be resolved by reference to the established practice that predominates in the industry and on which the trade or occupation rate/classification is based. Rate of pay and classification disputes shall be resolved by relying upon practices established by collective bargaining agreements and guidelines used in such determination by appropriate recognized trade unions operating within the City of Madison.

The Contractor, its Subcontractors and Agents shall submit to interrogation regarding compliance with the provisions of this ordinance.

Mulcting of the employees by the Contractor, Subcontractor, and Agents on Public Works contracts, such as by kickbacks or other devices, is prohibited. The normal rate of wage of the employees of the Contractor, Subcontractor, and Agents shall not be reduced or otherwise diminished as a result of payment of the prevailing wage rate on a public works contract.

**Hourly contributions.** Hourly contributions shall be determined in accordance with the prevailing wage rate and with DWD. 290.01(10), Wis. Admin. Code.

**Apprentices and Subjourney persons.** Apprentices and sub journeypersons performing work on the project shall be compensated in accordance with the prevailing wage rate and with DWD 290.02, and 290.025, respectively, Wis. Admin. Code.

**Straight Time Wages.** The Contractor may pay straight time wages as determined by the prevailing wage rate and DWD 290.04, Wis. Admin. Code.

**Overtime Wages.** The Contractor shall pay overtime wages as required by the prevailing wage rate and DWD 290.05, Wis. Admin. Code.

**Posting of Wage Rates and Hours.** A clearly legible copy of the prevailing wage rate, together with the provisions of Sec. 66.0903(10)(a) and (11)(a), Wis. Stats., shall be kept posted in at least one conspicuous and easily accessible place at the project site by the Contractor and such notice shall remain posted during the full time any laborers, workers or mechanics are employed on the contract.

**Evidence of Compliance by Contractor.** Upon completion of the contract, the Contractor shall file with the Department of Public Works an affidavit stating:

- a. That the Contractor has complied fully with the provisions and requirements of Sec. 66.0903(3), Wis. Stats., and Chapter DWD 290, Wis. Admin. Code; the Contractor has received evidence of compliance from each of the agents and subcontractors; and the

names and addresses of all of the subcontractors and agents who worked on the contract.

- b. That full and accurate records have been kept, which clearly indicate the name and trade or occupation of every laborer, worker or mechanic employed by the Contractor in connection with work on the project. The records shall show the number of hours worked by each employee and the actual wages paid therefore; where these records will be kept and the name, address and telephone number of the person who will be responsible for keeping them. The records shall be retained and made available for a period of at least three (3) years following the completion of the project of public works and shall not be removed without prior notification to the municipality.

**Evidence of Compliance by Agent and Subcontractor.** Each agent and subcontractor shall file with the Contractor, upon completion of their portion of the work on the contract an affidavit stating that all the provisions of Sec. 66.0903(3), Wis. Stats., have been fully complied with and that full and accurate records have been kept, which clearly indicate the name and trade or occupation of every laborer, worker or mechanic employed by the Contractor in connection with work on the project. The records shall show the number of hours worked by each employee and the actual wages paid therefore; where these records shall be kept and the name, address and telephone number of the person who shall be responsible for keeping them. The records shall be retained and made available for a period of at least three (3) years following the completion of the project of public works and shall not be removed without prior notification to the municipality.

**Failure to Comply with the Prevailing Wage Rate.** If the Contractor fails to comply with the prevailing wage rate, she/he shall be in default on the contract. In addition, if DWD finds that a contractor or subcontractor violated the prevailing wage law, DWD will assess liquidated damages of 100% of the wages owed to employees.

**Establishment of Wage Rates.** The Department of Public Works shall periodically obtain a current schedule of prevailing wage rates from DWD. The schedule shall be used to establish the City of Madison Prevailing Wage Rate Schedule for Public Works Construction (prevailing wage rate). The Department of Public Works may include known increases to the prevailing wage rate which can be documented and are to occur on a future specific date. The prevailing wage rate shall be included in public works contracts subsequently negotiated or solicited by the City. Except for known increases contained within the schedule, the prevailing wage rate shall not change during the contract. The approved wage rate and DWD prevailing wage requirements are attached hereto as Sec. I of the contract.

5. **Affirmative Action.** In the performance of the services under this Agreement the Contractor agrees not to discriminate against any employee or applicant because of race, religion, marital status, age, color, sex, disability, national origin or ancestry, income level or source of income, arrest record or conviction record, less than honorable discharge, physical appearance, sexual orientation, gender identity, political beliefs, or student status. The Contractor further agrees not to discriminate against any subcontractor or person who offers to subcontract on this contract because of race, religion, color, age, disability, sex, sexual orientation, gender identity or national origin.

The Contractor agrees that within thirty (30) days after the effective date of this agreement, the Contractor will provide to the City Affirmative Action Division certain workforce utilization statistics, using a form to be furnished by the City.

If the contract is still in effect, or if the City enters into a new agreement with the Contractor, within one year after the date on which the form was required to be provided, the Contractor will provide updated workforce information using a second form, also to be furnished by the City. The second form will be submitted to the City Affirmative Action Division no later than one year after the date on which the first form was required to be provided.

The Contractor further agrees that, for at least twelve (12) months after the effective date of this contract, it will notify the City Affirmative Action Division of each of its job openings at facilities in Dane County for which applicants not already employees of the Contractor are to be considered. The notice will include a job description, classification, qualifications and application procedures and deadlines. The Contractor agrees to interview and consider candidates referred by the Affirmative Action Division if the candidate meets the minimum qualification standards established by the Contractor, and if the referral is timely. A referral is timely if it is received by the Contractor on or before the date started in the notice.

#### Articles of Agreement Article I

The Contractor shall take affirmative action in accordance with the provisions of this contract to insure that applicants are employed, and that employees are treated during employment without regard to race, religion, color, age, marital status, disability, sex, sexual orientation, gender identity or national origin and that the employer shall provide harassment free work environment for the realization of the potential of each employee. Such action shall include, but not be limited to, the following: employment, upgrading, demotion or transfer, recruitment or recruitment advertising, layoff or termination, rates of pay or other forms of compensation and selection for training including apprenticeship insofar as it is within the control of the Contractor. The Contractor agrees to post in conspicuous places available to employees and applicants notices to be provided by the City setting out the provisions of the nondiscrimination clauses in this contract.

#### Article II

The Contractor shall in all solicitations or advertisements for employees placed by or on behalf of the Contractors state that all qualified or qualifiable applicants will be employed without regard to race, religion, color, age, marital status, disability, sex, sexual orientation, gender identity or national origin.

#### Article III

The Contractor shall send to each labor union or representative of workers with which it has a collective bargaining agreement or other contract or understanding a notice to be provided by the City advising the labor union or worker's representative of the Contractor's equal employment opportunity and affirmative action commitments. Such notices shall be posted in conspicuous places available to employees and applicants for employment.

#### Article V

The Contractor agrees that it will comply with all provisions of the Affirmative Action Ordinance of the City of Madison, including the contract compliance requirements. The Contractor agrees to submit the model affirmative action plan for public works contractors in a form approved by the Affirmative Action Division Manager.

#### Article VI

The Contractor will maintain records as required by Section 39.02(9)(f) of the Madison General Ordinances and will provide the City Affirmative Action Division with access to such records and to persons who have relevant and necessary information, as provided in Section 39.02(9)(f). The City agrees to keep all such records confidential, except to the extent that public inspection is required by law.

## Article VII

In the event of the Contractor's or subcontractor's failure to comply with the Equal Employment Opportunity and Affirmative Action Provisions of this contract or Section 39.03 and 39.02 of the Madison General Ordinances, it is agreed that the City at its option may do any or all of the following:

1. Cancel, terminate or suspend this Contract in whole or in part.
2. Declare the Contractor ineligible for further City contracts until the Affirmative Action requirements are met.
3. Recover on behalf of the City from the prime Contractor 0.5 percent of the contract award price for each week that such party fails or refuses to comply, in the nature of liquidated damages, but not to exceed a total of five percent (5%) of the contract price, or five thousand dollars (\$5,000), whichever is less. Under public works contracts, if a subcontractor is in noncompliance, the City may recover liquidated damages from the prime Contractor in the manner described above. The preceding sentence shall not be construed to prohibit a prime Contractor from recovering the amount of such damage from the non-complying subcontractor.

## Article VIII

The Contractor shall include the above provisions of this contract in every subcontract so that such provisions will be binding upon each subcontractor. The Contractor shall take such action with respect to any subcontractor as necessary to enforce such provisions, including sanctions provided for noncompliance.

## Article IX

The Contractor shall allow the maximum feasible opportunity to small business enterprises to compete for any subcontracts entered into pursuant to this contract. (In federally funded contracts the terms "DBE, MBE and WBE" shall be substituted for the term "small business" in this Article.)

6. Substance Abuse Prevention Program Required. Prior to commencing work on the Contract, the Contractor, and any Subcontractor, shall have in place a written program for the prevention of substance abuse among its employees as required under Wis. Stat. Sec. 103.503.





**SECTION I: PAYMENT AND PERFORMANCE BOND**

KNOW ALL MEN BY THESE PRESENTS, that we BACHMANN CONSTRUCTION COMPANY, INC. as principal, and Old Republic Surety Company Company of Brookfield, WI as surety, are held and firmly bound unto the City of Madison, Wisconsin, in the sum of FOUR HUNDRED TWELVE THOUSAND NINE HUNDRED (\$412,900.00) Dollars, lawful money of the United States, for the payment of which sum to the City of Madison, we hereby bind ourselves and our respective executors and administrators firmly by these presents.

The condition of this Bond is such that if the above bounden shall on his/her part fully and faithfully perform all of the terms of the Contract entered into between him/herself and the City of Madison for the construction of:

**HVAC UPGRADE FOR OLBRICH BOTANICAL GARDENS- PHASE I  
CONTRACT NO. 7383**

in Madison, Wisconsin, and shall pay all claims for labor performed and material furnished in the prosecution of said work, and save the City harmless from all claims for damages because of negligence in the prosecution of said work, and shall save harmless the said City from all claims for compensation (under Chapter 102, Wisconsin Statutes) of employees and employees of subcontractor, then this Bond is to be void, otherwise of full force, virtue and effect.

Signed and sealed this 22nd day of April, 2015

Countersigned:

Patti Raether  
Witness  
Sheryl Markland  
Secretary

BACHMANN CONSTRUCTION COMPANY, INC.  
Company Name (Principal)  
[Signature]  
President Seal NONE

Approved as to form:

[Signature]  
City Attorney

Old Republic Surety Company  
Surety Seal  
 Salary Employee  Commission  
By [Signature]  
Attorney-in-Fact, Elizabeth Mosca

This certifies that I have been duly licensed as an agent for the above company in Wisconsin under License No. 2530156 for the year 2015, and appointed as attorney-in-fact with authority to execute this payment and performance bond which power of attorney has not been revoked.

April 22, 2015  
Date

[Signature]  
Agent Signature





# OLD REPUBLIC SURETY COMPANY

## POWER OF ATTORNEY

KNOW ALL MEN BY THESE PRESENTS: That OLD REPUBLIC SURETY COMPANY, a Wisconsin stock insurance corporation, does make, constitute and appoint:

ANN P MAY, RANA R HUGHEY, JANICE F CLOOTEN, MICHELE A HOLZ, ELIZABETH MOSCA, OF MIDDLETON, WI

its true and lawful Attorney(s)-in-Fact, with full power and authority, not exceeding \$20,000,000, for and on behalf of the company as surety, to execute and deliver and affix the seal of the company thereto (if a seal is required), bonds, undertakings, recognizances or other written obligations in the nature thereof, (other than bail bonds, bank depository bonds, mortgage deficiency bonds, mortgage guaranty bonds, guarantees of installment paper and note guaranty bonds, self-insurance workers compensation bonds guaranteeing payment of benefits, asbestos abatement contract bonds, waste management bonds, hazardous waste remediation bonds or black lung bonds), as follows:

ALL WRITTEN INSTRUMENTS IN AN AMOUNT NOT TO EXCEED AN AGGREGATE OF FIVE MILLION DOLLARS(\$5,000,000)----- FOR ANY SINGLE OBLIGATION, REGARDLESS OF THE NUMBER OF INSTRUMENTS ISSUED FOR THE OBLIGATION.

and to bind OLD REPUBLIC SURETY COMPANY thereby, and all of the acts of said Attorneys-in-Fact, pursuant to these presents, are ratified and confirmed. This document is not valid unless printed on colored background and is multi-colored. This appointment is made under and by authority of the board of directors at a special meeting held on February 18, 1982. This Power of Attorney is signed and sealed by facsimile under and by the authority of the following resolutions adopted by the board of directors of the OLD REPUBLIC SURETY COMPANY on February 18, 1982.

RESOLVED that, the president, any vice-president, or assistant vice president, in conjunction with the secretary or any assistant secretary, may appoint attorneys-in-fact or agents with authority as defined or limited in the instrument evidencing the appointment in each case, for and on behalf of the company to execute and deliver and affix the seal of the company to bonds, undertakings, recognizances, and suretyship obligations of all kinds; and said officers may remove any such attorney-in-fact or agent and revoke any Power of Attorney previously granted to such person.

RESOLVED FURTHER, that any bond, undertaking, recognizance, or suretyship obligation shall be valid and binding upon the Company

- (i) when signed by the president, any vice-president or assistant vice president, and attested and sealed (if a seal be required) by any secretary or assistant secretary; or
- (ii) when signed by the president, any vice president or assistant vice president, secretary or assistant secretary, and countersigned and sealed (if a seal be required) by a duly authorized attorney-in-fact or agent; or
- (iii) when duly executed and sealed (if a seal be required) by one or more attorneys-in-fact or agents pursuant to and within the limits of the authority evidenced by the Power of Attorney issued by the company to such person or persons.

RESOLVED FURTHER, that the signature of any authorized officer and the seal of the company may be affixed by facsimile to any Power of Attorney or certification thereof authorizing the execution and delivery of any bond, undertaking, recognizance, or other suretyship obligations of the company; and such signature and seal when so used shall have the same force and effect as though manually affixed.

IN WITNESS WHEREOF, OLD REPUBLIC SURETY COMPANY has caused these presents to be signed by its proper officer, and its corporate seal to be affixed this 29TH day of APRIL, 2014.

OLD REPUBLIC SURETY COMPANY

*Phyllis M. Johnson*  
Assistant Secretary



*Alan Pavlic*  
President

STATE OF WISCONSIN, COUNTY OF WAUKESHA-SS

On this 29TH day of APRIL, 2014, personally came before me, Alan Pavlic and Phyllis M. Johnson, to me known to be the individuals and officers of the OLD REPUBLIC SURETY COMPANY who executed the above instrument, and they each acknowledged the execution of the same, and being by me duly sworn, did severally depose and say; that they are the said-officers of the corporation aforesaid, and that the seal affixed to the above instrument is the seal of the corporation, and that said corporate seal and their signatures as such officers were duly affixed and subscribed to the said instrument by the authority of the board of directors of said corporation.



*Kathryn R. Pearson*  
Notary Public

My commission expires: 9/28/2014

(Expiration of notary commission does not invalidate this instrument)

### CERTIFICATE

I, the undersigned, assistant secretary of the OLD REPUBLIC SURETY COMPANY, a Wisconsin corporation, CERTIFY that the foregoing and attached Power of Attorney remains in full force and has not been revoked; and furthermore, that the Resolutions of the board of directors set forth in the Power of Attorney, are now in force.

24-5330

Signed and sealed at the City of Brookfield, WI this 22 day of April, 2015



*Jan E. Cherny*  
Assistant Secretary

SCHWARZ INSURANCE AGENCY INC

THIS DOCUMENT HAS A COLORED BACKGROUND AND IS MULTI-COLORED ON THE FACE. THE COMPANY LOGO APPEARS ON THE BACK OF THIS DOCUMENT AS A WATERMARK. IF THESE FEATURES ARE ABSENT, THIS DOCUMENT IS VOID.



