$327,970.00
FILE

BID OF JOE DANIELS CONSTRUCTION CO., INC.

2015

PROPOSAL, CONTRACT, BOND AND SPECIFICATIONS

FOR

YAHARA HILLS FACILITY IMPROVEMENTS - HVAC UPGRADE

CONTRACT NO. 7458

PROJECT NO. 53W1772

MUNIS NO. 10714

IN

MADISON, DANE COUNTY, WISCONSIN

AWARDED BY THE COMMON COUNCIL
MADISON, WISCONSIN ON **MAY 19, 2015**

CITY ENGINEERING DIVISION
1600 EMIL STREET
MADISON, WISCONSIN 53713

https://bidexpress.com/login

YAHARA HILLS FACILITY IMPROVEMENTS - HVAC UPGRADE
CONTRACT NO. 7458

INDEX

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:	YAHARA HILLS FACILITY IMPROVEMENTS - HVAC UPGRADE
CONTRACT NO.:	7458
SBE GOAL	8%
BID BOND	5%
PRE BID MEETING (1:00 P.M.)	APRIL 17, 2015
PREQUALIFICATION APPLICATION DUE (1:00 P.M.)	APRIL 17, 2015
PRE-BID WALK THROUGH MEETING (1:00 P.M.)	APRIL 1, 2015
BID SUBMISSION (1:00 P.M.)	APRIL 24, 2015
BID OPEN (1:30 P.M.)	APRIL 24, 2015
PUBLISHED IN WSJ	March 20, 27 & APRIL 3, 10 & 17, 2015

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 conference will be conducted for the purposes of a pre-bid walk through and all bidding contractors are encouraged to attend.

1. The meeting will be held at **1:00 pm on Wednesday, APRIL 1, 2015**.
2. This meeting will take place on site at the Clubhouse at Yahara Hills Golf Course located at 6701 Hwy 12 & 18.
3. A representative from Hein Engineering Group and 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. 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.

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.

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)I. 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). 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. 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

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.

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. 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

YAHARA HILLS FACILITY IMPROVEMENTS - HVAC UPGRADE
CONTRACT NO. 7458

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 109.2: PROSECUTION OF THE WORK

Work shall begin only after the contract is completely executed. The Contractor shall begin work within seven (7) days after receiving the start work letter. It is anticipated that the start work letter shall be issued on or about **June 15, 2015**, after this time the contractor shall order all necessary materials with substantial lead times to ensure that all necessary materials are on site to begin construction work on **November 16th, 2015**.

SECTION 109.7: TIME OF COMPLETION

Construction Closeout: The point in the contract where all contractual requirements associated 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.

The golf and winter sports seasons for the Yahara Hills Clubhouse allows for the construction work to begin on **November 16th, 2015** and to be completed on or before **January 29th, 2016**.

Work confined to the basement of the facility may begin on **November 2nd, 2015** as long as it does not interfere with the golf activities conducted on the main level. Coordinate work with the project manager and submit a schedule per Section 1.17 Schedule of Operations of Division 01 00 00 General Requirements.

Construction Closeout shall occur on or before **January 29th, 2016**.

Contract Closeout shall occur on or before **March 4th 2016**.

BIDDING DOCUMENTS

YAHARA HILLS FACILITY IMPROVEMENTS
HVAC UPGRADE

CONTRACT# 7458

YAHARA HILLS GOLF COURSE
6701 Highway 12
Madison, Wisconsin 53718

March 13, 2015

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

ENGINEER: HEIN Engineering Group
CONTACT:
Michael Hein, PE, Project Engineer
17 Applegate Court, Suite #200
Madison, WI 53713
608-288-9260
Project No. H1403

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DATE: **March 13, 2015**

PROJECT: **YAHARA HILLS FACILITY IMPROVEMENTS - HVAC UPGRADE**
CONTRACT NO: **7458**

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SECTION 01 00 00 - GENERAL REQUIREMENT

Contents

PART 1 – GENERAL

1.1. SCOPE

A. The work under this section includes general rules for the project.
Work under this contract consist of the replacement of the existing HVAC system for the Yahara Clubhouse located at 6701 Hwy 12 &18. Work includes but is not limited to; demolition and removal of the existing HVAC system for both the Club-house and the Locker Room, installation of; two boilers, a central air handling unit with associated VAV zones, an exhaust recovery unit, a condensing unit, a perimeter heating loop, unit heaters, digital controls, all necessary plumbing, electrical

and ductwork as required per plans and specifications. Installation of a new HVAC system for the locker room area shall not be part of this contract.

1.2. PRE-BID INFORMATION

A. There will be a pre-bid tour of the existing building on **April 1th , 2015 at 1:00 pm** to provide bidders the opportunity to acquaint themselves with the project. A representative from the designer's office will be present to take questions that will be answered by addendum.

B. If you are unable to attend the above meeting, contact the Project Manager to schedule a site visit.

1.3. CONTACTS

A. Send all pre-bid inquiries to the owner's project management

B. The owner's representative and designee for project management:
   1. Paul Stauffer
   2. City of Madison- Facility Services
   3. Address: Room 115, 210 Martin Luther King Jr. Blvd.
   4. Phone: Office (608)-266-4366, cell (608) 575-5270
   5. Email:pstauffer@cityofmadison.com

C. The owner's designee for architecture and engineering is:
   1. Michel Hein
   2. Company: Hein Engineering Group
   3. Address: 17 Applegate Court, Suite #200
   4. Phone: (608)-288-9260
   5. Email: hein@chorus.net

1.4. QUALIFICATIONS OF BIDDER

A. By submitting the bid, the bidder and each subcontractor certifies as to meeting the following requirements:
   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 completed is similar to that being bid. Additional requirements will be described in the appropriate technical section of these specifications.
   2. Has access to all necessary equipment and has organizational capacity and technical competence necessary to do the work properly and expeditiously.
   3. Maintains a permanent place of business.

1.5. WORK BY THE OWNER AND OWNER FURNISHED EQUIPMENT

A. The following work shall be accomplished by the owner or will be let under a separate contracts at City's expense and will not be included under this Contract:
   1. **During the course of this project, the Yahara Clubhouse shall be undergoing the replacement of exterior window and doors under a different contract. See APPENDIX D at the end of this section for the anticipated work area. The HVAC contractor and the Window & Door Replacement contractor shall coordinate their work thru the project manager at regular project meetings. The window and door replacement work is scheduled to start on November 16th, 2015 and be completed by January 15th 2016.**
   2. **The City shall provide and pay for the removal of any brick veneer or the repair/patching work of the brick veneer as stated in the plans and specifications. The HVAC contractor shall be responsible for all other masonry repairs or patching. Work shall be coordinated thru the project manager.**
   3. **The attic spaces above the kitchen, stairwell, office and restrooms shall have closed cell foam insulation applied to the underside of the roof deck and at the end walls under a different contract. See APPENDIX E for location of these areas. Work shall begin immediately after the HVAC contractor has remove the ductwork. Work duration is expected to be 2 to 3 days and shall be coordinated thru the project manager.**

B. On January 20, 2015, A &A Environmental, Inc collected bulk samples of building material most likely to be disturbed during the installation of the new HVAC system, ductwork and plumbing for the Clubhouse area. The bulk samples were analyzed for asbestos content by polarized light microcopy. The results of the samples were as follows:

Samples 01 & 02; TSI (Thermal system Insulation) fittings in the furnace room. The fitting insulation was reported to contain 2% chrysolite and <1% amosite asbestos. There are 14 fittings present in the furnace room, 5 fittings present in the electrical room and 22 fittings in the attic above the bathrooms. There may be more fittings present in the walls but these were not accessible during the walkthrough.

Sample 03; Fire proofing on beams in the furnace room was reported as no asbestos detected.

Samples 04 & 05; Basement drywall/drywall compound was reported as no asbestos detected.

Sample 06; 2x2 ceiling tiles throughout the basement was reported as no asbestos detected.

Sample 07; Surfacing material on the first floor ceiling in the storeroom, stairwell next to the kitchen, men's and women's restrooms and office east of the restrooms- 670 ft² was reported to contain 3% chrysotile asbestos. This material is friable and in poor condition.

Additional bulk samples were collected on February 5th, 2015 by A&A Environmental, Inc., from the exterior window glazing and window/door frame caulking, These samples were reported to contain 2% asbestos. See APPENDIX D for location of windows and doors. The caulking and glazing are in good condition, however, when disturbed will become friable.

1. **The areas noted for samples 01 &02 and sample 07 shall be abated by the owner under a separate contract and at the City's expense. Work is anticipated to be completed prior the start work date of this project. If additional pipe fitting insulation is exposed during demolition, the contractor shall immediately notify the project manager.**
2. **The areas noted for the additional bulk samples taken on February 5th shall be abated by the Door & Window contractor during the course of this contract. Work shall be coordinate thru the project manager**

C. There is no asbestos removal anticipated for this project other than noted above, however, existing building materials that may have hazardous content and are located within the work area (example: floor tile, ceiling tile, pipe insulation) shall be sampled, tested, and removed by the City. If any suspect hazardous building materials are found by the contractor during demolition or renovation work that have not been sampled and tested, work must stop and a certified hazardous material inspector must be contacted by the City to assess the situation. Inaccessible areas may exist within the facility. **Any hazardous material removal shall be performed by the City under a separate contract at the City's expense.**

1.6. SALVAGE MATERIALS

A. **The Parks Maintenance Staff intends to salvage parts from some of the existing heating and cooling systems. The contractor shall meet with the Parks staff at the pre-construction meeting to coordinate when these parts may be removed from this equipment. It is the intent that the contractor notify the Parks Staff of any equipment that will be used for temporary heating so that the equipment shall not be disabled by the removal of any salvageable parts. The contractor shall notify the Parks Staff when the equipment will be removed from service so that parts may be salvaged..**

1.7. PROVISIONS FOR FUTURE WORK

A. Not applicable.

1.8. SPECIAL SITE CONDITIONS

A. Unless otherwise noted, construction operations shall be limited to the hours between ***7:00 a.m. and 6:00 p.m.***, Mondays through Fridays, except for holidays. A request must be made to the owner forty-eight hours in advance for approval of work days or hours other than those stated above. Compliance is required with applicable Noise Ordinances.

B. The existing toilets for the Clubhouse shall be shut down for the season and are not available for use by the contractor. The Contractor shall provide and maintain sanitary temporary toilets, located where directed by the owner, in sufficient number required for the labor force employed. The toilets shall comply with International Building Code Chapter 29 on Plumbing Systems. Toilets shall be self-contained chemical type. The Contractor shall maintain the temporary toilets in a sanitary condition at all times and shall supply toilet paper until completion of the job.

C. CONTRACTOR PARKING: Parking for the contractor shall be provided in the parking lot. The city shall provide for any snow removal to the parking lot and entrance to the building.

D. CONTRACTOR ON SITE MATERIAL STORAGE: A material lay down area and workspace shall be provided under the east deck and in the basement. The contractor shall be responsible for protecting and cleaning of the interior/exterior finishes in these lay down areas. Coordinate location with the project manager.

E. ON SITE TRASH CONTAINERS: No permanently reserved on-site space for a trash container shall be provided. Occasionally a trash container may be brought in for a short duration (e.g. two to three days) if arranged in advance with the project manager. Waste from the project shall not be disposed into the building owner's trash receptacles.

F. FIELD OFFICES: Not applicable.

1.9. ALTERNATES

A. Not applicable.

1.10. STANDARD SPECIFICATIONS

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

1.11. GENERAL REQUIREMENTS

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

B. The terms "city", "owner", city engineer" and "project manager" are used interchangeably. The terms "contractor", "sub-contractor" and "general contractor" are used interchangeably.

C. Portions of these specifications are of the abbreviated, simplified type and may include incomplete sentences. Omissions of words or phrases such as "the Contractor shall", "in conformity with", "shall be", "as noted on the drawings", "in accordance with details", are intentional. Omitted words or phrases shall be supplied by inference in the same manner, as they are when a note occurs on the drawings. Such terms as approved, reviewed, equal, as directed, , as permitted, acceptable, satisfactory mean by or to the owner.

D. If a conflict exists within the Specifications or exists within the Drawings, the Contractor shall furnish the item, system, or workmanship, which is the highest quality, largest, largest quantity or most closely fits the owner's intent. Materials and labor shall be new (unless noted or stated otherwise), first class, and workmanlike, and shall be subject at all times to the owner's inspections, tests and approval from the commencement until the acceptance of the completed work. Whenever a particular manufacturer's product is named, it is intended to establish a level of quality and performance requirements unless more explicit restrictions are stated to apply. It must be understood that the details and drawings are diagrammatic. The Contractor shall verify all dimensions at the site and be responsible for their accuracy. If items are too large to fit into existing space Contractor shall provide smaller model of same type upon approval by owner at no cost to owner. All sizes as given are minimum except as noted. Prior to bidding, bidder must visit site to become familiar and verify existing conditions. Failure to do so does not relieve the bidder from the responsibility to verify existing conditions, to point out errors in drawings or specifications or code violations.

E. The area to be set aside for the work under this contract is shown on the drawings, and the Contractor shall confine the construction to the immediate area within the construction limits. The Contractor shall immediately upon entering the site for purpose of beginning work, locate general reference points and take such action as is necessary to prevent their destruction. The Contractor shall lay out its work and be responsible for all lines, elevations and measurements of the building and other work executed under its Contract. The Contractor must exercise proper precaution to verify dimensions on the drawings before laying out work and will be held responsible for any error resulting from failure to exercise such precaution. The Contractor shall verify grades, lines, levels, locations, and dimensions as shown on drawings and report any errors or inconsistencies to owner before commencing work. Starting of work by the Contractor shall imply acceptance of existing conditions. Confine all operations, equipment, apparatus and storage of materials, to the immediate area of work to the greatest possible extent. Contractor shall ascertain, observe and comply with all rules and regulations in effect on the project site, including but not limited to parking and traffic regulations, use of walks, security restrictions and hours of allowable ingress and egress. Any special traffic control during construction involving lane closures shall be in accordance with the federal standard, Manual of Uniform Traffic Control Devices.

F. The work site shall be kept clean and neat at all times. Accumulation of debris shall be avoided and all new equipment and material shall be stored neatly and protected. Failure to comply will result in the contractor responsible for the disorderly conditions to be removed from job site.

G. Owner will not furnish Watchpersons. The Contractor shall provide such precautionary measures, to include the furnishing of watchpersons if deemed necessary, to protect persons and property from damage or loss where the Contractor's work is involved. The contractor is responsible for securing any material stored on site. In case of theft or damage

1.12. CONTRACTOR'S RESPONSIBILITY PRIOR BIDDING

A. Bidders shall bring inadequacies, omissions or conflicts to owner's attention at least ten (10) days before the date set for bid submission. Prompt clarification will be supplied to all bidders of record by addendum. Failure to request clarification or interpretation of the drawings and specifications will not relieve the successful Bidder of responsibility. Signing of the contract will be considered as implicitly denoting that the Contractor has thorough understanding of the scope of work, existing conditions, and comprehension of the contract documents. Owner is not responsible for verbal instructions.

B. During bidding time owner will allow contractors to visit the site to familiarize themselves with the existing conditions and to ask questions for clarification. Failure to attend the scheduled walkthrough implies that the contractor accepts all existing conditions and includes all work to handle existing conditions in his bid price.

C. Prior bidding, bidder must obtain information on payment conditions, discounts, shipping charges, and other cost from vendor and/or manufacturer of the products specified.

1.13. PAYMENT AND CHANGE ORDERS

A. PAYMENTS: will be made based on progress of work. No payments will be made for occurred overhead cost that did not materialize in actual installation. Examples of cost to the contractor that is not part of partial payment are project management cost, bond cost etc. These cost will be covered proportionally for actual work done on site. No payments shall be made for material that is not installed.

B. PAY APPLICATION: The Contractor is responsible for providing the Owner partial payment applications on form AIA Document G702 Application for Payment and AIA Document G703 Continuation Sheet (with schedule of values). Before the first Application for Payment, the Contractor shall submit to the A/E a schedule of values of the various portions of the Work, including quantities if required by the A/E aggregating the total Contract Sum, divided so as to facilitate payments to Subcontractors. Prepare a schedule of values in such form and supported by such substantiating data as the A/E and Owner may require. Each item in the schedule of values shall include its proper share of overhead and profit. This schedule, when approved by the A/E, shall be used only as a basis for reviewing the Contractor's Applications for Payment.

C. CHANGE ORDERS: Changes only will be accepted if approved prior work done. No payment shall be made if contractor if contractor commences work without a cost is agreed on. In case of field change orders a price range has to be agreed on at

minimum. If contractor does not provide cost before the additional work is done, it is assumed the contractor agreed that this work was part of the original contract.

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

1.14. COOPERATION AND RESPONSIBILITIES BETWEEN TRADES

A. The Contractor assumes responsibility for all work specified in this contract except for work explicitly noted as be done by owner or a Contractor separately hired by owner. The Contractor coordinate the work of all trades on the project. If plans 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 trades to agree on division of work and cost. Any work not done by a subcontractor will be the responsibility of the contractor (general contractor, party the owner is in contract with).

B. All Contractors shall work in cooperation with the Contractor and with each other, and fit their work into the structure as job conditions may demand. Owner shall make all final decisions as to the right-of-way and run of pipe, ducts, etc., at pre-arranged meetings with responsible representatives of the Contractors involved. Contractor(s) shall coordinate the work with adjacent work with other Contractors prior to installation and shall cooperate with all other trades to facilitate the general progress of the work. The Contractor shall coordinate and schedule the work of all its subcontractors, and shall furnish all information required by them for proper scheduling and execution of the work. In the same manner, the Contractor shall coordinate the work with that of owner, and any other Contractor operating in the area, including reasonable adjustments of schedule in order to allow other Contractors or the owner to do their work. Any installed work that is not coordinated and that interferes with other Contractor's work shall be removed or relocated at the Contractor's expense.

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 responsibility in its contracts with subcontractors to clarify who ultimately will do the work. If conflicts arise between the Contractor and subcontractor about who is responsible for which work to be done it is the Contractor's responsibility to make sure the work gets done in time even if the dispute between Contractor and subcontractor gets settled later.

1.15. SUBMITTALS

A. Documents have to be submitted in electronic form (PDF) as described elsewhere in addition to hardcopies no later than 3 business days after start work letter is issued. Owner will review, and process shop drawings and other required submittals with reasonable promptness. No delay will be allowed in the progress of the job attributable to Contractor's failure to supply submittals in time. PDF shall be in good quality in electronic original from manufacturer. Scanned PDF are not acceptable.

B. The Contractor shall submit three (3) prints of all shop drawings, submittal data consisting of brochures, catalogs, material lists, wiring diagrams, Material Safety Data Sheets (MSDS), samples, erection drawings, and equipment layouts for review by owner. General catalog sheets showing a series of the same device is not acceptable unless the specific model is clearly marked. Each submittal shall be provided together with a transmittal letter or form. Each original transmittal shall be assigned a transmittal number. The number shall begin with the first initial of the name of the Contractor's firm followed by a serial number. The re-submittals shall indicate the same number with numerical suffix in sequence. Each transmittal shall itemize the enclosures and indicate the distribution of the transmittal and the enclosures. The following information shall be included on all submitted documents: Agency/Location/Address obtained, project number, building name, project name. Submittals shall be grouped to include complete submittals of related systems, products, and accessories in a single submittal. Mark dimensions and values in units to match those specified. Include wiring diagrams of electrically powered equipment.

C. Submit all original documents providing information regarding sustainability requirements including but not limited to recycled content, VOC, certified wood, disposal certificates and transportation distance. Contractor is required to prove that material and methods used meet all requirements specified elsewhere.

D. Owner will return the marked and stamped drawings together with transmittal letter or form to Contractor. If re-submittal is required, owner will so note and Contractor shall make another submission for review after correction resolving the review comments on the prior submittals. The above procedure shall be repeated until owner favorably reviews the submittal. The submittals must be approved before material is ordered and fabrication is authorized.

E. Owner's favorable review of shop drawings and other submittals shall not relieve the Contractor of responsibility for deviations from drawings or specifications, unless the Contractor has in writing called the owner's attention to such deviations at the time of submission, and the owner has acknowledged in writing such deviations; nor shall it relieve the Contractor from responsibility for errors of any sort in such drawings. If deviations, discrepancies, or conflicts between shop drawing submittals and the drawings and specifications are discovered either prior to or after the shop drawing submittals are reviewed by owner, the drawings and specifications shall control and shall be followed. The Contractor shall be responsible for and shall check the correctness of all documents including those subcontractors prior to submitting them to owner for review.

F. The Contractor shall furnish prints of the favorably reviewed final shop drawings, erection drawings, equipment layouts and vendor data to subcontractors and suppliers for the proper coordination of their work. The Contractor shall keep one (1) complete set of the above documents at the job site for the use by owner.

G. <u>After the completion of the project, and prior to final payment, submit:</u>

1. One (1) copy of the Waste Manifest Records to the owner, if required in accordance with "Safety and Environment" Requirements Article "HAZARDOUS SUBSTANCES".
2. The original and one (1) copy of all guarantee/warranty documents.

3. Final copy O&M Manual.

1.16. GUARANTEES

A. All work, material and equipment is guaranteed by the Contractor to be free of faults for at least one year or longer if specified elsewhere. This year begins from the date of final acceptance from owner. The Contractor agrees to return to the project and commence work as directed upon notification by owner and will furnish at his own expense all necessary labor and material to make proper repairs or corrections made necessary by defective material or inferior workmanship furnished or performed under this contract. If a subcontractor is not complying, the Contractor is held responsible.

B. All corrections and repairs are to be made no more than 30 days after notification of the Contractor for equipment and material that is not critical to the operation of the building. Critical equipment and material, including but not limited to HVAC, roofing, electrical, elevator, shall be repaired or brought into temporary and safe working condition in less than 7 days and temporary alternatives have to be provided by the Contractor if function is critical for use of the facility. If Contractor fails to do so the owner reserves the right to perform the work himself or subcontract a different Contractor and charge the Contractor the full cost of the repair and correction and cost of any material, rental fee, labor and equipment to provide temporary relief and protection to enable safe operation of the building.

C. All equipment and material warranty by the manufacturer that lasts longer than the 1-year warranty by the contractor requires sufficient documentation acceptable by the manufacturer to honor the warranty beyond the first year. documents required include manufacturer's warranty certification for this specific material and equipment at the job site, purchase orders or any other documents that will be required beyond the first year for the manufacturer to honor warranty.

1.17. SCHEDULE OF OPERATIONS

A. Within 5 calendar days after the effective date of Start Work Letter, the Contractor shall provide a critical path method (CPM) network diagram and a preliminary construction progress schedule. The diagram shall show the order in which the Contractor proposes to accomplish the work. The CPM shall show interdependence and duration, along with installation man-hours by craft of each activity. Any work element longer than 15 days shall be broken down into component parts. The critical path and float for each activity shall also be shown. The diagram or bar chart shall be neatly lettered and legibly drawn to a time scale. This initial network diagram and all consecutive versions shall include preliminary dates throughout the end of the project.

B. Install work in phases to accommodate owner 's occupancy requirements. **Refer to Section D : Special Provisions, 109.7 for critical dates as required by the City.** During the construction period coordinate electrical schedule and operations with owner.

C. After the initial submittal, the Contractor shall update the schedule monthly by entering actual progress for the period and submit copies as part of the payment request. Contractor shall maintain and provide a 6-week construction schedule that is compatible and complimentary to the general CONSTRUCTION SCHEDULE, and shall include detail of daily tasks over a 6-week period to be updated weekly and communicated and coordinated at the weekly Trade Meetings by the Contractor's field supervisor.

D. Include tests activities in the schedule

1.18. DRAWINGS, SPECIFICATIONS AND OTHER DOCUMENTS

A. Drawings indicate approximate locations of the various items. These items are shown approximately to scale and attempt to show how these items should be integrated with building construction. Locate all the various items on-the-job measurements in conformance with code and cooperation with other trades. Before locating items, confer with the owner as to desired location in the various areas. In no case items shall be located by scaling drawings. Contractor must relocate items and bear cost of redoing work or other trades' work necessitated by failure to comply with this requirement.

B. Demolition drawings, location, circuit numbers, number and type of fixtures, type of mounting and control devices may not be correct. All sizes are approximations and have to be field-verified by contractor. In case of a discrepancy within and between the drawings that would cause and awkward or improper installation the engineer has to be notified for clarification prior to installation. Any work in conflict with the drawings shall be corrected at contractor's expense and at no cost to the owner. Contractor shall determine if scheduled devices fit into space and shall advice if not BEFORE ordering fixtures or devices.

C. Information pertaining to existing conditions that are described in the specifications or appear on the drawings is based on available records. While such data has been collected with reasonable care, there is no expressed or implied guarantee that conditions so indicated are entirely representative of those actually existing. This information is provided to inform the Contractor of known, existing conditions so that due diligence is taken by the Contractor to avoid damage. Where site observation or documents indicate existing underground utilities/services in close proximity (within four feet horizontally and/or four feet vertically) to necessary new construction work, the Contractor shall be responsible to test, probe or otherwise determine exact locations so as to prevent damage to such utilities/services.

D. Standard References such as ANSI, AASHO, AWWA, AISC, Commercial Standards, Federal Specifications, NEMA, UL, and the like incorporated in the requirements by reference shall be those of the latest edition at time of receiving bids, unless otherwise specified. The manufacturers, producers and their agents of required materials shall have such specifications available for reference and are fully familiar with their requirements as pertains to their product or material.

E. The Contractor shall not take advantage of any apparent error or omission in the plans or specifications, and the owner shall be permitted to make such corrections and interpretations as may be deemed necessary for the fulfillment of the intent of the plans and specifications.

F. In addition to verifying at the site all measurements shown on the Drawings, Contractor shall consult the Drawings and Specifications of related work or existing construction that may in any manner affect the work of this contract. Contractor shall promptly report to the owner, in writing, any errors, omissions, violations, or inconsistencies that may be discovered as a result of such verifications; otherwise, it shall be understood that Contractor accepts all such related data and conditions without reservations.

G. Each trade shall keep one set of plans and specifications on site. In addition construction bulletins, change orders etc. as applicable to the trades shall be on site.

H. It shall be the responsibility of the Contractor to submit to the owner within ten (10) days after final inspection, one complete marked-up set of contract drawings fully illustrating all revisions made by all the crafts in the course of the work. This shall include all field changes, adjustments, variances, substitutions and deletions, whether covered by Change Order or not. Underground utility installations must be located precisely as constructed on the marked-up drawings. Contractor shall markup changes for as-built drawings on a daily base.

I. Layout of existing piping, conduits, and locations of equipment are shown as exactly as could be determined during design of the facilities; but their accuracy, particularly when such layouts and drawings are schematic, cannot be guaranteed. Contractor shall check all Specifications including the Drawings for possible interference with electrical, mechanical, and structural details, as well as interference with existing building or equipment, and shall notify the owner of the interference for resolution of the interference before commencing work. Any completed work that interferes shall be corrected by Contractor at Contractor expense so that the original design can be followed.

J. Electronic design files may be provided by the owner at its digression as they are needed for the contractor to perform the work. Contractor shall use electronic design files on their own risk and assume all liability. Electronic documents are not contract documents and significant discrepancies may exist between these electronic files and contract documents and actual site conditions.

K. Contractor shall provide list with all equipment installed. This list shall contain, but not limited to, type, make and special product key and number. For grant purposes the contractor may have to provide detailed information about equipment installed and labor provided to third party institutions, such as Focus on Energy.

L. Using datum, the lot lines and present levels have been established as shown on the drawings. Other grades, lines, levels and benchmarks, shall be established and maintained by the Contractor, who shall be responsible for them. As work progresses, the Contractor shall lay out on forms and floor, the locations of all partitions, walls and fix column centerlines as a guide to all trades. The Contractor shall make provision to preserve property line stakes, benchmarks, or datum point. If any are lost, displaced or disturbed through neglect of any Contractor, Contractor's agents or employees, the Contractor responsible shall pay the cost of restoration.

1.19. QUALITY ASSURANCE

A. Any installed material not meeting the specification requirements must be replaced with material that meets these specifications without additional cost to owner.

B. All products and materials used are to be new, undamaged, clean and in good condition. Existing products and materials are not to be reused unless specifically indicated.

C. Where equipment or accessories are used which differ in arrangement, configuration, dimensions, ratings, or engineering parameters from those indicated on the contract documents, the Contractor is responsible for all costs involved in integrating the equipment or accessories into the system and for obtaining the performance from the system into which these items are placed. This may include changes found necessary during the testing, adjusting, and balancing phase of the project.