**SECTION J: PREVAILING WAGE RATES**

**PREVAILING WAGE RATE DETERMINATION**

Issued by the State of Wisconsin  
Department of Workforce Development  
Pursuant to s. 66.0903, Wis. Stats.  
Issued On: 1/7/2015

**DETERMINATION NUMBER:** 201500014

**EXPIRATION DATE:** Prime Contracts MUST Be Awarded or Negotiated On Or Before 12/31/2015. If NOT, You MUST Reapply.

**PROJECT NAME:** ALL PUBLIC WORKS PROJECTS UNDER SEC. 66.0903, STATS-CITY OF MADISON

**PROJECT LOCATION:** MADISON CITY, DANE COUNTY, WI

**CONTRACTING AGENCY:** CITY OF MADISON - ENGINEERING

|                         |  |
|-------------------------|--|
| <b>CLASSIFICATION:</b>  | Contractors are responsible for correctly classifying their workers. Either call the Department of Workforce Development (DWD) with trade or classification questions or consult DWD's Dictionary of Occupational Classifications & Work Descriptions on the DWD website at: <a href="http://dwd.wisconsin.gov/er/prevailing_wage_rate/Dictionary/dictionary_main.htm">dwd.wisconsin.gov/er/prevailing_wage_rate/Dictionary/dictionary_main.htm</a> .  |
| <b>OVERTIME:</b>        | <p>Time and one-half must be paid for all hours worked:</p> <ul style="list-style-type: none"><li>- over 10 hours per day on prevailing wage projects</li><li>- over 40 hours per calendar week</li><li>- Saturday and Sunday</li><li>- on all of the following holidays: January 1; the last Monday in May; July 4; the 1st Monday in September; the 4th Thursday in November; December 25;</li><li>- The day before if January 1, July 4 or December 25 falls on a Saturday;</li><li>- The day following if January 1, July 4 or December 25 falls on a Sunday.</li></ul> <p>Apply the time and one-half overtime calculation to whichever is higher between the Hourly Basic Rate listed on this project determination or the employee's regular hourly rate of pay. Add any applicable Premium or DOT Premium to the Hourly Basic Rate before calculating overtime.</p> <p>A DOT Premium (discussed below) may supersede this time and one-half requirement.</p> |
| <b>FUTURE INCREASE:</b> | When a specific trade or occupation requires a future increase, you MUST add the full hourly increase to the "TOTAL" on the effective date(s) indicated for the specific trade or occupation.  |
| <b>PREMIUM PAY:</b>     | If indicated for a specific trade or occupation, the full amount of such pay MUST be added to the "HOURLY BASIC RATE OF PAY" indicated for such trade or occupation, whenever such pay is applicable.  |
| <b>DOT PREMIUM:</b>     | This premium only applies to highway and bridge projects owned by the Wisconsin Department of Transportation and to the project type heading "Airport Pavement or State Highway Construction." DO NOT apply the premium calculation under any other project type on this determination.  |
| <b>APPRENTICES:</b>     | Pay apprentices a percentage of the applicable journey person's hourly basic rate of pay and hourly fringe benefit contributions specified in this determination. Obtain the appropriate percentage from each apprentice's contract or indenture.  |
| <b>SUBJOURNEY:</b>      | Subjourney wage rates may be available for some of the trades or occupations indicated below with the exception of laborers, truck drivers and heavy equipment operators. Any employer interested in using a subjourney classification on this project MUST complete Form ERD-10880 and request the applicable wage rate from the Department of Workforce Development PRIOR to using the subjourney worker on this project.  |

This document **MUST BE POSTED** by the **CONTRACTING AGENCY** in at least one conspicuous and easily accessible place on **site of the project**. A local governmental unit may post this document at the place normally used to post public notices if there is no common site on the project. This document **MUST** remain posted during the entire time any worker is employed on the project and **MUST** be physically incorporated into the specifications and all contracts and subcontracts. If you have any questions, please write to the Equal Rights Division, Labor Standards Bureau, P.O. Box 8928, Madison, Wisconsin 53708 or call (608) 266-6861.

**The following statutory provisions apply to local governmental unit projects of public works and are set forth below pursuant to the requirements of s. 66.0903(8), Stats.**

**s. 66.0903 (1) (f) & s. 103.49 (1) (c) "PREVAILING HOURS OF LABOR"** for any trade or occupation in any area means 10 hours per day and 40 hours per week and may not include any hours worked on a Saturday or Sunday or on any of the following holidays:

1. January 1.
2. The last Monday in May.
3. July 4.
4. The first Monday in September.
5. The 4th Thursday in November.
6. December 25.
7. The day before if January 1, July 4 or December 25 falls on a Saturday.
8. The day following if January 1, July 4 or December 25 falls on a Sunday.

**s. 66.0903 (10) RECORDS; INSPECTION; ENFORCEMENT.**

(a) Each contractor, subcontractor, or contractor's or subcontractor's agent performing work on a project of public works that is subject to this section shall keep full and accurate records clearly indicating the name and trade or occupation of every person performing the work described in sub. (4) and an accurate record of the number of hours worked by each of those persons and actual wages paid for the hours worked.

**s. 66.0903 (11) LIABILITY AND PENALTIES.**

- (a) 1. Any contractor, subcontractor, or contractor's or subcontractor's agent who fails to pay the prevailing wage rate determined by the department under sub. (3) or who pays less than 1.5 times the hourly basic rate of pay for all hours worked in excess of the prevailing hours of labor is liable to any affected employee in the amount of his or her unpaid wages or his or her unpaid overtime compensation and in an additional amount as liquidated damages as provided under subd. 2., 3., whichever is applicable.
2. If the department determines upon inspection under sub. (10) (b) or (c) that a contractor, subcontractor, or contractor's or subcontractor's agent has failed to pay the prevailing wage rate determined by the department under sub. (3) or has paid less than 1.5 times the hourly basic rate of pay for all hours worked in excess of the prevailing hours of labor, the department shall order the contractor to pay to any affected employee the amount of his or her unpaid wages or his or her unpaid overtime compensation and an additional amount equal to 100 percent of the amount of those unpaid wages or that unpaid overtime compensation as liquidated damages within a period specified by the department in the order.
3. In addition to or in lieu of recovering the liability specified in subd. 1. as provided in subd. 2., any employee for and in behalf of that employee and other employees similarly situated may commence an action to recover that liability in any court of competent jurisdiction. If the court finds that a contractor, subcontractor, or contractor's or subcontractor's agent has failed to pay the prevailing wage rate determined by the department under sub. (3) or has paid less than 1.5 times the hourly basic rate of pay for all hours worked in excess of the prevailing hours of labor, the court shall order the contractor, subcontractor, or agent to pay to any affected employee the amount of his or her unpaid wages or his or her unpaid overtime compensation and an additional amount equal to 100 percent of the amount of those unpaid wages or that unpaid overtime compensation as liquidated damages.
5. No employee may be a party plaintiff to an action under subd. 3. unless the employee consents in writing to become a party and the consent is filed in the court in which the action is brought. Notwithstanding s. 814.04 (1), the court shall, in addition to any judgment awarded to the plaintiff, allow reasonable attorney fees and costs to be paid by the defendant.

**BUILDING OR HEAVY CONSTRUCTION**

Includes sheltered enclosures with walk-in access for the purpose of housing persons, employees, machinery, equipment or supplies and non-sheltered work such as canals, dams, dikes, reservoirs, storage tanks, etc. A shelter enclosure need not be "habitable" in order to be considered a building. The installation of machinery and/or equipment, both above and below grade level, does not change a project's character as a building. On-site grading, utility work and landscaping are included within this definition. Residential buildings of four (4) stories or less, agricultural buildings, parking lots and driveways are NOT included within this definition.

**SKILLED TRADES**

| <b>Fringe Benefits Must Be Paid On <u>All</u> Hours Worked</b> |   | <b>HOURLY<br/>BASIC RATE<br/>OF PAY</b> | <b>HOURLY<br/>FRINGE<br/>BENEFITS</b> | <b>TOTAL</b> |
|--|---|---|---------------------------------------|--------------|
| <b>CODE</b>  | <b>TRADE OR OCCUPATION</b>  | <b>\$</b>                               | <b>\$</b>                             | <b>\$</b>    |
| 101  | Acoustic Ceiling Tile Installer<br>Future Increase(s):<br>Add \$1.42/hr on 6/1/2015; Add \$1.42/hr on 6/1/2016.   | 32.72                                   | 16.00                                 | 48.72        |
| 102  | Boilermaker<br>Future Increase(s):<br>Add \$1.50/hr. on 01/01/2016  | 33.35                                   | 28.24                                 | 61.59        |
| 103  | Bricklayer, Blocklayer or Stonemason<br>Future Increase(s):<br>Add \$1.40 on 06/01/2015; Add \$1.45 on 06/06/2016<br>Premium Increase(s):<br>DOT PREMIUM: Pay two times the hourly basic rate on<br>Sunday, New Year's Day, Memorial Day, Independence<br>Day, Labor Day, Thanksgiving Day & Christmas Day. | 32.82                                   | 18.66                                 | 51.48        |
| 104  | Cabinet Installer<br>Future Increase(s):<br>Add \$1.42/hr on 6/1/2015; Add \$1.42/hr on 6/1/2016.   | 32.72                                   | 16.00                                 | 48.72        |
| 105  | Carpenter<br>Future Increase(s):<br>Add \$1.42/hr on 6/1/2015; Add \$1.42/hr on 6/1/2016.<br>Premium Increase(s):<br>DOT PREMIUM: Pay two times the hourly basic rate on<br>Sunday, New Year's Day, Memorial Day, Independence<br>Day, Labor Day, Thanksgiving Day & Christmas Day.                         | 32.72                                   | 16.00                                 | 48.72        |
| 106  | Carpet Layer or Soft Floor Coverer<br>Future Increase(s):<br>Add \$1.42/hr on 6/1/2015; Add \$1.42/hr on 6/1/2016.  | 32.72                                   | 16.00                                 | 48.72        |
| 107  | Cement Finisher   | 31.98                                   | 12.04                                 | 44.02        |
| 108  | Drywall Taper or Finisher   | 26.05                                   | 18.23                                 | 44.28        |
| 109  | Electrician<br>Future Increase(s):<br>Add \$1.20/hr on 6/1/15; Add \$1.25/hr on 6/1/16.<br>Premium Increase(s):<br>DOT PREMIUM: Pay two times the hourly basic rate on<br>Sunday, New Year's Day, Memorial Day, Independence<br>Day, Labor Day, Thanksgiving Day & Christmas Day.                           | 34.82                                   | 19.67                                 | 54.49        |
| 110  | Elevator Constructor  | 43.84                                   | 27.09                                 | 70.93        |

| <b>Fringe Benefits Must Be Paid On <u>All</u> Hours Worked</b> |  | <b>HOURLY<br/>BASIC RATE<br/>OF PAY</b> | <b>HOURLY<br/>FRINGE<br/>BENEFITS</b> | <b>TOTAL</b> |
|--|--|---|---------------------------------------|--------------|
| <b>CODE</b>  | <b>TRADE OR OCCUPATION</b>   | <b>\$</b>                               | <b>\$</b>                             | <b>\$</b>    |
| 111  | Fence Erector  | 18.00                                   | 6.09                                  | 24.09        |
| 112  | Fire Sprinkler Fitter  | 36.79                                   | 18.81                                 | 55.60        |
| 113  | Glazier<br>Future Increase(s):<br>Add \$.75/hr eff. 06/01/2015; Add \$.90/hr eff. 06/01/2016   | 37.07                                   | 14.42                                 | 51.49        |
| 114  | Heat or Frost Insulator  | 33.43                                   | 25.81                                 | 59.24        |
| 115  | Insulator (Batt or Blown)<br>Future Increase(s):<br>Add \$1.42/hr on 6/1/2015; Add \$1.42/hr on 6/1/2016.  | 32.72                                   | 16.00                                 | 48.72        |
| 116  | Ironworker   | 31.50                                   | 20.01                                 | 51.51        |
| 117  | Lather   | 31.40                                   | 15.90                                 | 47.30        |
| 118  | Line Constructor (Electrical)  | 39.50                                   | 17.73                                 | 57.23        |
| 119  | Marble Finisher  | 16.25                                   | 2.32                                  | 18.57        |
| 120  | Marble Mason   | 32.09                                   | 18.04                                 | 50.13        |
| 121  | Metal Building Erector   | 19.05                                   | 8.08                                  | 27.13        |
|  | Millwright<br>Future Increase(s):<br>Add \$1.47/hr on 6/1/2015; Add \$1.47/hr on 6/1/2016.   | 34.44                                   | 16.07                                 | 50.51        |
| 123  | Overhead Door Installer  | 27.46                                   | 1.98                                  | 29.44        |
| 124  | Painter  | 25.75                                   | 16.60                                 | 42.35        |
| 125  | Pavement Marking Operator  | 30.10                                   | 17.34                                 | 47.44        |
| 126  | Piledriver<br>Future Increase(s):<br>Add \$1.50/hr on 6/1/2015; Add \$1.60/hr on 6/1/2016.<br>Premium Increase(s):<br>Add \$.65/hr for Piledriver Loftsmen; Add \$.75/hr for<br>Sheet Piling Loftsmen. DOT PREMIUM: Pay two times<br>the hourly basic rate on Sunday, New Year's Day,<br>Memorial Day, Independence Day, Labor Day,<br>Thanksgiving Day & Christmas Day. | 30.11                                   | 26.51                                 | 56.62        |
| 127  | Pipeline Fuser or Welder (Gas or Utility)  | 30.83                                   | 20.89                                 | 51.72        |
| 129  | Plasterer<br>Future Increase(s):<br>Add \$1.56 on 06/01/2015; Add \$1.61 on 06/01/2016;<br>Add \$1.66 on 06/01/2017  | 32.65                                   | 19.36                                 | 52.01        |
| 130  | Plumber<br>Future Increase(s):<br>Add \$1.80 on 6/1/15   | 37.57                                   | 17.47                                 | 55.04        |

| <b>Fringe Benefits Must Be Paid On <u>All</u> Hours Worked</b> |  | <b>HOURLY<br/>BASIC RATE<br/>OF PAY</b> | <b>HOURLY<br/>FRINGE<br/>BENEFITS</b> | <b>TOTAL</b> |
|--|--|---|---------------------------------------|--------------|
| <b>CODE</b>  | <b>TRADE OR OCCUPATION</b>   | <b>\$</b>                               | <b>\$</b>                             | <b>\$</b>    |
| 132  | Refrigeration Mechanic<br>Future Increase(s):<br>Add \$1.80 on 6/1/15  | 44.20                                   | 18.26                                 | 62.46        |
| 133  | Rofer or Waterproofer  | 29.40                                   | 11.31                                 | 40.71        |
| 134  | Sheet Metal Worker   | 34.45                                   | 22.54                                 | 56.99        |
| 135  | Steamfitter<br>Future Increase(s):<br>Add \$1.80/hr on 6/1/15.   | 44.20                                   | 18.26                                 | 62.46        |
| 137  | Teledata Technician or Installer<br>Premium Increase(s):<br>DOT PREMIUM: Pay two times the hourly basic rate on<br>Sunday, New Year's Day, Memorial Day, Independence<br>Day, Labor Day, Thanksgiving Day & Christmas Day. | 22.50                                   | 12.74                                 | 35.24        |
| 138  | Temperature Control Installer  | 42.95                                   | 15.04                                 | 57.99        |
| 139  | Terrazzo Finisher  | 16.25                                   | 2.32                                  | 18.57        |
| 140  | Terrazzo Mechanic  | 31.18                                   | 17.35                                 | 48.53        |
| 141  | Tile Finisher  | 23.85                                   | 17.18                                 | 41.03        |
| 142  | Tile Setter  | 29.81                                   | 17.18                                 | 46.99        |
| 143  | Tuckpointer, Caulker or Cleaner  | 23.60                                   | 7.10                                  | 30.70        |
| 144  | Underwater Diver (Except on Great Lakes)   | 35.40                                   | 15.90                                 | 51.30        |
| 146  | Well Driller or Pump Installer   | 25.32                                   | 15.65                                 | 40.97        |
| 147  | Siding Installer   | 36.17                                   | 19.44                                 | 55.61        |
| 150  | Heavy Equipment Operator - ELECTRICAL LINE CONSTRUCTION ONLY   | 30.16                                   | 15.11                                 | 45.27        |
| 151  | Light Equipment Operator -ELECTRICAL LINE CONSTRUCTION ONLY  | 31.60                                   | 26.76                                 | 58.36        |
| 152  | Heavy Truck Driver - ELECTRICAL LINE CONSTRUCTION ONLY   | 27.65                                   | 14.49                                 | 42.14        |
| 153  | Light Truck Driver - ELECTRICAL LINE CONSTRUCTION ONLY   | 27.83                                   | 15.01                                 | 42.84        |
| 154  | Groundman - ELECTRICAL LINE CONSTRUCTION ONLY  | 21.90                                   | 9.83                                  | 31.73        |

**TRUCK DRIVERS**

| <b>Fringe Benefits Must Be Paid On <u>All</u> Hours Worked</b> |                            | <b>HOURLY<br/>BASIC RATE<br/>OF PAY</b> | <b>HOURLY<br/>FRINGE<br/>BENEFITS</b> | <b>TOTAL</b> |
|--|----------------------------|---|---------------------------------------|--------------|
| <b>CODE</b>  | <b>TRADE OR OCCUPATION</b> | <b>\$</b>                               | <b>\$</b>                             | <b>\$</b>    |
| 201  | Single Axle or Two Axle    | 32.89                                   | 18.96                                 | 51.85        |
| 203  | Three or More Axle         | 18.00                                   | 21.99                                 | 39.99        |

| <b>Fringe Benefits Must Be Paid On <u>All</u> Hours Worked</b> |  | <b>HOURLY<br/>BASIC RATE<br/>OF PAY</b> | <b>HOURLY<br/>FRINGE<br/>BENEFITS</b> | <b>TOTAL</b> |
|--|--|---|---------------------------------------|--------------|
| <b>CODE</b>  | <b>TRADE OR OCCUPATION</b>   | <b>\$</b>                               | <b>\$</b>                             | <b>\$</b>    |
| 204  | Articulated, Euclid, Dumptor, Off Road Material Hauler<br>Future Increase(s):<br>Add \$1.60/hr on 6/2/2015; Add \$1.60/hr on 6/3/2016. | 33.69                                   | 19.78                                 | 53.47        |
| 205  | Pavement Marking Vehicle   | 20.85                                   | 11.02                                 | 31.87        |
| 207  | Truck Mechanic   | 18.00                                   | 21.99                                 | 39.99        |

**LABORERS**

| <b>Fringe Benefits Must Be Paid On <u>All</u> Hours Worked</b> |   | <b>HOURLY<br/>BASIC RATE<br/>OF PAY</b> | <b>HOURLY<br/>FRINGE<br/>BENEFITS</b> | <b>TOTAL</b> |
|--|---|---|---------------------------------------|--------------|
| <b>CODE</b>  | <b>TRADE OR OCCUPATION</b>  | <b>\$</b>                               | <b>\$</b>                             | <b>\$</b>    |
| 301  | General Laborer<br>Future Increase(s):<br>Add \$1.35/hr eff. 06/01/2015; Add \$1.25/hr eff.<br>06/06/2016<br>Premium Increase(s):<br>Add \$1.00/hr for certified welder; Add \$.25/hr for mason<br>tender                                     | 24.97                                   | 15.12                                 | 40.09        |
| 302  | Asbestos Abatement Worker   | 18.00                                   | 9.58                                  | 27.58        |
|  | Landscaper  | 18.75                                   | 10.26                                 | 29.01        |
| 310  | Gas or Utility Pipeline Laborer (Other Than Sewer and Water)  | 21.55                                   | 14.14                                 | 35.69        |
| 311  | Fiber Optic Laborer (Outside, Other Than Concrete Encased)<br>Premium Increase(s):<br>DOT PREMIUMS: Pay two times the hourly basic rate<br>on New Year's Day, Memorial Day, Independence Day,<br>Labor Day, Thanksgiving Day & Christmas Day. | 18.82                                   | 14.16                                 | 32.98        |
| 314  | Railroad Track Laborer  | 14.50                                   | 5.29                                  | 19.79        |
| 315  | Final Construction Clean-Up Worker<br>Future Increase(s):<br>Add \$1.35/hr eff. 06/01/2015; Add \$1.25/hr eff.<br>06/06/2016  | 24.97                                   | 15.12                                 | 40.09        |

**HEAVY EQUIPMENT OPERATORS  
SITE PREPARATION, UTILITY OR LANDSCAPING WORK ONLY**

| <b>Fringe Benefits Must Be Paid On <u>All</u> Hours Worked</b> |  | <b>HOURLY<br/>BASIC RATE<br/>OF PAY</b> | <b>HOURLY<br/>FRINGE<br/>BENEFITS</b> | <b>TOTAL</b> |
|--|--|---|---------------------------------------|--------------|
| <b>CODE</b>  | <b>TRADE OR OCCUPATION</b>   | <b>\$</b>                               | <b>\$</b>                             | <b>\$</b>    |
| 501  | Air Track, Rotary or Percussion Drilling Machine &/or Hammers, Blaster; Asphalt Milling Machine; Boring Machine (Directional, Horizontal or Vertical); Backhoe (Track Type) Having a Mfgr's Rated Capacity of 130,000 Lbs. or Over; Backhoe (Track Type) Having a Mfgr's Rated Capacity of Under 130,000 Lbs., Backhoe (Mini, 15,000 Lbs. & Under); Bulldozer or Endloader (Over 40 hp); Compactor (Self-Propelled 85 Ft Total Drum Width & Over, or Tractor Mounted, Towed & Light Equipment); Concrete Batch Plant, Batch Hopper; Concrete Breaker (Large, Auto, Vibratory/Sonic, Manual or Remote); Crane, Shovel, Dragline, Clamshells; Forklift (Machinery Moving or Steel Erection, 25 Ft & Over); Gradall (Cruz-Aire Type); Grader or Motor Patrol; Master Mechanic; Mechanic or Welder; Robotic Tool Carrier (With or Without Attachments); Scraper (Self Propelled or Tractor Drawn) 5 cu yds or More Capacity; Tractor or Truck Mounted Hydraulic Backhoe; Tractor or Truck Mounted Hydraulic Crane (10 Tons or Under); Tractor (Scraper, Dozer, Pusher, Loader); Trencher (Wheel Type or Chain Type Having Over 8 Inch Bucket).<br>Future Increase(s):<br>Add \$1.60/hr on 6/2/2015; Add \$1.60/hr on 6/3/2016. | 33.69                                   | 19.78                                 | 53.47        |
| 502  | Backfiller; Broom or Sweeper; Bulldozer or Endloader (Under 40 hp); Environmental Burner; Forestry Equipment, Timbco, Tree Shear, Tub Grinder, Processor; Jeep Digger; Screed (Milling Machine); Skid Rig; Straddle Carrier or Travel Lift; Stump Chipper; Trencher (Wheel Type or Chain Type Having 8 Inch Bucket & Under).<br>Future Increase(s):<br>Add \$1.60/hr on 6/2/2015; Add \$1.60/hr on 6/3/2016.   | 33.69                                   | 19.78                                 | 53.47        |
| 503  | Air Compressor (&/or 400 CFM or Over); Augers (Vertical & Horizontal); Compactor (Self-Propelled 84 Ft Total Drum Width & Under, or Tractor Mounted, Towed & Light Equipment); Crusher, Screening or Wash Plant; Farm or Industrial Type Tractor; Forklift; Generator (&/or 150 KW or Over); Greaser; High Pressure Utility Locating Machine (Daylighting Machine); Mulcher; Oiler; Post Hole Digger or Driver; Pump (3 Inch or Over) or Well Points; Refrigeration Plant or Freeze Machine; Rock, Stone Breaker; Skid Steer Loader (With or Without Attachments); Vibratory Hammer or Extractor, Power Pack.<br>Future Increase(s):<br>Add \$1.60/hr on 6/2/2015; Add \$1.60/hr on 6/3/2016.  | 31.62                                   | 19.78                                 | 51.40        |
| 504  | Work Performed on the Great Lakes Including Diver; Wet Tender or Hydraulic Dredge Engineer.  | 41.65                                   | 21.71                                 | 63.36        |
| 505  | Work Performed on the Great Lakes Including Crane or Backhoe Operator; Assistant Hydraulic Dredge Engineer; Hydraulic Dredge Leverman or Diver's Tender; Mechanic or Welder; 70 Ton & Over Tug Operator.<br>Premium Increase(s):<br>Add \$.50/hr for Friction Crane, Lattice Boom or Crane Certification (CCO).  | 41.65                                   | 21.71                                 | 63.36        |

**Fringe Benefits Must Be Paid On All Hours Worked**

| <u>CODE</u> | <u>TRADE OR OCCUPATION</u>  | <u>HOURLY BASIC RATE OF PAY</u><br>\$ | <u>HOURLY FRINGE BENEFITS</u><br>\$ | <u>TOTAL</u><br>\$ |
|-------------|---|---------------------------------------|-------------------------------------|--------------------|
| 506         | Work Performed on the Great Lakes Including Deck Equipment Operator or Machineryman (Maintains Cranes Over 50 Tons or Backhoes 115,000 Lbs. or More); Tug, Launch or Loader, Dozer or Like Equipment When Operated on a Barge, Breakwater Wall, Slip, Dock or Scow, Deck Machinery.     | 35.72                                 | 17.85                               | 53.57              |
| 507         | Work Performed on the Great Lakes Including Deck Equipment Operator, Machineryman or Fireman (Operates 4 Units or More or Maintains Cranes 50 Tons or Under or Backhoes 115,000 Lbs. or Under); Deck Hand, Deck Engineer or Assistant Tug Operator; Off Road Trucks - Great Lakes ONLY. | 35.46                                 | 20.40                               | 55.86              |

**HEAVY EQUIPMENT OPERATORS  
EXCLUDING SITE PREPARATION, UTILITY, PAVING LANDSCAPING WORK**

**Fringe Benefits Must Be Paid On All Hours Worked**

| <u>CODE</u> | <u>TRADE OR OCCUPATION</u>  | <u>HOURLY BASIC RATE OF PAY</u><br>\$ | <u>HOURLY FRINGE BENEFITS</u><br>\$ | <u>TOTAL</u><br>\$ |
|-------------|---|---------------------------------------|-------------------------------------|--------------------|
| 508         | Boring Machine (Directional); Crane, Tower Crane, Pedestal Tower or Derrick, With or Without Attachments, With a Lifting Capacity of Over 100 Tons, Self-Erecting Tower Crane With a Lifting Capacity of Over 4,000 Lbs., Crane With Boom Dollies; Crane, Tower Crane, Pedestal Tower or Derrick, With Boom, Leads &/or Jib Lengths Measuring 176 Ft or Over; Master Mechanic.<br>Future Increase(s):<br>Add \$1.60/hr on 6/2/2015; Add \$1.60/hr on 6/3/2016.<br>Premium Increase(s):<br>Add \$.50/hr for >200 Ton; Add \$1/hr at 300 Ton; Add \$1.50/hr at 400 Ton; Add \$2/hr at 500 Ton & Over.   | 36.67                                 | 19.78                               | 56.45              |
| 509         | Backhoe (Track Type) Having a Mfgr.'s Rated Capacity of 130,000 Lbs. or Over; Boring Machine (Horizontal or Vertical); Caisson Rig; Crane, Tower Crane, Portable Tower, Pedestal Tower or Derrick, With or Without Attachments, With a Lifting Capacity of 100 Tons or Under, Self-Erecting Tower Crane With A Lifting Capacity Of 4,000 Lbs. & Under; Crane, Tower Crane, Portable Tower, Pedestal Tower or Derrick, With Boom, Leads &/or Jib Lengths Measuring 175 Ft or Under; Pile Driver; Versi Lifts, Tri-Lifts & Gantrys (20,000 Lbs. & Over).<br>Future Increase(s):<br>Add \$1.60/hr on 6/2/2015; Add \$1.60/hr on 6/3/2016.<br>Premium Increase(s):<br>Add \$.25/hr for all >45 Ton lifting capacity cranes. | 35.42                                 | 19.78                               | 55.20              |
| 510         | Backhoe (Track Type) Having a Mfgr.'s Rated Capacity of Under 130,000 Lbs., Backhoe (Mini, 15,000 Lbs. & Under); Concrete Bump Cutter, Grinder, Planing or Grooving Machine; Concrete Laser/Screed; Concrete Paver (Slipform); Concrete Pump (Over 46 Meter), Concrete Conveyor (Rotec or Bidwell Type); Concrete Slipform Placer Curb & Gutter Machine; Concrete Spreader & Distributor; Dredge (NOT Performing Work on the Great Lakes); Forklift (Machinery Moving or Steel Erection, 25 Ft & Over); Gradall (Cruz-Aire Type); Hydro-Blaster (10,000 PSI or Over); Milling Machine; Skid Rig; Traveling Crane (Bridge Type).<br>Future Increase(s):<br>Add \$1.60/hr on 6/2/2015; Add \$1.60/hr on 6/3/2016.         | 34.22                                 | 19.78                               | 54.00              |

| <b>Fringe Benefits Must Be Paid On <u>All</u> Hours Worked</b> |   | <b>HOURLY<br/>BASIC RATE<br/>OF PAY</b> | <b>HOURLY<br/>FRINGE<br/>BENEFITS</b> | <b>TOTAL</b> |
|--|---|---|---------------------------------------|--------------|
| <b>CODE</b>  | <b>TRADE OR OCCUPATION</b>  | <b>\$</b>                               | <b>\$</b>                             | <b>\$</b>    |
| 511  | Air, Track, Rotary or Percussion Drilling Machine &/or Hammers, Blaster; Bulldozer or Endloader (Over 40 hp); Compactor (Self-Propelled 85 Ft Total Drum Width & Over, or Tractor Mounted, Towed & Light Equipment); Concrete Pump (46 Meter & Under), Concrete Conveyor (Rotec or Bidwell Type); Crane (Carry Deck, Mini) or Truck Mounted Hydraulic Crane (10 Tons or Under); Environmental Burner; Gantrys (Under 20,000 Lbs.); Grader or Motor Patrol; High Pressure Utility Locating Machine (Daylighting Machine); Manhoist; Material or Stack Hoist; Mechanic or Welder; Railroad Track Rail Leveling Machine, Tie Placer, Extractor, Tamper, Stone Leveler or Rehabilitation Equipment; Roller (Over 5 Ton); Scraper (Self Propelled or Tractor Drawn) 5 cu yd or More Capacity; Screed (Milling Machine); Sideboom; Straddle Carrier or Travel Lift; Tining or Curing Machine; Tractor (Scraper, Dozer, Pusher, Loader); Tractor or Truck Mounted Hydraulic Backhoe; Tractor or Truck Mounted Hydraulic Crane (10 Tons or Under); Trencher (Wheel Type or Chain Type Having Over 8-Inch Bucket).<br>Future Increase(s):<br>Add \$1.60/hr on 6/2/2015; Add \$1.60/hr on 6/3/2016. | 33.69                                   | 19.78                                 | 53.47        |
| 512  | Backfiller; Broom or Sweeper; Bulldozer or Endloader (Under 40 hp); Compactor (Self-Propelled 84 Ft Total Drum Width & Under, or Tractor Mounted, Towed & Light Equipment); Concrete Batch Plant, Batch Hopper; Concrete Breaker (Large, Auto, Vibratory/Sonic, Manual or Remote); Concrete Conveyor System; Concrete Finishing Machine (Road Type); Fireman (Pile Driver & Derrick NOT Performing Work on the Great Lakes); Grout Pump; Hoist (Tugger, Automatic); Industrial Locomotives; Jeep Digger; Lift Slab Machine; Mulcher; Roller (Rubber Tire, 5 Ton or Under); Screw or Gypsum Pumps; Stabilizing or Concrete Mixer (Self-Propelled or 14S or Over); Stump Chipper; Trencher (Wheel Type or Chain Type Having 8-Inch Bucket & Under); Winches & A-Frames.<br>Future Increase(s):<br>Add \$1.60/hr on 6/2/2015; Add \$1.60/hr on 6/3/2016.   | 31.62                                   | 19.78                                 | 51.40        |
| 513  | Air Compressor (&/or 400 CFM or Over); Air, Electric or Hydraulic Jacking System; Augers (Vertical & Horizontal); Boatmen (NOT Performing Work on the Great Lakes); Boiler (Temporary Heat); Crusher, Screening or Wash Plant; Elevator; Farm or Industrial Type Tractor; Fireman (Asphalt Plant NOT Performing Work on the Great Lakes); Forklift; Generator (&/or 150 KW or Over); Greaser; Heaters (Mechanical); Loading Machine (Conveyor); Oiler; Post Hole Digger or Driver; Prestress Machine; Pump (3 Inch or Over) or Well Points; Refrigeration Plant or Freeze Machine; Robotic Tool Carrier (With or Without Attachments); Rock, Stone Breaker; Skid Steer Loader (With or Without Attachments); Vibratory Hammer or Extractor, Power Pack.<br>Future Increase(s):<br>Add \$1.60/hr on 6/2/2015; Add \$1.60/hr on 6/3/2016.   | 30.99                                   | 19.78                                 | 50.77        |
| 514  | Gas or Utility Pipeline, Except Sewer & Water (Primary Equipment).<br>Future Increase(s):<br>Add \$1/hr on 6/1/2015; Add \$1/hr on 5/30/2016.   | 36.34                                   | 22.14                                 | 58.48        |
| 515  | Gas or Utility Pipeline, Except Sewer & Water (Secondary Equipment).<br>Future Increase(s):<br>Add \$1.65/hr on 6/1/2015.   | 33.12                                   | 19.35                                 | 52.47        |
| 516  | Fiber Optic Cable Equipment   | 28.89                                   | 17.95                                 | 46.84        |



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| <b>SEWER, WATER OR TUNNEL CONSTRUCTION</b> |
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Includes those projects that primarily involve public sewer or water distribution, transmission or collection systems and related tunnel work (excluding buildings).