D. Welding procedures, welders, and welding operators for all building service piping to be in accordance with certified welding procedures of the National Certified Pipe Welding Bureau and Section 927.5 of ASME B31.9 Building Services Piping or AWS 10.9 Qualification of Welding Procedures and Welders for Piping and Tubing. Before any metallic welding is performed, Contractor to submit his Standard Welding Procedure Specification together with the Procedure Qualification Record as required by Section 927.6 of ASME B31.9 Building Services Piping. Before any metallic welding is performed, Contractor to 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. Before any polyethylene fusion welding is performed, Contractor to submit certification that the welders to be used on this project have successfully demonstrated proper welding procedures in accordance with the Code of Federal Regulations, Title 49, Part 192, Section 192.285.

E. Contractor shall assume the responsibility for the protection of all finished construction under the Contract and shall repair and restore any and all damage of finished work to its original state. Wheeling of any loads over any type of floor, either with or without plank protection, will be permitted only in rubber-tired wheelbarrows, buggies, trucks or dollies. Where structural concrete is also the finished surface, care must be taken to avoid marking or damaging those surfaces. All structures and equipment shall be constructed, installed and operated with guards, controls and other devices in place.

F. Contractor shall obtain complete data at the site and inspect surfaces that are to receive the Work before proceeding with fabricating, assembling, fitting or erecting any work under this contract. Contractor shall notify owner in writing in case of discrepancies between existing work and drawings, and of any defects in such surfaces that are to receive the Contractor's work. Owner will evaluate the notice and direct what remedial action will be taken.

G. Starting of work implies acceptance of existing work or the work of others. Removal and replacement of work applied to defective surfaces, in order to correct defects, shall be done at the expense of the Contractor who applied work to defective surfaces.

H. For outdoor work the Contractor shall:

1. Provide, erect and maintain all required planking, barricades, guard rails, temporary walkways, etc., of sufficient size and strength necessary for protection of stored material and equipment; paved surfaces, walks, curbs, gutters and drives; streets adjacent to or within project area; adjoining property and all project work to prevent accidents to the public and the workmen at the job site.
2. Notify adjacent property owners if their property interferes with the work so that arrangements for proper protection can be made.
3. Provide and maintain proper shoring and bracing to prevent earth from caving or washing into the building excavation. Provide temporary protection around openings through floors and roofs, including elevator openings, stairwells, and edge of slabs.
4. Provide and maintain proper shoring and bracing for existing underground utilities, sewers, etc., encountered during excavation work, to protect them from collapse or other type of damage until such time as they are to be removed, incorporated into the new work, or can be properly backfilled upon completion of new work.
5. Provide protection against rain, snow, wind, ice, storms, or heat to maintain all work, materials, apparatus, and fixtures, 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 work likely to be damaged. Remove snow and ice as necessary for safety and proper execution of the work.
6. Protect the building and foundations from damage at all times from rain, ground water and back up from drains or sewers. Provide all equipment and enclosures as necessary to provide this protection.
7. Damaged property shall be repaired or replaced in order to return it to its original condition. Damaged lawns shall be replaced with sod.
8. Protect materials, work and equipment, not normally covered by above protection, until construction proceeds to a point where the general building protection of the area where located, dispenses with the necessity therefore. Protect work outside of the building lines such as trenches and open excavations, as specified above.
9. Take all necessary precautions to protect owner 's property as well as adjacent property, including trees, shrubs, buildings, sanitary and storm sewers, water piping, gas piping, electric conduit or cable, etc., from any and all damage which may result due to work on this project.
10. Repair work outside of property line in accordance with the requirements of the authority having jurisdiction.
11. Repair any work, damaged by failure to provide proper and adequate protection, to its original state to the satisfaction of owner or remove and replace with new work at the Contractor's expense.

I. The contractor shall be fully responsible for inspecting the work of its suppliers, and subcontractors to assure that the work complies with the standards for materials and workmanship required by the contract documents. The Contractor shall:
1. Monitor quality control over subcontractors, suppliers, manufacturers, products, services, site conditions, and workmanship, to produce work of the quality specified in the contract documents.
2. Comply fully with manufacturer's instructions, including each step in sequence.
3. Request clarification from owner before proceeding with work when manufacturers' instructions or reference standards conflict with Subcontract Documents.
4. Comply with specified standards as a minimum quality for the work except when more stringent tolerances, codes, or manufactures instructions require more precise workmanship.
5. Ensure that work is performed by persons specializing in the specific trade and class of work required, and qualified to produce workmanship of specified quality.
6. Secure products in place with positive anchorage devices designed and sized to withstand seismic, static and dynamic loading, vibration, physical distortion or disfigurement.

J. If reference standards or manufacturers' instructions contain provisions that would alter or are at variance with relationships between the parties to the contract set forth in the contract Documents, the provisions in the contract Documents shall take precedence.

K. When required by individual Specification sections, Contractor shall provide the following services from a manufacturer's representative:
1. Review of Specifications and design and concurrence or suggestions for modification.
2. Site observation of conditions of use and substrate.
3. Observation of the installation work in progress and on completion.
4. Start up, testing, and adjustment of equipment.
5. Instruction to the owner in operation and maintenance.
6. Provide written signed report by manufacturer's representative documenting services provided and any comments or recommendations.

L. Inspection or testing performed by the owner shall not relieve the Contractor from responsibility for performing his own quality control and for complying with the requirements of the contract Documents. Owner will not be responsible for the Contractor's failure to carry out work in accordance with the contract Documents.

1.20. CODES AND PERMITS

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

3. Wisconsin Mechanical Code
4. Wisconsin Plumbing Code
5. Wisconsin Energy Code
6. Wisconsin Fire Code
7. NFPA 70 National Electrical Code
8. General Services Administration 41 CFR Part 101-19
9. Americans with Disabilities Act (ADA)
10. Energy Conservation Performance Standards,
11. Local Codes
12. Occupational Safety and Health Act (OSHA)
13. Occupational Safety and Health Standards, Department of Labor
14. Safety and Health Regulations for Construction, Department of Labor
15. Wisconsin Fire Code
16. National Electrical Safety Code, ANSI C2
17. Environmental Protection Agency regulations
18. Clean Air Act
19. Clean Water Act
20. Resource Conservation and Recovery Act
21. Toxic substances Control Act
22. Wisconsin Department of Health and Family Services
23. State and Regional Water Quality Control Boards
24. County and Municipal ordinances

B. In case of conflict or overlap of the above references, the most stringent provision shall apply.

C. The newest version of the a code or standard shall apply even if an older version is adopted by the Jurisdiction Having Authority.

D. If necessary, file and maintain Notification of Demolition and/or Renovation and Application for Permit Exemption (WDNR Form 4500-113) in accordance with the Wisconsin Administrative Code Chapter NR447.

E. Contractor is expected to know or to ascertain, in general and in detail, the requirements of all codes and ordinances, and all rulings and interpretations of code requirements being made by all authorities having jurisdiction over the work performed by them, applicable to the construction and operation of systems covered by this contract. Where codes or standard specifications other than those listed in this paragraph are referred to in the different Divisions of these specifications, it is understood that they apply as fully as if cited here. Where differences exist between codes affecting this work, the code affording the greatest protection to the owner shall govern.

F. All cost for items and procedures necessary to satisfy requirements of all applicable codes, ordinances and authorities, whether or not these are specifically covered by drawings or specifications. All cases of serious conflict or omission between the drawings, specifications, and codes shall be brought to the owner's attention as herein before specified. The Contractor shall carry out work and complete construction as required by applicable codes and ordinances and in such a manner as to obtain approval of all authorities whose approval is required.

G. Contractor is responsible for obtaining permits at its own cost including expenses for supporting documents. Deliver original permits to the owner before work starts. Apply for, arrange and pay for all required installation inspections required. Deliver originals of these certificates to the owner. Include copies of the certificates in the Operating and Maintenance Instructions. Contractor shall arrange all required inspections and correct all deficiencies at no cost to owner.

H. The Contractor must maintain all licenses required for the work performed and required by authorities. The Contractor must submit proof of holding the license or certificate upon request. If a Contractor loses a license for whatever reason he must inform the owner immediately after learning about that himself.

I. PERMIT TO PENETRATE GROUND OR EXISTING SURFACES OF OWNER PROPERTY:
1. Prior to any penetration of the ground or existing concrete surfaces (including the use of stakes or poles) in excess of 1.5", the Subcontractor shall obtain from the Project Representative a Permit to penetrate or Excavate Existing Surface of owner property and shall adhere to the conditions of the permit during such work. The Permit and all conditions in it shall be considered part of these specifications and shall be included in the contractor's bid amount.
2. In areas where a Permit to penetrate or excavate existing surfaces of owner property is not required, contractors shall verify by safe means, prior to drilling, that no utilities or services are enclosed within the area to be drilled.

J. FIRE SAFETY PERMIT:
1. All operations with open flames or that cause sparks or is near gas lines or near combustible storage containers require a daily Fire Safety Permit issued by the Project Representative. Contractor shall not commence such work until the permit is issued. Activities requiring a Permit include, but are not limited to, electric arc and gas welding and flame cutting, other open flame operations, tar kettles, powder activated tools and excavations. Fire watch personnel shall be provided the contractor in sufficient number to continuously monitor all locations where work is conducting requiring a fire permit. The fire watch personnel shall remain on the job at least thirty minutes after such operations are completed. Fire safety personnel may be installers or welders.
2. Noncombustible shields or covers shall be provided by the contractor on tables, floors, walls, around the workstation, and over equipment to protect building structures, equipment and personnel from sparks and fragments of hot metal. Contractor shall also take these precautions to protect against sparks and hot metallic oxides generated by grinding, drilling or sawing operations.

K. AIR EMISSIONS PERMITS AND NOTIFICATIONS:

1. For all projects that involve demolition of a structure, the contractor shall complete the asbestos demolition forms and 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
11. Radiation Protection
12. Construction Safety Training
13. Control of silica dust released during demolition or drilling of concrete or released from work with other materials that contain silica.

G. A comprehensive activity hazard analysis and hazard abatement plan shall be established including but not be limited to:
1. Description of work phase or activity
2. Identification of potential hazards associated with the activity
3. A list of the contractor's planned controls to mitigate the identified hazards
4. Name of the contractor's employee responsible for inspecting the activity and ensuring that all proposed safety measures are followed
5. Construction activities for which an Activity Hazard Analysis and Hazard Abatement Plan may be required include, but are not limited to:
6. Roofing
7. Hoisting and handling of materials
8. Excavations
9. Trenching and drilling
10. Concrete placement and false work
11. Welding
12. Steel erection
13. Work performed six feet or higher above ground
14. Electrical work
15. Demolition
16. Work in confined spaces
17. Work that causes the release of silica such as demolition or drilling of concrete or work with materials that contain silica.
18. Work with epoxy coatings
19. Work with or around hazardous materials
20. Work on hilly terrain
21. Use and handling of flammable materials
22. The owner must favorably review the Activity Hazard analysis and Hazard Abatement Plan before work can start on that activity.

H. ELECTRICAL WORK:
1. Energized electrical work within panels and equipment is not allowed.
2. Workers shall be qualified to perform electrical tasks in accordance with OSHA 29 CFR 1910 and 1926 requirements.
3. Work practices must be compliant with NFPA 70E, newest edition – Standard for Electrical Safety in the Workplace.

I. Rubbish, debris and scrap shall not be thrown through any window or other opening, or dropped from any great height; it shall be conducted to the ground, to waiting truck(s) or removable container(s) by means of approved chutes or other means of controlled conveyance.

J. Form and scrap lumber shall have all nails withdrawn or bent over; shall be neatly stacked, placed in trash bins, or removed from the premises.

K. Take all necessary precautions while dismantling piping containing gas, gasoline, oil or other explosive or toxic fluids or gases. Purge lines and contain materials in accordance with all applicable regulations. Store such piping outdoors until fumes are removed. Verify that all gas and electrical utilities have been abandoned or disconnected and associated hazards mitigated, prior to beginning any demolition.

L. All material classified by authorities to be a material that needs special treatment must be recycled, reused or disposed of by a special contractor that holds a valid license to work with such material. If hazardous materials are not anticipated, but encountered, terminate operations and contact owner immediately.

M. CONTROL OF CRYSTALLINE SILICA DUST: The subcontractor shall provide all necessary control measures at the work site to keep worker exposure to crystalline silica dust within the OSHA Established Permissible Exposure Limits (PEL's). Dust control measures may require spraying of water or engineering controls at the dust generating points. It also may include the use of respirators, industrial grade HEPA vacuums, and HEPA filtered locally exhausted tools. Construction operations known to cause the release of silica dusts include, but are not limited to:
1. Chipping, sawing, grinding, hammering, and drilling of concrete, rock, or brick.
2. Work with cementitious materials such as grout, mortar, stucco, gunnite, etc.
3. Dry sweeping of dust originating from concrete or rock

N. CONSTRUCTION ACTIVITY POLLUTION PREVENTION:
1. Follow Requirements in Storm Water Pollution Prevention Plan (SWPPP) and Erosion and Sedimentation Control (ESC) Plan
2. Stabilize any relocated and moved soil with fast growing grasses and place mulch (hay, woodchips, straw) on it to cover and hold soil
3. Divert surface runoff from distributed areas into sediment basin or sediment traps with a mound of stabilized soil
4. Construct posts with filter fabric media to remove sediment from stormwater leaving the site.
5. Follow requirements in site development plan and don't disturb areas beyond the marked areas

O. INDOOR AIR QUALITY:
1. During construction the recommended control measures of the Sheet Metal and Air Conditioning Contractors National Association (SMACNA) IAQ guidelines for occupied buildings under construction, (1995, chapter 3) must be met or exceeded.
2. Stored on-site or installed absorptive material must be protected from moisture damage.
3. In case permanently installed air handlers are used for ventilation, filtration media with a Minimum efficiency Reporting Value (MERV) of 8 shall be used at each return air grille, as determined by ASHRAE 52.2-1999. Contractor shall replace all filtration media immediately prior occupancy.
4. All to be installed ductwork, air handlers and other equipment later connected to the indoor air path are to be protected from dirt and debris.

P. FIRE PROTECTION AND PREVENTION:
1. The contractor shall develop and maintain an effective fire protection and prevention program at the job site through all phases of demolition, alteration, repair, and construction work. Contractor shall ensure the accessibility and availability of fire protection and suppression equipment.
2. Smoking is be prohibited everywhere on the job site – no exceptions. Signs shall be posted. In visible locations.
3. No burning of rubbish or debris will be allowed at the site. Combustible waste shall be removed immediately or stored in fire resistive containers until disposed of in an approved manner.
4. The Contractor shall provide and maintain in working order during the entire construction period, a minimum of three (3) fire extinguishers on each floor level, including basement of the building, and one (1) in temporary office. Extinguishers shall be nonfreezing type such as A-B-C rated dry chemical, of not less than 10-pound capacity each. In addition, any subcontractor who maintains an enclosed shed on the site shall provide and maintain, in an accessible location, one or more similar nonfreezing type fire extinguisher in each enclosed shed.

Q. ACCIDENTS AND SPILLS:
1. The contractor shall immediately notify the owner of any accidents, injuries or occupational illnesses that occur on the project, regardless of the employer of the involved personnel or the owner of the involved materials or equipment. For OSHA recordable injuries, the subcontractor shall also furnish a copy of the OSHA Form 301(or equivalent) to the Project Representative within five days of the injury.
2. In the event a job site accident occurs, the contractor shall immediately implement controls and restrictions on the accident site to ensure the site remains undisturbed until released in writing by the owner to resume work. The contractor shall provide accident investigation follow-up and shall support Owner's accident Investigation and reporting protocol.
3. The contractor shall promptly report to owner any spill, deposit, leak, drainage, debris, residue, spoil, residual, and/or by-product, whether its presence at the jobsite is occasioned by accident, inadvertence, intent, discarding, or abandonment by the Subcontractor or its lower tier subcontractors. This reporting requirement applies to petroleum products, oil, lubricants, chemical substances, waste materials, and waste substances, which are <u>in such quantities</u> as to constitute a hazardous substance or hazardous waste. All such occurrences of <u>any quantity</u> involving paints, solvents, thinners, degreasers, PCBs, halogenated hydrocarbons, volatile organic compounds, and/or asbestos shall be deemed a reportable event. These identification and reporting requirements shall be the responsibility of the contractor for both its own work forces as well as for any sub tier contractor, material man or supplier performing work on site for the contractor. All removal, cleanup, and associated costs, which result from contractor or lower tier subcontractor, material man, or supplier presence at the jobsite, shall be at the contractor's sole expense.

R. WASTE MANAGEMENT:
1. Recycle all recyclable material. This includes any material for which there is a recycling facility in Wisconsin.
2. Separate all waste material in plastic, metal, paper, acoustical tile, brick, concrete, clean wood, glass, gypsum drywall, carpet and insulation and provide designated on-site collection areas.
3. Keep track of volume and weight of each material and track if it was recycled, reused, donated or disposed otherwise.
4. It is permissible to separate waste off-site by specialized recycling contractor. This contractor needs to be provide proof of recycling and needs to be WASTECAP certified as "Accredited Professional in Construction and Demolition Debris Recycling".
5. Prior to demolition or construction activities, the General Contractor, with input of all contractors and their subcontractors, shall develop and submit a Waste Management Plan to owner. Priority is given to reuse, followed by recycling followed by disposal including proper land filling or incineration. Disposal only will be acceptable if other methods are not commercially available. The Waste Management Plan includes but is not limited to the following:
    a. A list of each material proposed to be salvaged, reused, or recycled, Materials to be included, at a minimum, are the following:
        i. Concrete: Clean concrete, concrete with rebar, asphalt concrete.
        ii. Metals: Steel, iron, galvanized sheet steel, stainless steel, aluminum, copper, zinc, lead, brass or bronze, including banding, ductwork, framing, roofing and siding, flashing, piping and rebar.
        iii. Clean Fill: Earth, rocks, and gravel.
        iv. Wood: Clean dimensional wood, wood pallets, engineered wood products including plywood, particleboard, I joist.
        v. Biodegradable landscaping materials.
        vi. Cardboard, paper, packaging.
        vii. Masonry: Brick, ceramic tile, CMU.
        viii. Roofing: Clay or concrete tiles, asphalt shingles.

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 uprights from resting directly on the floor construction.

B. Contractor shall provide and pay for its own hoist/crane or other apparatus necessary for unloading/setting or moving their equipment and materials. Installation and removal of equipment for this activity must be accounted for in the Project Schedule. Equipment and operations for this activity shall comply with applicable Department of Commerce and OSHA requirements. No material hoist may be used to transport personnel unless it meets Department of Commerce and OSHA requirements for that purpose.

C. Existing elevators may be used on a limited basis with the owner's permission and agreement. The Contractor will pay costs of warranty extensions and additional service work required. Appropriate protection must be provided by the using Contractor and that Contractor shall be responsible for any structural, mechanical or finish damage to the elevator and its parts and to adjoining building finishes and components.

1.23. SAFEGUARDS - EXISTING EQUIPMENT, UNDERGROUND UTILITIES AND ARTIFACTS

A. Existing utilities, including those listed as abandoned, shall not be moved or otherwise disturbed without written verification by the owner that the utility is abandoned.

B. When altering existing facilities, the Contractor shall take every precaution to preserve and protect existing facilities, both those to be altered and those to remain unaltered that are within the limits of the work.

C. The Contractor shall notify the owner of structural members, piping, conduit, or equipment not indicated for removal that may cause interference with the work. Work shall not proceed in the affected area until instructions have been issued. Do not drill or penetrate existing structures without prior permission. The removal of existing work shall be by methods that will not jeopardize the integrity of structures or systems that are to remain.

D. Existing utilities, including but not limited to roof drainage systems, underground cables, ducts, roadways, manholes, building fire alarm, public address or telecommunications wiring shall not be moved or otherwise disturbed, nor electrical circuits or switches operated or taken in or out of service, without prior consent of the owner. Contractor shall compensate loss to the owner resulting from damage to utilities, facilities and other owner or public items damaged.

E. Take measures necessary to safeguard all existing work and facilities that are inside and outside the limits of the work or items that are within the construction limits but are intended to remain. Report any damage to the owner immediately. Correct and pay for all damages.

1.24. OPERATION AND MAINTENANCE DATA

A. All OM documents are to be submitted as electronic copy for review at the time the respective equipment is delivered. No hardcopy shall be provided until the OM manuals are approved.

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 covers. Submit all documents in electronic form as well as in hardcopy. Prepare binder cover with printed title "OPERATION AND MAINTENANCE INSTRUCTIONS", title of project and subject matter of binder when multiple binders are required.

C. Internally subdivide the binder contents with permanent page dividers, logically organized as described below; with tab titling clearly printed under reinforced laminated plastic tabs.

D. Contents: Prepare a Table of Contents for each volume, with each Product or system description identified, typed on 20-pound white paper, in three parts as follows:

E. Part 1: Directory, listing names, addresses, and telephone numbers of Architect/Engineer, Contractor, subcontractors, and major equipment suppliers.

F. Part 2: Operation and maintenance instructions, arranged by system and subdivided by specification section. For each category, identify names, addresses, and telephone numbers of subcontractors and suppliers. Identify the following:

1. Summary list of maintenance items indicating frequency and type of maintenance required for all systems covered in this contract.
2. List of equipment (including assigned equipment numbers).
3. A description of recommended replacement parts and materials, which the owner should stock.
4. Parts list for each component.
5. A summary of equipment vendors, or location where replacement parts can be purchased.
6. List indicating types and grades of oil and/or grease, packing materials, normal and abnormal tolerances for devices, and method of equipment adjustment.
7. Copies of all approved submittals.
8. Operating instructions.
9. Maintenance instructions for equipment and systems, Preventive maintenance recommendations.
10. Maintenance instructions for finishes, including recommended cleaning methods and materials, and special precautions identifying detrimental agents.
11. Manufacturer's wiring diagrams for electrically powered equipment.
12. A complete set of record control drawings.
    a. Copies of all checkout tests and calibrations performed by the Contractor (not commissioning tests).
    b. The manual shall be organized and subdivided with permanently labeled tabs for each of the following data in the given order:
        i. Sequences of operation including points and schematics of operations
        ii. Control drawings
        iii. Points lists
        iv. Controller / module data
        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 CEILINGS: 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.

2. Electrical Testing Laboratories, Inc.

2.3. HAZARDOUS SUBSTANCES

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

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

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

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 used. All Federal, state, county and local codes and ordinances regarding are to be considered deciding if a piece of equipment or material is to be used.

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

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

G. ASBESTOS:

1. Contractor's attention is directed to WAC NR 447, WAC HSS 159 and the Occupational Safety and Health Act (OSHA) in general, part 1926.1101--ASBESTOS in particular. Contractor is responsible for compliance with all applicable regulations when the work includes fastening to or coring through Asbestos Containing Materials (ACM) and disturbance of asbestos containing caulking and mastics. Unless otherwise indicated, all caulking, sealants, glazing compounds, gaskets, asphalt roofing materials and miscellaneous adhesives are assumed to contain asbestos and are considered to be Category I non-friable ACM as defined in NR 447. Waste material containing Category I non-friable ACM, is regulated as Construction and Demolition (C&D) waste and may be disposed of at a Department of Natural Resources (DNR) approved C&D waste landfill. If Contractor's work methods cause non-friable ACM to become friable, the Contractor is responsible for the disposal of the friable asbestos waste at a landfill specifically approved by DNR to accept friable asbestos. A copy of the signed waste manifest for the disposal of all friable asbestos waste shall be provided to owner prior to request for final payment.
2. The regulations referenced above require removal of friable ACM and Category II non-friable ACM prior to demolition of a building. Category I non-friable ACM does not need to be removed from a building prior to demolition if the waste generated from the demolition is taken to a DNR approved C & D waste landfill. If the contractor chooses to recycle building materials from a building to be demolished, the contractor is responsible for removal and disposal of all Category I non-friable ACM in accordance with applicable regulations prior to demolition. If the contractor's demolition methods will cause non-friable ACM to become friable, the contractor is responsible for removal and disposal of all Category I non-friable ACM in accordance with applicable regulations prior to demolition.
3. The asbestos abatement contractor will require sole occupancy of the workspace during asbestos abatement work. Contractor shall communicate with the asbestos abatement contractor and make adequate allowance for the asbestos abatement work in the work schedule

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

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

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

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

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

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

2.4. BARRICADES, SIGNS, WARNING DEVICES, AND TEMPORARY PLASTIC BARRIERS

A. Traffic barricades, traffic signs, and warning devices shall meet the requirements of applicable OSHA standards and the FHA Manual of Uniform Traffic Control Devices (MUTCD).

B. UV stabilized high-density polyethylene barrier fence free of holes tears and other defects. Provide 4' tall fence in diamond or rectangular pattern. Fencing shall be "safety orange" color, unless otherwise noted.

C. Posts for temporary plastic barrier fencing shall be 5' tall, minimum 12 gauge, painted metal posts.

2.5. SEALING AND FIRESTOPPING

A. Manufacturers: 3M, Hilti, Rectorseal, STI/SpecSeal, Tremco, or approved equal.

B. All firestopping systems shall be provided by the same manufacturer and shall be UL listed.

C. Submittals: Contractor shall submit product data for each firestop system. Submittals shall include product characteristics, performance and limitation criteria, test data, MSDS sheets, installation details and procedures for each method of installation applicable to this project. For non-standard conditions where no UL tested system exists, submit manufacturer's drawings for UL system with known performance for which an engineering judgement can be based upon.

D. Use a product that has a rating not less than the rating of the wall or floor being penetrated.

E. Contractor shall use firestop putty, caulk sealant, intumescent wrapstrips, intumescent firestop collars, firestop blocks, firestop mortar or a combination of these products to provide a UL listed system for each application required for this project. Provide mineral wool backing where specified in manufacturer's application detail.

F. Where shown or specified, pack annular space with fiberglass batt insulation or mineral wool insulation. Provide 4" sheet metal escutcheon around duct on both sides of partition or floor to cover annular space.

G. Install approved product in accordance with the manufacturer's instructions where an installation penetrates a fire/smoke rated surface. When pipe is insulated, use a product, which maintains the integrity of the insulation and vapor barrier.

H. Whenever possible, avoid penetrations of fire and smoke rated partitions. When they cannot be avoided, verify that sufficient space is available for the penetration to be effectively fire and smoke stopped.

PART 3 – EXECUTION

3.1. PROJECT MEETINGS

A. Project meetings will be held at the time designated by the owner. If the principal of the firm does not attend meetings, a responsible representative of the Contractor who can bind the Contractor to a decision at the meetings shall attend. The contractor will write a report covering all items discussed and decisions reached and copy of such report distributed to all parties involved within 3 business days. All contractors, sub-contractors and other related parties shall attend. Attendance especially is required if such contractor is scheduled to perform work within the next 6 weeks.

B. PRE-CONSTRUCTION MEETING: Owner, design representatives and all contractor and sub-contractor representatives attend.

C. PRE-INSTALLATION MEETING: prior installation, layout or other activities related to major systems, separate meetings will be held to ensure proper coordination. These meetings will be initiated by the contractor. Not initiating these meetings doesn't relieve the contractor from coordination responsibilities. The owner may set up such meetings as needed

3.2. CONTINUITY OF SERVICE, TRAFFIC, SHUTDOWN AND ACCESS

A. BUILDING ACCESS: Unless otherwise shown or directed, maintain existing access and egress to the facility throughout construction. Maintain ANSI A117 compliant access for disabled persons, delivery access, emergency vehicle access, and emergency egress. Do not interrupt access and egress without prior written approval by owner.

B. Contractor shall verify the locations of any water, drainage, gas, sewer, electric, drainage, gas, sewer, electric, telephone/communication, fuel, steam lines or other utilities and site features which may be encountered in any excavations or other site work. All lines shall be properly underpinned and supported to avoid disruption of service.

C. TRAFFIC:

a. Do not interrupt or change existing traffic, delivery, or parking without prior written approval from owner. When interruption is required, coordinate schedule with the Owner agency to minimize disruptions. When working in public right-of-way, obtain all necessary approvals and permits from applicable municipalities and WISDOT.

b. When Contractor's activities impede or obstruct traffic flow, Contractor shall provide traffic control devices, signs and flaggers in accordance with other Contract Documents and the current version of the MUTCD, or as shown on the Drawings.