### SKILLED TRADES

| <u>CODE</u>  | <u>TRADE OR OCCUPATION</u>  | <u>HOURLY<br/>BASIC RATE<br/>OF PAY</u><br>\$ | <u>HOURLY<br/>FRINGE<br/>BENEFITS</u><br>\$ | <u>TOTAL</u><br>\$ |
|--|---|---|---|--------------------|
| <b>Fringe Benefits Must Be Paid On <u>All</u> Hours Worked</b> |   |   |   |                    |
| 103  | Bricklayer, Blocklayer or Stonemason  | 32.09   | 18.04                                       | 50.13              |
| 105  | Carpenter<br>Future Increase(s):<br>Add \$1.50/hr on 6/1/2015; Add \$1.65/hr on 6/1/2016.<br>Premium Increase(s):<br>DOT PREMIUM: Pay two times the hourly basic rate on Sunday, New Year's Day, Memorial Day, Independence Day, Labor Day, Thanksgiving Day & Christmas Day.   | 34.13   | 20.61                                       | 54.74              |
| 107  | Cement Finisher<br>Future Increase(s):<br>Add \$1.87 on 6/1/15; Add \$1.75 on 6/1/16.<br>Premium Increase(s):<br>DOT PREMIUMS: 1) Pay two times the hourly basic rate on Sunday, New Year's Day, Memorial Day, Independence Day, Labor Day, Thanksgiving Day & Christmas Day. 2) Add \$1.40/hr when the Wisconsin Department of Transportation or responsible governing agency requires that work be performed at night under artificial illumination with traffic control and the work is completed after sunset and before sunrise. | 35.18   | 16.78                                       | 51.96              |
| 109  | Electrician<br>Premium Increase(s):<br>DOT PREMIUM: Pay two times the hourly basic rate on Sunday, New Year's Day, Memorial Day, Independence Day, Labor Day, Thanksgiving Day & Christmas Day.   | 33.93   | 22.77                                       | 56.70              |
| 111  | Fence Erector   | 18.00   | 6.09  | 24.09              |
| 116  | Ironworker  | 31.50   | 20.01                                       | 51.51              |
| 118  | Line Constructor (Electrical)   | 39.50   | 17.73                                       | 57.23              |
| 125  | Pavement Marking Operator   | 30.10   | 17.34                                       | 47.44              |
| 126  | Piledriver  | 29.56   | 25.71                                       | 55.27              |
| 130  | Plumber   | 21.50   | 0.00  | 21.50              |
| 135  | Steamfitter   | 42.95   | 17.81                                       | 60.76              |
| 137  | Teledata Technician or Installer  | 22.25   | 12.24                                       | 34.49              |
| 143  | Tuckpointer, Caulker or Cleaner   | 23.60   | 7.10  | 30.70              |
| 144  | Underwater Diver (Except on Great Lakes)  | 35.40   | 15.90                                       | 51.30              |

**Fringe Benefits Must Be Paid On All Hours Worked**

| <u>CODE</u> | <u>TRADE OR OCCUPATION</u>                                   | <u>HOURLY BASIC RATE OF PAY</u><br>\$ | <u>HOURLY FRINGE BENEFITS</u><br>\$ | <u>TOTAL</u><br>\$ |
|-------------|--|---------------------------------------|-------------------------------------|--------------------|
| 146         | Well Driller or Pump Installer                               | 25.32                                 | 15.65                               | 40.97              |
| 150         | Heavy Equipment Operator - ELECTRICAL LINE CONSTRUCTION ONLY | 35.55                                 | 15.57                               | 51.12              |
| 151         | Light Equipment Operator -ELECTRICAL LINE CONSTRUCTION ONLY  | 31.60                                 | 15.19                               | 46.79              |
| 152         | Heavy Truck Driver - ELECTRICAL LINE CONSTRUCTION ONLY       | 27.65                                 | 13.44                               | 41.09              |
| 153         | Light Truck Driver - ELECTRICAL LINE CONSTRUCTION ONLY       | 25.68                                 | 13.28                               | 38.96              |
| 154         | Groundman - ELECTRICAL LINE CONSTRUCTION ONLY                | 21.75                                 | 12.97                               | 34.72              |

**TRUCK DRIVERS**

**Fringe Benefits Must Be Paid On All Hours Worked**

| <u>CODE</u> | <u>TRADE OR OCCUPATION</u>   | <u>HOURLY BASIC RATE OF PAY</u><br>\$ | <u>HOURLY FRINGE BENEFITS</u><br>\$ | <u>TOTAL</u><br>\$ |
|-------------|--|---------------------------------------|-------------------------------------|--------------------|
| 201         | Single Axle or Two Axle<br>Future Increase(s):<br>Add \$1.15/hr on 6/1/2015.<br>Premium Increase(s):<br>DOT PREMIUM: Pay two times the hourly basic rate on Sunday, New Year's Day, Memorial Day, Independence Day, Labor Day, Thanksgiving Day & Christmas Day. | 25.18                                 | 18.31                               | 43.49              |
| 203         | Three or More Axle   | 19.50                                 | 4.97                                | 24.47              |
| 204         | Articulated, Euclid, Dumptor, Off Road Material Hauler   | 32.89                                 | 18.96                               | 51.85              |
| 205         | Pavement Marking Vehicle   | 20.85                                 | 11.02                               | 31.87              |
| 207         | Truck Mechanic   | 19.50                                 | 4.97                                | 24.47              |

**LABORERS**

**Fringe Benefits Must Be Paid On All Hours Worked**

| <u>CODE</u> | <u>TRADE OR OCCUPATION</u>  | <u>HOURLY BASIC RATE OF PAY</u><br>\$ | <u>HOURLY FRINGE BENEFITS</u><br>\$ | <u>TOTAL</u><br>\$ |
|-------------|---|---------------------------------------|-------------------------------------|--------------------|
| 301         | General Laborer<br>Future Increase(s):<br>Add \$1.35/hr eff. 06/01/2015; Add \$1.25/hr eff. 06/06/2016<br>Premium Increase(s):<br>Add \$.20 for blaster, bracer, manhole builder, caulker, bottomman and power tool; Add \$.55 for pipelayer; Add \$1.00 for tunnel work 0-15 lbs. compressed air; Add \$2.00 for over 15-30 lbs. compressed air; Add \$3.00 for over 30 lbs. compressed air. | 26.34                                 | 15.13                               | 41.47              |
| 303         | Landscaper  | 39.43                                 | 0.00                                | 39.43              |

| <b>Fringe Benefits Must Be Paid On <u>All</u> Hours Worked</b> |  | <b>HOURLY<br/>BASIC RATE<br/>OF PAY</b> | <b>HOURLY<br/>FRINGE<br/>BENEFITS</b> | <b>TOTAL</b> |
|--|--|---|---------------------------------------|--------------|
| <b>CODE</b>  | <b>TRADE OR OCCUPATION</b>                                 | <b>\$</b>                               | <b>\$</b>                             | <b>\$</b>    |
| 304  | Flagperson or Traffic Control Person                       | 31.95                                   | 0.00                                  | 31.95        |
| 311  | Fiber Optic Laborer (Outside, Other Than Concrete Encased) | 18.33                                   | 13.65                                 | 31.98        |
| 314  | Railroad Track Laborer                                     | 14.50                                   | 5.29                                  | 19.79        |

**HEAVY EQUIPMENT OPERATORS  
SEWER, WATER OR TUNNEL WORK**

| <b>Fringe Benefits Must Be Paid On <u>All</u> Hours Worked</b> |   | <b>HOURLY<br/>BASIC RATE<br/>OF PAY</b> | <b>HOURLY<br/>FRINGE<br/>BENEFITS</b> | <b>TOTAL</b> |
|--|---|---|---------------------------------------|--------------|
| <b>CODE</b>  | <b>TRADE OR OCCUPATION</b>  | <b>\$</b>                               | <b>\$</b>                             | <b>\$</b>    |
| 521  | Backhoe (Track Type) Having a Mfgr.'s Rated Capacity of 130,000 Lbs. or Over; Caisson Rig; Crane, Tower Crane, Pedestal Tower or Derrick, With Boom, Leads &/or Jib Lengths Measuring 176 Ft or Over; Crane, Tower Crane, Pedestal Tower or Derrick, With or Without Attachments, With a Lifting Capacity of Over 100 Tons, Self-Erecting Tower Crane With a Lifting Capacity Of Over 4,000 Lbs., Crane With Boom Dollies; Master Mechanic; Pile Driver.<br>Future Increase(s):<br>Add \$1.55/hr on 6/1/2015.<br>Premium Increase(s):<br>Add \$.25/hr for operating tower crane.  | 37.24                                   | 20.10                                 | 57.34        |
| 522  | Backhoe (Track Type) Having a Mfgr.'s Rated Capacity of Under 130,000 Lbs., Backhoe (Mini, 15,000 Lbs. & Under); Boring Machine (Directional); Concrete Bump Cutter, Grinder, Planing or Grooving Machine; Concrete Laser/Screed; Concrete Paver (Slipform); Concrete Pump (Over 46 Meter), Concrete Conveyor (Rotec or Bidwell Type); Concrete Spreader & Distributor; Crane, Tower Crane, Portable Tower, Pedestal Tower or Derrick, With Boom, Leads &/or Jib Lengths Measuring 175 Ft or Under; Crane, Tower Crane, Portable Tower, Pedestal Tower or Derrick, With or Without Attachments, With a Lifting Capacity of 100 Tons or Under, Self-Erecting Tower Crane With a Lifting Capacity of 4,000 Lbs. & Under; Dredge (NOT Performing Work on the Great Lakes); Milling Machine; Skid Rig; Telehandler; Traveling Crane (Bridge Type).<br>Future Increase(s):<br>Add \$1.60/hr on 6/2/2015; Add \$1.60/hr on 6/3/2016.  | 34.22                                   | 19.78                                 | 54.0         |
| 523  | Air Track, Rotary or Percussion Drilling Machine &/or Hammers, Blaster; Boring Machine (Horizontal or Vertical); Bulldozer or Endloader (Over 40 hp); Crane (Carry Deck, Mini) or Truck Mounted Hydraulic Crane (10 Tons or Under); Concrete Pump (46 Meter & Under), Concrete Conveyor (Rotec or Bidwell Type); Concrete Slipform Placer Curb & Gutter Machine; Gradall (Cruz-Aire Type); Grader or Motor Patrol; Hydro-Blaster (10,000 PSI or Over); Manhoist; Material or Stack Hoist; Mechanic or Welder; Roller (Over 5 Ton); Scraper (Self Propelled or Tractor Drawn) 5 cu yd or More Capacity; Screed (Milling Machine); Sideboom; Straddle Carrier or Travel Lift; Tractor (Scraper, Dozer, Pusher, Loader); Tractor or Truck Mounted Hydraulic Backhoe; Tractor or Truck Mounted Hydraulic Crane (10 Tons or Under); Trencher (Wheel Type or Chain Type Having Over 8-Inch Bucket).<br>Future Increase(s):<br>Add \$1.60/hr on 6/2/2015; Add \$1.60/hr on 6/3/2016. | 33.69                                   | 19.78                                 | 53.47        |

| <b>Fringe Benefits Must Be Paid On <u>All</u> Hours Worked</b> |   | <b>HOURLY<br/>BASIC RATE<br/>OF PAY</b> | <b>HOURLY<br/>FRINGE<br/>BENEFITS</b> | <b>TOTAL</b> |
|--|---|---|---------------------------------------|--------------|
| <b>CODE</b>  | <b>TRADE OR OCCUPATION</b>  | <b>\$</b>                               | <b>\$</b>                             | <b>\$</b>    |
| 524  | Backfiller; Broom or Sweeper; Bulldozer or Endloader (Under 40 hp); Compactor (Self-Propelled 85 Ft Total Drum Width & Over, or Tractor Mounted, Towed & Light Equipment); Concrete Batch Plant, Batch Hopper; Concrete Breaker (Large, Auto, Vibratory/Sonic, Manual or Remote); Concrete Conveyor System; Concrete Finishing Machine (Road Type); Environmental Burner; Fireman (Pile Driver & Derrick NOT Performing Work on the Great Lakes); Forestry Equipment, Timbco, Tree Shear, Tub Grinder, Processor; Hoist (Tugger, Automatic); Grout Pump; Jeep Digger; Lift Slab Machine; Mulcher; Power Subgrader; Pump (3 Inch or Over) or Well Points; Robotic Tool Carrier (With or Without Attachments); Roller (Rubber Tire, 5 Ton or Under); Screw or Gypsum Pumps; Stabilizing or Concrete Mixer (Self-Propelled or 14S or Over); Stump Chipper; Tining or Curing Machine; Trencher (Wheel Type or Chain Type Having 8-Inch Bucket & Under); Winches & A-Frames. | 30.82                                   | 18.96                                 | 49.78        |
| 525  | Air Compressor (&/or 400 CFM or Over); Air, Electric or Hydraulic Jacking System; Augers (Vertical & Horizontal); Compactor (Self-Propelled 84 Ft Total Drum Width & Under, or Tractor Mounted, Towed & Light Equipment); Crusher, Screening or Wash Plant; Farm or Industrial Type Tractor; Fireman (Asphalt Plant NOT Performing Work on the Great Lakes); Generator (&/or 150 KW or Over); Heaters (Mechanical); High Pressure Utility Locating Machine (Daylighting Machine); Loading Machine (Conveyor); Post Hole Digger or Driver; Refrigeration Plant or Freeze Machine; Rock, Stone Breaker; Skid Steer Loader (With or Without Attachments); Vibratory Hammer or Extractor, Power Pack.   | 30.69                                   | 18.46                                 | 49.15        |
| 526  | Boiler (Temporary Heat); Forklift; Greaser; Oiler.  | 30.19                                   | 18.96                                 | 49.15        |
| 527  | Work Performed on the Great Lakes Including Diver; Wet Tender or Hydraulic Dredge Engineer.   | 41.65                                   | 21.71                                 | 63.36        |
| 528  | Work Performed on the Great Lakes Including 70 Ton & Over Tug Operator; Assistant Hydraulic Dredge Engineer; Crane or Backhoe Operator; Hydraulic Dredge Leverman or Diver's Tender; Mechanic or Welder.  | 41.65                                   | 21.71                                 | 63.36        |
| 529  | Work Performed on the Great Lakes Including Deck Equipment Operator or Machineryman (Maintains Cranes Over 50 Tons or Backhoes 115,000 Lbs. or More); Tug, Launch or Loader, Dozer or Like Equipment When Operated on a Barge, Breakwater Wall, Slip, Dock or Scow, Deck Machinery.   | 35.72                                   | 17.85                                 | 53.57        |
| 530  | Work Performed on the Great Lakes Including Deck Equipment Operator; Machineryman or Fireman (Operates 4 Units or More or Maintains Cranes 50 Tons or Under or Backhoes 115,000 Lbs. or Under), Deck Hand, Deck Engineer or Assistant Tug Operator; Off Road Trucks - Great Lakes ONLY.   | 35.46                                   | 20.40                                 | 55.86        |

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|---|
| <b>AIRPORT PAVEMENT OR STATE HIGHWAY CONSTRUCTION</b> |
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Includes all airport projects (excluding buildings) and all projects awarded by the Wisconsin Department of Transportation (excluding buildings).

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**SKILLED TRADES**

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| <b>CODE</b> | <b>TRADE OR OCCUPATION</b>  | <b>HOURLY<br/>BASIC RATE<br/>OF PAY</b> | <b>HOURLY<br/>FRINGE<br/>BENEFITS</b> | <b>TOTAL</b> |
|-------------|---|---|---------------------------------------|--------------|
|             |   | \$                                      | \$                                    | \$           |
| 103         | Bricklayer, Blocklayer or Stonemason  | 32.09                                   | 18.04                                 | 50.13        |
| 105         | Carpenter<br>Future Increase(s):<br>Add \$1.42/hr on 6/1/2015; Add \$1.42/hr on 6/1/2016.<br>Premium Increase(s):<br>DOT PREMIUM: Pay two times the hourly basic rate on Sunday, New Year's Day, Memorial Day, Independence Day, Labor Day, Thanksgiving Day & Christmas Day.   | 32.72                                   | 16.00                                 | 48.72        |
| 107         | Cement Finisher<br>Future Increase(s):<br>Add \$1.87 on 6/1/15; Add \$1.75 on 6/1/16.<br>Premium Increase(s):<br>DOT PREMIUMS: 1) Pay two times the hourly basic rate on Sunday, New Year's Day, Memorial Day, Independence Day, Labor Day, Thanksgiving Day & Christmas Day. 2) Add \$1.40/hr when the Wisconsin Department of Transportation or responsible governing agency requires that work be performed at night under artificial illumination with traffic control and the work is completed after sunset and before sunrise. | 35.18                                   | 16.78                                 | 51.96        |
| 109         | Electrician<br>Premium Increase(s):<br>DOT PREMIUM: Pay two times the hourly basic rate on Sunday, New Year's Day, Memorial Day, Independence Day, Labor Day, Thanksgiving Day & Christmas Day.   | 33.93                                   | 22.77                                 | 56.70        |
| 111         | Fence Erector   | 18.00                                   | 6.09                                  | 24.09        |
| 116         | Ironworker  | 31.50                                   | 20.01                                 | 51.51        |
| 118         | Line Constructor (Electrical)   | 39.50                                   | 17.73                                 | 57.23        |
| 124         | Painter   | 26.65                                   | 13.10                                 | 39.75        |
| 125         | Pavement Marking Operator   | 29.22                                   | 25.90                                 | 55.12        |
| 126         | Piledriver<br>Future Increase(s):<br>Add \$1.44/hr on 6/1/2015; Add \$1.44/hr on 6/1/2016.<br>Premium Increase(s):<br>DOT PREMIUM: Pay two times the hourly basic rate on Sunday, New Year's Day, Memorial Day, Independence Day, Labor Day, Thanksgiving Day & Christmas Day.  | 33.24                                   | 16.00                                 | 49.24        |
| 133         | Rofer or Waterproofer   | 29.40                                   | 11.31                                 | 40.71        |

| <b>Fringe Benefits Must Be Paid On <u>All</u> Hours Worked</b> |  | <b>HOURLY<br/>BASIC RATE<br/>OF PAY</b> | <b>HOURLY<br/>FRINGE<br/>BENEFITS</b> | <b>TOTAL</b> |
|--|--|---|---------------------------------------|--------------|
| <b>CODE</b>  | <b>TRADE OR OCCUPATION</b>                                   | <b>\$</b>                               | <b>\$</b>                             | <b>\$</b>    |
| 137  | Teledata Technician or Installer                             | 22.25                                   | 12.24                                 | 34.49        |
| 143  | Tuckpointer, Caulker or Cleaner                              | 23.60                                   | 7.10                                  | 30.70        |
| 144  | Underwater Diver (Except on Great Lakes)                     | 35.40                                   | 15.90                                 | 51.30        |
| 150  | Heavy Equipment Operator - ELECTRICAL LINE CONSTRUCTION ONLY | 35.55                                   | 15.57                                 | 51.12        |
| 151  | Light Equipment Operator -ELECTRICAL LINE CONSTRUCTION ONLY  | 31.60                                   | 15.29                                 | 46.89        |
| 152  | Heavy Truck Driver - ELECTRICAL LINE CONSTRUCTION ONLY       | 27.65                                   | 13.44                                 | 41.09        |
| 153  | Light Truck Driver - ELECTRICAL LINE CONSTRUCTION ONLY       | 25.68                                   | 12.83                                 | 38.51        |
| 154  | Groundman - ELECTRICAL LINE CONSTRUCTION ONLY                | 21.73                                   | 12.17                                 | 33.90        |

**TRUCK DRIVERS**

| <b>Fringe Benefits Must Be Paid On <u>All</u> Hours Worked</b> |  | <b>HOURLY<br/>BASIC RATE<br/>OF PAY</b> | <b>HOURLY<br/>FRINGE<br/>BENEFITS</b> | <b>TOTAL</b> |
|--|--|---|---------------------------------------|--------------|
| <b>CODE</b>  | <b>TRADE OR OCCUPATION</b>   | <b>\$</b>                               | <b>\$</b>                             | <b>\$</b>    |
| 201  | Single Axle or Two Axle<br>Future Increase(s):<br>Add \$1.15/hr on 6/1/2015.<br>Premium Increase(s):<br>DOT PREMIUM: Pay two times the hourly basic rate on Sunday, New Year's Day, Memorial Day, Independence Day, Labor Day, Thanksgiving Day & Christmas Day.   | 25.18                                   | 18.31                                 | 43.49        |
| 203  | Three or More Axle<br>Future Increase(s):<br>Add \$1.15/hr on 6/1/2015.<br>Premium Increase(s):<br>DOT PREMIUM: Pay two times the hourly basic rate on Sunday, New Year's Day, Memorial Day, Independence Day, Labor Day, Thanksgiving Day & Christmas Day.  | 25.28                                   | 18.31                                 | 43.59        |
| 204  | Articulated, Euclid, Dumptor, Off Road Material Hauler<br>Future Increase(s):<br>Add \$1.25/hr on 6/1/2015; Add \$1.30/hr on 6/1/2016;<br>Add \$1.25/hr on 6/1/2017.<br>Premium Increase(s):<br>DOT PREMIUMS: 1) Pay two times the hourly basic rate on Sunday, New Year's Day, Memorial Day, Independence Day, Labor Day, Thanksgiving Day & Christmas Day. 2) Add \$1.50/hr night work premium. See DOT'S website for details about the applicability of this night work premium at: <a href="http://www.dot.wi.gov/business/civilrights/laborwages/pwc.htm">http://www.dot.wi.gov/business/civilrights/laborwages/pwc.htm</a> . | 30.27                                   | 21.15                                 | 51.42        |
|  | Pavement Marking Vehicle   | 23.16                                   | 21.13                                 | 44.29        |
| 206  | Shadow or Pilot Vehicle  | 24.37                                   | 17.77                                 | 42.14        |

|     |                |       |       |       |
|-----|----------------|-------|-------|-------|
| 207 | Truck Mechanic | 24.52 | 17.77 | 42.29 |
|-----|----------------|-------|-------|-------|

**LABORERS**

**Fringe Benefits Must Be Paid On All Hours Worked**

| <u>CODE</u> | <u>TRADE OR OCCUPATION</u>   | <u>HOURLY BASIC RATE OF PAY</u><br>\$ | <u>HOURLY FRINGE BENEFITS</u><br>\$ | <u>TOTAL</u><br>\$ |
|-------------|--|---------------------------------------|-------------------------------------|--------------------|
| 301         | General Laborer<br>Future Increase(s):<br>Add \$1.05/hr eff. 06/01/2015; Add \$1.00/hr eff. 06/01/2016; Add \$1.00/hr eff. 06/01/2017<br>Premium Increase(s):<br>Add \$.10/hr for topman, air tool operator, vibrator or tamper operator (mechanical hand operated), chain saw operator and demolition burning torch laborer; Add \$.15/hr for bituminous worker (raker and luteman), formsetter (curb, sidewalk and pavement) and strike off man; Add \$.20/hr for blaster and powderman; Add \$.25/hr for bottomman; Add \$.35/hr for line and grade specialist; Add \$.45/hr for pipelayer. / DOT PREMIUMS: 1) Pay two times the hourly basic rate on Sunday, New Year's Day, Memorial Day, Independence Day, Labor Day, Thanksgiving Day & Christmas Day. 2) Add \$1.25/hr for work on projects involving temporary traffic control setup, for lane and shoulder closures, when work under artificial illumination conditions is necessary as required by the project provisions (including prep time prior to and/or cleanup after such time period). | 30.41                                 | 15.14                               | 45.55              |
| 302         | Asbestos Abatement Worker  | 18.00                                 | 9.58                                | 27.58              |
| 303         | Landscaper<br>Future Increase(s):<br>Add \$1.05/hr eff. 06/01/2015; Add \$1.00/hr eff. 06/01/2016; Add \$1.00/hr eff. 06/01/2017<br>Premium Increase(s):<br>DOT PREMIUMS: 1) Pay two times the hourly basic rate on Sunday, New Year's Day, Memorial Day, Independence Day, Labor Day, Thanksgiving Day & Christmas Day. 2) Add \$1.25/hr for work on projects involving temporary traffic control setup, for lane and shoulder closures, when work under artificial illumination conditions is necessary as required by the project provisions (including prep time prior to and/or cleanup after such time period).  | 30.41                                 | 15.14                               | 45.55              |
| 304         | Flagperson or Traffic Control Person<br>Future Increase(s):<br>Add \$1.05/hr eff. 06/01/2015; Add \$1.00/hr eff. 06/01/2016; Add \$1.00/hr eff. 06/01/2017<br>Premium Increase(s):   | 26.76                                 | 15.14                               | 41.90              |

**Fringe Benefits Must Be Paid On All Hours Worked**

| <u>CODE</u> | <u>TRADE OR OCCUPATION</u>   | <u>HOURLY BASIC RATE OF PAY</u><br>\$ | <u>HOURLY FRINGE BENEFITS</u><br>\$ | <u>TOTAL</u><br>\$ |
|-------------|--|---------------------------------------|-------------------------------------|--------------------|
|             | DOT PREMIUMS: 1) Pay two times the hourly basic rate on Sunday, New Year's Day, Memorial Day, Independence Day, Labor Day, Thanksgiving Day & Christmas Day. 2) Add \$1.25/hr when the Wisconsin Department of Transportation or responsible governing agency requires that work be performed at night under artificial illumination with traffic control and the work is completed after sunset and before sunrise. |                                       |                                     |                    |
| 311         | Fiber Optic Laborer (Outside, Other Than Concrete Encased)   | 18.33                                 | 13.65                               | 31.98              |
| 314         | Railroad Track Laborer   | 14.50                                 | 5.29                                | 19.79              |

**HEAVY EQUIPMENT OPERATORS  
AIRPORT PAVEMENT OR STATE HIGHWAY CONSTRUCTION**

**Fringe Benefits Must Be Paid On All Hours Worked**

| <u>CODE</u> | <u>TRADE OR OCCUPATION</u>   | <u>HOURLY BASIC RATE OF PAY</u><br>\$ | <u>HOURLY FRINGE BENEFITS</u><br>\$ | <u>TOTAL</u><br>\$ |
|-------------|--|---------------------------------------|-------------------------------------|--------------------|
| 531         | Crane, Tower Crane, Pedestal Tower or Derrick, With Boom, Leads &/or Jib Lengths Measuring 176 Ft or Over; Crane, Tower Crane, Pedestal Tower or Derrick, With or Without Attachments, With a Lifting Capacity of Over 100 Tons, Self-Erecting Tower Crane With a Lifting Capacity Of Over 4,000 Lbs., Crane With Boom Dollies; Traveling Crane (Bridge Type).<br>Future Increase(s):<br>Add \$1.25/hr on 6/1/2015; Add \$1.30/hr on 6/1/2016;<br>Add \$1.25/hr on 6/1/2017.<br>Premium Increase(s):<br>DOT PREMIUMS: 1) Pay two times the hourly basic rate on Sunday, New Year's Day, Memorial Day, Independence Day, Labor Day, Thanksgiving Day & Christmas Day. 2) Add \$1.50/hr night work premium. See DOT'S website for details about the applicability of this night work premium at: <a href="http://www.dot.wi.gov/business/civilrights/laborwages/pwc.htm">http://www.dot.wi.gov/business/civilrights/laborwages/pwc.htm</a> .   | 37.72                                 | 21.15                               | 58.87              |
| 532         | Backhoe (Track Type) Having a Mfgr.'s Rated Capacity of 130,000 Lbs. or Over; Caisson Rig; Crane, Tower Crane, Portable Tower, Pedestal Tower or Derrick, With Boom, Leads &/or Jib Lengths Measuring 175 Ft or Under; Crane, Tower Crane, Portable Tower, Pedestal Tower or Derrick, With or Without Attachments, With a Lifting Capacity of 100 Tons or Under, Self-Erecting Tower Crane With A Lifting Capacity Of 4,000 Lbs., & Under; Dredge (NOT Performing Work on the Great Lakes); Licensed Boat Pilot (NOT Performing Work on the Great Lakes); Pile Driver.<br>Future Increase(s):<br>Add \$1.25/hr on 6/1/2015; Add \$1.30/hr on 6/1/2016;<br>Add \$1.25/hr on 6/1/2017.<br>Premium Increase(s):<br>DOT PREMIUMS: 1) Pay two times the hourly basic rate on Sunday, New Year's Day, Memorial Day, Independence Day, Labor Day, Thanksgiving Day & Christmas Day. 2) Add \$1.50/hr night work premium. See DOT'S website for details about the applicability of this night work premium at: <a href="http://www.dot.wi.gov/business/civilrights/laborwages/pwc.htm">http://www.dot.wi.gov/business/civilrights/laborwages/pwc.htm</a> . | 37.22                                 | 21.15                               | 58.37              |