D. UTILITIES:

a. Verify the locations of any water, drainage, gas, sewer, electric, drainage, gas, sewer, electric, telephone/communication, fuel, steam lines or other utilities and site features which may be encountered in any excavations or other site work. All lines shall be properly underpinned and supported to avoid disruption of service.

b. Do not interrupt or change existing utilities without prior written approval from owner, affected utilities and users. Notify all users impacted by outages a minimum of 48 hours in advance of outage. Notification shall be provided in writing and describe the nature and duration of outages and provide the name and number of Contractor's foreman or other contact.

E. Contractor shall provide and maintain continuous service (power, controls, alarms, communication, elevators, HVAC, roads etc.) during the entire construction period. No outages shall be permitted on existing systems except at the time and during the interval specified by the owner. Any outage must be scheduled when the interruption causes the least interference with normal institutional schedules and business routines and might be scheduled during after-hours if regular business hours are not acceptable to the owner. No extra costs will be paid to the Contractor for such outages, which must occur outside of regular weekly working hours. Cost to the utility is paid by Contractor. The Contractor shall provide temporary utility services and bypasses for any disruptions not completed within this period. The Contractor shall restore any circuit interrupted as a result of this work to proper operation as soon as possible.

F. HVAC: If the building is occupied and continues operation during construction, retrofit or demolition, Contractor must maintain ventilation and air conditioning for as large parts of the building as technically feasible. Where maintaining space conditioning is not feasible with the existing system, the Contractor shall provide temporary sufficient air conditioning, heating and ventilation in coordination with the owner. Heating to prevent freeze damage is required for all construction

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

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

3.3. DEMOLITION

A. Perform all demolition as indicated on the drawings to accomplish new work. Demolition Drawings are based on casual field observation and/or existing record documents. Verify field measurements and circuiting arrangements as shown on Drawings, verify that abandoned wiring, piping, ducting and equipment serve only abandoned facilities. Report discrepancies to the owner before disturbing existing installation. Beginning of demolition means installer accepts existing conditions.

B. Demolition all abandoned services and devices in areas affected by this contract, even if not shown on plans. This includes but is not limited to wiring, conduits, piping, and equipment.

C. Before demolition of any load bearing concrete a ground-penetrating radar or concrete X-ray scan needs to be performed to detect any rebar, conduit or other damageable items. This work shall be performed at least a week before demolition starts to give A/E the opportunity to resolve any issues by rebar or other obstacles in unexpected locations. Drawings with existing subsurface obstacles may not be correct and shall not be relied on.

D. Where pipe or duct is removed and not reconnected with new work, cap ends of existing services as if they were new work. Coordinate work with owner to minimize disruption to the existing building occupants.

E. All pipe, wiring and associated conduit, insulation, ductwork, and similar items demolished, abandoned, or deactivated are to be removed from the site by the Contractor. Maintain the condition of material and/or equipment that is indicated to be reused equal to that existing before work began.

F. Patch holes and openings caused by removal of material and equipment, or formerly covered by such, with like material and texture of surrounding surface. Paint to match surroundings.

G. Disconnect all services in a manner which allows for future connection to that service. Disconnect services to equipment at unions, flanges, valves, or fittings wherever possible.

H. Approval of all Jurisdictions Having Authority shall be obtained prior to disposal of any equipment and materials. All disposal has to be in compliance with all local, county, state and nationwide regulations.

I. All disconnected wiring shall be removed from all raceway systems, panels, enclosures pull boxes, junction boxes etc. irrespective of whether the removal is specified in the construction documents or not. The empty raceway systems shall be tagged spare on both ends of each termination.

J. Don't demolition or damage equipment and material that is to stay in place. Replace and repair any equipment and installations that get damaged during demolition. The Contractor shall restore all disturbed areas in accordance with the drawings and specifications. If plans and specifications do not address restoration of specific areas, these areas will be restored to pre-construction conditions as approved by owner.

K. Verify the locations of, and protect, any buildings, structures, utilities, paved surfaces, signs, streetlights, utilities, landscaping and all other such facilities that are intended to remain or be salvaged. Make such explorations and probes as necessary to ascertain any required protection measures that shall be used before proceeding with demolition.

L. Provide and maintain adequate catch platforms, warning lights, barricades, guards, weather protection, dust protection, fences, planking, bracing, shoring, piling, signs, and other items required for proper protection.

M. Report damage of any facilities or items scheduled for salvaging to owner.

N. Explosives shall not be used for demolition.

O. Remove all equipment, fixtures and other materials scheduled for salvage prior to beginning demolition operations.

P. Abandon gas, electric and communication utilities in accordance with local utility company requirements, or applicable substantive requirements if considered private.

Q. Carry out vehicle loading as necessary within the project boundaries or as defined or indicated on the drawings, but not in locations that block vehicular traffic on the streets or pedestrian traffic on adjacent public walks.

R. Dismantle each structure in an orderly manner to provide complete stability of the structure at all times. Provide bracing and shoring where necessary to avoid premature collapse of structure.

S. Conduct demolition operations and the removal of rubbish and debris in such a way that a minimum of nuisance dust is caused. Constantly sprinkle rubbish and debris with water if necessary to keep nuisance dust to a minimum.

T. Where necessary to prevent collapse of any construction, install temporary shores, underpinning, struts or bracing. Do not commence demolition work until all temporary construction is complete.

U. During the execution of the work, provide, operate, and maintain all pumping equipment, suction and discharge lines in a number of capacity as required to keep all cellars and pits free of water from any source whatsoever at all times.

V. Masonry and concrete shall be demolished in small sections. Use braces and shores as necessary to support the structure of the building or structure and protect it from damage. Where limits of demolition are exposed in the finished work, cutting shall be made with saws, providing an absolutely straight line, plumb, true and square.

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 minimum.

X. BUILDING DEMOLITION:

1. Proceed with demolition in a systematic manner, from top of structure to ground. Complete demolition work above each floor or tier before disturbing supporting members on lower levels.
2. Neatly saw or cut joints at the limits of removal; whenever possible, locate cuts at existing joints.
3. Cut existing plaster with power saws equipped with plaster cutting blades and dust collection system.
4. Patch or repair any damaged surfaces or structural members at the limits of removal.
5. Remove structural framing members and lower to ground by hoists, derricks or other suitable means.
6. Remove all existing flooring in accordance with plans. Leave exposed existing sub flooring or surface in suitable condition for receiving new finished flooring.
7. Locate demolition equipment and remove structure so as to not impose excessive loads to supporting walls, floors or framing.
8. Break up and remove concrete slabs-on-grade, unless otherwise shown to remain.

Y. DEMOLITION BELOW GRADE:

1. Demolish foundation walls and other below grade features in accordance with the plans. Unless otherwise noted, remove all below grade features to a point 4' below adjoining existing grade, or proposed grade, whichever is lower. Basement and/or lowest level floors more than 4' below existing grade need not be removed, but must be broken up to permit drainage.
2. Backfill and compact below grade areas and voids resulting from demolition of structures and other abandonment and demolition. Backfilling shall not begin until demolition and abandonment has been approved and documented by owner. Prior to placement of fill materials, ensure that areas to be filled are free of standing water, frost, frozen materials, trash and debris.

Z. DRAIN TILE:

1. Carefully protect and/or replace drain tiles encountered during demolition which are necessary to maintain site drainage conditions. Immediately repair or replace any drain tiles not scheduled for demolition, but damaged. Report damage to owner.
2. Repairs to drain tile or replacement drain tile shall be comparable or better than the existing drain tile system.
3. Test drain lines with water to assure free flow before covering. Remove all obstructions which may be found, retest until satisfactory.

3.4. TEMPORARY CONSTRUCTION

A. Temporary construction shall conform to all requirements and laws of state and local authorities, which pertain to operation, safety, and fire hazards. Contractor shall furnish and install all items necessary for conformance with such requirements, whether called for under separate sections of these Specifications or not. Contractor shall provide, maintain, and remove upon completion of his work:

B. Provide temporary rigging, scaffolding, shoring, hoisting equipment, and all other temporary work as required for this project.

C. TEMPORARY ELECTRIC:

1. Lighting shall be supplied and maintained by the Contractor so that construction work can be safely performed. The temporary lighting system shall be sufficient to enable all trades to safely complete their work and to enable owner to check all work as it is being done. Illumination shall be 5 foot-candles minimum in all areas and, in addition, shall meet or exceed the requirements of 29 CFR 1926.56 Illumination (OSHA regulations) or be higher if the type of work requires more lighting for quality control.
2. All temporary electrical circuits for construction purposes shall be equipped with combination ground fault interrupter and circuit breakers meeting the requirements of UL for Class A, Group 1 devices.

D. TEMPORARY HEATING

1. **The HVAC contractor shall be responsible for providing the necessary heating equipment to maintain the temperature of the interior of the building.** A minimum temperature of 45 degrees and a maximum temperature of 65 degrees for the building shall be maintained. Every precaution shall be taken to prevent unnecessary escape of heat. The contractor is responsible for providing the proper trades for the installation of the temporary gas lines and heating equipment. All portable temporary heating units shall be properly ventilated to prevent combustion gases from remaining in the heating area. Heating equipment shall be able to provide automatic control of space temperatures. Temperatures must be checked during nighttime and on weekends. Restitution shall be made by Contractor responsible for damage to building and contents caused by overheating, freezing, fumes, soot or residue given off by temporary heating or lack of thereof.
2. The window replacement contractor shall provide temporary tenting and heating to the exterior work space of the building when exterior portions are opened up. They shall be responsible for maintaining the temperature of the exterior building wall in order to provide adequate sustained air temperatures per the manufacturer instructions in order to provide proper drying or curing of paints and sealants.

3. Permanent or existing heating systems may be used for temporary heating at owners discretion. Warranty period may not be affected by use of permanent heating equipment. Temporary filters shall be used in the permanent system. If the permanent heating system appears to be dirty after use, owner may require cleaning at contractor's expense. **Note: The Parks Maintenance Staff intends to salvage parts from some of the existing heating and cooling systems. The contractor shall meet with the Parks staff at the pre-construction meeting to coordinate when these parts may be removed from this equipment. It is the intent that the contractor notify the Parks Staff of any equipment that will be used for temporary heating so that the equipment shall not be disabled by the removal of any salvageable parts. The contractor shall notify the Parks Staff when the equipment will be removed from service so that parts may be salvaged.**
4. **The City shall provide and pay for all natural gas used in providing temporary heat.**

E. TEMPORARY ELECTRICAL SERVICE
1. Contractor shall provide and maintain electrical services in single phase or multiphase as required by equipment to be used. Provide at multiple services to ensure service to run at less than 75% of its capacity at all times and to enable short cable runs of less than 300 ft to equipment to be used.

F. TEMPORARY WATER, SEWER AND PUMPS:
1. The City shall supply all water required for construction and other purposes.
2. Waste of water shall be avoided and valves, connections, pumps pipes and hoses shall be provided by Contractor prevent waste of water.

3.5. INSTALLATION

A. Install in accordance with manufacturer's instructions and all code requirements. Provide the owner with copy of manufacturer's instructions prior to installation. Coordinate equipment location with piping, ductwork, conduit and equipment of other trades to allow sufficient clearances. Locate equipment to provide access space for servicing all components. Install in accordance with recognized industry practices. The manufacturer's latest recommendations shall be used. It is Contractor's responsibility to enforce these requirements with all the Contractors. The Contractor shall be responsible for correcting any infringement on this requirement at no cost to owner.

B. Startup and test equipment and adjust operating and safety controls for proper operation.

C. Contractor shall coordinate work with existing equipment so that all systems, equipment and other components will fit the available space, and will allow proper service and repair. Each location needs to be approved by owner. This also applies to existing equipment if newly installed equipment interferes with its accessibility. Location of equipment has to fit into existing panels, decoration or finish. Owner can request position changes of equipment before the work has begun.

D. The Contractor shall cooperate in reducing objectionable noise or vibration. If noise or vibration is a result of improper material or installation, these conditions shall be corrected at no cost to owner. Abnormal buzzing in equipment is not acceptable.

E. Provide carpentry, cutting, patching, and core drilling required for installation of material and equipment.

F. WATERPROOF CONSTRUCTION: Maintain waterproof integrity of penetrations of materials intended to be waterproof. Provide flashings at exterior roof penetrations. Caulk penetrations of foundation walls and floors watertight. Provide membrane clamps at penetrations of waterproof membranes.

G. PAINTING OF EQUIPMENT AND HARDWARE: Provide moisture resistant paint for all exterior painting. Colors shall be as shown on the drawings unless specified. All exposed conduits, raceways and gutters inside (finished spaces) and outside the building shall be painted to match the wall color.

H. Lubricate all bearings with lubricant as recommended by the manufacturer before the equipment is operated for any reason. Once the equipment has been run, maintain lubrication in accordance with the manufacturer's instructions until the work is accepted by owner. Maintain a log of all lubricants used and frequency of lubrication; include this information in the Operating and Maintenance Manuals at the completion of the project.

3.6. DELIVERY, STORAGE AND HANDLING OF MATERIALS

A. Contractor must be present to accept delivery of all equipment and material shipments. Owner will not knowingly accept, unload or store anything delivered to the site for the Contractor's use. Inadvertent acceptance of delivered items by owner shall not constitute acceptance or responsibility for any of the materials or equipment. It is the Contractor's responsibility to assume liability for equipment or material delivered to the job site.

B. Comply with manufacturer's ordering instructions and lead-time requirements to avoid construction delays. Materials and equipment shall be delivered to the site in adequate time to ensure uninterrupted progress of the work and inspection of material by owner. Deliver materials in manufacturer's original, unopened, undamaged containers with identification labels intact. Packaged units shall be delivered in their original crates.

C. Store in a clean and dry space. Maintain factory wrapping or provide an additional heavy canvas or heavy plastic cover to protect units from dirt, water, construction debris, and traffic. Promptly inspect shipments to insure that the material is undamaged and complies with specifications. Materials or equipment, which do not conform to the Specifications or are damaged shall not be incorporated in the work and shall be immediately removed from the site.

D. Arrange for the necessary openings in the building to allow for admittance of all apparatus. When the building access was not previously arranged and must be provided by this Contractor, restore any opening to its original condition after the apparatus has been brought into the building.

E. Contractor shall confine equipment, apparatus, storage of materials and operations to limits indicated on the drawings or by specific direction of owner. Storage of materials within the building shall at no time exceed the design carrying capacity of the structural system. The Contractor assumes full responsibility for damage due to the storage of materials.

F. Material shall be stored according to manufacturer's recommendations as a minimum. Provide and maintain watertight storage sheds on the premises where directed, for storage of materials that might be damaged by weather. Sheds shall have wood floors raised at least 6" above the ground. Materials, construction sheds, and earth stockpiles shall be located so as not to interfere with the installation of the utilities nor cause damage to existing lines. Should it be necessary at any time to move material sheds or storage platforms, the Contractor shall move it at the Contractor's expense, when directed by owner.

G. If necessary, material will be stored off site at the Contractor's expense. Offsite storage agreements will not relieve the Contractor from using proper storage techniques. Storage and protection methods must allow inspection to verify products.

H. All materials shall be stored in a manner that prevents release of hazardous material to the environment. All hazardous materials, including motor fuels, shall be properly handled and contained to prevent spills or other releases. The Contractor shall develop and maintain a contingency plan to provide emergency response, containment, and cleanup of spills of hazardous materials resulting from contract activities. All spills and releases shall be reported to owner immediately

3.7. CONCRETE WORK

A. Provide all layout drawings, anchor bolts, metal shapes, and/or templates required to be cast into concrete or used to form concrete for support or installation of electrical, mechanical, plumbing piping, fixtures, specialties and equipment. This includes but is not limited to piping thrust restraints, pipe supports, hydrant supports, manholes, catch basins, grease traps, septic tanks, distribution boxes, valve pits, meter pits, cleanout cover pads, yard hydrant pads, etc. Coordinate locations of equipment, pipe penetrations in wet areas, etc. with other trades.

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

3.8. OPENINGS, SLEEVES, CUTTING, STRUCTURAL ATTACHMENT, PATCHING AND PAINTING

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

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

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

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

E. PIPE SLEEVES:
   1. Provide galvanized sheet metal sleeves for pipe penetrations through interior and exterior walls to provide a backing for sealant or firestopping. Pipe sleeves in new poured concrete construction shall be schedule 40 steel pipe (sized to allow insulated pipe to run through sleeve), cast in place.
   2. Pipe sleeves are not required in interior non-rated drywall, plaster or wood partitions and sleeves are not required in existing poured concrete walls where penetrations are core drilled.
   3. Pipe sleeves in new poured concrete construction shall be schedule 40 steel pipe (sized to allow insulated pipe to run through sleeve), cast in place.
   4. Extend the top of sleeve 2 inch above the adjacent floor in piping floor penetrations located in the mechanical rooms and wet locations listed below. In finished areas sleeves shall be flush with rough floor.

F. DUCT SLEEVES:
   1. Duct sleeves are not required in non-rated partitions or floors.
   2. Provide sleeve required for fire dampers in fire-rated partitions and floors.

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

2. Conduit and Cable Tray Penetrations: At conduit and cable tray penetrations of non-rated interior partitions, floors and exterior walls above grade, use urethane caulk in annular space between conduit and sleeve, or the core-drilled opening.
3. In exterior wall openings below grade, assemble rubber links of mechanical seal to the proper size for the pipe and tighten in place, in accordance with manufacturer's instructions.

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

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

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

3.9. IDENTIFICATION

A. All labels shall be permanent, and machine generated. NO HANDWRITTEN OR NON-PERMANENT LABELS ARE ALLOWED.

B. Identify all equipment with engraved name plates (White letters on a black background, 1/16 inch thick plastic laminate, beveled edges, screw mounting, Setonply Style 2060 by Seton Name Plate Company or Emedolite Style EIP by EMED Co., or equal by W. H. Brady).

C. Identify interior piping with >1" stencils or snap-around pipe marker Equal to Seton Setmark not less than once every 25 feet, not less than once in each room, not less than once per 6' (or larger) section, adjacent to each access door or panel, and on both side of the partition where accessible piping passes through walls or floors. Place flow directional arrows at each pipe identification location. Label all pipes with name of loop and arrows for flow direction with permanent label. Mark pipes based on served system as "hot", "cold", and as "boiler", "chilled", "geothermal" and also as "glycol" or "water". All supply water shall be labeled per code as "potable" (green background / white letters) or "non-potable" (yellow background / black letters). Label all gauges. Use one coat of black enamel against a light background or white enamel against a dark background.

D. Extend tape to surface at building entrances, meters, hydrants and valves. Where existing underground warning tape is broken during excavation, replace with new tape identifying appropriate service and securely spliced to ends of existing tape.

E. All underground non-metallic sewers/mains and water services/mains shall be provided with tracer wire installations. Tracer wire installations shall conform with code. Tracer wire shall be continuous solid copper or steel plastic coated with split bolt or compression-type connectors.

F. Identify valves with brass tags bearing a system identification and a valve sequence number. Use round brass tags with 1/2 inch numbers, 1/4 inch system identification abbreviation, 1-1/4 inch minimum diameter, with brass jack chains, brass "S" hooks or one piece nylon ties around the valve stem, available from EMED Co., Seton Name Plate Company, or W. H. Brady. Valve tags are not required at a terminal device unless the valves are greater than ten feet from the device, located in another room or not visible from device. Provide a typewritten valve schedule and pipe identification schedule indicating the valve number and the equipment or areas supplied by each valve and the symbols used for pipe identification; locate schedules in mechanical room and in each Operating and Maintenance manual. Schedule in mechanical room to be framed under clear plastic.

G. Identify balancing valves like valves above and in addition include balancing chart for the specific balancing valve and detail the setting and flow set at time of balancing.

H. Label fire, smoke and combination fire smoke dampers on the exterior surface of ductwork directly adjacent to access doors using a minimum of 0.5 inch height lettering reading, "SMOKE DAMPER" or "FIRE DAMPER". Smoke and combination fire smoke dampers shall also include a second line listing the individual damper tag. The tags must be coordinated with the mechanical schedules. Utilize stencils or manufactured labels. All other forms of identification are unacceptable. All labels shall be clearly visible from the ceiling access point.

I. Label all conductors. Size shall be appropriate for the conductor or cable size(s), outlet faceplate layout and patch panel design. All labels shall be self-laminating, white/transparent vinyl and be wrapped around the cable or sheath. Flag type labels are not allowed. The labels shall be of adequate size to accommodate the circumference of the cable being labeled and properly self-laminate over the full extent of the printed area of the label.

3.10. TRAINING AND DEMONSTRATION

A. The owner's facility staff (and occupants and service Contractors as needed), shall receive orientation and training on features, systems and equipment in this facility requisite with the complexity and criticality of the system and the owner's needs. Additional training requirements may be found in specific equipment sections. Owner may video-record all training sessions.

B. Only training on equipment that works as designed and with approved Operations and Maintenance manual is acceptable. If system fails, training will be repeated.

C. The Contractor shall be responsible for training coordination and scheduling and ultimately for ensuring that training is completed on all equipment per the Specifications. Unless otherwise required or approved, the training shall be given during regular business hours during a regular work week.
D. Owner will be responsible for coordinating and approving the content and adequacy of the training.
E. Training team shall consist of, as needed and at the discretion of the owner, the installing technician, installing Contractor and the appropriate trade or manufacturer's representative on each major piece of equipment. Practical building operating expertise as well as in-depth knowledge of all modes of operation of the specific piece of equipment as installed in this project is required by the person training. If owner determines training was not adequate, it will be repeated in improved form.
F. Follow the outline in the table of contents of the operation and maintenance manual and illustrate whenever possible the use of the O&M manuals for reference. Training Shall Include the Following:
    1. Use of the printed installation, operation and maintenance instruction material included in the O&M manuals.
    2. A review of the written O&M instructions emphasizing safe and proper operating requirements, preventative maintenance, and special tools needed and spare parts inventory suggestions. The training shall include start-up, operation in all modes possible, shutdown, seasonal changeover, as applicable, and any emergency procedures.
    3. Discussion of relevant health and safety issues and concerns.
    4. Discussion of warranties and guarantees.
    5. Common troubleshooting and maintenance issues, problems and solutions.
    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 onwer 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 exceed 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 advice 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.

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

END OF SECTION

APPENDIX A - WASTE MATERIALS ESTIMATING SHEET

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
Total									

APPENDIX B - LANDFILL LOG

Instructions: Use as many sheets as needed.

Project Title: _____

Company: _____

Log Dates: ___ ___ through ___

Date	Destination	Cubic Yards Land filled	Tons Land filled
Total			

APPENDIX C - WASTE DIVERSION LOG

Instructions: Use as many sheets as needed.

Project Title: _____

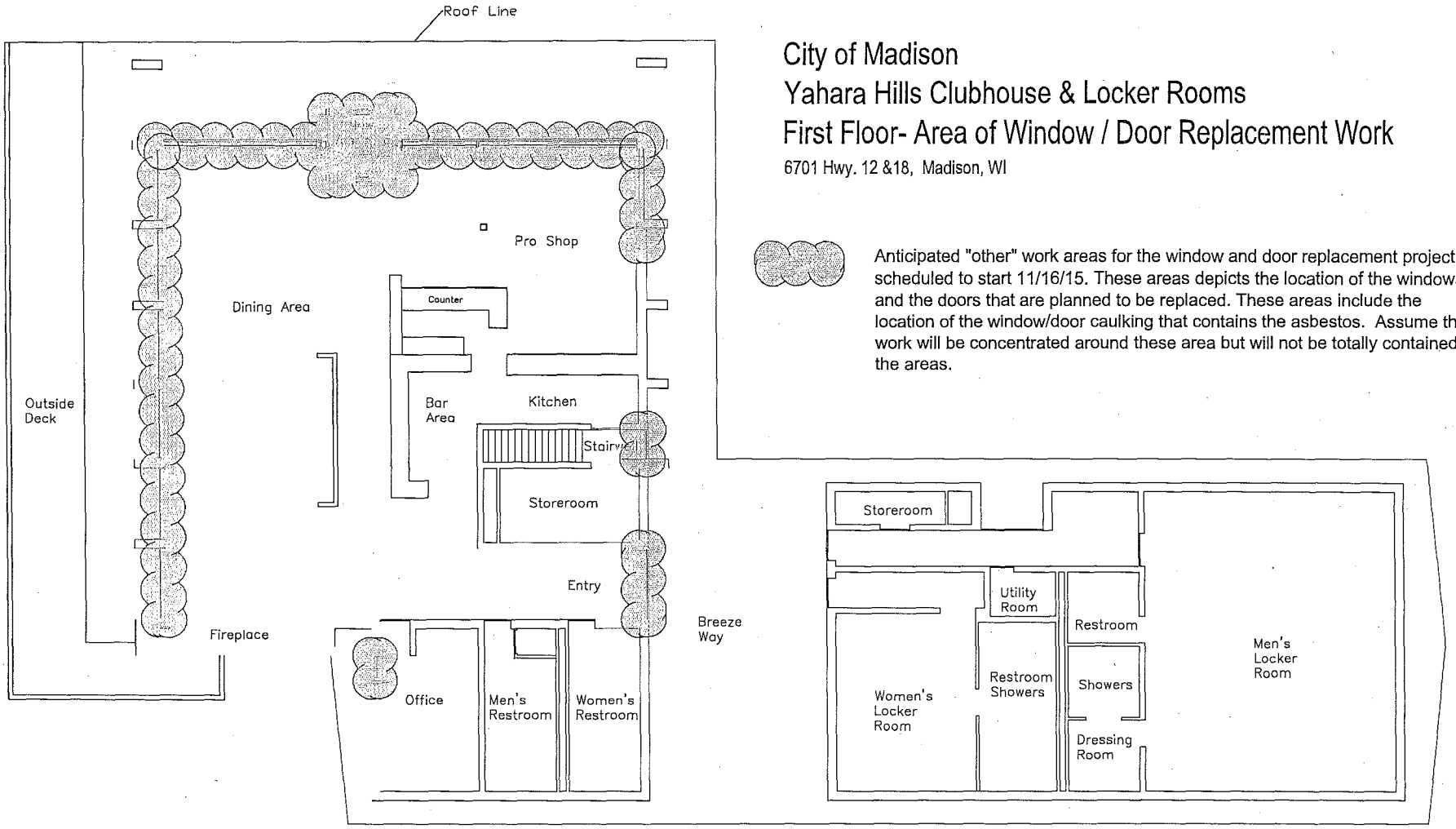
Company: _____

Log Dates: ___ ___ through ___

Material	Date	Destination	Salvaged	Recycled	Tons	Cubic Yards	Cost
Total							

City of Madison
Yahara Hills Clubhouse & Locker Rooms
First Floor- Area of Window / Door Replacement Work

6701 Hwy. 12 &18, Madison, WI



Anticipated "other" work areas for the window and door replacement project scheduled to start 11/16/15. These areas depicts the location of the windows and the doors that are planned to be replaced. These areas include the location of the window/door caulking that contains the asbestos. Assume that work will be concentrated around these area but will not be totally contained to the areas.