| <b>Fringe Benefits Must Be Paid On <u>All</u> Hours Worked</b> |   | <b>HOURLY<br/>BASIC RATE<br/>OF PAY</b> | <b>HOURLY<br/>FRINGE<br/>BENEFITS</b> | <b>TOTAL</b> |
|--|---|---|---------------------------------------|--------------|
| <b>CODE</b>  | <b>TRADE OR OCCUPATION</b>  | <b>\$</b>                               | <b>\$</b>                             | <b>\$</b>    |
| 533  | <p>Air Track, Rotary or Percussion Drilling Machine &amp;/or Hammers, Blaster; Asphalt Heater, Planer &amp; Scarifier; Asphalt Milling Machine; Asphalt Screed; Automatic Subgrader (Concrete); Backhoe (Track Type) Having a Mfgr.'s Rated Capacity of Under 130,000 Lbs., Backhoe (Mini, 15,000 Lbs. &amp; Under); Bituminous (Asphalt) Plant &amp; Paver, Screed; Boatmen (NOT Performing Work on the Great Lakes); Boring Machine (Directional, Horizontal or Vertical); Bridge (Bidwell) Paver; Bulldozer or Endloader; Concrete Batch Plant, Batch Hopper; Concrete Breaker (Large, Auto, Vibratory/Sonic, Manual or Remote); Concrete Bump Cutter, Grinder, Planing or Grooving Machine; Concrete Conveyor System; Concrete Laser/Screed; Concrete Paver (Slipform); Concrete Pump, Concrete Conveyor (Rotec or Bidwell Type); Concrete Slipform Placer Curb &amp; Gutter Machine; Concrete Spreader &amp; Distributor; Crane (Carry Deck, Mini) or Truck Mounted Hydraulic Crane (10 Tons or Under); Crane With a Lifting Capacity of 25 Tons or Under; Forestry Equipment, Timbco, Tree Shear, Tub Grinder, Processor; Gradall (Cruz-Aire Type); Grader or Motor Patrol; Grout Pump; Hydro-Blaster (10,000 PSI or Over); Loading Machine (Conveyor); Material or Stack Hoist; Mechanic or Welder; Milling Machine; Post Hole Digger or Driver; Roller (Over 5 Ton); Scraper (Self Propelled or Tractor Drawn) 5 cu yds or More Capacity; Shoulder Widener; Sideboom; Skid Rig; Stabilizing or Concrete Mixer (Self-Propelled or 14S or Over); Straddle Carrier or Travel Lift; Tractor (Scraper, Dozer, Pusher, Loader); Tractor or Truck Mounted Hydraulic Backhoe; Trencher (Wheel Type or Chain Type); Tube Finisher; Tugger (NOT Performing Work on the Great Lakes); Winches &amp; A-Frames.</p> <p>Future Increase(s):<br/>                     Add \$1.25/hr on 6/1/2015; Add \$1.30/hr on 6/1/2016;<br/>                     Add \$1.25/hr on 6/1/2017.</p> <p>Premium Increase(s):<br/>                     DOT PREMIUMS: 1) Pay two times the hourly basic rate on Sunday, New Year's Day, Memorial Day, Independence Day, Labor Day, Thanksgiving Day &amp; Christmas Day. 2) Add \$1.50/hr night work premium. See DOT'S website for details about the applicability of this night work premium at: <a href="http://www.dot.wi.gov/business/civilrights/laborwages/pwc.htm">http://www.dot.wi.gov/business/civilrights/laborwages/pwc.htm</a>.</p> | 36.72                                   | 21.15                                 | 57.87        |

**Fringe Benefits Must Be Paid On All Hours Worked**

| <u>CODE</u> | <u>TRADE OR OCCUPATION</u>  | <u>HOURLY BASIC RATE OF PAY</u><br>\$ | <u>HOURLY FRINGE BENEFITS</u><br>\$ | <u>TOTAL</u><br>\$ |
|-------------|---|---------------------------------------|-------------------------------------|--------------------|
| 534         | <p>Belting, Burlap, Texturing Machine; Broom or Sweeper; Compactor (Self-Propelled or Tractor Mounted, Towed &amp; Light Equipment); Concrete Finishing Machine (Road Type); Environmental Burner; Farm or Industrial Type Tractor; Fireman (Asphalt Plant, Pile Driver &amp; Derrick NOT Performing Work on the Great Lakes); Forklift; Greaser; Hoist (Tugger, Automatic); Jeep Digger; Joint Sawyer (Multiple Blade); Launch (NOT Performing Work on the Great Lakes); Lift Slab Machine; Mechanical Float; Mulcher; Power Subgrader; Robotic Tool Carrier (With or Without Attachments); Roller (Rubber Tire, 5 Ton or Under); Self Propelled Chip Spreader; Shouldering Machine; Skid Steer Loader (With or Without Attachments); Telehandler; Tining or Curing Machine.</p> <p>Future Increase(s):<br/>Add \$1.25/hr on 6/1/2015; Add \$1.30/hr on 6/1/2016;<br/>Add \$1.25/hr on 6/1/2017.</p> <p>Premium Increase(s):<br/>DOT PREMIUMS: 1) Pay two times the hourly basic rate on Sunday, New Year's Day, Memorial Day, Independence Day, Labor Day, Thanksgiving Day &amp; Christmas Day. 2) Add \$1.50/hr night work premium. See DOT'S website for details about the applicability of this night work premium at: <a href="http://www.dot.wi.gov/business/civilrights/laborwages/pwc.htm">http://www.dot.wi.gov/business/civilrights/laborwages/pwc.htm</a>.</p> | 36.46                                 | 21.15                               | 57.61              |
| 535         | <p>Air Compressor (&amp;/or 400 CFM or Over); Air, Electric or Hydraulic Jacking System; Augers (Vertical &amp; Horizontal); Automatic Belt Conveyor &amp; Surge Bin; Boiler (Temporary Heat); Concrete Proportioning Plant; Crusher, Screening or Wash Plant; Generator (&amp;/or 150 KW or Over); Heaters (Mechanical); High Pressure Utility Locating Machine (Daylighting Machine); Mudjack; Oiler; Prestress Machine; Pug Mill; Pump (3 Inch or Over) or Well Points; Rock, Stone Breaker; Screed (Milling Machine); Stump Chipper; Tank Car Heaters; Vibratory Hammer or Extractor, Power Pack.</p> <p>Future Increase(s):<br/>Add \$1.25/hr on 6/1/2015; Add \$1.30/hr on 6/1/2016;<br/>Add \$1.25/hr on 6/1/2017.</p> <p>Premium Increase(s):<br/>DOT PREMIUMS: 1) Pay two times the hourly basic rate on Sunday, New Year's Day, Memorial Day, Independence Day, Labor Day, Thanksgiving Day &amp; Christmas Day. 2) Add \$1.50/hr night work premium. See DOT'S website for details about the applicability of this night work premium at: <a href="http://www.dot.wi.gov/business/civilrights/laborwages/pwc.htm">http://www.dot.wi.gov/business/civilrights/laborwages/pwc.htm</a>.</p>   | 36.17                                 | 21.15                               | 57.32              |
| 536         | Fiber Optic Cable Equipment.  | 28.89                                 | 17.95                               | 46.84              |
| 537         | Work Performed on the Great Lakes Including Diver; Wet Tender or Hydraulic Dredge Engineer.   | 41.65                                 | 21.71                               | 63.36              |
| 538         | Work Performed on the Great Lakes Including 70 Ton & Over Tug Operator; Assistant Hydraulic Dredge Engineer; Crane or Backhoe Operator; Hydraulic Dredge Leverman or Diver's Tender; Mechanic or Welder.  | 41.65                                 | 21.71                               | 63.36              |

| <b>Fringe Benefits Must Be Paid On <u>All</u> Hours Worked</b> |   | <b>HOURLY<br/>BASIC RATE<br/>OF PAY</b> | <b>HOURLY<br/>FRINGE<br/>BENEFITS</b> | <b>TOTAL</b> |
|--|---|---|---------------------------------------|--------------|
| <b>CODE</b>  | <b>TRADE OR OCCUPATION</b>  | <b>\$</b>                               | <b>\$</b>                             | <b>\$</b>    |
| 539  | Work Performed on the Great Lakes Including Deck Equipment Operator or Machineryman (Maintains Cranes Over 50 Tons or Backhoes 115,000 Lbs. or More); Tug, Launch or Loader, Dozer or Like Equipment When Operated on a Barge, Breakwater Wall, Slip, Dock or Scow, Deck Machinery.   | 35.72                                   | 17.85                                 | 53.57        |
| 540  | Work Performed on the Great Lakes Including Deck Equipment Operator, Machineryman or Fireman (Operates 4 Units or More or Maintains Cranes 50 Tons or Under or Backhoes 115,000 Lbs. or Under); Deck Hand, Deck Engineer or Assistant Tug Operator; Off Road Trucks-Great Lakes ONLY. | 35.46                                   | 20.40                                 | 55.86        |

**LOCAL STREET OR MISCELLANEOUS PAVING CONSTRUCTION**

Includes roads, streets, alleys, trails, bridges, paths, racetracks, parking lots and driveways (except residential or cultural), public sidewalks or other similar projects (excluding projects awarded by the Wisconsin Department of Transportation).

**SKILLED TRADES**

| <b>Fringe Benefits Must Be Paid On <u>All</u> Hours Worked</b> |   | <b>HOURLY<br/>BASIC RATE<br/>OF PAY</b> | <b>HOURLY<br/>FRINGE<br/>BENEFITS</b> | <b>TOTAL</b> |
|--|---|---|---------------------------------------|--------------|
| <b>CODE</b>  | <b>TRADE OR OCCUPATION</b>  | <b>\$</b>                               | <b>\$</b>                             | <b>\$</b>    |
| 103  | Bricklayer, Blocklayer or Stonemason  | 32.09                                   | 18.04                                 | 50.13        |
| 105  | Carpenter<br>Future Increase(s):<br>Add \$1.42/hr on 6/1/2015; Add \$1.42/hr on 6/1/2016.<br>Premium Increase(s):<br>DOT PREMIUM: Pay two times the hourly basic rate on Sunday, New Year's Day, Memorial Day, Independence Day, Labor Day, Thanksgiving Day & Christmas Day.   | 32.72                                   | 16.00                                 | 48.72        |
| 107  | Cement Finisher<br>Future Increase(s):<br>Add \$1.87 on 6/1/15; Add \$1.75 on 6/1/16.<br>Premium Increase(s):<br>DOT PREMIUMS: 1) Pay two times the hourly basic rate on Sunday, New Year's Day, Memorial Day, Independence Day, Labor Day, Thanksgiving Day & Christmas Day. 2) Add \$1.40/hr when the Wisconsin Department of Transportation or responsible governing agency requires that work be performed at night under artificial illumination with traffic control and the work is completed after sunset and before sunrise. | 35.18                                   | 16.78                                 | 51.96        |
| 109  | Electrician   | 35.72                                   | 19.17                                 | 54.89        |
| 111  | Fence Erector   | 18.00                                   | 6.09                                  | 24.09        |
| 116  | Ironworker  | 31.50                                   | 20.01                                 | 51.51        |
| 118  | Line Constructor (Electrical)   | 39.50                                   | 17.73                                 | 57.23        |
| 124  | Painter   | 25.75                                   | 16.60                                 | 42.35        |
| 125  | Pavement Marking Operator   | 30.10                                   | 17.34                                 | 47.44        |
| 126  | Piledriver  | 29.56                                   | 25.71                                 | 55.27        |
| 133  | Roofer or Waterproofer  | 29.40                                   | 11.31                                 | 40.71        |
| 137  | Teledata Technician or Installer  | 22.25                                   | 12.24                                 | 34.49        |
| 143  | Tuckpointer, Caulker or Cleaner   | 23.60                                   | 7.10                                  | 30.70        |
| 144  | Underwater Diver (Except on Great Lakes)  | 35.40                                   | 15.90                                 | 51.30        |
| 150  | Heavy Equipment Operator - ELECTRICAL LINE CONSTRUCTION ONLY  | 35.55                                   | 15.57                                 | 51.12        |

| <b>Fringe Benefits Must Be Paid On <u>All</u> Hours Worked</b> |   | <b>HOURLY<br/>BASIC RATE<br/>OF PAY</b> | <b>HOURLY<br/>FRINGE<br/>BENEFITS</b> | <b>TOTAL</b> |
|--|---|---|---------------------------------------|--------------|
| <b>CODE</b>  | <b>TRADE OR OCCUPATION</b>                                  | <b>\$</b>                               | <b>\$</b>                             | <b>\$</b>    |
| 151  | Light Equipment Operator -ELECTRICAL LINE CONSTRUCTION ONLY | 31.60                                   | 15.19                                 | 46.79        |
| 152  | Heavy Truck Driver - ELECTRICAL LINE CONSTRUCTION ONLY      | 27.65                                   | 13.44                                 | 41.09        |
| 153  | Light Truck Driver - ELECTRICAL LINE CONSTRUCTION ONLY      | 25.68                                   | 13.28                                 | 38.96        |
| 154  | Groundman - ELECTRICAL LINE CONSTRUCTION ONLY               | 21.75                                   | 12.97                                 | 34.72        |

**TRUCK DRIVERS**

| <b>Fringe Benefits Must Be Paid On <u>All</u> Hours Worked</b> |  | <b>HOURLY<br/>BASIC RATE<br/>OF PAY</b> | <b>HOURLY<br/>FRINGE<br/>BENEFITS</b> | <b>TOTAL</b> |
|--|--|---|---------------------------------------|--------------|
| <b>CODE</b>  | <b>TRADE OR OCCUPATION</b>   | <b>\$</b>                               | <b>\$</b>                             | <b>\$</b>    |
| 201  | Single Axle or Two Axle<br>Future Increase(s):<br>Add \$1.15/hr on 6/1/2015.<br>Premium Increase(s):<br>DOT PREMIUM: Pay two times the hourly basic rate on<br>Sunday, New Year's Day, Memorial Day, Independence<br>Day, Labor Day, Thanksgiving Day & Christmas Day. | 25.18                                   | 18.31                                 | 43.49        |
| 203  | Three or More Axle   | 16.00                                   | 0.00                                  | 16.00        |
| 204  | Articulated, Euclid, Dumptor, Off Road Material Hauler<br>Future Increase(s):<br>Add \$1.60/hr on 6/2/2015; Add \$1.60/hr on 6/3/2016.   | 33.69                                   | 19.78                                 | 53.47        |
| 205  | Pavement Marking Vehicle   | 20.85                                   | 11.02                                 | 31.87        |
| 206  | Shadow or Pilot Vehicle  | 24.37                                   | 17.77                                 | 42.14        |
| 207  | Truck Mechanic   | 16.00                                   | 0.00                                  | 16.00        |

**LABORERS**

| <b>Fringe Benefits Must Be Paid On <u>All</u> Hours Worked</b> |   | <b>HOURLY<br/>BASIC RATE<br/>OF PAY</b> | <b>HOURLY<br/>FRINGE<br/>BENEFITS</b> | <b>TOTAL</b> |
|--|---|---|---------------------------------------|--------------|
| <b>CODE</b>  | <b>TRADE OR OCCUPATION</b>  | <b>\$</b>                               | <b>\$</b>                             | <b>\$</b>    |
| 301  | General Laborer   | 29.32                                   | 12.44                                 | 41.76        |
| 303  | Landscaper<br>Future Increase(s):<br>Add \$1.05/hr eff. 06/01/2015; Add \$1.00/hr eff.<br>06/01/2016; Add \$1.00/hr eff. 06/01/2017<br>Premium Increase(s): | 30.13                                   | 15.14                                 | 45.27        |

**Fringe Benefits Must Be Paid On All Hours Worked**

| <u>CODE</u> | <u>TRADE OR OCCUPATION</u>  | <u>HOURLY BASIC RATE OF PAY</u><br>\$ | <u>HOURLY FRINGE BENEFITS</u><br>\$ | <u>TOTAL</u><br>\$ |
|-------------|---|---------------------------------------|-------------------------------------|--------------------|
|             | DOT PREMIUMS: 1) Pay two times the hourly basic rate on Sunday, New Year's Day, Memorial Day, Independence Day, Labor Day, Thanksgiving Day & Christmas Day. 2) Add \$1.25/hr for work on projects involving temporary traffic control setup, for lane and shoulder closures, when work under artificial illumination conditions is necessary as required by the project provisions (including prep time prior to and/or cleanup after such time period). |                                       |                                     |                    |
| 304         | Flagperson or Traffic Control Person  | 19.06                                 | 14.29                               | 33.35              |
| 311         | Fiber Optic Laborer (Outside, Other Than Concrete Encased)  | 18.33                                 | 13.65                               | 31.98              |
| 314         | Railroad Track Laborer  | 14.50                                 | 5.29                                | 19.79              |