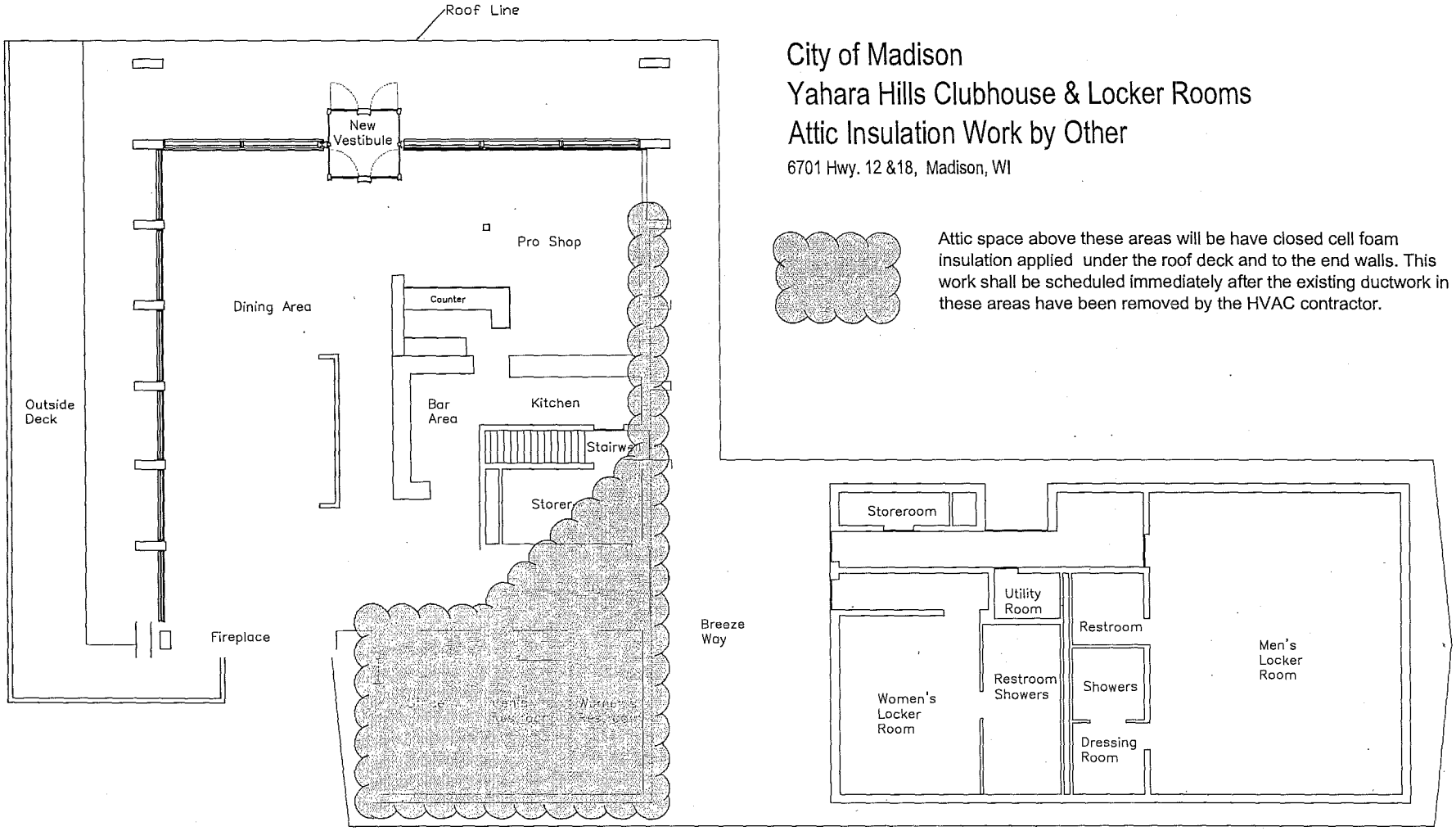
Clubhouse

Locker Rooms

City of Madison
Yahara Hills Clubhouse & Locker Rooms
Attic Insulation Work by Other

6701 Hwy. 12 &18, Madison, WI

Attic space above these areas will be have closed cell foam insulation applied under the roof deck and to the end walls. This work shall be scheduled immediately after the existing ductwork in these areas have been removed by the HVAC contractor.



Clubhouse

Locker Rooms

SECTION 22 00 00 - GENERAL PLUMBING PROVISIONS

1.01 DESCRIPTION

A. *Work Included:* Provide plumbing where shown on the Drawings, as specified herein, and as needed for a complete and proper installation including, but not necessarily limited to:

1. Domestic Hot and Cold Water Piping.
2. Gas Piping.
3. Piping Insulation
4. Gas Fired Water Heater.

B. *Related Work*:

1. Documents affecting work of this Section include, but are not necessarily limited to, General Conditions, Supplementary Conditions, and Sections in Division 1 of these Specifications.

C. *Work of Other Sections:*

1. Openings for new Plumbing work in new construction walls, floors, roof, ceiling, etc. shall be provided by the General Contractor. Location and size of these openings shall be the responsibility of the Plumbing Contractor.
2. Electrical line voltage wiring (110 volts and greater) by the Electrical Contractor. Wiring diagrams shall be furnished to the Electrical Contractor by the Plumbing Contractor.
3. Final gas piping connections for HVAC Equipment by the HVAC Contractor.
4. Roofing, exterior wall and related exterior openings shall be caulked, sealed and patched by the General Contractor.

1.02 GENERAL PROVISIONS

A. This specification Section is a general description of the work requirements. The particular descriptions are not intended to be all-inclusive. Bidders shall also refer to the Drawings.

B. Prior to submitting a bid, the Contractor shall call the Engineer's attention (in writing only) to any materials or items of work believed to be inadequate. Bidders are required to visit the premises, take measurements, inspect existing conditions and limitations, and obtain first hand information necessary to submit a bid. The intent of the Contract is to obtain complete system installations, tested, ready for operation. No extras will be allowed because Contractor's misunderstanding of the scope work involved.

C. Everything essential for the completion of the work implied to be covered by these Specifications to make the system ready for normal and proper operation must be furnished and installed by this Contractor. Accordingly, any omission from either the plans or the Specifications, or both of details necessary for the proper installation and operation of the system shall not relieve this Contractor from furnishing such detail in full and proper manner.

D. The Drawings show various details indicating the general arrangement of the plumbing work, sizes and locations of piping, equipment, etc. The said Drawings with figures, lettering, etc., shall be considered a part of these Specifications and no charge or alternation shall be made in any case unless ordered by the Engineer.

E. In addition to the Plumbing work, refer to the Plumbing work shown on the general Construction Drawings of the building as being part of this Contract, unless specified to be done by other contractors.

1.03 QUALITY ASSURANCE

A. Use adequate number of skilled workmen who are thoroughly trained and experienced in the necessary crafts and who are completely familiar with the specified requirements and the methods needed for proper performance of the work of this Section.

B. Without additional cost to the Owner, provide such other labor and materials as required to be complete the work of the Section in accordance, with the requirements of governmental agencies having jurisdiction, regardless of whether such materials and associated labor are called for elsewhere in the Contract Documents.

C. In acceptance or rejection of installed work, the Architect or Engineer shall make no allowance for lack of skill on the part of the Workmen.

D. For the actual field fabrication, installation and testing of the Plumbing work, use only thoroughly trained and experienced workmen complete familiar with the items required and manufacturer's current recommended methods of installation.

E. *Reference Standards:*

ANSI	American National Standards Institute
ASME	American Society of Mechanical Engineers
ASSE	American Society of Sanitary Engineering
ASTM	American Society of Testing and Material
AWWA	American Waterworks Association
CISPI	Cast Iron Soil Pipe Institute
FM	Factory Mutual
MCA	Mechanical Contractors Association
NEC	National Electric Code
NEMA	National Electrical Manufacturers Association
NFPA	National Fire Protection Association
NSF	National Sanitation Foundation
WQA	Water Quality Association

1.04 CODES AND PERMITS

A. This contractor must comply with building codes and other ordinances in force where the building is located as far as same apply to his work.

B. Plumbing work shall meet all Federal, State, Local Codes, ordinances and utility regulations.

1. In the event of conflict between or among specified requirements and pertinent regulations, the more stringent requirement will govern when so directed by the Engineer.

C. Plumbing Contractor must secure permits from proper offices and pay all legal fees as may be necessary for fulfilling the requirements of these specifications.

D. Submit one (1) copy of all permits to the Owner.

1.05 COORDINATION

A. Cooperate and coordinate with other trades to assure that all systems pertaining to the Plumbing work shall be installed in the best feasible arrangement. Coordinate as required with all other trades to share space in common areas and to provide the maximum of access to each system.

B. Arrange plumbing work in neat, well organized manner with piping and similar services running with primary lines of building construction, and with minimum of 8 foot overhead clearance, where possible.

C. Locate equipment properly to provide easy access, and arrange entire plumbing work with adequate access for operation and maintenance.

D. Give right-of-way to piping, which must slope for drainage.

E. Where Plumbing work is to connect to existing, the Contractor must field verify all connection points before beginning any rough-in work. Verify gravity flow lines and proper invert elevations required prior to starting piping installation.

1.06 ELECTRICAL PROVISIONS OF PLUMBING WORK

A. *Line Voltage Wiring:* The Electrical Contractor is to make all line voltage (100 volts and greater) electrical wiring connections for hookup of the units and systems.

B. *Low Voltage Control Wiring*: Exposed low voltage (less than 100 volts) temperature control wiring in connection with the Plumbing systems shall be in EMT conduit by the Plumbing Contractor in strict accordance with the applicable sections of the Electrical Specifications. *Concealed low-voltage control* wiring may be routed to equipment without conduit, unless subject to physical damage.

C. The Plumbing Contractor shall consult with the Electrical Contractor before ordering electrical motors, to ascertain correct electrical current characteristics. Plumbing Contractor shall furnish complete list and location of equipment requiring electrical connections and necessary wiring diagrams to the Electrical Contractor.

D. *Motors:* Where not otherwise indicated, comply with applicable provisions of the National Electrical Code, NEMA Standards, and sections of Division 16 of Specifications.

1. *Phases and Current:* 1/6 HP and smaller is Contractor's option; up to 1/3 HP, capacitor-start, 120 volt, 60 cycle single-phase; 1/2 HP and larger, squirrel-cage induction NEMA rated 200 volt, three-phase, 60 cycle. Provide 2 separate windings on 2 speed three-phase motors. Coordinate with actual current characteristics; refer to Division 16 of Specifications.
2. *High Efficiency Motors:* All motors 1 HP and larger shall be high efficiency motors meeting or exceeding values tested in accordance with IEEE Standards 112, Method B procedures as stated in NEMA MG 1-12.53a.
3. *Temperature Rating:* Class B insulation for 70 degree C temperature rise.
4. *Service Factor:* 1.15 for three-phase; 1.35 for single-phase.
5. *Construction:* General purpose, continuous duty.
6. *Frames:* NEMA Standard for horsepower specified.
7. *Overload Protection:* Built-in thermal, with internal sensing device for stopping motor, and for signaling where indicated.
8. *Bearings:* Permanently lubricated and sealed ball bearings.

E. *Motor Starter &Disconnect Switches:* Where motor starters and disconnect switches are indicated to be an integral part of equipment furnished by Plumbing Contractor, they shall meet requirements of Division 16 and shall be connected by the Electrical installer.

1. Field assembled motor starters and disconnect switches are to be the responsibility of the Electrical Contractor, unless indicated otherwise.

F. *Wiring Connections:* Wired connections in flexible conduit, except where plug-in electrical cords are indicated and permitted by governing regulations.

G. *General Wiring:* Comply with applicable provisions of Division 16 Section.

H. *Drip Pans:* Furnish drain pans below piping which passes directly above electrical work. Install drain piping and drain valve.

1.07 PAINTING PLUMBING WORK

A. *General*: All field painting of plumbing equipment shall be done by the General Contractor, unless equipment is specified otherwise or is to be furnished with factory-applied finish coats.

B. All equipment shall be provided with factory-applied prime and final coat paint finish, unless otherwise specified.

C. If factory-applied paint finish in any Plumbing equipment furnished by the Plumbing Contractor is damaged in shipment or during construction of the building, the equipment shall be refinished by the Plumbing Contractor to the satisfaction of the Architect or Engineer.

D. Prime paint all field-fabricated metal work under plumbing work, comply with applicable provisions of Division 9.

1.08 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.

1. Furnish and install adequate marking, tagging and labeling of all *accessible and exposed* Plumbing equipment, piping and control devices, per ANSI A13.1-1981. Accessible locations shall include all ceiling spaces above accessible ceilings.

B. *Equipment:* Identify all major Plumbing equipment with plastic-laminate signs of 2" high painted stencils and contrasting background. Provide test 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 laminate nameplates with 1/4" high lettering.

C. *Piping:* Identify piping once every 30 feet at each branch, at termination of lines, and near valve or equipment connections. Place flow directional arrows at each piping system for identification of flow direction. Provide lettering of the appropriate size to convey information on wrap-around signage, adhesive-backed or paint stenciled labels.

D. *Valves:* Identify all valves with 1-1/2" diameter polished brass tags with stamp-engraved labels 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, and incorporate in Instruction Operations Manual.

E. *Operational Labels: Where* needed for proper or adequate information on operation and maintenance of Plumbing systems, provide tags or labels of plastic or laminated card stock, typewritten to convey the message.

1.09 FLOOR, WALL, ROOF AND CEILING OPENINGS

A. The General Contractor will be required to leave openings in ceiling, floors, walls, roof, partitions, etc., as required to install the Plumbing work specified or shown on the Drawings. The Plumbing Contractor is responsible for correct size and location of his openings. Where penetrations through existing construction are required, they shall be the responsibility of the Plumbing Contractor.

1. *Pipe Sleeves:* Schedule 40 black steel pipe, 1" larger than carrier pipe.

B. The Plumbing Contractor shall set sleeves and anchors for all equipment, etc., and shall provide watertight seals on pipes through exterior walls, floors and roof and where noted on the Drawings.

C. Pack annular space between sleeves and pipe with fiberglass insulation and seal with approved caulking materials. Where penetrations occur through fire-rated walls or floors, fill space with fire-resistive insulation similar to high-temperature mineral wool, US Gypsum

Thermafiber batts or Cera-blanket FS insulation by Tremco. Seal openings with UL approved fire-resistive fire stop caulk/sealant or assembly.

1. Fireproof plastic piping through fire-rated construction per approved UL listed assembly.

D. Provisions for openings, holes and clearances through walls, floors, ceilings and partitions to be made in advance of construction of such parts of the building.

E. If the Plumbing Contractor should neglect to inform the General Contractor of his opening requirements and that portion of the Building construction has been completed, the Plumbing Contractor shall pay the General Contractor for providing such openings.

F. Make arrangements with various other contractors for all special framing, spacing and chases. Mason will leave chases in mason work, but Plumbing Contractor is responsible for correct size and location.

1.10 CUTTING AND PATCHING

A. *General:* Refer to Division 1 General Requirements.

B. Perform all cutting and patching required for complete installation of the HVAC systems, unless specifically noted otherwise. Provide all materials required for patching unless otherwise noted.

1. All cutting and patching necessary of structural members to install any Plumbing work shall not be done without permission, and then only carefully done under the direction of the Architect and General Contractor.

C. The Contractor shall not endanger any work of other trades by demolition, cutting, digging or otherwise. Any cost caused by defective or ill-timed cutting and patching work shall be borne by the contractor responsible. Each contractor requiring cutting and patching shall hire men skilled in such cutting and patching to do the work.

1. All patching work in existing areas shall match existing work and restore the finish to its original condition in material, quality, texture, finish and color unless specifically noted or scheduled otherwise.

1.11 TESTS AND INSPECTIONS:

A. All plumbing tests shall be conducted in the presence of and to the satisfaction of the Governing Authorities, Architect/ Engineer, and Owner or his authorized representative.

B. The Plumbing Contractor shall be responsible for applying tests and ordering inspections as required by Federal, State and local Code and Inspection authorities.

1. All work shall remain exposed until it has been tested, inspected and approved.

1.12 TEMPORARY SERVICES

A. Provide temporary services for all plumbing services to the existing facility to maintain function of sanitary, storm, natural gas and water services during the construction period.

1.13 CONCRETE FOR PLUMBING WORK

A. *General:* Comply with pertinent provisions of Division 1 and Division 3.

B. All concrete work for equipment pads by the Plumbing Contractor.

C. *Concrete Equipment Pads*: For each piece of floor or ground mounted HVAC equipment as indicated on the Drawings, provide a 4" concrete housekeeping pad at a minimum of 4 inches

wider than the full size of the respective equipment's base. Equipment pads are required for the following equipment:

1. Water Heater.

1.14 EQUIPMENT ACCESS

A. *General:* All valves, equipment and accessories shall be installed to permit access to equipment for maintenance, servicing or repairs. Relocation of piping, or equipment to accomplish equipment access shall be completed by this Contractor at no additional cost.

B. *Location:* Provide access doors where equipment is located in chases or inaccessible locations. Access panels shall be furnished by this Contractor and installed by the specific trade responsible for the material in which the access panels are installed.

C. *Construction:* Access doors in fire-rated construction must have UL label. Access doors shall be of size to provide adequate access to equipment concealed in wall, ceiling and furred-in spaces. Milcor or approved equal, 14-gauge steel frame and door, prime-coated, except stainless steel in areas subject to excessive moisture.

1.15 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.

1. Prime coat paint all metal supports.

1.16 EQUIPMENT GUARDS

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

1. All belt guards shall be OSHA-approved types.

1.17 GUARANTEE

A. All material and workmanship must be new and first class in every respect; the plumbing equipment must be turned over to the owner in complete working order and free from mechanical or performance defects.

B. The Plumbing Contractor must guarantee all labor and materials for one (1) year from the completion of the plumbing system. Maintain and repair plumbing equipment for the above period, unless such defects are clearly the result of bad management after plumbing system is turned over to the Owner.

C. Before final acceptance of the plumbing work, the Plumbing Contractor shall have the entire apparatus and system in complete and satisfactory operation and shall maintain same in satisfactory and continuous operation for a period of ten days prior to the date of acceptance; fuel to be furnished by Owner.

D. The Plumbing Contractor shall submit to the Engineer in triplicate, at the completion of his work, a certified statement, signed by a principal of the firm, stating that the system has been fully installed and is operating within the intent of the Drawings and Specifications and that all system components have been tested and adjusted. This statement shall be submitted before the system is presented to the Owner for final inspection.

1.18 SUBMITTALS

A. Refer to Division 1 for additional submittal requirements.

B. The Plumbing Contractor will be held responsible for correction of work deemed necessary by the Engineer due to proceeding with the work without shop drawings that have the Architect/Engineers final approval.

C. Shop drawings shall include data on physical dimensions, gauges, materials of construction and capacities.

1. Incomplete drawings will be disapproved.

D. This Contractor will be responsible for all figures and dimensions shown on the shop drawings. Approval of shop drawings describing equipment that cannot fit in the space allotted does not relieve this Contractor from providing equipment that will meet the space requirements.

E. Submit six (6) copies of shop drawings to the Architect/Engineer for approval, with complete detail for all equipment, materials, etc., to be furnished and installed for this project as follows:

1. Valves.
2. Pipe and piping specialties.
3. Insulation systems.
4. Plumbing equipment.
5. Instructions and O&M manuals(2 copies).
6. As-built Drawings(1 copy).

1.19 HOUSEKEEPING AND CLEANUP

A. Periodically as work progress and/or as directed by the Architect/Engineer, the Contractor shall remove waste materials from the building and leave the area of the work room clean. Upon completion of work remove all tools, scaffolding, broken and waste materials, etc., from the site.

1.20 LUBRICATION

A. 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.

1. The Contractor is responsible for maintaining lubrication of all mechanical equipment under his contract until work is accepted by the Owner.

B. Furnish a chart with each piece of equipment listed, itemizing location for lubricant required and recommended periods of lubrication. Incorporate chart in Instruction Manual.

1.21 INSTRUCTIONS AND MANUALS

A. Upon completion of the installation, but before final acceptance of the system, the Plumbing Contractor shall instruct the Owner on the care and operation of all parts of the Plumbing system.

B. Assemble two (2) complete sets of manufacturer's printed operating and maintenance instructions for all mechanical equipment and installed under this contract. Prepare in bound copies complete with index tabs. Information must include parts lists, equipment warranties, and wiring diagrams. Submit bound copies to Architect for disbursement.

1.22 AS-BUILT DRAWINGS

A. During construction maintain a set of prints showing installed as-built work for the project.

B. Upon completion of construction before final acceptance, provide a set of as-built drawings to the Architect/Engineer.

PART 2 - PRODUCTS

2.01 DOMESTIC WATER PIPE SCHEDULE

A. *Above Ground Piping:*

1. Type 'L' copper water tube, H(hard drawn) temper, ASTM B88; with cast copper fittings, ANSI B16.18; wrought copper fittings, ANSI B16.22; lead-free(less than 0.2%) solder, ASTM B32; flux ASTM B813.
2. Wisconsin approved PEXa piping.
3. Mechanically formed brazed tee connections may be used in lieu of specified fittings.

B. *Below Ground*: 2-1/2" and Smaller:

1. Type 'K' copper water tube, O(annealed-soft) temper, ASTM B88; with cast copper fittings, ANSI B16.18; wrought copper fittings, ANSI B16.22; lead-free(less than 0.2%) solder, ASTM B32; flux ASTM B813; or cast copper flared pressure fittings, ANSI B16.26.
2. Wisconsin approved PEXa piping.

2.02 GAS PIPING AND FITTINGS

A. General: Provide gas piping and fittings in accordance with the following listing:

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

2.02 VALVES

A. *Approved Manufacturers:*

1. Conbraco Apollo;
2. Milwaukee;
3. Watts;
4. Nibco.

B. *Check valves:*

1. *2" and smaller:* Bronze, screwed, Y-pattern, 200# WOG, swing check type.

C. *Ball valves:*

1. *2" and smaller:* Two or Three piece, bronze-body, chrome-plated bronze ball, Teflon seat and packing, 400 pig WOG, with stem extensions on insulated piping. Appollo 70-200 series.

D. 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.

E. 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.

2.03 PIPE HANGERS

A. *Piping:*

1. Split ring hangers with supporting rods.
2. Adjustable clevis.

B. *Multiple or Trapeze Hangers:*

1. Steel channels with welded spacers and hanger rods.

C. *Floor Support:*

1. Painted steel pipe saddle, stand and bolted floor flange.

D. *Copper Pipe Supports:*

1. All supports, fasteners, clamps, etc. directly connected to copper piping shall be copper-plated or polyvinylchloride(PVC)-coated.
2. Where steel strut supports are used, provide isolation collar between supports/clamp and copper piping.

E. *Approved Manufacturers*: Fee and Mason, B-line, Grinnell or approved equal.

2.04 PIPE INSULATION

A. *General:* Provide composite piping insulation (insulation, jackets, coverings, sealers, mastics, and adhesives) with ratings not exceeding flame spread of 25 and a smoke developed of 50 in active return air plenums. Ratings in all other areas shall not exceed a flame spread of 25 and a smoke developed of 150 (test method ASTM E-84). Comply with all codes regarding the use of foam insulation.

B. Insulate piping located in interior space, including (but not necessarily limited to) the following services:

1. Interior cold and hot domestic water piping.

C. Insulate each piping system with one of the following types and thickness of insulation, except as otherwise indicated (Installer's option where more than one type is indicated).

1. *Fibrous Glass:* Minimum density 3 lb./cu.ft., thermal conductivity of not more than 0.23 at 75 degrees F mean temperature, suitable for temperatures to 450 degrees F. Kraft-reinforced, foil-vapor barrier, laminate all-service jacket, factory applied to insulation with a self-sealing pressure sensitive adhesive lap, maximum permeance of 0.02 perms and minimum beach puncture resistance of 50 units.

2. *Elastomeric Insulation:* Closed-cell type, with minimum nominal density of 5.5 lbs./cu.ft., thermal conductivity shall be not more than 0.27 at 75 degrees F mean temperature, and maximum water vapor transmission of 0.17 perm/inch. The material shall be suitable for a temperature range from 220 degrees F to minus 40 degrees F.

D. *Insulation Installation Schedule:*

Service	*Pipe Size*	*Insulation Thickness*

1.	Hot Water Piping	Less than 1"	1"
		1-1/4 thru 4"	1"
2.	Cold Water Piping	Less than 1"	½"
		1-1/4"thru 4"	1"

2.05 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" 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: 25 - 76 MBH.
2. Turn down: 5:1
3. Thermal Efficiency: 97%.
4. Storage: 80 gallon.
5. 107 GPH recovery @ 90 deg F rise.

E. Acceptable Manufacturers:

1. HTP Phoenix PH76-80 or approved equal.

2.06 OTHER MATERIALS

A. Provide other materials, not specifically described but required for a complete and proper installation, as selected by the Contractor subject to the approval of the Architect.

PART 3 - EXECUTION

3.01 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.

3.02 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 that 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.

3.03 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.

3.04 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.

3.05 PIPE JOINTS

A. Copper tubing:

1. Cut square, remove burrs, and clean inside of female filling 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. 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.

3.06 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:

Pipe size:	Maximum spacing on centers:
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:

Tube size:	Maximum spacing on centers:
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.

3.07 SLEEVES AND OPENINGS

A. Provide sleeves for each pipe passing through walls, partitions, floors, roofs, and ceilings.

1. Set pipe sleeves in place before concrete is placed.
2. For uninsulated pipe, provide sleeves two pipe sizes larger than the pipe passing through, or provide a minimum of 1/2" clearance between inside and outside of the pipe.
3. For insulated pipe, provide sleeves of adequate size to accommodate the full thickness of pipe covering, with clearance for packing and caulking.

B. Caulk the space between sleeve and pipe or pipe covering, using a noncombustible, permanently plastic, waterproof, non-staining compound which leaves a smooth finished appearance, or pack with noncombustible asbestos cotton, or fiberglass to within 1/2" of both wall faces, and provide the waterproof compound described above.

C. Finish and escutcheons:

1. Smooth up rough edges around sleeves with plaster or spackling compound.
2. Provide 1" wide chrome or nickel plated escutcheons on all pipes exposed to view where passing through walls, floors, partitions, ceilings, and similar locations.
   a. Size the escutcheons to fit pipe and covering.
   b. Hold escutcheons in place with set screw.

3.08 VALVES

A. Provide valves in water and gas systems. Locate and arrange so as to give complete regulation of apparatus, equipment, and fixtures.

B. Provide valves in at least the following locations:

1. In branches and/or headers of water piping serving a group of fixtures.
2. On both sides of apparatus and equipment.
3. For shutoff of risers and branch mains.
4. For flushing and sterilizing the system.
5. Where shown on the Drawings.

C. Locate valves for easy accessibility and maintenance.

3.09 BACKFLOW PREVENTION

A. Protect plumbing fixtures, faucets with hose connections, and other equipment having plumbing connection, against possible back siphonage.

B. Arrange for testing of backflow devices as required by the governmental agencies having jurisdiction.

3.10 DISINFECTION OF WATER SYSTEMS

A. Disinfect hot and cold water systems.

1. Perform disinfection under the Architect's observation. Notify the Architect at least 48 hours prior to start of the disinfection process.
2. Upon completion of disinfecting, secure and submit the Certificate of Performance, stating system capacity, disinfectant used, time and rate of disinfectant applied, and resultant residuals in ppm at completion.
3. Use disinfectant method approved by the Architect.

B. When disinfection operation is completed, and after final flushing, secure an analysis by a laboratory approved by the Architect, based on water samples from the system, showing test negative for coli-aerogene organisms. Provide a total plate count of less than 100 bacteria per cc, or equal to the control sample.

C. If analysis results are not satisfactory, repeat the disinfection procedures and retest until specified standards are achieved.

3.11 OTHER TESTING AND ADJUSTING

A. Provide personnel and equipment, and arrange for and pay the costs of, all required tests and inspections required by governmental agencies having jurisdiction.

B. Where test show materials or workmanship to be deficient, replace or repair as necessary, and repeat the tests until the specified standards are achieved.

C. Adjust the system to optimum standards of operation.

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 23 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 62 00	Heating Hot Water Boilers
23 63 00	Water Treatment
23 66 00	Air-Cooled Condensing Units
23 74 00	Terminal Air Distribution Units
23 74 10	Terminal Heating Units
23 76 30	Air Handling Units
23 82 00	Fans
23 83 50	Energy Recovery Units
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. Equipment structural supports, prime painted.
6. Motors for all HVAC equipment.
7. Secure and pay all fee
8. Test, adjust and balance HVAC systems.
9. 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.

B. Temperature Control specifications are provided for reference and coordination purposes only; all temperature control work will be the responsibility of the Temperature Control Sub-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 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:

	Winter	Summer
Inside:	70 degrees F	74 deg. F 50% RH
Outside:	-15 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.

1. 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 materials in compliance with a UL approved fire rated assembly. Seal annular space through fire rated walls or floors with a UL listed fire resistant sealant and materials in conjunction with the fire rated assembly.

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 necessary for HVAC equipment by the HVAC 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 to install a 4" concrete housekeeping pad a minimum of 2 inches wider than full size of the respective equipment's base. Equipment pads are required for the following equipment.

1. Air Handling Units.
2. Energy Recovery Units.

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.
2. Exposed ductwork scheduled for a paint finish shall be shop painted from a finish color selected by the Owner.

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 or 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 90 - 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 and variable volume terminals.
   b. Energy recovery units.
   c. Hydronic 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 74 00	Terminal Air Distribution Units
3.	23 76 30	Air Handling Units
4.	23 83 50	Energy Recovery Units
5.	23 89 50	Variable Frequency Drives
6.	23 90 00	Controls and Instrumentation
7.	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 six (6) certified test report 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. Refrigerant piping.
3. Make-up water.
4. 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.
4. Rated PEXa piping may provided from copper manifolds to terminal unit reheat coils.

2.2 REFRIGERATION PIPING

A. ASTM B88 seamless, Type L, ACR hard temper copper tube with flare-type fittings or wrought copper ANSI/ASTM B32 grade 96TS silver-lead solder-joint fittings. Frost proof flare nuts on suction piping.

1. Refrigerant grade tubing; cleaned, dehydrated and capped.
2. Soft temper ACR copper tube line sets may be used on units less than 5 tons.

2.3 MAKE-UP WATER

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

2.4 CONDENSATE AND DRAINAGE

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

2.5 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.

2.5 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 pipings.
2. Use unions of a pressure class equal to or higher than specified for the fittings of the respective piping service.

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 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.

3.5 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.

3.6 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.

3.7 REFRIGERATION PIPING

A. After completion of refrigerant piping system and before changing, test piping with nitrogen at 350 PSIG for two hours without pressure loss. Isolate expansion and other accessories, which may be damaged by high pressure.

1. Test joints for leaks with soap solution.
2. After testing, introduce a mixture of refrigerant and dry carbon dioxide at 250 for two-hours without pressure loss.
3. Test all joints including gauges, seals, expansion valves and devices.
4. Rap joints with rubber mallet and check for leaks with electronic leak detector.
5. Seal all leaks and retest.

B. Evacuate and dehydrate piping system with vacuum pumps of proven micronic capacity. System temperature shall be above 60 degrees F during evacuation.

1. Draw a vacuum of at least 2,500 microns on the system.

C. Charge refrigerant into system to a pressure of zero (0) PSIG.

1. Repeat evacuation to a vacuum of 2,500 microns and again charge with refrigerant to zero (0) PSIG, and repeat evacuation.
2. Hold vacuum for 24 hours.

D. Furnish first refrigerant and oil charge and make-up refrigerant required during guaranteed period.

E. Do not insulate suction piping until piping has been successfully tested.

3.8 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.

3.9 COOLING COIL CONDENSATE

A. Trap each cooling coil drain pan connection with a trap seal of sufficient depth to prevent conditioned air from moving through the piping. Extend drain piping to nearest code approved drain locations. Construct trap with plugged tees for cleanout purposes as detailed

3.10 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.

3.11 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.

3.12 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.

E.

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

3.13 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.

3.14 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 15639B.

END OF SECTION

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. Manual and automatic air vents.

E. Flow sensors.

F. Air Separators.

G. Buffer Tanks.

H. Refrigeration Specialties.

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:

Service	Scale Range	Increment
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:

	Scale Range	Decrement
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. 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 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.

2.7 FLOW SENSORS

A. Calibrated Balancing Valves:

1. 2" and smaller: 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. Tag valve plan mark number, flow and pressure drop as specified.
3. Manufacturers: B&G CB plus calibrated balance valves or approved equal.

2.8 AIR SEPARATORS

A. Approved Manufacturers: Spirovent.

1. Micro bubble eliminator.
2. Dirt separator.

B. 1-1/2" 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. 2" and Larger: Cast iron or welded steel construction, flanged and/or threaded 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.

2.9 BUFFER TANKS

A. Tanks shall be constructed per ASTM A-569 steel certification of 12 or 14-gauge welded steel and factory insulated with foam insulation to meet R-14 value with an outer shell of high density polythylene plastic. All tanks shall be factory tested for leaks at 1-1/2 times working pressure of 75 psig.

B. Buffer tank shall include four(4) piping connections - two(2) high and two(2) low with a 1/2" brass automatic air vent at the top and 3/4" drain connection at the bottom. Provide threaded thermo well for installation of aquastat immersion sensor.

C. Buffer tank shall be warrantied for 3-years from manufacturing material defects and leaks.

2.10 REFRIGERATION SPECIALTIES

A. Refrigerant Strainer: Brass shell and end connections, brazed joints, Monel screen, 100 mesh, UL listed, 350 psig working pressure.

B. Moisture-Liquid Indicators: Forged brass, single port, removable cap, polished optical glass, solder connections, UL listed 299 degrees F temperature rating, 500 psig work pressure.

C Refrigerant Filter-Driers: Corrosion-resistant steel shell, steel flange ring and spring, wrought copper fittings, ductile iron cover plate with steel cap screws, replaceable filter-drier core, 500 psig working pressure.

D. Expansion Valves:

1. Angle type or straight through design suitable for the 250 degree F temperature, 500 psig working pressure.
2. Brass body, internal or external equalizer, and adjustable superheat setting, complete with capillary tube and remote sensing bulb.
3. Size expansion valves to avoid of being undersized at full load and excessively oversized at partial load. Select valves for maximum load at design operating pressure and minimum 43 degrees F superheat.
4. Provide electronic controlled expansion valves where scheduled and recommended by the equipment manufacturer for the application.

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 tappings 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 tappings for water service with pressure snubbers and gauge valves.

3.5 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.

3.6 FLOW SENSORS

A. Install flow sensors as indicated on the drawings and/or schedules and in accordance with the manufacturer's recommendations.

3.7 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.

3.8 BUFFER TANKS

A. Install buffer tanks in the locations as shown on the plans, details and/or schedules on concrete pad.

B. Install thermostatic sensor in thermo well as scheduled.

C. Provide valved blow down connections and extend drain piping to nearest floor drain.

3.9 REFRIGERATION SPECIALTIES

A. Refrigerant Strainers: Install in refrigerant lines as indicated, and in accessible location for servicing.

B. Moisture-Liquid Indicators: Install as indicated on refrigerant liquid lines, and in accessible locations.

C. Refrigerant Filter-Dryers: Install in refrigerant lines as indicated, in accessible locations for service. Install with bypass assembly to permit isolation for servicing.

D. Expansion Valves: Locate expansion valve sensing bulb immediately after evaporator outlet mounted on the suction line properly insulated.

E. Install the expansion valve, indicator, solenoid valve and filter-drier as close to the evaporator as possible.

END OF SECTION

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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:

Pipe Size	Length	Gauge
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:

Pipe size	Maximum Rod Diameter	Load (lbs.)
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:

Pipe size	Steel	Copper
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.

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.

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.

D. Balancing Valves(non-calibrated):

1. Valves 2-1/2" and smaller: Use eccentric plug valves or ball valves with 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.

F. 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.

G. 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.

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

1. 2" and smaller: Provide check valve and balance valve in series at pump discharge.
3. Design valves to permit repacking under full line pressure.

I. 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. Trerice 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 VALVES

A. Ball 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

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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. Inline 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 INLINE CENTRIFUGAL PUMPS

A. General: Provide in-line pipe-mounted, single suction, centrifugal type pumps where indicated, and of capacities as scheduled.

B. Acceptable Manufacturers:

1. Bell and Gossett
2. Grundfos

3. Taco

C. Casing: Cast iron bronze - fitted with a working pressure of 175 PSIG and operating temperature of 225 degrees F continuous, 250 degrees F intermittent. Provide tapped and plugged openings for vent, drain, suction and discharge gauge connections.

D. Shaft: Alloy steel with integral thrust collar.

E. Bearings: Oil lubricated bronze sleeve bearings or regreasable ball bearings.

F. Seal: Mechanical single unbalanced type with Buna-N/Carbon rotating element and ceramic, Ni-resist stationary seat or other approved product.

G. Impeller: Single-suction enclosed type, hydraulically and dynamically balanced, and keyed to shaft. Bronze Construction.

H. Motor: Non-overloading at any point on pump curve, open, drip-proof, oil-lubricated journal bearings, resilient mounted construction, built-in thermal overload protection on single phase motors.

1. Motor shall be non-overloading over the entire pump curve.
2. Premium efficiency motor per IEEE Standard 112, Method B and EPACT requirements.

I. 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.

J. ECM Motor and Controller: Where scheduled, inline pump shall be equipped with an ECM motor with integral controller for constant pressure control of pump output as setup integrally on motor-mounted controller.

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.

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. 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.

D. Lubricate pump before start-up. Start-up in accordance with manufacturer's instructions.

E. Ensure that pump units are wired properly, with rotation in correct direction, and that pump and motor grounding have been provided.

F. 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.

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, form 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.

1. Upon completion of the installation and after the system is put into operation, the manufacturer, or his representative, shall make a final inspection and submit his report to the A/E in writing, certifying the correctness of installation and compliance with the specifications.

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 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.

2.5 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.

B.

	Floor Span					
	On Grade		20 feet		30 feet	
	Min. Static		Min. Static		Min. Static	
	Type	Defl	Type	Defl.	Type	Defl.
1. Suspended Fans:	--	--	FD-D	1.5"	FD-D	1.5"

Note: Air Handling Units are internally isolated and do not require external vibration isolation.

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. Spring Isolators:

1. Suspended Fans

C. Flexible Duct Connectors:

1. Duct connections with air handling equipment mounted on vibration isolators.

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.

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
Hot Water:							
Low Temp.	141-200	0.5	1.0	1.0	1.5	1.5	1.5
Cooling Systems:							
Refrigerant Suction	40-55	0.5	0.5	0.75	1.0	1.0	1.0
Cond. Drains	40-55	0.375	0.375	0.5	0.5	0.5	0.5

*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
Hot Water:		
Low Temp/HWS&R	141-200	Glass Fiber
Cooling Systems:		
Refrigerant Suction	40-55	Elastomeric
Cond. Drains	40-55	Elastomeric

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 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 DUCTWORK INSULATION SCHEDULE

A. Concealed - Supply Air Ducts:

1. Type Insulation: 1-1/2" Flexible Wrap (R5 min).

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.

C. Exhaust and Tempered 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.

D. Fresh and Tempered Fresh Air Ducts:

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

E. Transfer Air Ducts:

1. Type Insulation: 1" Acoustic Duct Liner. Refer to Section 15840B.

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 convector, 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 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. Modular hot water 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).

D. Warranty:

1. Sealed combustion boiler, condensing, hi-efficiency, (modular,) helical heat exchanger/combustion chamber design that will be self-supporting, and warranted for a period of 10 years to withstand thermal shock. Heat exchanger shall be warranted against leakage for a period of 10 years.
2. Heat exchanger/combustion chamber assembly: 3 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. Provide units with capacity and operating characteristics indicated on schedules
2. AGA Design certified input = 28-160,000 BTU/HR.
3. Heating capacity = 26-147,000 BTU/HR.
4. Conversion efficiency AFUE = 95%.
5. 5:1 turn down.

B. Manufactures: IBC, Lochinvar, Aerco and Laars.

C. Boiler ASME stamped for 160 psig and designed per ASME section IV. Furnish a relief valve in compliance with ASME section IV, and set at 30 psig. All internal combustion chamber, and internal burner components, shall be manufactured with materials suitable to withstand constant operation under condensing conditions. Combustion chamber shall have a condensate drain to discharge any condensate buildup.

D. Boiler efficiency 95%+ per ANSI Z21.13a, and operation in the condensing mode with inlet temperatures as low as 90 F.

E. Combustion air intake capable of accepting either free mechanical room air, or direct outside air through a sealed intake pipe of the length and diameter shown on drawings. Provide inlet/outlet combustion vent temperature fittings with direct outside air application

F. Category IV flue vent connection, condensing positive pressure, for both roof and sidewall venting. The vent outlet shall be compatible with PVC/CPVC plastic vent material.

G. Baked enamel finish boiler sheet metal jacket with removal panels for maintenance access.

H. Inlet and outlet temperature gauge to monitor inlet and outlet water temperatures.

I. Provide a water temperature controller with integral outdoor reset with customizable reset curves, outdoor air sensor and hot water supply header sensor. Controller shall employ electronic PID modulating control to maintain setpoint hot water header temperature. Provide auxiliary contacts for external 4-20ma or 0-10VDC BAS signal to reset of hot water supply, if selected. BACnet protocol controller with network link.

J. Provide each boiler shall be provided with a hydronic flow switch to prevent operation without proper flow.

K. Provide each boiler with dual over temperature protection, including manual reset, in accordance with ASME Section IV and CSD-1.

L. Boiler control panel shall be equipped with a LCD display and keypad to setup control parameter and provide diagnostic interface with operator.

M. Provide remote fault alarm contact for flame sensor and high temperature limit failure.

N. Provide integral primary boiler pump prewired and mounted inside the boiler enclosure. The primary pump shall be capable of serving the boiler's heat exchanger flow requirements with 30 feet equivalent external piping losses.

O. Provide single point 115 volt 1-phase wiring for controls and combustion fan.

P. Natural gas-fired burners, forced draft power type with a positive pressure at the boiler discharge. Stainless steel burner mixer. Maximum Nox emissions under 20 PPM.

1. Gas burner shall modulate down to 20% capacity(5:1 turndown).

Q. Furnish units with fuel trains and operating controls conforming to the latest UL or equivalent agency approval, and shall be factory assembled, wired, mounted, and factory fire tested.

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, tolyltriazole 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 23 66 00 - AIR-COOLED CONDENSING UNITS

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK

A. Pad-mounted condensing units.

B. Refrigerant piping and controls.

C. Refrigerant charge.

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 00	Pipe and Pipe Fittings
3.	23 06 30	Piping Specialties
4.	23 90 00	Controls and Instrumentation

1.3 QUALITY ASSURANCE

A. Regulatory Requirements:

1. Air Conditioning and Refrigeration Institute, ARI:
   a. ARI 210: Unitary Air Conditioning Equipment.
   b. ARI 270: Sound Rating.
2. Underwriter's Laboratories, UL: Conform to requirements of UL.

1.4 SUBMITTALS

A. Shop Drawings:

1. Submit with shop drawings, schematic layouts showing condensing units, cooling coils, refrigerant piping, and accessories required for complete system.
2. Submit complete pipe sizing data and piping schematic for refrigerant piping with valves and refrigerant specialties indicated.
3. Submit manufacturer's installation instructions.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Air Cooled Condensing Units:

1. AAON
2. Carrier Corp.
3. McQuay Co.
4. York

2.2 TYPE AND PERFORMANCE

A. Self-contained, packaged, factory-assembled and prewired units suitable for outdoor use consisting of cabinet, compressors, condensing coils and fans, integral sub-cooling coil, controls, liquid receiver, wind deflector, and screens.

1. Refrigerants: R-410A as scheduled.
2. Two circuits, where scheduled.

B. Minimum Operating Condition EER: 13.8.

C. Electrical Service: 208 volt, 3-phase, 60 Hertz.

2.3 MATERIALS

A. Use corrosion-resistant materials for parts in contract with refrigerant.

B. Timer circuits to prevent rapid loading and unloading of compressor.

2.4 CABINET

A. Galvanized steel (14 gauge) with anti-corrosion, baked enamel finish, and removable access doors or panels with quick fasteners.

1. 2500 hrs salt spray tested exterior paint finish.

B. PVC coated steel wire condenser coil guard.

2.5 COMPRESSORS

A. Hermetically sealed, 1750 or 3500 RPM, resiliently mounted compressor with positive lubrication, crankcase heater, motor overload protection, service valves, and filter-drier.

1. Modular scroll compressors.
2. Digital modulating capacity scroll compressors, where scheduled as lead compressor.

B. Extended compressor warranty: 5 years.

2.6 CONDENSER

A. Coil: Seamless copper tubing with aluminum fins.

B. Fans: Vertical discharge, direct-drive axial fans, resiliently mounted with guard and motor.

C. Motors: Permanently lubricated ball bearing motors with built-in current and overload protection.

2.8 CONTROLS

A. High and low pressure cut-outs for compressor, oil pressure control, anti-cycle timer 5 min. (adj.) and reset relay.

B. Accessory Controls: As scheduled on Drawings.

1. One circuit: digital scroll compressor with modulating capacity(0-5 VDC control signal).
2. Low-ambient(35 deg F) modulating condenser fan speed(ECM motor) controlled by refrigerant condensing pressure.
3. Anti-corrosion paint finish.

C. Unit Controls:

1. 115 volt 1-phase fusing and control power transformer.
2. Magnetic contactors for compressor and condenser.

3. High/low pressure cutouts.
4. Reset relay.
5. Anti-recycle compressor timer.
6. Terminal strip for Temperature Control Contractor interface and control of cooling enable/disable and steps or modulation.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Complete structural, mechanical, and electrical connections in accordance with manufacturer's installation instructions.

B. Furnish charge of refrigerant and oil.

3.2 FIELD QUALITY CONTROL

A. Start-up: Supply initial charge of refrigerant and oil for each refrigeration system.

B. Testing:

1. Charge system with refrigerant and test entire system for leaks after completion of installation.
2. Repair leaks, put system into operation, and test equipment performance.
3. Shut-down system if initial start-up and testing takes place in winter and machines are to remain inoperative.
4. Repeat start-up and testing operation at beginning of first cooling season.

C. Manufacturer's Start-up Test Report and Acceptance:

1. Submit start-up test report and acceptance letter from Manufacturer's representative indicating the air-cooled condensers are properly installed and piped for refrigerant flow.
2. Test report shall indicate operating pressures and temperatures for the suction and liquid lines under normal cooling operation.

END OF SECTION

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SECTION 23 74 00 - TERMINAL AIR DISTRIBUTION UNITS

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK

A. Extent of terminal air distribution unit equipment work is indicated by drawings and schedules, and by requirements of this section.

B. Types of terminal air distribution unit equipment required for project include the following:

1. VAV Boxes with reheat.

C. Refer to other Division 15 temperature control system sections for control work required in conjunction with air distribution equipment.

1.2 RELATED DOCUMENTS

A. Applicable provision of Division 1 governs work under this section.

B. Specified Elsewhere:

1.	23 05 90	Testing, Adjusting and Balancing
2.	23 06 30	Piping Specialties
3.	23 25 00	Mechanical Insulation
4.	23 90 00	Controls and Instrumentation

1.3 QUALITY ASSURANCE

A. IBR Compliance: Provide terminal heating units bearing the IBR Hydronics Institute Certified Rating Seal.

B. AMCA Compliance: Provide air distribution equipment bearing the Air Movement and Control Association, Inc. (AMCA) Certified Rating Seal.

C. UL Compliance: Provide air distribution equipment electrical components which have been listed and labeled by Underwriter Laboratories (UL).

1.4 SUBMITTALS

A. Submit shop drawings for all equipment including all data concerning dimensions, air flow capacities, sound ratings, unit pressure drop, finish and appropriate identification.

B. Submit certified sound data for both casing discharge and radiated sound levels from 125 thru 8000 Hz as tested in accordance with Air Diffusion Council (ADC) Test Standard 1062R4.

PART 2 - PRODUCTS

2.1 VARIABLE AIR VOLUME BOXES

A. General: Provide single-duct VAV boxes of size and arrangement as indicated on Drawings, and of capacities and having accessories as scheduled.

B. Housing: Factory assembled unit with welded 26-gauge galvanized steel casing, acoustically and thermally lined with 1" thick 3 PSF fiberglass with high-density facing. Leakage rate 2% maximum at 0.5 inch W.G. Insulation to be UL listed and meet NFPA 90A requirements.

1. Provide bottom or side access panel for air valve.

2. Provide bottom or side access panel upstream and downstream of reheat coil. Access panel shall be large enough to allow proper cleaning of reheat coil without dismantling ductwork.

C. Air Valves: Air flow control device with integral actuator. Electronic volume regulator supplied by Temperature Control Contractor, factory or field installed. Integral flow ring sensor with taps and calibration chart to measure air flow with 10% regardless of inlet connections.

D. V.A.V. Box Control: DDC/Electronic actuators, sensor wiring and application-specific controller supplied by Temperature Control Contractor, field-installed.

F. Hot Water Coil: Performance and rated capacities as indicated on schedules on Drawings.

1. Hot water coil with aluminum fins mechanically bonded to 5/8" OD seamless copper tube. Same end connections.
2. Coil leak tested at 300 PSIG air pressure, under water.
3. Provide duct extensions for access panel installation upstream of reheat coil to clean coil surface.

G. Acceptable Manufacturers:

1. Enviro-Tec
2. Trane
3. Carnes
4. Titus

PART 3 - EXECUTION

3.1 INSPECTION

A. Examine areas and conditions under which terminal air distribution units are to be installed. Do not proceed with work until unsatisfactory conditions have been corrected.

3.2 INSTALLATION OF TERMINAL AIR DISTRIBUTION EQUIPMENT

A. Install terminal air distribution equipment where indicated, in accordance with equipment manufacturers installation instructions, and with recognized industry practices to ensure that equipment complies with requirements and serves intended purposes.

1. Provided proper service clearance space for controls and damper actuators.
2. Provide duct access panels upstream and downstream of reheat coils.

B. Coordinate with other work, including ductwork, piping and control work as necessary to interface installation of terminal air distribution equipment with other work.

3.3 FIELD QUALITY CONTROL

A. Upon completion of installation of terminal unit equipment, test equipment to demonstrate compliance with requirements. Where possible, field correct malfunctioning equipment, and then retest to demonstrate compliance. Replace equipment which cannot be satisfactorily corrected.

END OF SECTION

SECTION 23 74 10 - TERMINAL HEATING UNITS

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK

A. Extent of terminal heating unit equipment work is indicated by drawings and schedules, and by requirements of this section.

B. Types of terminal heating unit equipment required for project include the following:

1. Ceiling Cassette Fan Coil Heaters.
2. Finned Tube Radiation.

C. Refer to other Division 23 temperature control system sections for control work required in conjunction with terminal heating equipment equipment.

1.2 RELATED DOCUMENTS

A. Applicable provision of Division 1 governs work under this section.

B. Specified Elsewhere:

1.	23 05 90	Testing, Adjusting and Balancing
2.	23 06 30	Piping Specialties
3.	23 90 00	Controls and Instrumentation

1.3 QUALITY ASSURANCE

A. IBR Compliance: Provide terminal heating units bearing the IBR Hydronics Institute Certified Rating Seal.

B. AMCA Compliance: Provide air distribution equipment bearing the Air Movement and Control Association, Inc. (AMCA) Certified Rating Seal.

C. UL Compliance: Provide air distribution equipment electrical components, which have been listed and labeled by Underwriter Laboratories (UL).

1.4 SUBMITTALS

A. Submit shop drawings for all equipment including all data concerning dimensions, air flow and heating capacities, sound ratings, unit pressure drop, cabinet construction, finish and appropriate identification.

PART 2 - PRODUCTS

2.1 CEILING CASSETTE FAN COIL HEATERS

A. General: Furnish hydronic ceiling cassette fan coil units and accessories as indicated and scheduled on Drawings.

B. Cabinet: galvanized steel construction with fire/smoke rated foam insulation with high-impact resistant polystyrene ceiling grille. Ceiling grille is equiped with adjustable 4-way air vanes with options for blanking off up to 2 air slots.

C. Coils: 6 row hydronic coil with aluminum fins mechanically bonded to copper tubing. Coils suitable for 300 PSIG working pressure and 275 deg. F entering water temperature.

D. Fan and Motor: Fan wheel shall be centrifugal, backward curved and double-width of aluminum or fire-retardant plastic construction. Motors shall be ECM type with integral thermal overload and sealed bearings. Detachable motor cord connector.

E. Filters: Permanent media type mounted in hinged ceiling grille.

F. Condensate Pump: Fan coil is fitted with intergral condensate pump to carry condensate away from unit.

G. Controls: Microprocessor based controls managed from a low-voltage wireless controller or wall mounted thermostat.

1. Unit controls will be programmed for BAS space sensor will start and stop unit fan for heating mode only.

2.2 WALL FIN RADIATION

A. General: Furnish wall fin radiation units and accessories as indicated, and scheduled on plans.

B. Heating Elements: Elements shall have integral fin collars which space fins. Tubes shall be mechanically expanded into fin collars to eliminate noise and insure durability and performance.

1. Elements shall be positively positioned front-to-back for silent horizontal expansion and contraction.
2. Copper tubes: 1" and 1-1/4" diameter, as scheduled.
3. Fin thickness: 0.020"
4. Maximum fin spacing: 40 or 48 per foot, as scheduled.
5. Based on IBR ratings as scheduled performance.

C. Enclosure: Enclosures shall be constructed of 14-gauge steel, as scheduled, and shall mount on continuous roll-formed access channel with invisible hinge-type fastener for tilting. Enclosure brackets shall be spaced at not more than 4-foot intervals. Front panels shall be individually removable for servicing with slide bolt fastener for alignment.

1. Refer to Drawing schedules for type of enclosure required.
2. Finish: Baked-on enamel finish over phosphatized prime coat color selection by Architect from manufacturer's standard colors.

D. Accessories: End panels, inside and outside corners, enclosure extensions, sill extensions and related as indicated on drawings.

1. All accessories shall have non-visible fasteners.

E. Acceptable Manufacturers:

1. Vulcan
2. Trane
3. Rittling

PART 3 - EXECUTION

3.1 INSPECTION

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

3.2 INSTALLATION OF TERMINAL HEATING UNITS

A. Install terminal heating units where indicated, in accordance with equipment manufacturers installation instructions, and with recognized industry practices to ensure that equipment complies with requirements and serves intended purposes.

B. Coordinate with other work, including recessed wall installations, floor-mounted construction, and control work as necessary to interface installation of terminal heating units with work of other Trades.

C. Coordinate installation of fin tube supports and enclosure for continuous wall fin radiation installation, straight and true to outside wall.

3.3 FIELD QUALITY CONTROL

A. Upon completion of installation of terminal heating unit equipment, test equipment to demonstrate compliance with requirements. Where possible, field correct malfunctioning equipment, then retest to demonstrate compliance. Replace equipment, which cannot be satisfactorily corrected.

END OF SECTION

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SECTION 23 76 30 - AIR HANDLING UNITS

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK

A. This section includes material specifications and installation requirements for air handling units, coils mounted in the units and other accessories normally furnished by the equipment supplier.

B. Types of air handling units with coils specified in this Section.

1. Horizontal Draw-Thru Units.

C. Mechanical Room Access: Air handlling unit AH-1 shall be split in sections to allow access through 36" standard door opening.

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 96 00	Starting of Mechanical Systems
3.	23 89 50	Variable Frequency Drives
4.	23 90 00	Controls and Instrumentation

1.3 SUBMITTALS

A. Submittals are required for all material in this section.

B. Submittals shall include all data concerning dimensions, capacities, materials of construction, weights, appropriate identification and fan curves.

1. Fan curves shall include a series of curves indicating the relationship of CFM and static pressure for various RPM, brake horsepower curves, and selection range (surge curves, maximum RPM, etc.).
2. Indicate operating point on the fan curves at design air quantity and at 110 percent of design air quantity.
3. For variable air volume application, indicate all operation points on the fan curves.

1.4 MANUFACTURERS

A. McQuay
B. Trane
C. Carrier
D. York

PART 2 - PRODUCTS

2.1 DESIGN CRITERIA

A. Furnish units complete with fans, motors, coils, drain pans, filter sections, face and bypass, air blending and mixing sections as shown on the plans and/or as scheduled. All materials shall meet requirements of NFPA 90A.
B. Units shall have the configuration as indicated on the plans and/or as scheduled.

C. Each fan and motor combination shall be capable of delivering plus 10% of the air quantity scheduled at the scheduled static pressure.

D. Air handling unit static pressure shall take into consideration the actual static pressure loss of the components furnished within the unit.

E. Where inlet and outlet ductwork at any fan is changed from that shown on the drawings, submit a scaled layout of the change and system effect factor calculations, indicating increased static pressure requirement as described in AMCA Publication 201. This Trade shall be responsible for any motor, drive and/or wiring changes required as a result of duct configuration changes at the fan.

2.2 CASING

A. Unit casing shall be constructed of factory-painted finish 18-gauge G90 galvanized steel throughout, with steel framework. Casings shall be furnished with removable panels to provide access to all internal parts. Units shall be constructed air tight and water tight, shall be rust inhibited and furnished prime coated or galvanized. Closed cell foam gasketing shall be employed where modules are joined.

B. Unit casings shall be double-wall solid-liner construction of 2-inch thermally broken double-wall construction with injected foam insulation for an R-value of not less than R-13. All connecting channels shall be insulated to prevent sweating.

C. Drain pan to be insulated, double-wall stainless steel construction under cooling coil sections. Provide drain connection on both sides.

D. Air handling unit and accessories shall be furnished with a nameplate which includes model number, serial number and unit tag number.

E. Casing sections with internal fan and motor isolation packages do not require piping vibration isolators, piping flexible connectors or external vibration isolation.

2.3 FANS

A. Fans shall be double width, double inlet centrifugal or single width single-inlet air foil plenum fan type, statically and dynamically balanced in unit fan section. Fans shall be securely fastened to solid or hollow steel shafts and shall be designed for continuous operation at the maximum rate static pressure.

1. Housed fan performance shall be certified as complying with ARI standard 430-89.
2. Centrifugal fans shall be dynamically balanced at factory as a complete fan assembly.
3. Fan shafts shall not exceed 75% of their first critical speed at any cataloged RPM.