**HEAVY EQUIPMENT OPERATORS  
CONCRETE PAVEMENT OR BRIDGE WORK**

**Fringe Benefits Must Be Paid On All Hours Worked**

| <u>CODE</u> | <u>TRADE OR OCCUPATION</u>   | <u>HOURLY BASIC RATE OF PAY</u><br>\$ | <u>HOURLY FRINGE BENEFITS</u><br>\$ | <u>TOTAL</u><br>\$ |
|-------------|--|---------------------------------------|-------------------------------------|--------------------|
| 541         | Crane, Tower Crane, Pedestal Tower or Derrick, With or Without Attachments, With a Lifting Capacity of Over 100 Tons, Self-Erecting Tower Crane With a Lifting Capacity Of Over 4,000 Lbs., Crane With Boom Dollies; Crane, Tower Crane, Pedestal Tower or Derrick, With Boom, Leads &/or Jib Lengths Measuring 176 Ft or Over; Master Mechanic.<br>Future Increase(s):<br>Add \$1.25/hr on 6/1/2015; Add \$1.30/hr on 6/1/2016;<br>Add \$1.25/hr on 6/1/2017.<br>Premium Increase(s):<br>DOT PREMIUMS: 1) Pay two times the hourly basic rate on Sunday, New Year's Day, Memorial Day, Independence Day, Labor Day, Thanksgiving Day & Christmas Day. 2) Add \$1.50/hr night work premium. See DOT'S website for details about the applicability of this night work premium at: <a href="http://www.dot.wi.gov/business/civilrights/laborwages/pwc.htm">http://www.dot.wi.gov/business/civilrights/laborwages/pwc.htm</a> . | 37.72                                 | 21.15                               | 58.87              |

| <b>Fringe Benefits Must Be Paid On <u>All</u> Hours Worked</b> |  | <b>HOURLY<br/>BASIC RATE<br/>OF PAY</b> | <b>HOURLY<br/>FRINGE<br/>BENEFITS</b> | <b>TOTAL</b> |
|--|--|---|---------------------------------------|--------------|
| <b>CODE</b>  | <b>TRADE OR OCCUPATION</b>   | <b>\$</b>                               | <b>\$</b>                             | <b>\$</b>    |
| 542  | <p>Backhoe (Track Type) Having a Mfgr.'s Rated Capacity of 130,000 Lbs. or Over; Caisson Rig; Crane, Tower Crane, Portable Tower, Pedestal Tower or Derrick, With or Without Attachments, With a Lifting Capacity of 100 Tons or Under, Self-Erecting Tower Crane With a Lifting Capacity of 4,000 Lbs. &amp; Under; Crane, Tower Crane Portable Tower, Pedestal Tower or Derrick, With Boom, Leads &amp;/or Jib Lengths Measuring 175 Ft or Under; Dredge (NOT Performing Work on the Great Lakes); Licensed Boat Pilot (NOT Performing Work on the Great Lakes); Pile Driver.</p> <p>Future Increase(s):<br/>                     Add \$1.25/hr on 6/1/2015; Add \$1.30/hr on 6/1/2016;<br/>                     Add \$1.25/hr on 6/1/2017.</p> <p>Premium Increase(s):<br/>                     DOT PREMIUMS: 1) Pay two times the hourly basic rate on Sunday, New Year's Day, Memorial Day, Independence Day, Labor Day, Thanksgiving Day &amp; Christmas Day. 2) Add \$1.50/hr night work premium. See DOT'S website for details about the applicability of this night work premium at: <a href="http://www.dot.wi.gov/business/civilrights/laborwages/pwc.htm">http://www.dot.wi.gov/business/civilrights/laborwages/pwc.htm</a>.</p>   | 37.22                                   | 21.15                                 | 58.37        |
| 543  | <p>Air Track, Rotary or Percussion Drilling Machine &amp;/or Hammers, Blaster; Automatic Subgrader (Concrete); Backhoe (Track Type) Having a Mfgr.'s Rated Capacity of Under 130,000 Lbs., Backhoe (Mini, 15,000 Lbs. &amp; Under); Boring Machine (Directional, Horizontal or Vertical); Bridge (Bidwell) Paver; Bulldozer or Endloader; Concrete Batch Plant, Batch Hopper; Concrete Breaker (Large, Auto, Vibratory/Sonic, Manual or Remote); Concrete Bump Cutter, Grinder, Planing or Grooving Machine; Concrete Conveyor System; Concrete Laser/Screed; Concrete Paver (Slipform); Concrete Pump, Concrete Conveyor (Rotec or Bidwell Type); Concrete Slipform Placer Curb &amp; Gutter Machine; Concrete Spreader &amp; Distributor; Crane (Carry Deck, Mini) or Truck Mounted Hydraulic Crane (10 Tons or Under); Crane With a Lifting Capacity of 25 Tons or Under; Forestry Equipment, Timbco, Tree Shear, Tub Grinder, Processor; Gradall (Cruz-Aire Type); Grader or Motor Patrol; Grout Pump; Hydro-Blaster (10,000 PSI or Over); Loading Machine (Conveyor); Manhoist; Material or Stack Hoist; Mechanic or Welder; Milling Machine; Post Hole Digger or Driver; Scraper (Self Propelled or Tractor Drawn) 5 cu yds or More Capacity; Shoulder Widener; Sideboom; Skid Rig; Stabilizing or Concrete Mixer (Self-Propelled or 14S or Over); Straddle Carrier or Travel Lift; Tractor (Scraper, Dozer, Pusher, Loader); Tractor or Truck Mounted Hydraulic Backhoe; Trencher (Wheel Type or Chain Type); Tube Finisher; Tugger (NOT Performing Work on the Great Lakes); Winches &amp; A-Frames.</p> | 35.72                                   | 17.85                                 | 53.57        |

| <b>Fringe Benefits Must Be Paid On <u>All</u> Hours Worked</b> |   | <b>HOURLY<br/>BASIC RATE<br/>OF PAY</b> | <b>HOURLY<br/>FRINGE<br/>BENEFITS</b> | <b>TOTAL</b> |
|--|---|---|---------------------------------------|--------------|
| <b>CODE</b>  | <b>TRADE OR OCCUPATION</b>  | <b>\$</b>                               | <b>\$</b>                             | <b>\$</b>    |
| 544  | Backfiller; Belting, Burlap, Texturing Machine; Broom or Sweeper; Compactor (Self-Propelled or Tractor Mounted, Towed & Light Equipment); Concrete Finishing Machine (Road Type); Environmental Burner; Farm or Industrial Type Tractor; Fireman (Pile Driver & Derrick NOT Performing Work on the Great Lakes); Forklift; Greaser; Jeep Digger; Joint Sawyer (Multiple Blade); Launch (NOT Performing Work on the Great Lakes); Lift Slab Machine; Mechanical Float; Mulcher; Power Subgrader; Robotic Tool Carrier (With or Without Attachments); Self Propelled Chip Spreader; Shouldering Machine; Skid Steer Loader (With or Without Attachments); Telehandler; Tining or Curing Machine.<br>Future Increase(s):<br>Add \$1.25/hr on 6/1/2015; Add \$1.30/hr on 6/1/2016;<br>Add \$1.25/hr on 6/1/2017.<br>Premium Increase(s):<br>DOT PREMIUMS: 1) Pay two times the hourly basic rate on Sunday, New Year's Day, Memorial Day, Independence Day, Labor Day, Thanksgiving Day & Christmas Day. 2) Add \$1.50/hr night work premium.<br>See DOT'S website for details about the applicability of this night work premium at: <a href="http://www.dot.wi.gov/business/civilrights/laborwages/pwc.htm">http://www.dot.wi.gov/business/civilrights/laborwages/pwc.htm</a> . | 36.46                                   | 21.15                                 | 57.61        |
| 545  | Air Compressor (&/or 400 CFM or Over); Air, Electric or Hydraulic Jacking System; Automatic Belt Conveyor & Surge Bin; Boiler (Temporary Heat); Concrete Proportioning Plant; Crusher, Screening or Wash Plant; Generator (&/or 150 KW or Over); Heaters (Mechanical); High Pressure Utility Locating Machine (Daylighting Machine); Mudjack; Oiler; Prestress Machine; Pug Mill; Pump (3 Inch or Over) or Well Points; Rock, Stone Breaker; Screed (Milling Machine); Stump Chipper; Tank Car Heaters; Vibratory Hammer or Extractor, Power Pack.  | 35.17                                   | 20.40                                 | 55.57        |
| 546  | Fiber Optic Cable Equipment.  | 28.89                                   | 17.95                                 | 46.84        |
| 547  | Work Performed on the Great Lakes Including Diver; Wet Tender or Hydraulic Dredge Engineer.   | 41.65                                   | 21.71                                 | 63.36        |
| 548  | Work Performed on the Great Lakes Including 70 Ton & Over Tug Operator; Assistant Hydraulic Dredge Engineer; Crane or Backhoe Operator; Hydraulic Dredge Leverman or Diver's Tender; Mechanic or Welder.  | 41.65                                   | 21.71                                 | 63.36        |
| 549  | Work Performed on the Great Lakes Including Deck Equipment Operator or Machineryman (Maintains Cranes Over 50 Tons or Backhoes 115,000 Lbs. or more); Tug, Launch or Loader, Dozer or Like Equipment When Operated on a Barge, Breakwater Wall, Slip, Dock or Scow, Deck Machinery.   | 35.72                                   | 17.85                                 | 53.57        |
| 550  | Work Performed on the Great Lakes Including Deck Equipment Operator; Machineryman or Fireman (Operates 4 Units or More or Maintains Cranes 50 Tons or Under or Backhoes 115,000 Lbs. or Under); Deck Hand, Deck Engineer or Assistant Tug Operator; Off Road Trucks - Great Lakes ONLY.   | 35.46                                   | 20.40                                 | 55.86        |

**HEAVY EQUIPMENT OPERATORS  
ASPHALT PAVEMENT OR OTHER WORK**

| <b>Fringe Benefits Must Be Paid On <u>All</u> Hours Worked</b> |   | <b>HOURLY<br/>BASIC RATE<br/>OF PAY</b> | <b>HOURLY<br/>FRINGE<br/>BENEFITS</b> | <b>TOTAL</b> |
|--|---|---|---------------------------------------|--------------|
| <b>CODE</b>  | <b>TRADE OR OCCUPATION</b>  | <b>\$</b>                               | <b>\$</b>                             | <b>\$</b>    |
| 551  | Crane, Tower Crane, Pedestal Tower or Derrick, With or Without Attachments, With a Lifting Capacity of Over 100 Tons, Self Erecting Tower Crane With a Lifting Capacity of Over 4,000 Lbs., Crane With Boom Dollies; Crane, Tower Crane, Pedestal Tower or Derrick, With Boom, Leads and/or Jib Lengths Measuring 176 Ft or Over; Master Mechanic.  | 36.72                                   | 20.40                                 | 57.12        |
| 552  | Backhoe (Track Type) Having a Mfgr.'s Rated Capacity of 130,000 Lbs. or Over; Caisson Rig; Crane, Tower Crane, Portable Tower, Pedestal Tower or Derrick, With or Without Attachments, With a Lifting Capacity of 100 Tons or Under, Self-Erecting Tower Crane With a Lifting Capacity Of 4,000 Lbs. & Under; Crane, Tower Crane, Portable Tower, Pedestal Tower or Derrick, With Boom, Leads &/or Jib Lengths Measuring 175 Ft or Under; Dredge (NOT Performing Work on the Great Lakes); Licensed Boat Pilot (NOT Performing Work on the Great Lakes); Pile Driver.<br>Future Increase(s):<br>Add \$1.25/hr on 6/1/2015; Add \$1.30/hr on 6/1/2016;<br>Add \$1.25/hr on 6/1/2017.<br>Premium Increase(s):<br>DOT PREMIUMS: 1) Pay two times the hourly basic rate on Sunday, New Year's Day, Memorial Day, Independence Day, Labor Day, Thanksgiving Day & Christmas Day. 2) Add \$1.50/hr night work premium.<br>See DOT'S website for details about the applicability of this night work premium at: <a href="http://www.dot.wi.gov/business/civilrights/laborwages/pwc.htm">http://www.dot.wi.gov/business/civilrights/laborwages/pwc.htm</a> .  | 37.22                                   | 21.15                                 | 58.37        |
| 553  | Air, Track, Rotary or Percussion Drilling Machine &/or Hammers; Blaster; Asphalt Heater, Planer & Scarifier; Asphalt Milling Machine; Asphalt Screed; Backhoe (Track Type) Having a Mfgr.'s Rated Capacity of Under 130,000 Lbs., Backhoe (Mini, 15,000 Lbs. & Under); Bituminous (Asphalt) Plant & Paver, Screed; Boring Machine (Directional, Horizontal or Vertical); Bulldozer or Endloader; Concrete Breaker (Large, Auto, Vibratory/Sonic, Manual or Remote); Concrete Conveyor System; Concrete Laser/Screed; Concrete Slipform Placer Curb & Gutter Machine; Crane (Carry Deck, Mini) or Truck Mounted Hydraulic Crane (10 Tons or Under); Crane With a Lifting Capacity of 25 Tons or Under; Forestry Equipment, Timbco, Tree Shear, Tub Grinder, Processor; Gradall (Cruz-Aire Type); Grader or Motor Patrol; Hydro-Blaster (10,000 PSI or Over); Loading Machine (Conveyor); Manhoist; Material or Stack Hoist; Mechanic or Welder; Milling Machine; Post Hole Digger or Driver; Railroad Track Rail Leveling Machine, Tie Placer, Extractor, Tamper, Stone Leveler or Rehabilitation Equipment; Roller (Over 5 Ton); Scraper (Self Propelled or Tractor Drawn) 5 cu yds or More Capacity; Shoulder Widener; Sideboom; Skid Rig; Stabilizing or Concrete Mixer (Self-Propelled or 14S or Over); Tractor (Scraper, Dozer, Pusher, Loader); Tractor or Truck Mounted Hydraulic Backhoe; Trencher (Wheel Type or Chain Type); Tube Finisher; Tugger (NOT Performing Work on the Great Lakes); Winches & A-Frames.<br>Future Increase(s):<br>Add \$1.60/hr on 6/2/2015; Add \$1.60/hr on 6/3/2016. | 33.69                                   | 19.78                                 | 53.47        |

**Fringe Benefits Must Be Paid On All Hours Worked**

| <u>CODE</u> | <u>TRADE OR OCCUPATION</u>  | <u>HOURLY BASIC RATE OF PAY</u><br>\$ | <u>HOURLY FRINGE BENEFITS</u><br>\$ | <u>TOTAL</u><br>\$ |
|-------------|---|---------------------------------------|-------------------------------------|--------------------|
| 554         | Backfiller; Broom or Sweeper; Compactor (Self-Propelled or Tractor Mounted, Towed & Light Equipment); Concrete Finishing Machine (Road Type); Environmental Burner; Farm or Industrial Type Tractor; Fireman (Asphalt Plant, Pile Driver & Derrick NOT Performing Work on the Great Lakes); Forklift; Greaser; Hoist (Tugger, Automatic); Jeep Digger; Joint Sawyer (Multiple Blade); Launch (NOT Performing Work on the Great Lakes); Lift Slab Machine; Mechanical Float; Mulcher; Power Subgrader; Robotic Tool Carrier (With or Without Attachments); Roller (Rubber Tire, 5 Ton or Under); Self-Propelled Chip Spreader; Shouldering Machine; Skid Steer Loader (With or Without Attachments); Telehandler.<br>Future Increase(s):<br>Add \$1.25/hr on 6/1/2015; Add \$1.30/hr on 6/1/2016;<br>Add \$1.25/hr on 6/1/2017.  | 36.17                                 | 20.80                               | 56.97              |
| 555         | Air Compressor (&/or 400 CFM or Over); Air, Electric or Hydraulic Jacking System; Augers (Vertical & Horizontal); Automatic Belt Conveyor & Surge Bin; Boiler (Temporary Heat); Crusher, Screening or Wash Plant; Generator (&/or 150 KW or Over); Heaters (Mechanical); High Pressure Utility Locating Machine (Daylighting Machine); Mudjack; Oiler; Prestress Machine; Pug Mill; Pump (3 Inch or Over) or Well Points; Rock, Stone Breaker; Screed (Milling Machine); Stump Chipper; Tank Car Heaters; Vibratory Hammer or Extractor, Power Pack.<br>Future Increase(s):<br>Add \$1.25/hr on 6/1/2015; Add \$1.30/hr on 6/1/2016;<br>Add \$1.25/hr on 6/1/2017.<br>Premium Increase(s):<br>DOT PREMIUMS: 1) Pay two times the hourly basic rate on Sunday, New Year's Day, Memorial Day, Independence Day, Labor Day, Thanksgiving Day & Christmas Day. 2) Add \$1.50/hr night work premium.<br>See DOT'S website for details about the applicability of this night work premium at: <a href="http://www.dot.wi.gov/business/civilrights/laborwages/pwc.htm">http://www.dot.wi.gov/business/civilrights/laborwages/pwc.htm</a> . | 36.17                                 | 21.15                               | 57.32              |
| 556         | Fiber Optic Cable Equipment.  | 27.89                                 | 17.20                               | 45.09              |

|   |
|---|
| <b>RESIDENTIAL OR AGRICULTURAL CONSTRUCTION</b> |
|---|

Includes single family houses or apartment buildings of no more than four (4) stories in height and all buildings, structures or facilities that are primarily used for agricultural or farming purposes, excluding commercial buildings. For classification purposes, the exterior height of a residential building, in terms of stories, is the primary consideration. All incidental items such as site work, driveways, parking lots, private sidewalks, private septic systems or sewer and water laterals connected to a public system and swimming pools are included within this definition. Residential buildings of five (5) stories and above are NOT included within this definition.