B. Bearings shall be internally mounted and provided with an extended grease line and fitting to allow servicing without entering or dismantling of the unit. Bearings shall be self aligning, anti-friction pillow block bearings with a minimum life of L-50 200,000 hours.

C. Fans shall be provided with a belt guard to insure than no rotating parts are exposed. Provision shall be made so that a tachometer may be used to verify fan speed without removing the belt guard assembly.

D. Provide variable pitch V-belt drives for purposes of system balancing within 5% of specified RPM.

E. Fan and motor assembly shall be internally isolated from unit casing with spring isolators furnished and installed by unit manufacturer. Fan scroll shall be attached to the unit casing by a flexible canvas duct.

2.4 MOTORS

A. Motors shall have characteristics consistent with the torque and speed of the fans being driven. All motors shall be NEMA frames and be rated in accordance with NEMA performance standards for continuous full load performance at 40 degrees C temperature rise above ambient, with a 1.15 service factor. Motor horsepowers and voltages shall be as scheduled.

B. The motor furnished with the fan shall not operate into the motor service factor. Drive efficiency shall be considered in motor selection according to manufacturers published recommendations, or according to AMCA publication 203.

C. Furnish premium-efficiency motors per Section 23 05 00. Provide VFD compatible motors where fans are controlled by VFD drives.

2.5 WATER COILS

A. Construct coils of 1/2" or 5/8" O.D. min. copper tubes with aluminum fins suitable for working pressures to 200 PSIG.

B. Coil fins shall be the continuous or plate fin type. Maximum fin spacing 10 fins per inch.

C. Construct coil headers of cast iron with tubes expanded into the headers, steel pipe with brazed tube connections, or of heavy seamless copper with all tubes brazed to the header.

D. Casing shall have galvanized steel end supports and top and bottom channels of rigid construction with allowance for expansion and contraction of the finned tube section.

2.6 REFRIGERANT COILS

A. Construct coils of 1/2" or 5/8" O.D. min. copper tubes with aluminum fins suitable for working pressures to 200 PSIG.

1. Provide distributor quantities as scheduled for multiple DX stages.

B. Coil fins shall be the continuous or plate fin type. Maximum fin spacing 12 fins per inch.

C. Construct coil headers of cast iron with tubes expanded into the headers, steel pipe with brazed tube connections, or of heavy seamless copper with all tubes brazed to the header.

D. Casing shall have galvanized steel end supports and top and bottom channels of rigid construction with allowance for expansion and contraction of the finned tube section.

2.7 FILTERS

A. MERV 8 Filter Media: Air filters shall consist of disposable 2" thick, pleated, lofted, non-woven, cotton and synthetic media, reinforced fabric, supported and bonded to a welded wire grid, and enclosed in cardboard frame. UL Class 2. FARR 30/30 or approved equal.

1. Media nominal rating shall be 500 FPM face velocity, 0.30 inch W.G. initial resistance. Efficiency to be 25-30% dust spot test, and 90-95% weight arrestance.
2. Filter shall provide a minimum of 4.6 S.F. of media per square foot of filter face area and shall contain not less than 15 pleats per linear foot.

B. Provide extra set of prefilter media to be used during the construction period.

2.8 MIXING BOX SECTION

A. Furnish mixing box sections where indicated on Drawings. Outdoor damper shall be low-leakage type with fully gasketted continuous vinyl seals and stainless steel jamb seals rated at less than 0.2% leakage at 2" pressure differential per AMCA Standard 500.

B. Casing shall be insulated equal to air handler with access door in section.

1. Provide access door at mixing box section for mounting actuators.

2.9 BLENDER SECTION

A. Furnish blender sections where indicated on Drawings. Blender sections shall provide for air mixing and distribution of the outside and return air streams. Proper spacing provided in the direction of air flow as recommended by the blender manufacturer, approved as follows:

1. Kees.
2. Blender Products.

B. Casing shall be insulated equal to air handler unit section.

1. Provide access door at blender section for access upstream of cooling coil.

2.10 VIBRATION ISOLATION

A. All units shall be provided with internal, factory-installed internal vibration isolation for the fan section.

2.11 ACCESSORIES

A. Provide factory installed filter section air pressure drop magnahelic gauge (0-1.00 W.G.) at each filter section.

PART 3 - EXECUTION

3.1 AIR HANDLING UNIT INSTALLATION

A. Install units according to manufacturer's instructions in locations as indicated on the drawings and as detailed.

B. All units shall be installed on concrete pad, factory-mounted rail or welded steel stand, as indicated or specified.

C. Sufficient room shall be allowed for maintenance of the equipment and for removal of coils and the fan shafts.

D. Install all belts, sheaves and motors to form a complete drive package for each fan according to the manufacturer's recommendations.

E. Belt tension and alignment shall be inspected and corrected, if necessary, every week after start-up until corrections are no longer necessary.

F. Install belt gauge so that belts are completely enclosed. Provisions shall be made for measuring fan speed with a tachometer without removing entire guard.

G. Provide drains connections from coils with shutoff valve. Trap height 1/2" and total static pressure. Mount units at proper height above floor so that proper trap depth is provided.

3.2 COILS IN GENERAL

A. Install coils in factory packaged air handling units or on a structural steel frame for field erected air handling units as indicated on the drawings and/or as detailed. Pitch coils for proper drainage according to the manufacturer's installation.

B. Comb out fins when bent or crushed before enclosing coils in housing. Clean dust and debris from each coil to ensure its cleanliness.

C. Provide offsets in piping to facilitate coil removal. Unless otherwise specified, pipe coils for counterflow arrangement.

D. Provide air vent and drain valve at each coil.

END OF SECTION

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SECTION 23 82 00 - 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 INLINE FANS

A. Centrifugal inline 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. 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. Spring vibration isolation supports.
2. ECM motor with remote 0-10VDC input control.
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 26 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 23 20 00.

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 83 50 - ENERGY RECOVERY UNITS

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK

A. Extent of energy recovery ventilation equipment work is indicated by drawings and schedules, and by requirements of this section.

B. Types of energy recovery ventilation equipment required for project include the following:

1. Indoor static plate enthalpy recovery type

C. Refer to other Division 23 temperature control system sections for control work required in conjunction with energy recovery ventilator equipment.

1.2 RELATED DOCUMENTS

A. Applicable provision of Division 1 governs work under this section.

B. Specified Elsewhere:

1.	23 05 90	Testing, Adjusting and Balancing
2.	23 90 00	Controls and Instrumentation

1.3 QUALITY ASSURANCE

A. Reference Standards:

1.	NFPA 90A	Standard for Installation of Air Conditioning and Ventilating Systems
2.	CSA 22.2	
3.	UL 1812	
4.	AMCA 210	
5.	ASHRAE 84-78P	
6.	ARI 1060 standards	

B. UL Compliance: Provide air distribution equipment electrical components, which have been listed and labeled by Underwriter Laboratories (UL).

1. Manufacturer shall be able to provide evidence of independent testing of the core by Underwriters Laboratory (UL), verifying a maximum flame spread index (FSI) of 25 and a maximum smoke developed index (SDI) of 50 thereby meeting NFPA 90A and NFPA 90B requirements for materials in a compartment handling air intended for circulation through a duct system. The method of test shall be UL Standard 723.
2. Unit shall be Listed under UL 1812 Standard for Ducted Air to Air Heat Exchangers. Some exceptions to UL Listing may apply.

C. The energy recovery cores used in these products shall be third party Certified by AHRI under its Standard 1060 for Energy Recovery Ventilators. AHRI published certifications shall confirm manufacture's published performance for airflow, static pressure, temperature and total effectiveness, purge air (OACF) and exhaust air leakage (EATR). Products that are not currently AHRI Certified will not be accepted.

1.4 WARRANTY

A. The ERV core shall be warranted to be free of manufacturing defects and to retain its functional characteristics, under circumstances of normal use, for a period of ten years from the date of purchase.

B. The balance-of-unit shall be warranted to be free of manufacturing defects and to retain its functional characteristics, under circumstances of normal use, for a period of two years from the date of purchase.

1.5 SUBMITTALS

A. Refer to division 1, General Conditions, Submittals.

B. Submit shop drawings for all equipment including all data concerning dimensions, air flow capacities, sound ratings, heat recovery performance and appropriate identification.

PART 2 - PRODUCTS

2.1 AIR-TO-AIR HEAT EXCHANGERS (Static Plate Enthalpy Recovery Type)

A. MANUFACTURERS:

1. RenewAire or approved equal.

B. GENERAL: Indoor draw-though energy recovery unit consisting of a static plate enthalpy heat exchanger, ventilation air supply fan and exhaust air fan, unit electrical wiring and related control wiring

C. Unit Cabinet: Cabinet shall be single-walled constructed of 20-gauge G90 galvanized steel, insulated with minimum Rv4 foil-faced rigid insulation. The working components shall be fully accessible by a fully hinged access doors.

D. HEAT EXCHANGER CORE: Enthalpic heat exchanger core shall consist of laminar flow, fixed-media, cross-flow construction with no moving parts. Latent energy transfer shall be accomplished by direct water vapor transfer through molecular transport. Exhaust and fresh air streams shall be separated and not mix. Heat exchanger core shall not require defrost control or condensate removal.

1. The ERV core shall perform without condensing or frosting under normal operating conditions (defined as outside temperatures above -10°F and inside relative humidity below 40%). Occasional more extreme conditions shall not affect the usual function, performance or durability of the core. No condensate drains will be allowed.

E. FANS: Fans shall be DWDI forward-curved, belt or direct-driven with internal vibration isolation, if specified. Unit shall be constant volume air units operating at the specified external static pressure.

F. MOTORS: Motors shall have characteristics consistent with the torque and speed of the fans being driven. All motors shall be NEMA frames and be rated in accordance with NEMA performance standards for continuous full load performance at 40 degrees C temperature rise above ambient, with a 1.15 service factor. Motor horsepower and voltages shall be as scheduled.

1. The motor furnished with the fan shall not operate into the motor service factor.
2. Furnish NEMA EPACT premium-efficiency motors.
3. Furnish ECM controlled motors (available for EV450IN and HE1XIN models) allowing for to preset speeds or variable speed operation with a 0-10 volt DC control signal, where scheduled on the Drawings.

G. FILTERS: Furnish 2" pleated MERV 8 filters and filter track on both entering air sides of unit. Filter rack may be integral with unit or installed independently in duct upstream of unit.

H. CONTROLS: All unit controls shall be factory wired so that only field connections are required. Unit shall provide terminal connections for fan interlock with air handling unit operation and dirty filter signal.

1. IBC - Independent Blower Control: Provide dual fan contactors for independent supply and exhaust fan control for economizer operation.
2. Provide 24 volt control relay-transformer for 208-volt/3-phase service.

I. ELECTRICAL: Single point power connection.

1. Electric Service: 120-volt, 1-phase or 208-volt, 3-phase; as scheduled on the Drawings.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install units in accordance with unit manufacturer's installation requirements in locations indicated on the drawings and as detailed.

3.2 ENERGY RECOVERY VENTILATORS

A. Support or suspend the unit with proper mounting arrangement and connect with flexible duct connections.

B. Coordinate low-voltage controls with the Temperature Control Contractor.

C. Verify unit and fan controls are operating properly. Interlock unit operation with associated air handler for occupied ventilation operation.

D. Confirm fan is operating in the correct rotation. Verify filters and cores are installed properly. Arrange for filter gauges and related accessories to be installed.

E. Coordinate ERV final balance work the TAB Contractor.

END OF SECTION

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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. High-Pressure Ductwork
3. Plenums
4. Flexible Ductwork.
5. Acoustic Duct Lining.

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" 3rd edition 2005 for fabrication and installation of metal and flexible ductwork.

1. Duct Leakage Standards: HVAC Air Duct Leakage Test Manual, 2nd Edition, 2012.
2. HVAC Systems - Duct Design: 4th Edition, 2006

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 24th 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.

1.5 DELIVERY, STORAGE AND HANDLING

A. Protect Ductwork by storing inside or by durable, waterproof, above ground packaging. Do not store material on grade. Protect Ductwork from dirt, dust, construction debris and foreign material. Where end caps/packaging are provided, take precautions so caps/packaging remain in place and free from damage.

B. Offsite storage agreements do not relieve the contractor from using proper storage techniques.

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.

C. High Pressure Ductwork:

1. Static Pressure Class: +4" W.G.
2. Maximum Velocity Level: 4000 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.

C. High Pressure Ductwork:

1. Seal Class: A seal transverse joints and longitudinal seams and ductwall penetrations.

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 HIGH PRESSURE DUCTWORK

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

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

C. Transform duct sizes gradually, not exceeding 15 degrees divergence and 30 degrees convergence.

D. Fabricate continuously welded medium and high pressure round and oval duct fittings as indicated in SMACNA Standard. Joints shall be minimum 4-inch cemented slip joint, brazed or electric welded. Prime coat welded joints.

E. Round or flat oval type ducts shall be constructed with lock tight spiral seams, gored elbows with centerline radius of 1-1/2 times the duct diameter and male/female fittings.

F. Take-Offs: Conical tees, conical 45 degree laterals, conical bellmouth taps and fittings shall be used. Seal all joints airtight with gaskets and mastic sealants.

G. Fabricated rectangular ducts shall be constructed with companion angle flanged joints secured to duct walls. Use continuous closed cell gasket at joints with snap-on cleats and corner bolts. Provide 45-degree close openings at takeoffs and corners. Seal all joints air tight with gaskets and mastic sealants.

2.7 DUCTWORK APPLICATION SCHEDULE

	Air System	Classification	Material
A.	Supply air - AHU's to VAV boxes:	High Press	Steel
B.	Return air - to AHU's:	Low Press	Steel
C.	Supply air - VAV boxes to outlets:	Low Press	Steel
D.	Exhaust air:	Low Press	Steel
E.	Fresh air:	Low Press	Steel

2.8 ACOUSTIC DUCT LINING APPLICATION SCHEDULE

	Air System	Thickness
A.	Transfer Ducts - Square or rectangular:	1"
B.	Exhaust Fan RH-1 Inlet ductwork to inlets:	1"

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.

L. Flexible Ductwork:

1. Do not exceed 6 feet in length in accordance with NFPA 90.
2. Install flexible ductwork with minimum offsets and trim.
3. Connect with factory-installed compression coupling each end or provide separate adjustable bond and clamp to secure duct to trunk fitting and to distribution unit fitting.
4. Where recommended by manufacturer, make connections with mastic duct tape and adjustable clamp.

3.2 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%.

E. High pressure ductwork leakage rate shall not exceed 2%.

END OF SECTION

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 25 00	Mechanical Insulation
2.	23 84 00	Ductwork
3.	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.

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

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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. Ceiling Diffusers.
2. Return & Exhaust Registers and Grilles.
3. Door and Ceiling Transfer Grilles.

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. Metal-Aire
4. Krueger
5. 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 CEILING DIFFUSERS

A. Ceiling Diffusers: Face panel and blades shall be constructed of galvanized steel with exposed surfaces finished in off-white or as scheduled. Diffuser shall have horizontal directional blades for airflow, round or square neck with opposed blade damper. Adjustable vertical or horizontal hinged blades, where scheduled.

1. Extruded aluminum construction.

B. Diffuser is designed to mount over T-bar suspended or surface mounted in plaster ceiling systems.

2.3 RETURN AND EXHAUST GRILLES AND REGISTERS

A. Square and Rectangular: Steel or extruded aluminum construction, 40 degrees fixed deflection, surface-mounted.

1. Opposed blade damper, as scheduled.
2. Finish: White.
3. Reversible bar aluminum bar grilles, as scheduled.

B. Heavy Duty Wall Grille and Register: Heavy duty welded steel or extruded aluminum construction as scheduled, 1/8" face bars, 1/3" O.C., 30 degree fixed deflection down, extruded aluminum frame.

1. Opposed blade damper, as scheduled.

2.4 SUPPLY REGISTERS

A. Square and Rectangular: Aluminum construction, double-deflection, streamlined bars spaced 1/2" O.C., 1 1/4" margin, and gasket seals.

1. Opposed blade damper, as scheduled.

2.5 TRANSFER CEILING GRILLES

A. Steel or aluminum construction, perforated or egg crate grille design, surface or T-Bar mounted, white finish with black interior, as scheduled. Square or round neck, as scheduled.

2.6 TRANSFER DOOR GRILLES

A. Steel or aluminum construction, heavy duty bar core with inverted-V sight proof grille design, flanged frame for door mounted, finish as scheduled.

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. Diffusers:

1. At each duct drop or take-off to individual diffusers, locate extractor or scoop.
2. Support diffusers adequately for type of ceiling receiving diffusers.
3. Adjust diffuser air pattern as required to provide draft less uniform air distribution.

E. 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.

F. Louvers:

1. Coordinate required wall openings with other trades.
2. Turn over louver to General Contractor for installation.
3. Verify proper opening requirement with General Contractor.
4. Caulking and waterproofing by General Contractor.

3.2 FIELD QUALITY CONTROL

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

END OF SECTION

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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 30	Piping Specialties
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

BUILDING AUTOMATION SPECIFICATIONS

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.

1. The Building Automation Contractor(BAC) is responsible for this Section of Work.

B. Types of variable frequency drives required for this project include the following:

1. Air Handling Unit AH-1 Supply Fan SF-1(5 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 center line.

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 for VFD and bypass mode with transfer switch.
3. Input disconnect switch, not required if existing starter and disconnect reused.
4. Electrical noise filter.

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/bypass 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.

D. Special Features:

1. Two N.C. and N.O. auxiliary contacts.
2. Input disconnect switch.
3. Bypass contactor.

E. Provided devices to permit field adjustment of minimum and maximum output frequency.

F. 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.

G. 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.

H. 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 BAC 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 Building Automation Contractor(BAC).

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 units for proper operation, and instruct and train the owner's maintenance personnel in the operation and maintenance of the units. Manufacturer's representative shall demonstrate operational capability of units during instruction and training period.
2. 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

BUILDING AUTOMATION SPECIFICATIONS

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 City of Madison Honeywell SymmetrE Network.
3 Electrical Control system.
4 Control devices, components, wiring and material.
5 Instructions for users.

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 90 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.
3. Confirm final sensor requirements with Owner prior to ordering.

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 food 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 fame 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 tappings 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

BUILDING AUTOMATION SPECIFICATIONS

SECTION 23 95 00 - CONTROL SEQUENCES

PART 1 - GENERAL

1.1 DESCRIPTION

A. Section 23 90 00 - Controls and Instrumentation, applies to the work of this section.

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 OCCUPIED/UNOCCUPIED CONTROL

A. Building Automation System (BAS) controls shall schedule occupied/unoccupied schedules for HVAC equipment.

B. Provide occupied/unoccupied schedules for the following HVAC Equipment.

1. Air Handling Unit AH-1/ERV-1.

3.3 HOT WATER CIRCULATION PUMPS P-1A & 1B

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 or current 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: Integral pump static pressure controller shall modulate pump capacity through signal to ECM motor speed controls to maintain setpoint pressure differential between HWS and HWR piping. Provide BACnet connection to DDC control network.

3.4 BOILER CIRCULATION PUMPS HWP-2

A. Interlock boiler pump shall be interlocked with the respective boiler control to operate with the boiler. Pumps shall be monitored for failure, as sensed by current switches.

3.5 HOT WATER HEATING SYSTEM

A. Boiler manufacturer shall provide a microprocessor controller at each boiler and networked together to provide a tandem operating system as part of the integral boiler management system(BMS) at the master boiler control panel. The master boiler control panel shall be BACnet protocol compatible and provide a DDC control network connection.

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	Hot Water Supply Temperature
-10 degrees F	160 degrees F
60 degrees F	100 degrees F

C. Two(2) modular boilers shall be staged and modulated into operation on a first-on/first-off basis to maintain a hot water supply temperature in the hot water buffer tank and HWS header as scheduled. Lead boiler selection shall be automatically rotated for equal run time on both boilers.

D. HWS high limit alarm set at 200 degree F.

E. The BAS controls shall be provided by the Temperature Control Contractor(TCC), the BACnet protocol controller at each boiler shall be provided by the boiler equipment supplier as part of the boiler equipment package. The boiler control system shall enable and disable boilers, sequence boilers, control each boiler capacity, optimize boiler plant efficiency, monitor and control hot water supply and return temperatures. The BAS controls shall access BACnet boiler system points and monitor boiler status an through each boiler control communication interface(BACnet network).

F. Temperature Control Contractor shall be responsible for mounting all Boiler Control Panel sensors and interfacing with the boiler representative upon boiler startup and control panel setup.

3.6 AIR HANDLER UNIT AH-1

A. System consists of a draw-through single path air handling unit with variable volume supply fan, mixing box control dampers, 2-way control valve on hot water heating coil, two-stage DX cooling coil with modulating compressor capacity on one stage, fresh and exhaust air control dampers on ERV - 1. Air handler is coupled with energy recovery ventilator ERV-1 to temper minimum fresh air requirements.

B. Furnish normally open two-way modulating automatic valve for the heating coil. Provide water-based freezestat control.

C. Provide damper operators only for mixing box return/ fresh air dampers mounted in factory air handling unit.

D. Furnish filter section pressure drop monitoring and alarm signal .

E. Occupied Mode: Supply fan SF-1 and ERV-1 shall run continuously. Open fresh and exhaust dampers serving AH-1 and ERV-1. Mixed air dampers shall be indexed to minimum fresh air

position. Discharge air controller shall sequence economizer low-limit mixed air control, modulate 2-way hot water valve on the heating coil and sequence on two(2) stages of mechanical cooling with modulating(0-5 VDV) compressor capacity to maintain discharge air temperature setpoint(cooling only). Discharge air temperature setpoint shall be reset by the BAS based on the most demanding VAV damper position(call for cooling).

1. Reset range: 53 to 60 degrees F.
2. Interlock Energy Recovery Ventilator ERV-1 supply and exhaust fans to run continuous with AH-1 occupied mode.

F. Unoccupied Mode: Supply fan SF-1 and energy recovery ventilator ERV-1 will be deactivated with dampers and valves in normal positions.

1. Perimeter radiation will be the primary heating source during unoccupied mode.
2. If space temperatures drop below unoccupied setpoint with perimeter radiation; cycle air handler AH-1 with 100% return to supplement heating requirements of spaces.

G. Morning Warm-Up Mode: On morning warm-up cycle, supply fan SF-1 shall operate continuously with 100% return air. Energy Recovery Ventilator ERV-1 will remain deactivated. Hot water coil and reheat coil valves shall open 100% to supply heat to discharge air until return air temperatures reach a preset warm-up set point temperature.

1. Initial Warm-Up Set Point: 68 degrees F.

H. VAV Supply Air Fan SF-1 Capacity Control: Static pressure controller with duct-mounted pressure sensor in main supply trunk shall modulate supply air fan volume through VFD motor speed controls to maintain minimum duct static setpoint in supply duct at sensor location.

1. Initial Setpoint: 0.75" W.G.(adjustable). Provide digital electronic manometer at duct sensing location.
2. High limit supply duct static pressure control set at 3.0" W.G. shall shut down supply fan and signal alarm with manual reset.

I. Economizer Control: A low-limit mixed air dry bulb controller will sense tempered fresh air temperature and outside air temperature conditions and modulate mixing box dampers in sequence to maintain optimum mixture for discharge air setpoint conditions.

J. Building Space Pressurization Control: Static air pressure controller with one reference sensor located outside the building on the roof and one(1) space sensors in the occupied space modulate relief damper open, start and sequenced relief air fan RF-1 through ECM motor speed controls(0-10 VDV) to limit maximum space static pressure setpoint differential.

1. Initial Setpoint: positive(+) 0.05" W.G.(adjustable).

K. Building Humidity Monitoring: Humidity sensor in the return air duct shall be used for monitoring and alarm purposes only.

L. Demand Controlled Ventilation Control: A carbon dioxide sensor in the return air duct shall be used to reset minimum fresh air quantities higher upon carbon dioxide levels exceeding setpoint of 900 PPM(adjustable).

M. Freeze Control: Low-limit immersion water sensor in the heating coil leaving water stream(HWR) shall upon sensing temperature below 35 degrees: Close fresh air damper, open heating coil valve 100%, shut down supply fan and energy recovery ventilator ERV-1 and move mixed air dampers to 100% return air. Signal local and BAS alarm with manual local reset and remote BAS reset.

N. Smoke Detector: Smoke detector in the return air ductwork shall shut down supply fan and energy recovery ventilator ERV-1 supply fan, close fresh air damper and return mixing box dampers to 100%

tempered fresh air position upon detection of products of combustion. Duct-mounted smoke detector shall be provided by the Electrical Trade; associated wiring to the temperature control panel and interlocks shall be provided by this Contractor. Signal local and BAS alarm with manual local reset.

3.7 ENERGY RECOVERY VENTILATOR ERV-1

A. Interlock energy recovery ventilator supply and exhaust fans to operate continuously in the occupied mode with air handler AH-1.

1. Furnish filter/core pressure drop monitoring and alarm signals on tempered fresh air and tempered exhaust air steams.
2. Interlock tempered fresh air and tempered exhaust air dampers with ERV operation.

3.8 VAV TERMINAL UNITS WITH REHEAT

A. The VAV terminal units shall be individually controlled by a DDC VAV controller per VAV terminal unit. VAV box manufacturer shall provide flow ring with VAV box. The DDC controller, damper motor, and differential pressure transducer shall be supplied by the BAS Contractor and furnished to the terminal unit supplier for factory installation.

B. The room sensor working through the pressure independent DDC controller shall modulate the box damper from minimum damper position and reheat coil valve to maintain discharge air setpoint at 70 deg F heating and 75 deg F cooling. Discharge air shall be reset by the space stat to satisfy the space conditions.

1. Reset range 55 deg F - 100 deg F.
2. Sequence perimeter radiation valves at VAV zones as first priority in heating mode with reheat coil valves secondary.
3. Provide maximum air damper positions for cooling and heating as scheduled on VAV Terminal Unit schedules.

C. Unoccupied: The reheat coil valve shall move to its 100% open position.

D. Morning Warm-Up: The box damper and reheat coil valve shall remain in 100% open position.

3.9 FAN COIL HEATERS

A. Upon a call for heating from space sensor, fan shall cycle to satisfy space temperature set point.

3.10 WALL FIN RADIATION

A. Upon a call for heating from space sensor, 2-way valve on HWS shall open to satisfy space temperature set point.

END OF SECTION

BUILDING AUTOMATION SPECIFICATIONS

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 Sequences

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 sheets 23 95 10 - 2 and 3.