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**SKILLED TRADES**

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| <u>CODE</u>  | <u>TRADE OR OCCUPATION</u>  | <u>HOURLY<br/>BASIC RATE<br/>OF PAY</u><br>\$ | <u>HOURLY<br/>FRINGE<br/>BENEFITS</u><br>\$ | <u>TOTAL</u><br>\$ |
|--|---|---|---|--------------------|
| <b>Fringe Benefits Must Be Paid On <u>All</u> Hours Worked</b> |   |   |   |                    |
| 101  | Acoustic Ceiling Tile Installer   | 33.07   | 16.07                                       | 49.14              |
| 102  | Boilermaker   | 32.05   | 28.04                                       | 60.09              |
| 103  | Bricklayer, Blocklayer or Stonemason<br>Future Increase(s):<br>Add \$1.40 on 06/01/2015; Add \$1.45 on 06/06/2016<br>Premium Increase(s):<br>DOT PREMIUM: Pay two times the hourly basic rate on<br>Sunday, New Year's Day, Memorial Day, Independence<br>Day, Labor Day, Thanksgiving Day & Christmas Day. | 32.82   | 18.66                                       | 51.48              |
| 104  | Cabinet Installer   | 34.42   | 0.00  | 34.42              |
| 105  | Carpenter   | 31.40   | 2.01  | 33.41              |
| 106  | Carpet Layer or Soft Floor Coverer  | 30.00   | 0.00  | 30.00              |
| 107  | Cement Finisher   | 24.08   | 0.00  | 24.08              |
| 108  | Drywall Taper or Finisher   | 8.50  | 0.00  | 8.50               |
| 109  | Electrician   | 20.00   | 6.62  | 26.62              |
| 110  | Elevator Constructor  | 23.26   | 0.00  | 23.26              |
| 111  | Fence Erector   | 16.00   | 3.76  | 19.76              |
| 112  | Fire Sprinkler Fitter   | 39.00   | 18.00                                       | 57.00              |
| 113  | Glazier<br>Future Increase(s):<br>Add \$.75/hr eff. 06/01/2015; Add \$.90/hr eff. 06/01/2016  | 37.07   | 14.42                                       | 51.49              |
| 114  | Heat or Frost Insulator   | 33.43   | 25.81                                       | 59.24              |
| 115  | Insulator (Batt or Blown)   | 23.00   | 10.55                                       | 33.55              |
| 116  | Ironworker  | 31.50   | 20.01                                       | 51.51              |
| 117  | Lather  | 31.40   | 2.01  | 33.41              |
| 119  | Marble Finisher   | 16.25   | 2.32  | 18.57              |
| 120  | Marble Mason  | 32.09   | 18.04                                       | 50.13              |

| <b>Fringe Benefits Must Be Paid On <u>All</u> Hours Worked</b> |   | <b>HOURLY<br/>BASIC RATE<br/>OF PAY</b> | <b>HOURLY<br/>FRINGE<br/>BENEFITS</b> | <b>TOTAL</b> |
|--|---|---|---------------------------------------|--------------|
| <b>CODE</b>  | <b>TRADE OR OCCUPATION</b>  | <b>\$</b>                               | <b>\$</b>                             | <b>\$</b>    |
| 121  | Metal Building Erector  | 18.00                                   | 5.88                                  | 23.88        |
| 123  | Overhead Door Installer   | 16.65                                   | 1.03                                  | 17.68        |
| 124  | Painter   | 25.75                                   | 8.94                                  | 34.69        |
| 125  | Pavement Marking Operator   | 18.75                                   | 2.47                                  | 21.22        |
| 129  | Plasterer   | 25.00                                   | 10.45                                 | 35.45        |
| 130  | Plumber   | 30.00                                   | 10.44                                 | 40.44        |
| 132  | Refrigeration Mechanic  | 17.00                                   | 13.56                                 | 30.56        |
| 133  | Rofer or Waterproofer   | 15.00                                   | 1.37                                  | 16.37        |
| 134  | Sheet Metal Worker  | 22.54                                   | 5.20                                  | 27.74        |
| 135  | Steamfitter   | 23.62                                   | 16.12                                 | 39.74        |
| 137  | Teledata Technician or Installer  | 18.00                                   | 28.48                                 | 46.48        |
| 138  | Temperature Control Installer   | 22.00                                   | 1.62                                  | 23.62        |
| 139  | Terrazzo Finisher   | 16.25                                   | 2.32                                  | 18.57        |
|  | Terrazzo Mechanic   | 30.71                                   | 16.52                                 | 47.23        |
| 141  | Tile Finisher   | 23.85                                   | 17.18                                 | 41.03        |
| 142  | Tile Setter<br>Future Increase(s):<br>Add \$1.40/hr on 6/01/2015; Add \$1.45/hr on 6/06/2016. | 31.55                                   | 18.26                                 | 49.81        |
| 143  | Tuckpointer, Caulker or Cleaner   | 14.00                                   | 8.75                                  | 22.75        |
| 146  | Well Driller or Pump Installer  | 12.75                                   | 9.50                                  | 22.25        |
| 147  | Siding Installer  | 17.25                                   | 0.00                                  | 17.25        |

**TRUCK DRIVERS**

| <b>Fringe Benefits Must Be Paid On <u>All</u> Hours Worked</b> |                            | <b>HOURLY<br/>BASIC RATE<br/>OF PAY</b> | <b>HOURLY<br/>FRINGE<br/>BENEFITS</b> | <b>TOTAL</b> |
|--|----------------------------|---|---------------------------------------|--------------|
| <b>CODE</b>  | <b>TRADE OR OCCUPATION</b> | <b>\$</b>                               | <b>\$</b>                             | <b>\$</b>    |
| 201  | Single Axle or Two Axle    | 16.50                                   | 0.00                                  | 16.50        |
| 203  | Three or More Axle         | 18.00                                   | 2.44                                  | 20.44        |
| 205  | Pavement Marking Vehicle   | 20.85                                   | 11.02                                 | 31.87        |
| 207  | Truck Mechanic             | 18.00                                   | 2.44                                  | 20.44        |

**LABORERS**

Fringe Benefits Must Be Paid On All Hours Worked

| <u>CODE</u> | <u>TRADE OR OCCUPATION</u>                                 | <u>HOURLY<br/>BASIC RATE<br/>OF PAY</u><br>\$ | <u>HOURLY<br/>FRINGE<br/>BENEFITS</u><br>\$ | <u>TOTAL</u><br>\$ |
|-------------|--|---|---|--------------------|
| 301         | General Laborer  | 24.21   | 8.02  | 32.23              |
| 302         | Asbestos Abatement Worker                                  | 16.50   | 8.21  | 24.71              |
| 303         | Landscaper   | 12.00   | 0.00  | 12.00              |
| 311         | Fiber Optic Laborer (Outside, Other Than Concrete Encased) | 18.33   | 13.65                                       | 31.98              |
| 315         | Final Construction Clean-Up Worker                         | 10.00   | 3.47  | 13.47              |

**HEAVY EQUIPMENT OPERATORS  
RESIDENTIAL OR AGRICULTURAL CONSTRUCTION**

Fringe Benefits Must Be Paid On All Hours Worked

| <u>CODE</u> | <u>TRADE OR OCCUPATION</u>   | <u>HOURLY<br/>BASIC RATE<br/>OF PAY</u><br>\$ | <u>HOURLY<br/>FRINGE<br/>BENEFITS</u><br>\$ | <u>TOTAL</u><br>\$ |
|-------------|--|---|---|--------------------|
| 557         | Asphalt Heater, Planer & Scarifier; Asphalt Milling Machine; Asphalt Screed; Backhoe (Track Type); Backhoe (Mini, 15,000 Lbs. & Under); Bituminous (Asphalt) Plant & Paver, Screed; Boring Machine (Directional, Horizontal or Vertical); Bulldozer or Endloader; Concrete Breaker (Large, Auto, Vibratory/Sonic, Manual or Remote); Concrete Bump Cutter, Grinder, Planing or Grooving Machine; Concrete Conveyor System; Concrete Laser/Screed; Concrete Paver (Slipform); Concrete Pump, Concrete Conveyor (Rotec or Bidwell Type); Concrete Slipform Placer Curb & Gutter Machine; Concrete Spreader & Distributor; Crane (Carry Deck, Mini) or Truck Mounted Hydraulic Crane (10 Tons or Under); Crane With a Lifting Capacity of 25 Tons or Under; Crane, Shovel, Dragline, Clamshells; Forestry Equipment, Timbco, Tree Shear, Tub Grinder, Processor; Grader or Motor Patrol; Grout Pump; Hydro-Blaster (10,000 PSI or Over); Loading Machine (Conveyor); Manhoist; Material or Stack Hoist; Mechanic or Welder; Milling Machine; Roller (Over 5 Ton); Scraper (Self Propelled or Tractor Drawn) 5 cu yds or More Capacity; Shoulder Widener; Skid Rig; Stabilizing or Concrete Mixer (Self-Propelled or 14S or Over); Tractor (Scraper, Dozer, Pusher, Loader); Tractor or Truck Mounted Hydraulic Backhoe; Tractor or Truck Mounted Hydraulic Crane (10 Tons or Under); Trencher (Wheel Type or Chain Type); Winches & A-Frames. | 34.22   | 19.78                                       | 54.00              |

Future Increase(s):

Add \$1.60/hr on 6/2/2015; Add \$1.60/hr on 6/3/2016.

|     |  |       |       |       |
|-----|--|-------|-------|-------|
| 558 | Air Compressor (&/or 400 CFM or Over); Air, Electric or Hydraulic Jacking System; Backfiller; Belting, Burlap, Texturing Machine; Boiler (Temporary Heat); Broom or Sweeper; Compactor (Self-Propelled or Tractor Mounted, Towed & Light Equipment); Concrete Finishing Machine (Road Type); Farm or Industrial Type Tractor; Forklift; Generator (&/or 150 KW or Over); Heaters (Mechanical); High Pressure Utility Locating Machine (Daylighting Machine); Jeep Digger; Lift Slab Machine; Mulcher; Oiler; Post Hole Digger or Driver; Power Subgrader; Pump (3 Inch or Over) or Well Points; Robotic Tool Carrier (With or Without Attachments); Rock, Stone Breaker; Roller (Rubber Tire, 5 Tons or Under); Screed (Milling Machine); Self Propelled Chip Spreader; Shouldering Machine; Skid Steer Loader (With or Without Attachments); Stump Chipper; Telehandler; Vibratory Hammer or Extractor, Power Pack. | 36.72 | 21.15 | 57.87 |
|-----|--|-------|-------|-------|

Future Increase(s):

- Add \$1.25/hr on 6/1/2015; Add \$1.30/hr on 6/1/2016;
- Add \$1.25/hr on 6/1/2017.

Premium Increase(s):

- DOT PREMIUMS: 1) Pay two times the hourly basic rate on Sunday, New Year's Day, Memorial Day, Independence Day, Labor Day, Thanksgiving Day & Christmas Day. 2) Add \$1.50/hr night work premium. See DOT'S website for details about the applicability of this night work premium at: <http://www.dot.wi.gov/business/civilrights/laborwages/pwc.htm>.

\*\*\*\*\* END OF RATES \*\*\*\*\*

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## PREVAILING WAGE – Contractors

Any public works project that has a total estimated project cost that equals or exceeds prevailing wage project thresholds requires a prevailing wage rate determination issued by the Department of Workforce Development (DWD). Public works include erecting, constructing, remodeling, repairing, demolishing, alterations, painting and decorating projects for a local governmental unit or state agency. State law excludes minor service or maintenance work, warranty work, or work under a supply-and-installation contract. There is a statutory definition for most of these exclusions. The prevailing wage laws that apply to local governmental units and their contractors are §§66.0903 and 103.503, Wis. Stats. The prevailing wage laws that apply to state agencies and their contractors are §§103.49 and 103.503, Wis. Stats. The applicable administrative rules for all prevailing wage projects are DWD 290 and DWD 294, Wis. Adm. Code. These laws include provisions that apply to all contractors and subcontractors working on prevailing wage projects.

Any contractor or subcontractor working on a local governmental unit or state agency's public works project that equals or exceeds current prevailing wage project thresholds must do all of the following:

- Receive and review the project's prevailing wage rate determination (i.e., white sheet).
- Tell subcontractors the project is subject to state prevailing wage law and include the prevailing wage rate determination in the construction contract, or if there is no written contract, provide a copy of the project determination to each subcontractor.
- Hire subcontractors who do *not* appear on the "Consolidated List of Debarred Contractors."
- Have a written substance abuse testing program in place that fulfills the requirements of §103.503, Wis. Stats., before commencing work on the project.

- Notify subcontractors that if DWD finds that a contractor or subcontractor violated the prevailing wage law, DWD will assess liquidated damages of 100% of the wages owed to employees.
- Apply to DWD for subjourney wage rates prior to employing these individuals on the project.
- Receive and retain a completed Affidavit of Compliance from each subcontractor brought on to the project before providing final payment to those subcontractors.
- Submit a completed Affidavit of Compliance to the contractor who brought the subcontractor on to the project before receiving final payment for the project.
- Maintain payroll records for 3 years that comply with §§66.0903(10)(a) or 103.49(5)(a), Stats. and DWD 274.06.
- Respond to requests from DWD or the project owner to provide payroll records and/or respond to prevailing wage complaints filed by employees or third parties.

For more information, visit the prevailing wage website: [http://dwd.wisconsin.gov/er/prevailing\\_wage\\_rate/default.htm](http://dwd.wisconsin.gov/er/prevailing_wage_rate/default.htm). For further assistance, call the Equal Rights Division at 608-266-6861 and ask for prevailing wage.





Hand  
Carry

Contract Routing Form

printed on: 04/24/2015

ROUTING: Hand Carry

Contract between: Bachmann Construction Company  
and Dept. or Division: Engineering Division  
Name/Phone Number:

Project: HVAC Upgrade for Olbrich Botanical Gardens-Phase 1

Contract No.: 7383  
Enactment No.: RES-15-00363  
Dollar Amount: 412,900.00

File No.: 37835  
Enactment Date: 04/23/2015

(Please DATE before routing)

| Signatures Required      | Date Received | Date Signed |
|--------------------------|---------------|-------------|
| City Clerk               |               |             |
| Director of Civil Rights |               |             |
| Risk Manager             |               |             |
| Finance Director         |               |             |
| City Attorney            |               |             |
| Mayor                    |               |             |
|                          |               |             |

Please return signed Contracts to the City Clerk's Office  
Room 103, City-County Building for filing.

Original + 2 Copies