END OF SECTION

DDC POINT LIST

POINT DESCRIPTION	TYPE	OPERATION SCHEDULE	ALARM	HISTORY	FIELD DEVICE
AIR HANDLING UNIT AH-1 & RELIEF EXHAUST FAN RF-1					
SF-1 FAN(AH-1)	DIGITAL OUTPUT	START/STOP	--	RUNTIME	RELAY @ VFD
SF-1 FAN(AH-1)	DIGITAL INPUT	STATUS	FLOW FAIL	--	CURRENT SENSOR
SF-1 VFD	ANALOG OUTPUT	FAN SPEED	--	15 MIN.	0-10 VDC SIGNAL
AH-1 MA	ANALOG INPUT	TEMP.	H/L TEMP.	15 MIN.	SENSOR-AHU
AH-1 FA	ANALOG INPUT	TEMP.	H/L TEMP.	15 MIN.	SENSOR-DUCT
AH-1 RA	ANALOG INPUT	TEMP.	H/L TEMP.	15 MIN.	SENSOR-DUCT
AH-1 CC TEMP	ANALOG INPUT	TEMP.	H/L TEMP.	15 MIN.	SENSOR-AHU CLG COIL
AH-1 DA	ANALOG INPUT	TEMP.	H/L TEMP.	15 MIN.	SENSOR-DUCT
AH-1 RA CO_2 SENSOR	ANALOG INPUT	CO_2 PPM	H/L	15 MIN	CO_2 SENSOR IN RA DUCT
AH-1 SD	DIGITAL INPUT	STATUS	SMOKE	15 MIN.	AUX. CONTACT @ SD
CU-1	ANALOG OUTPUT	CAPACITY	--	15 MIN.	0-5 VDC SIGNAL MOD COMP
CU-1	DIGITAL OUTPUT	ENABLE/DISABLE	--	15 MIN.	CU CONDENSER RELAY
AH-1 FILTER APD	ANALOG INPUT	PRESS	H PRESS.	15 MIN.	DIFF. PRESS. SW.
AH-1 MA DPRS	ANALOG OUTPUT	MODULATE	--	15 MIN.	DAMPER ACTUATOR
AH-1 FA DPRS	BINARY OUTPUT	OPEN/CLOSE	--	15 MIN.	DAMPER ACTUATOR
HC-1 VALVE	ANALOG OUTPUT	MODULATE	--	15 MIN.	2-WAY VALVE ACTUATOR
SA DUCT PRESS.	ANALOG INPUT	PRESS.	H/L PRESS.	15 MIN.	DUCT PRESS. SENSOR
SA HL DUCT PRESS.	DIGITAL INPUT	PRESS.	HIGH PRESS.		HIGH LIMIT DUCT PRESS.
SPACE SP PRESS. DIFF	ANALOG INPUT	PRESS	H/L PRESS	15 MIN.	SPACE STATIC DIFF PRESS.
RF-1 EF	DIGITAL INPUT	STATUS	FLOW FAIL	--	CURRENT SENSOR
RF-1 ECM	ANALOG OUTPUT	FAN SPEED	--	15 MIN.	0-10 VDC SIGNAL
RF-1 EA DPR	ANALOG OUTPUT	MODULATE	--	15 MIN.	DAMPER ACTUATOR
ENERGY RECOVERY VENTILATOR ERV-1					
ERV-1 SF	DIGITAL OUTPUT	START/STOP	--	30 MIN	AUX. CONTACT @ ERV
ERV-2 SF	DIGITAL INPUT	STATUS	FLOW FAIL	--	CURRENT SENSOR
ERV-1 EF	DIGITAL OUTPUT	START/STOP	--	30 MIN	AUX. CONTACT @ ERV
ERV-1 EF	DIGITAL INPUT	STATUS	FLOW FAIL	--	CURRENT SENSOR
ERV-1 EA	ANALOG INPUT	TEMP.	H/L TEMP.	30 MIN.	SENSOR-DUCT
ERV-1 TFA	ANALOG INPUT	TEMP.	H/L TEMP.	30 MIN.	SENSOR-DUCT
ERV-1 TEA	ANALOG INPUT	TEMP.	H/L TEMP.	30 MIN.	SENSOR-DUCT
ERV-1 TEA DPR	DIGITAL OUTPUT	OPEN/CLOSE	--	30 MIN.	DAMPER ACTUATOR
ERV-1 FA DPR	DIGITAL OUTPUT	OPEN/CLOSE	--	30 MIN.	DAMPER ACTUATOR
ERV-1 FA FILTER APD	DIGITAL INPUT	PRESS	H PRESS.	30 MIN.	DIFF. PRESS. SW.
ERV-1 EA FILTER APD	DIGITAL INPUT	PRESS	H PRESS.	30 MIN.	DIFF. PRESS. SW.

DDC POINT LIST

POINT DESCRIPTION	TYPE	OPERATION SCHEDULE	ALARM	HISTORY	FIELD DEVICE
VAV TERMINAL UNITS					
VAV BOX (TYPICAL EA.)	ANALOG INPUT	TEMP.	H/L TEMP	15 MIN.	SPACE SENSOR
VAV BOX (TYPICAL EA.)	ANALOG OUTPUT	MODULATE	--	15 MIN.	AIR VALVE ACTUATOR
VAV BOX (TYPICAL EA.)	ANALOG OUTPUT	MODULATE	--	15 MIN	REHEAT HW VALVE ACTUATOR
VAV BOX (TYPICAL EA.)	ANALOG INPUT	AIR FLOW	H/L TEMP	15 MIN.	CFM OF VAV BOX
VAV BOX (TYPICAL EA.)	ANALOG INPUT	TEMP.	H/L TEMP	15 MIN.	ENTERING SA
VAV BOX (TYPICAL EA.)	ANALOG INPUT	TEMP.	H/L TEMP	15 MIN.	LEAVING SA
HEATING UNITS					
SPACE SENSOR	ANALOG INPUT	TEMP.	H/L TEMP	15 MIN.	SPACE SENSOR
WALL FIN RADIATION	DIGITAL OUTPUT	OPEN/CLOSE	--	15 MIN	2-WAY CONTROL VALVE
FAN COIL HEATER	DIGITAL OUTPUT	START/STOP	--	15 MIN	RELAY TYP(3)
FAN COIL HEATER	ANALOG INPUT	INTERFACE	--	--	BACnet INTERFACE TYP(3)
BOILER HEATING PLANT					
PUMP P-1A	BINARY OUTPUT	START/STOP	--	RUNTIME	RELAY
PUMP P-1A	ANALOG INPUT	INTERFACE	--	--	BACnet INTERFACE
PUMP P-1B	BINARY OUTPUT	START/STOP	--	RUNTIME	RELAY
PUMP P-1B	ANALOG INPUT	INTERFACE	--	--	BACnet INTERFACE
HWS TEMP	ANALOG INPUT	TEMP.	H/L TEMP.	15 MIN.	IMMERSION SENSOR - PIPE
BUFFER TANK HWS TEMP	ANALOG INPUT	TEMP.	H/L TEMP.	15 MIN.	IMMERSION SENSOR - TANK
HWR TEMP	ANALOG INPUT	TEMP.	H/L TEMP.	15 MIN.	IMMERSION SENSOR - PIPE
BOILER B-1	BINARY INPUT	ENABLE/DISABLE	--	RUNTIME	RELAY
BOILER B-1	ANALOG INPUT	INTERFACE	--	--	BACnet INTERFACE
BOILER B-2	BINARY INPUT	ENABLE/DISABLE	--	RUNTIME	RELAY
BOILER B-2	ANALOG INPUT	INTERFACE	--	--	BACnet INTERFACE
HWS TEMP	ANALOG OUTPUT	TEMP.	--	--	HW RESET SIGNAL 0-10 VDC
BOILER PUMP P-2	BINARY INPUT	STATUS	FLOW FAIL	--	CURRENT SWITCH TYP(2)

END OF SECTION

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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 17 00 Motor and Circuit Disconnects
26 18 50 Equipment Connections
26 19 00 Supporting Devices
26 45 00 Grounding and Bonding
26 51 00 Interior Building Lighting

C. Work Included in Division 26:

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 electrical equipment, light fixtures, raceways and conductors.
   b. Remove and replace HVAC motors.
   c. Provide new lighting, electrical devices and distribution.

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

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 beat 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. Light Fixtures.
5. Lighting Controls.

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. The Electrical Contractor shall work with WPS(Electrical Utility) to coordinate the disconnection of the all electrical services to the building. It is the responsibility of the demolition contractor for demolition of any interior electrical equipment. The Electrical Contractor shall verify for demolition contractor that all electrical equipment is de-energized prior to demolition.

B. Prior to demolition or alteration of structures, the following shall be accomplished:

1. Owner release of such structure.
2. Disconnection of electrical power to equipment and circuits removed or affected by demolition work.
3. Electrical services rerouted or shut off outside area of demolition.
4. Coordinate sequencing with Owner and other Contractors.
5. 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. Remove all and any unused materials not complying or reused with new electrical plan.

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 serving remodeled as required to install new equipment with proper notice to General Contractor and Owner prior to starting shutdown.

1. Refer to Division 1 for further requirements regarding continuation of existing services.

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 LIGHTING FIXTURE BALLAST DISPOSAL

A. The contractor shall inspect all ballasts in all light fixtures removed as part of this project and take the actions described below.

B. All ballasts labeled as "NON PCB'S" or "NO PCB'S" shall be handled as described in other sections of these specifications which describe demolition or salvage materials handling. If the PCB content is not stated on the ballast label, the ballast shall be handled as a PCB ballast.

C. All PCB ballasts shall have the wires clipped off and the ballasts placed in US DOT approved type 17C or type 17H barrels and placed in storage in a location within the building as designated by the Owner. The Contractor shall provide to the Owner, in typewritten form, a total count of these ballasts and where they are stored.

D. These ballasts are not to be removed from the work site by the Contractor.

E. The Contractor shall label and mark the PCB storage barrels with EPA approved PCB labels and shall mark the storage area with signs, marks, and lines to meet the regulations of Wisconsin Code NR 157.

F. The Contractor shall provide approved PCB absorbent materials to be stored immediately adjacent to the barrel storage area. Do not place loose absorbent material in the barrels.

G. When the ballast demolition is completed and all PCB ballasts are placed in barrels ready to be
picked up for disposal, the Contractor shall notify the Owner in writing so the Owner can make arrangements for pick up and disposal of the PCB ballasts.

3.4 LIGHTING FIXTURE LAMP DISPOSAL

A. The Contractor shall be responsible for the proper removal and recycling of all existing fixture lamps being removed from service in accordance with EPA and State of Wisconsin DNR requirements. Lamps shall not be disposed of in any way except as described herein.

B. The Contractor shall be responsible for arranging for recycling of lamps by a licensed waste lamp and bulb recycler. The cost for recycling of removed lamps shall be included in the Contractor's bid.

C. The Contractor shall carefully package removed lamps to prevent breakage. The Contractor shall store waste lamps in a secure area, either in the container that the lamps are shipped in or in other ways so as to eliminate breakage. Both the lamp storage area and individual containers should be labeled as hazardous waste. Store lamps in covered containers to prevent lamps from being broken as a result of other debris being placed on top of them.

3.5 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.

3.6 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

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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 ferroalloy, 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, gasketted 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 iscuss location of outlets with workmen installing other piping and equipment and to fit all lectrical outlets to job conditions.

1. ase 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 standed 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.

E. *Armored Cable (AC) or Metal-Clad Cable (MC):*

1. Limit AC and MC usage to concealed only locations, branch-circuit wiring after the first junction box from the panelboards; where approved by NEC, state and local electrical inspecting authorities.
2. Not allowed for Panelboard feeders or service conduit.
3. Provide and install per NEC Articles 333 and 334 with grounding conductor.

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 hereinfore 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. Receptacle Cover Plate: Specification Grade 302/304 smooth stainless steel or nylon construction.

1. Plate color to be selected by Architect.

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, "Hand-Off Automatic" selector and 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.

C. Manual starter shall have melting allow 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

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SECTION 26 17 00 - MOTOR AND CIRCUIT DISCONNECTS

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK

A. Provide fused and unfused disconnect switches for distribution and branch circuits and motors as shown on plans and as required by code.

B. Provide all fuses, circuit breakers, and motor overload elements as described in the specifications and drawings or required by code to protect all equipment.

1.2 RELATED DOCUMENTS

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

B. Specified Elsewhere:

1.	26 05 00	Basic Materials and Methods
	a.	Identification.
	b.	Spare fuses.
2.	26 15 10	Motors and Motor Wiring
3.	26 18 50	Equipment Connections

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 motor and circuit disconnect switches.
2. National Electrical Manufacturers Association, NEMA: Classification of Standard Type of Non-Ventilating Enclosures for Electrical Controllers.
3. Underwriters Laboratories, UL: Motor and circuit disconnect switches listed and labeled by UL.

1.4 SUBMITTALS

A. Submit in accordance with Division 1 and Section 26 0500.

B. Submit manufacturers data circuit disconnect switches.

1.5 DELIVERY, STORAGE AND HANDLING

A. Deliver switches individually wrapped in factory-fabricated fiberboard type containers.

B. Store switches in clean, dry space.

C. Protect switches from dirt, fumes, water and physical damage.

D. Handle switches carefully to avoid damage to material components, enclosure and finish.

E. Do not install damaged switches. Remove from project site.

PART 2 - PRODUCTS

2.1 SAFETY SWITCHES

A. Heavy-duty type or as scheduled:

1. Sheet steel enclosed safety switches, size and electrical characteristics indicated, rated at 250 or 600 volts.
2. Quick-make, quick-break constructed so switch blades are visible in "OFF" position with door open.
3. Operating handle as integral part of enclosure base, easily recognizable position, padlockable in "OFF" position.
4. Current carrying parts constructed of high-conductivity copper and silver-tungsten type switch contact.
5. Positive pressure type reinforced fuse clips.
6. Neutral bars shall be provided in all disconnects serving distribution circuits carrying a neutral.
7. Fuses shall be dual element type. Size per NEC code and equipment manufacturer's requirements.
8. Enclosures:
   a. NEMA Type 1.
   b. NEMA Type 3R.

B. Motor and Circuit Disconnects:

1. General Electric.
2. Square D Company.
3. Cutler-Hammer.

2.2 FUSES

A. All fuses shall be of one manufacturer and shall, where possible, be coordinated per manufacturer's instructions for short circuit currents so that the fuse or circuit breaker closest to the short circuit will trip and clean the fault first.

B. Low voltage fuses shall be Buss KRP-C, JJN, FRN or equal as required. FRN fuses shall only be used for motor loads. No single element fuses will be permitted.

PART 3 - EXECUTION

3.1 DISCONNECT SWITCHES

A. Install disconnect switches as shown on plans and Motor Equipment schedule.

B. Install fuses in all fused disconnects.

C. The Electrical Contractor shall be responsible for maintaining working clearance around all electrical equipment as required by 2008 NEC.

3.2 FUSES

A. Furnish and install all fuses for project.

B. Turn over to Owner 3 spare fuses of each rating 100 amperes and over, 1 box of fuses for each rating less than 100 amperes.

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 ¼" 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 ¾" 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 26 51 00 - INTERIOR BUILDING LIGHTING

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK

A. Provide and install lighting fixtures, supports and accessories for mounting condition encountered.

B. Lamps.

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. Certified Ballasts Manufacturers Association, CBM: Ballast labeled by CBM.
2. National Electrical Code, NEC: Comply with NEC/NFPA No. 70, as applicable to installation and construction of interior lighting fixtures.
3. Life Safety Code: Comply with NFPA 101 as applicable to exit signs.
4. Underwriter's Laboratories, UL:
   a. Interior lighting fixtures listed and labeled by UL.
   b. UL 57: Electric lighting fixtures.

B. Lamps General:

1. All lamps shall be new.
2. Approved Manufacturers:
   a. Fluorescent: Philips, Osram/Sylvania, General Electric
   b. Ballast and lamp combinations shall meet Focus On Energy Guidelines.
3. Lamps shall be U.S. Green Building Council (USGBC) Leed certified.

1.4 REFERENCES

A. Standards:

1. American National Standards Institute, ANSI: Comply with applicable ANSI standards pertaining to lamp materials and lighting ballasts.

B. Manufacturers:

1. National Electrical Manufacturer's Association, NEMA: Comply with applicable portions of NEMA standards pertaining to lighting equipment.

1.5 SUBMITTALS

A. Submit in accordance with Division 1 and Section 16050.

1. Shop Drawings: Submit shop drawings for luminaires indicating pertinent physical characteristics and photometric data.

1.6 DELIVERY, STORAGE AND HANDLING

A. Acceptance: Deliver interior lighting fixtures individually wrapped in factory fabricated fiberboard type containers.

B. Storage:

1. Store interior lighting fixtures in clean, dry space.
2. Store in original cartons and protect from dirt, physical damage, weather and construction traffic.

C. Handling:

1. Handle interior lighting fixtures carefully to prevent breakage, denting and scoring fixture finish.
2. Do not install damaged lighting fixtures.
3. Replace and return damaged units to equipment manufacturer.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Refer to fixture schedule. Engineer has final decision on whether submitted fixture is equal.

B. Other fixture manufacturers who consider their products equal to those specified are required to request approval for bidding as base bid in accord with Instructions to Bidders section.

C. Approval of products will be considered subject to the following:

1. Equal manufacturers are required to nominally meet specifications of specified fixtures and lenses in regard to ceiling opening size and shape, housing, and trim/door appearance and construction, general overall appearance, efficiency, thickness, brightness control and lamp hiding characteristics.
2. Provide equivalent performance to specified fixtures considering application in the environment and intended usage by the Owner.
3. Manufacturers shall submit complete fixture and lens data for evaluation and shall be prepared to submit sample fixtures and/or lenses. Samples shall be submitted only at the request of the Engineer.

2.2 GENERAL

A. Subject to compliance with requirements, fixtures that may be incorporated into the work include the products specified in the Lighting Fixture Schedule on the drawings, and the equals listed in the accompanying notes.

B. The basic catalog number only is indicated in the Lighting Fixture Schedule. The EC shall furnish complete lighting fixtures in quantities, and/or row lengths as shown on the plans, including plaster frames, ends, or caps, couplings, connectors, suspension assemblies, mounting brackets and all auxiliary accessories as required.

C. Refer to Schedule for description of fixture nomenclature and associated ceiling type and suspension system.

2.3 LUMINAIRES

A. Housings:

1. Shall be free from burrs, sharp corners and edges.

2. Shall be steel, unless noted otherwise, formed and supported to prevent warping and sagging.
3. Provide spring loaded latches for all troffers.
4. Provide UL approved earthquake clips for all troffers.
5. Provide locking sockets for fluorescent lamps.

B. Mounting Accessories:

1. Recessed fixtures:
   a. Provide trim type and accessories required for installation in ceiling types specified and/or shown on the reflected ceiling plan.
   b. Fixtures mounted in sloped ceilings shall be provided with sloped ceiling adapters and appropriate trim rings and other accessories as required.
2. Surface-mounted fixtures:
   a. Provide ceiling spacers as required for fixtures not labeled as suitable for direct mounting to a low density ceiling.
3. Suspended fixtures:
   a. Provide swivel canopy to accommodate any sloped ceilings shown on the plans.
   b. Provide pendant or cable length required to suspend luminaires at indicated height.
   c. Swivel hangers in mechanical equipment areas shall be shock- absorbing type.

C. Finishes:

1. Painted finishes:
   a. Shall be polyester powder painted enamel finish.
2. Polished, brushed, other metal finishes:
   a. Shall be finished with clear coat to inhibit finish deterioration and corrosion.
3. All finish types and colors shall be verified with the architect prior to ordering.

D. Louvers, Reflectors, Lenses:

1. All louvers and reflectors shall be semi-specular, low iridescent, clear alzak, unless noted otherwise.
2. Provide reflector channels to separate all lamp sections.
3. All acrylic lenses shall be pattern 12 prismatic, overall 0.125" minimum thickness.

2.4 FLUORESCENT BALLASTS

A. All fluorescent ballasts shall be electronic type, unless noted otherwise, and shall meet the following specs:

1. UL Listed (Class P) sound rating A and CSA certified.
2. Comply with EMI and RFI limits set by the FCC (CFR 47 part 18) or NEMA and not interfere with normal electrical equipment.
3. Meet any applicable standards set forth by ANSI.
4. Be potted or conformal coated in a metallic case and not contain PCBs.
5. Provide normal rated lamp life as stated by lamp manufacturers (i.e. rated life at 3 hour burn time per start).

B. All compact fluorescent ballasts shall be electronic type, unless noted otherwise, and shall meet the following specs, in addition to those listed above:

C. Nominal power factor of .95 or higher.

D. Operate in rapid start mode and have less than a 1.5 Lamp Current Crest Factor as defined by ANSI in paragraph 3.3.3 of the March 18, 1992, draft of ANSI C82.11-199X. "Specification for High-Frequency Fluorescent Lamp Ballasts."

E. Total harmonic distortion of less than 10% at 120 or 277 volts.

F. Ballast factor 0.88 or better or as indicated on drawings. For dimming or step dimming ballast factor shall be 0.88 or better, or as indicated on drawings.

G. Frequency of operation shall be 20 khz - 50 khz and units shall operate without visible flicker.

H. Units shall operate at an input voltage of 108 volts to 132 volts (nominal 120 volts) or 249 volts to 305 volts (nominal 277 volts) at an input frequency of 60 hz. Light output shall remain constant for line voltage fluctuation of +/- 5%.

I. Operating temperature shall not exceed 65 degrees C at any point on the case at a 40 degree C ambient.

J. Ballasts shall carry a minimum 3 year warranty fully covering replacement parts and labor for the life of the warranty.

K. Ballasts shall be marked with manufacturer's name, part number, supply voltage, power factor, open circuit voltage, current draw for each lamp type and UL Listing.

L. Ballasts shall withstand line transients as defined in IEEE 587, Category A. Fluorescent Ballasts-Other than electronic type.

1. Fluorescent ballasts shall be high power factor type. CBM and ETL Certified. Best energy saving type where available. Best sound rating available.

N. Ballasts meeting the requirements of this specification shall be manufactured by the following companies, and are acceptable: GE, Advance, Universal, Osram Sylvania, or as listed by Focus On Energy.

O. Cold weather ballast shall be rated for -20°F.

P. Exit Lights:

1. 6-inch high green or red letters with 3/4-inch stroke directional arrows indicated. Mount as indicated or scheduled.
2. Modify mounting type to meet job conditions.
3. Include LED lamps with voltage rating to match system voltage.
4. Provide emergency battery pack when scheduled on Drawings.

2.5 LAMPS

A. Fluorescent:

1. Color Temperature: 3,500K unless noted otherwise.
2. Minimum Color Rendering Index (CRI): 90 unless noted otherwise.
3. Non-compact Lamps:
   a. Lamp Life: Minimum 24,000 hours average based on 3 hours per start when used on program rapid start circuits.
   b. Lamps shall be 32 watt, T8, minimum 3,100 lumens initial, program rapid start, unless noted otherwise.
   c. Lamps shall be 28 watt, T5, minimum 2,800 lumens initial, programmed start, unless noted otherwise.
   c. All lamps shall meet EPA TCLP standards for disposal as non- hazardous waste.
4. Compact Fluorescent:
   a. Lamp Life: Minimum 10,000 hours average based on 3 hours per start when used on rapid start circuits.
   b. Lamps shall be 4-pin type, unless noted otherwise.

2.6 LED LIGHTING

A. The manufacturer of the LED lighting fixture shall utilize high-brightness LEDs and high-efficiency electronic LED drivers, dimmed or no dimmed as required.

B. The LED fixture shall be thermally designed as to not exceed the maximum junction temperature of the LED for the ambient temperature of the location the fixture is to be installed.

C. Light output of the LED system shall be the absolute photometry following IESNA LM-79 and IESNA LM-80 requirements and guidelines.

D. Minimum power factor of 0.90.

E. LED lighting fixture shall be mercury-free, lead-free and RoHS compliant.

F. The LED lighting fixture shall maintain 70% lumen output for a minimum of 50,000 hours.

G. All components of the LED lighting fixture shall be replaceable.

H. The LED lighting fixture shall carry a limited 3-year warranty minimum.

PART 3 - EXECUTION

3.1 INSTALLATION

A. General:

1. It shall be the Contractor's responsibility to determine mounting requirements and verify ceiling types and to coordinate locations of lighting with other contractors to assure that installation will not interfere with other equipment.
2. Anchor surface mounted fixtures on walls or ceilings in a manner to prevent rotation and light leakage. Do not use plastic, composition or wood type anchors.
3. Provide pendant mounted fixtures with self aligning stem hangers and rigid steel conduit stems, cut and threaded to fit required length. One stem must serve as wireway.
4. Mount suspended fixtures at heights indicated on the drawings. If height is not indicated, mount as high as possible, but not above lowest point of mechanical equipment.
5. Support all suspended fixtures from structural building components. Unless directed otherwise, do not suspend from other suspended equipment.
6. Support system capable of supporting 300% fixture and lamp weight.

B. Recessed Luminaires:

1. Install recessed luminaire to permit removal from below for access to outlet or prewired fixture box.
2. Connect recessed luminaire to boxes with flexible conduit and fixture wire.
3. Suspended ceiling with exposed tee bar grid system. Support from ceiling tee bar grid structure and with bolts, screws, rivets or approved ceiling framing member clips.

C. Fluorescent Lay-In:

1. Install with plastic protection over louver.
2. Remove plastic protection after final clean up.
3. Fixtures used for temporary lighting shall have louver removed and safely stored.
4. Any contact with louver shall be made utilizing clean gloves to prevent fingerprints on specular finish.

3.2 LAMP INSTALLATION

A. Install lamps in accordance with manufacturer's instructions.

B. All lamps shall be delivered to job in sealed cartons and protected from dust and dirt during storage.

C. Lamps shall be taken directly from the cartons and installed in the fixture with special care so they do not become dusty or soiled. Any fingerprints on the lamps shall be wiped off before the lamps are energized.

D. Install specified lamps in each luminaire, emergency lighting unit and exit sign.

E. Relamp luminaires which have failed at completion of Work.

F. Lamps shall be furnished and installed by the contractor for all fixtures installed, moved, or otherwise reworked on this project, whether or not this contractor installs, moves, or otherwise reworks the fixture.

3.3 FIELD QUALITY CONTROL

A. At time of substantial completion, replace lamps in fixtures, which are observed to be noticeably dimmed after Contractor's use and testing as judged by Architect-Engineer.

B. Prior to final acceptance replace all cracked or broken lenses, dented, scratched or otherwise damaged fixtures at no cost to the Owner.

3.4 ADJUST AND CLEAN

A. Align luminaires and clean diffusers prior to final acceptance.

B. Provide lamps, as scheduled, for each luminaire.

3.5 SCHEDULES

A. Lighting Fixture Schedule on Drawings.

END OF SECTION

SECTION E: BIDDERS ACKNOWLEDGEMENT

YAHARA HILLS FACILITY IMPROVEMENTS - HVAC UPGRADE
CONTRACT NO. 7458

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.

1. 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. _____ through _____ 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)
2. 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.
3. 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.
4. 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).*
5. I hereby certify that all statements herein are made on behalf of Joe Daniels Construction Co., Inc. (name of corporation, partnership, or person submitting bid) a corporation organized and existing under the laws of the State of Wisconsin a partnership consisting of _____; an individual trading as _____; of the City of Madison State of Wisconsin; 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 Joseph A. Daniels

Joseph A. Daniels

President
TITLE, IF ANY

Sworn and subscribed to before me this
24th day of April, 2015.

Keea L. Sainsbury
(Notary Public or other officer authorized to administer oaths)
My Commission Expires 07/17/2016

Bidders shall not add any conditions or qualifying statements to this Proposal.

KEEA L. SAINSBURY NOTARY PUBLIC STATE OF WISCONSIN

Contract 7458 – Joe Daniels Construction Co., Inc.

Section F: Disclosure of Ownership and BVC

This section is a required document for the bid to be considered complete. There are two methods for completing the Disclosure of Ownership and BVC form. Method one: The form can be filled out online and submitted to this site to be included with your electronic bid. Method two: The form can be downloaded from the site and submitted by hand to the City of Madison.

Method of Submittal for Disclosure of Ownership and BVC (click in box below to choose) *

I will submit Bid Express fillable online form (Disclosure of Ownership and BVC).

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), Wisconsin Statutes. The use of this form is mandatory. The penalty for failing to complete this form is prescribed in Section 103.005(12). 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 Statues.

(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 PO Box
City
State and Zip Code

Best Value Contracting
1. The Contractor shall indicate the non-apprenticeable trades used on this contract.
Trucking

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 and FROST)
- ☐ IRON WORKER
- ☐ IRON WORKER (ASSEMBLER, METAL BLDGS)
- ☐ PAINTER and DECORATOR
- ☐ PLASTERER
- ☐ PLUMBER
- ☐ RESIDENTIAL ELECTRICIAN
- ☐ ROOFER and WATER PROOFER
- ☐ SHEET METAL WORKER
- ☐ SPRINKLER FITTER
- ☐ STEAMFITTER
- ☐ STEAMFITTER (REFRIGERATION)
- ☐ STEAMFITTER (SERVICE)
- ☐ TAPER and FINISHER
- ☐ TELECOMMUNICATIONS (VOICE, DATA and VIDEO) INSTALLER-TECHNICIAN
- ☐ TILE SETTER

YAHARA HILLS FACILITY IMPROVEMENTS - HVAC UPGRADE
CONTRACT NO. 7458

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: Joe Daniels Construction Co., Inc.

Address: 919 Applegate Road, Madison, WI 53713

Telephone Number: 608/271-4800 Fax Number: 608/271-4570

Contact Person/Title: Joseph A. Daniels - President

Prime Bidder Certification

I, Joseph A. Daniels (Name), President (Title) of

Joe Daniels Construction Co., Inc. (Company) certify that the information

contained in this SBE Compliance Report is true and correct to the best of my knowledge and belief.

Witness' Signature

April 24, 2015
Date

Bidder's Signature

YAHARA HILLS FACILITY IMPROVEMENTS - HVAC UPGRADE
CONTRACT NO. 7458

Small Business Enterprise Compliance Report

Summary Sheet

SBE Subcontractors Who Are NOT Suppliers

Name(s) of SBEs Utilized	Type of Work	% of Total Bid Amount
		%
		%
		%
		%
		%
		%
		%
		%
		%
		%
		%
		%
		%
Subtotal SBE who are NOT suppliers:		-0- %

SBE Subcontractors Who Are Suppliers

Name(s) of SBEs Utilized	Type of Work	% of Total Bid Amount
		%
		%
		%
		%
		%
		%
Subtotal Contractors who are suppliers:	-0- % x 0.6 =	-0- % (discounted to 60%)

Total Percentage of SBE Utilization: -0- %.

DANIELS
General Contractors

April 24, 2015

Affirmative Action Department
Madison Municipal Building
215 Martin Luther King Jr. Blvd.
Madison, WI 53701-1626

Re: Yahara Hills Facility Improvements - HVAC Upgrade
Contract #7458

On the above listed project, we intend to subcontract the following work.

HVAC and Electrical

Sincerely,

Joseph A. Daniels
President

kis

YAHARA HILLS FACILITY IMPROVEMENTS - HVAC UPGRADE
CONTRACT NO. 7458
Date: 4/24/15

		Joe Daniels Construction	
Item	**Quantity**	**Price**	**Extension**
Section B: Proposal Page			
1 - LUMP SUM BID - L.S.	1.00	$327,970.00	$327,970.00
Totals			$327,970.00

Department of Public Works
City Engineering Division

608 266 4751

Robert F. Phillips, P.E.
City Engineer

City-County Building, Room 115
210 Martin Luther King, Jr. Boulevard
Madison, Wisconsin 53703
608 264 9275 FAX
1 866 704 2315 Textnet

Principal Engineers
Michael R. Dailey, P.E.
Christina M. Bachmann, P.E.
John S. Fahrney, P.E.
Gregory T. Fries, P.E.

Facilities & Sustainability
Jeanne E. Hoffman, Manager
James C. Whitney, A.I.A.

Operations Manager
Kathleen M. Cryan

GIS Manager
David A. Davis, R.L.S.

Financial Officer
Steven B. Danner-Rivers

Hydrogeologist
Brynn Bemis

BIENNIAL BID BOND

Joe Daniels Construction Co. Inc.
(a corporation of the State of Wisconsin)
(individual), (partnership), (hereinafter referred to as the "Principal") and
The Cincinnati Insurance Company,
a corporation of the State of Ohio (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, Wisconsin (hereinafter referred to as the "City"), in the sum equal to the individual proposal guaranty amounts of the total bid or bids of the Principal herein accepted by the City, for the payment of which the Principal and the Surety hereby jointly and severally bind ourselves, our heirs, executors, administrators, successors and assigns.

The condition of this obligation is that the Principal has submitted to the City certain bids for projects from the time period of February 1st, 2014 through January 31st, 2016.

If the Principal is awarded the contract(s) by the City and, within the time and manner required by law after the prescribed forms are presented for its signature, the Principal enters into (a) written contract(s) in accordance with the bid(s), and files with the City its bond(s) guaranteeing faithful performance and payment for all labor and materials, as required by law, or if the City rejects all bids for the work described, then this obligation shall be null and void; otherwise, it shall remain in full force and effect.

In the event the Principal shall fail to execute and deliver the contract(s) or the performance and payment bond(s), all within the time specified or any extension thereof, the Principal and Surety agree jointly and severally to pay to the City within ten (10) calendar days of written demand a total equal to the sum of the individual proposal guaranty amounts of the total bid(s) as liquidated damages.

The Surety, for value received, hereby agrees that the obligations of it and its bond shall be in no way impaired or affected by any extension of time within which the City may accept a bid, and the Surety does hereby waive notice of any such extension.

This bond may be terminated by the Surety upon giving thirty (30) days written notice to the City of its intent to terminate this bond and to be released and discharged therefrom, but such termination shall not operate to relieve or discharge the Surety from any liability already accrued or which shall accrue before the expiration of such thirty (30) day period.

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.

PRINCIPAL

Joe Daniels Construction Co. Inc. — COMPANY NAME — AFFIX SEAL

1/13/14 — DATE

By: Joseph A Daniel — SIGNATURE AND TITLE

Joseph A. Daniels - President

SURETY

The Cincinnati Insurance Company — COMPANY NAME — AFFIX SEAL

1/13/14 — DATE

By: Brooke L Parker — SIGNATURE AND TITLE Brooke L. Parker, Attorney-in-Fact

This certifies that I have been duly licensed as an agent for the Surety in Wisconsin under License No. 2512433 for the year 2014, and appointed as attorney in fact with authority to execute this bid bond, which power of attorney has not been revoked.

1/13/14 — DATE

Brooke L Parker — AGENT Brooke L. Parker, Hausmann-Johnson

700 Regent St. — ADDRESS

Madison, WI 53715 — CITY, STATE AND ZIP CODE

608-257-3795 — TELEPHONE NUMBER

Note to Surety and Principal: Any bid submitted which this bond guarantees may be rejected if the Power of Attorney form showing that the Agent of Surety is currently authorized to execute bonds on behalf of Surety is not attached to this bond.

THE CINCINNATI INSURANCE COMPANY

Fairfield, Ohio

POWER OF ATTORNEY

KNOW ALL MEN BY THESE PRESENTS: That THE CINCINNATI INSURANCE COMPANY, a corporation organized under the laws of the State of Ohio, and having its principal office in the City of Fairfield, Ohio, does hereby constitute and appoint

Tim Hausmann; Jeff Hausmann; Steven L. Squires; Sheila Dickey; Judith A. Walker; Patrick A. McKenna; Brooke L. Parker and/or Kelsey Jacobson

of Madison, Wisconsin its true and lawful Attorney(s)-in-Fact to sign, execute, seal and deliver on its behalf as Surety, and as its act and deed, any and all bonds, policies, undertakings, or other like instruments, as follows:

Any such obligations in the United States, up to Thirty Million and No/100 Dollars ($30,000,000.00).

This appointment is made under and by authority of the following resolution passed by the Board of Directors of said Company at a meeting held in the principal office of the Company, a quorum being present and voting, on the 6th day of December, 1958, which resolution is still in effect:

"RESOLVED, that the President or any Vice President be hereby authorized, and empowered to appoint Attorneys-in-Fact of the Company to execute any and all bonds, policies, undertakings, or other like instruments on behalf of the Corporation, and may authorize any officer or any such Attorney-in-Fact to affix the corporate seal; and may with or without cause modify or revoke any such appointment or authority. Any such writings so executed by such Attorneys-in-Fact shall be binding upon the Company as if they had been duly executed and acknowledged by the regularly elected officers of the Company."

This Power of Attorney is signed and sealed by facsimile under and by the authority of the following Resolution adopted by the Board of Directors of the Company at a meeting duly called and held on the 7th day of December, 1973.

"RESOLVED, that the signature of the President or a Vice President and the seal of the Company may be affixed by facsimile on any power of attorney granted, and the signature of the Secretary or Assistant Secretary and the seal of the Company may be affixed by facsimile to any certificate of any such power and any such power of certificate bearing such facsimile signature and seal shall be valid and binding on the Company. Any such power so executed and sealed and certified by certificate so executed and sealed shall, with respect to any bond or undertaking to which it is attached, continue to be valid and binding on the Company."

IN WITNESS WHEREOF, THE CINCINNATI INSURANCE COMPANY has caused these presents to be sealed with its corporate seal, duly attested by its Vice President this 10th day of May, 2012.

THE CINCINNATI INSURANCE COMPANY

Stephen A. Walter

Vice President

STATE OF OHIO) ss:
COUNTY OF BUTLER)

On this 10th day of May, 2012, before me came the above-named Vice President of THE CINCINNATI INSURANCE COMPANY, to me personally known to be the officer described herein, and acknowledged that the seal affixed to the preceding instrument is the corporate seal of said Company and the corporate seal and the signature of the officer were duly affixed and subscribed to said instrument by the authority and direction of said corporation.

Mark J. Huller

MARK J. HULLER, Attorney at Law
NOTARY PUBLIC - STATE OF OHIO
My commission has no expiration date. Section 147.03 O.R.C.

I, the undersigned Secretary or Assistant Secretary of THE CINCINNATI INSURANCE COMPANY, hereby certify that the above is a true and correct copy of the Original Power of Attorney issued by said Company, and do hereby further certify that the said Power of Attorney is still in full force and effect.

GIVEN under my hand and seal of said Company at Fairfield, Ohio.

this 13 day of January, 2014

Scott R Bolen

Assistant Secretary

BN-1005 (5/12)

SECTION H: AGREEMENT

THIS AGREEMENT made this 20 day of MAY in the year Two Thousand and Fifteen between **JOE DANIELS CONSTRUCTION CO., 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 **MAY 19, 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:

YAHARA HILLS FACILITY IMPROVEMENTS - HVAC UPGRADE
CONTRACT NO. 7458

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 **THREE HUNDRED TWENTY-SEVEN THOUSAND NINE HUNDRED-SEVENTY** (**$327,970.00**) 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 original 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.

YAHARA HILLS FACILITY IMPROVEMENTS - HVAC UPGRADE
CONTRACT NO. 7458

IN WITNESS WHEREOF, the Contractor has hereunto set his/her hand and seal and the City has caused these presents to be sealed with its corporate seal and to be subscribed by its Mayor and City Clerk the day and year first above written.

Countersigned:

Witness 5/20/15 Date

Witness 5/20/15 Date

JOE DANIELS CONSTRUCTION CO., INC.
Company Name

President Joseph A. Daniels 5/20/15 Date

Secretary Jerrald M. Daniels 5/20/15 Date

CITY OF MADISON, WISCONSIN

Provisions have been made to pay the liability that will accrue under this contract.

Finance Director

Approved as to form:

City Attorney

Signed this 4th day of June 2015 20

Witness

Witness

Mayor Date

City Clerk 5-22-15 Date

Bond no. 12147776

SECTION I: PAYMENT AND PERFORMANCE BOND

KNOW ALL MEN BY THESE PRESENTS, that we **JOE DANIELS CONSTRUCTION CO., INC.** as principal, and Cincinnati Insurance Company Company of Cincinnati, Ohio as surety, are held and firmly bound unto the City of Madison, Wisconsin, in the sum of **THREE HUNDRED TWENTY-SEVEN THOUSAND NINE HUNDRED-SEVENTY** (**$327,970.00**)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:

YAHARA HILLS FACILITY IMPROVEMENTS - HVAC UPGRADE
CONTRACT NO. 7458

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 20th day of May 2015

Countersigned:

Witness

Secretary Jerrald M. Daniels

Approved as to form:

City Attorney

JOE DANIELS CONSTRUCTION CO., INC.
Company Name (Principal)

President Joseph A. Daniels Seal (no seal)

CINCINNATI INSURANCE COMPANY
Surety Seal
☐ Salary Employee ☒ Commission

By
Attorney-in-Fact Patrick A. McKenna

This certifies that I have been duly licensed as an agent for the above company in Wisconsin under License No. 2349196 for the year 20 15, and appointed as attorney-in-fact with authority to execute this payment and performance bond which power of attorney has not been revoked.

May 20, 2015
Date

Agent Signature Patrick A. McKenna

THE CINCINNATI INSURANCE COMPANY

Fairfield, Ohio

POWER OF ATTORNEY

KNOW ALL MEN BY THESE PRESENTS: That THE CINCINNATI INSURANCE COMPANY, a corporation organized under the laws of the State of Ohio, and having its principal office in the City of Fairfield, Ohio, does hereby constitute and appoint

Tim Hausmann; Jeff Hausmann; Sheila Dickey; Judith A. Walker;
Patrick A. McKenna and/or Brooke L. Parker

of Madison, Wisconsin its true and lawful Attorney(s)-in-Fact to sign, execute, seal and deliver on its behalf as Surety, and as its act and deed, any and all bonds, policies, undertakings, or other like instruments, as follows:

Any such obligations in the United States, up to
Thirty Million and No/100 Dollars ($30,000,000.00).

This appointment is made under and by authority of the following resolution passed by the Board of Directors of said Company at a meeting held in the principal office of the Company, a quorum being present and voting, on the 6th day of December, 1958, which resolution is still in effect:

"RESOLVED, that the President or any Vice President be hereby authorized, and empowered to appoint Attorneys-in-Fact of the Company to execute any and all bonds, policies, undertakings, or other like instruments on behalf of the Corporation, and may authorize any officer or any such Attorney-in-Fact to affix the corporate seal; and may with or without cause modify or revoke any such appointment or authority. Any such writings so executed by such Attorneys-in-Fact shall be binding upon the Company as if they had been duly executed and acknowledged by the regularly elected officers of the Company."

This Power of Attorney is signed and sealed by facsimile under and by the authority of the following Resolution adopted by the Board of Directors of the Company at a meeting duly called and held on the 7th day of December, 1973.

"RESOLVED, that the signature of the President or a Vice President and the seal of the Company may be affixed by facsimile on any power of attorney granted, and the signature of the Secretary or Assistant Secretary and the seal of the Company may be affixed by facsimile to any certificate of any such power and any such power of certificate bearing such facsimile signature and seal shall be valid and binding on the Company. Any such power so executed and sealed and certified by certificate so executed and sealed shall, with respect to any bond or undertaking to which it is attached, continue to be valid and binding on the Company."

IN WITNESS WHEREOF, THE CINCINNATI INSURANCE COMPANY has caused these presents to be sealed with its corporate seal, duly attested by its Vice President this 10th day of May, 2012.

The Cincinnati Insurance Company CORPORATE SEAL OHIO

THE CINCINNATI INSURANCE COMPANY

Stephen A. Jutte

Vice President

STATE OF OHIO)
) ss:
COUNTY OF BUTLER)

On this 10th day of May, 2012, before me came the above-named Vice President of THE CINCINNATI INSURANCE COMPANY, to me personally known to be the officer described herein, and acknowledged that the seal affixed to the preceding instrument is the corporate seal of said Company and the corporate seal and the signature of the officer were duly affixed and subscribed to said instrument by the authority and direction of said corporation.

NOTARIAL SEAL STATE OF OHIO

Mark J. Huller

MARK J. HULLER, Attorney at Law
NOTARY PUBLIC - STATE OF OHIO
My commission has no expiration
date. Section 147.03 O.R.C.

I, the undersigned Secretary or Assistant Secretary of THE CINCINNATI INSURANCE COMPANY, hereby certify that the above is a true and correct copy of the Original Power of Attorney issued by said Company, and do hereby further certify that the said Power of Attorney is still in full force and effect.

GIVEN under my hand and seal of said Company at Fairfield, Ohio.
this 20th day of May, 2015.

The Cincinnati Insurance Company CORPORATE SEAL OHIO

Scott R Bolen

Assistant Secretary

BN-1005 (5/12)

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

CLASSIFICATION:	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: dwd.wisconsin.gov/er/prevailing_wage_rate/Dictionary/dictionary_main.htm.
OVERTIME:	Time and one-half must be paid for all hours worked: - over 10 hours per day on prevailing wage projects - over 40 hours per calendar week - Saturday and Sunday - 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; - The day before if January 1, July 4 or December 25 falls on a Saturday; - The day following if January 1, July 4 or December 25 falls on a Sunday. 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. A DOT Premium (discussed below) may supersede this time and one-half requirement.
FUTURE INCREASE:	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.
PREMIUM PAY:	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, whevenever such pay is applicable.
DOT PREMIUM:	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.
APPRENTICES:	Pay apprentices a percentage of the applicable journeyperson'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.
SUBJOURNEY:	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 the 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 the 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 sheltered 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

Fringe Benefits Must Be Paid On All Hours Worked

CODE	TRADE OR OCCUPATION	HOURLY BASIC RATE OF PAY $	HOURLY FRINGE BENEFITS $	TOTAL $
101	Acoustic Ceiling Tile Installer Future Increase(s): Add $1.42/hr on 6/1/2015; Add $1.42/hr on 6/1/2016.	32.72	16.00	48.72
102	Boilermaker Future Increase(s): Add $1.50/hr. on 01/01/2016	33.35	28.24	61.59
103	Bricklayer, Blocklayer or Stonemason Future Increase(s): Add $1.40 on 06/01/2015; Add $1.45 on 06/06/2016 Premium Increase(s): 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.	32.82	18.66	51.48
104	Cabinet Installer Future Increase(s): Add $1.42/hr on 6/1/2015; Add $1.42/hr on 6/1/2016.	32.72	16.00	48.72
105	Carpenter Future Increase(s): Add $1.42/hr on 6/1/2015; Add $1.42/hr on 6/1/2016. Premium Increase(s): 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
106	Carpet Layer or Soft Floor Coverer Future Increase(s): 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 Future Increase(s): Add $1.20/hr on 6/1/15; Add $1.25/hr on 6/1/16. Premium Increase(s): 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.	34.82	19.67	54.49
110	Elevator Constructor	43.84	27.09	70.93

CODE	Fringe Benefits Must Be Paid On All Hours Worked TRADE OR OCCUPATION	HOURLY BASIC RATE OF PAY $	HOURLY FRINGE BENEFITS $	TOTAL $
111	Fence Erector	18.00	6.09	24.09
112	Fire Sprinkler Fitter	36.79	18.81	55.60
113	Glazier Future Increase(s): 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) Future Increase(s): 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
122	Millwright Future Increase(s): 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 Future Increase(s): Add $1.50/hr on 6/1/2015; Add $1.60/hr on 6/1/2016. Premium Increase(s): Add $.65/hr for Piledriver Loftsman; Add $.75/hr for Sheet Piling Loftsman. 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.	30.11	26.51	56.62
127	Pipeline Fuser or Welder (Gas or Utility)	30.83	20.89	51.72
129	Plasterer Future Increase(s): Add $1.56 on 06/01/2015; Add $1.61 on 06/01/2016; Add$1.66 on 06/01/2017	32.65	19.36	52.01
130	Plumber Future Increase(s): Add $1.80 on 6/1/15	37.57	17.47	55.04

CODE	Fringe Benefits Must Be Paid On All Hours Worked TRADE OR OCCUPATION	HOURLY BASIC RATE OF PAY $	HOURLY FRINGE BENEFITS $	TOTAL $
132	Refrigeration Mechanic Future Increase(s): Add $1.80 on 6/1/15	44.20	18.26	62.46
133	Roofer or Waterproofer	29.40	11.31	40.71
134	Sheet Metal Worker	34.45	22.54	56.99
135	Steamfitter Future Increase(s): Add $1.80/hr on 6/1/15.	44.20	18.26	62.46
137	Teledata Technician or Installer Premium Increase(s): 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.	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

CODE	Fringe Benefits Must Be Paid On All Hours Worked TRADE OR OCCUPATION	HOURLY BASIC RATE OF PAY $	HOURLY FRINGE BENEFITS $	TOTAL $
201	Single Axle or Two Axle	32.89	18.96	51.85
203	Three or More Axle	18.00	21.99	39.99

CODE	Fringe Benefits Must Be Paid On All Hours Worked TRADE OR OCCUPATION	HOURLY BASIC RATE OF PAY $	HOURLY FRINGE BENEFITS $	TOTAL $
204	Articulated, Euclid, Dumptor, Off Road Material Hauler Future Increase(s): 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

CODE	Fringe Benefits Must Be Paid On All Hours Worked TRADE OR OCCUPATION	HOURLY BASIC RATE OF PAY $	HOURLY FRINGE BENEFITS $	TOTAL $
301	General Laborer Future Increase(s): Add $1.35/hr eff. 06/01/2015; Add $1.25/hr eff. 06/06/2016 Premium Increase(s): Add $1.00/hr for certified welder; Add $.25/hr for mason tender	24.97	15.12	40.09
302	Asbestos Abatement Worker	18.00	9.58	27.58
303	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) Premium Increase(s): DOT PREMIUMS: Pay two times the hourly basic rate on New Year's Day, Memorial Day, Independence Day, 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 Future Increase(s): Add $1.35/hr eff. 06/01/2015; Add $1.25/hr eff. 06/06/2016	24.97	15.12	40.09

HEAVY EQUIPMENT OPERATORS
SITE PREPARATION, UTILITY OR LANDSCAPING WORK ONLY

CODE	Fringe Benefits Must Be Paid On All Hours Worked TRADE OR OCCUPATION	HOURLY BASIC RATE OF PAY $	HOURLY FRINGE BENEFITS $	TOTAL $
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). Future Increase(s): 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). Future Increase(s): 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. Future Increase(s): 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. Premium Increase(s): Add $.50/hr for Friction Crane, Lattice Boom or Crane Certification (CCO).	41.65	21.71	63.36

CODE	Fringe Benefits Must Be Paid On All Hours Worked TRADE OR OCCUPATION	HOURLY BASIC RATE OF PAY $	HOURLY FRINGE BENEFITS $	TOTAL $
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

CODE	Fringe Benefits Must Be Paid On All Hours Worked TRADE OR OCCUPATION	HOURLY BASIC RATE OF PAY $	HOURLY FRINGE BENEFITS $	TOTAL $
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. Future Increase(s): Add $1.60/hr on 6/2/2015; Add $1.60/hr on 6/3/2016. Premium Increase(s): 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). Future Increase(s): Add $1.60/hr on 6/2/2015; Add $1.60/hr on 6/3/2016. Premium Increase(s): 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). Future Increase(s): Add $1.60/hr on 6/2/2015; Add $1.60/hr on 6/3/2016.	34.22	19.78	54.00

CODE	Fringe Benefits Must Be Paid On All Hours Worked TRADE OR OCCUPATION	HOURLY BASIC RATE OF PAY $	HOURLY FRINGE BENEFITS $	TOTAL $
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). Future Increase(s): 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. Future Increase(s): 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. Future Increase(s): 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). Future Increase(s): 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). Future Increase(s): 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

SEWER, WATER OR TUNNEL CONSTRUCTION

Includes those projects that primarily involve public sewer or water distribution, transmission or collection systems and related tunnel work (excluding buildings).

SKILLED TRADES

CODE	Fringe Benefits Must Be Paid On All Hours Worked TRADE OR OCCUPATION	HOURLY BASIC RATE OF PAY $	HOURLY FRINGE BENEFITS $	TOTAL $
103	Bricklayer, Blocklayer or Stonemason	32.09	18.04	50.13
105	Carpenter Future Increase(s): Add $1.50/hr on 6/1/2015; Add $1.65/hr on 6/1/2016. Premium Increase(s): 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 Future Increase(s): Add $1.87 on 6/1/15; Add $1.75 on 6/1/16. 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 $1.40/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 Premium Increase(s): 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

CODE	Fringe Benefits Must Be Paid On All Hours Worked TRADE OR OCCUPATION	HOURLY BASIC RATE OF PAY $	HOURLY FRINGE BENEFITS $	TOTAL $
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

CODE	Fringe Benefits Must Be Paid On All Hours Worked TRADE OR OCCUPATION	HOURLY BASIC RATE OF PAY $	HOURLY FRINGE BENEFITS $	TOTAL $
201	Single Axle or Two Axle Future Increase(s): Add $1.15/hr on 6/1/2015. Premium Increase(s): 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

CODE	Fringe Benefits Must Be Paid On All Hours Worked TRADE OR OCCUPATION	HOURLY BASIC RATE OF PAY $	HOURLY FRINGE BENEFITS $	TOTAL $
301	General Laborer Future Increase(s): Add $1.35/hr eff. 06/01/2015; Add $1.25/hr eff. 06/06/2016 Premium Increase(s): 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

CODE	Fringe Benefits Must Be Paid On All Hours Worked TRADE OR OCCUPATION	HOURLY BASIC RATE OF PAY $	HOURLY FRINGE BENEFITS $	TOTAL $
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

CODE	Fringe Benefits Must Be Paid On All Hours Worked TRADE OR OCCUPATION	HOURLY BASIC RATE OF PAY $	HOURLY FRINGE BENEFITS $	TOTAL $
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. Future Increase(s): Add $1.55/hr on 6/1/2015. Premium Increase(s): 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). Future Increase(s): Add $1.60/hr on 6/2/2015; Add $1.60/hr on 6/3/2016.	34.22	19.78	54.00
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). Future Increase(s): Add $1.60/hr on 6/2/2015; Add $1.60/hr on 6/3/2016.	33.69	19.78	53.47

CODE	Fringe Benefits Must Be Paid On All Hours Worked TRADE OR OCCUPATION	HOURLY BASIC RATE OF PAY $	HOURLY FRINGE BENEFITS $	TOTAL $
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

AIRPORT PAVEMENT OR STATE HIGHWAY CONSTRUCTION

Includes all airport projects (excluding buildings) and all projects awarded by the Wisconsin Department of Transportation (excluding buildings).

SKILLED TRADES

Fringe Benefits Must Be Paid On All Hours Worked

CODE	TRADE OR OCCUPATION	HOURLY BASIC RATE OF PAY $	HOURLY FRINGE BENEFITS $	TOTAL $
103	Bricklayer, Blocklayer or Stonemason	32.09	18.04	50.13
105	Carpenter Future Increase(s): Add $1.42/hr on 6/1/2015; Add $1.42/hr on 6/1/2016. Premium Increase(s): 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 Future Increase(s): Add $1.87 on 6/1/15; Add $1.75 on 6/1/16. 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 $1.40/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 Premium Increase(s): 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 Future Increase(s): Add $1.44/hr on 6/1/2015; Add $1.44/hr on 6/1/2016. Premium Increase(s): 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	Roofer or Waterproofer	29.40	11.31	40.71

CODE	Fringe Benefits Must Be Paid On All Hours Worked TRADE OR OCCUPATION	HOURLY BASIC RATE OF PAY $	HOURLY FRINGE BENEFITS $	TOTAL $
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

CODE	Fringe Benefits Must Be Paid On All Hours Worked TRADE OR OCCUPATION	HOURLY BASIC RATE OF PAY $	HOURLY FRINGE BENEFITS $	TOTAL $
201	Single Axle or Two Axle Future Increase(s): Add $1.15/hr on 6/1/2015. Premium Increase(s): 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 Future Increase(s): Add $1.15/hr on 6/1/2015. Premium Increase(s): 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 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.	30.27	21.15	51.42
205	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

CODE	Fringe Benefits Must Be Paid On All Hours Worked TRADE OR OCCUPATION	HOURLY BASIC RATE OF PAY $	HOURLY FRINGE BENEFITS $	TOTAL $
301	General Laborer Future Increase(s): Add $1.05/hr eff. 06/01/2015; Add $1.00/hr eff. 06/01/2016; Add $1.00/hr eff. 06/01/2017 Premium Increase(s): 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 Future Increase(s): Add $1.05/hr eff. 06/01/2015; Add $1.00/hr eff. 06/01/2016; Add $1.00/hr eff. 06/01/2017 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 $1.25/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 Future Increase(s): Add $1.05/hr eff. 06/01/2015; Add $1.00/hr eff. 06/01/2016; Add $1.00/hr eff. 06/01/2017 Premium Increase(s):	26.76	15.14	41.90

CODE	Fringe Benefits Must Be Paid On All Hours Worked TRADE OR OCCUPATION	HOURLY BASIC RATE OF PAY $	HOURLY FRINGE BENEFITS $	TOTAL $
	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

CODE	Fringe Benefits Must Be Paid On All Hours Worked TRADE OR OCCUPATION	HOURLY BASIC RATE OF PAY $	HOURLY FRINGE BENEFITS $	TOTAL $
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). 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.	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. 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.	37.22	21.15	58.37

CODE	Fringe Benefits Must Be Paid On All Hours Worked TRADE OR OCCUPATION	HOURLY BASIC RATE OF PAY $	HOURLY FRINGE BENEFITS $	TOTAL $
533	Air Track, Rotary or Percussion Drilling Machine &/or Hammers, Blaster; Asphalt Heater, Planer & 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. & Under); Bituminous (Asphalt) Plant & 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 & 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; 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 & A-Frames. 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.	36.72	21.15	57.87

CODE	Fringe Benefits Must Be Paid On All Hours Worked TRADE OR OCCUPATION	HOURLY BASIC RATE OF PAY $	HOURLY FRINGE BENEFITS $	TOTAL $
534	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 (Asphalt Plant, Pile Driver & Derrick NOT Performing Work on the Great Lakes); Forklift; Greaser; Hoist (Tugger, Automatic); Jeep Digger; Joint Sawer (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. 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.	36.46	21.15	57.61
535	Air Compressor (&/or 400 CFM or Over); Air, Electric or Hydraulic Jacking System; Augers (Vertical & Horizontal); 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. 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.	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

CODE	Fringe Benefits Must Be Paid On All Hours Worked TRADE OR OCCUPATION	HOURLY BASIC RATE OF PAY $	HOURLY FRINGE BENEFITS $	TOTAL $
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 agricultural), public sidewalks or other similar projects (excluding projects awarded by the Wisconsin Department of Transportation).

SKILLED TRADES

CODE	Fringe Benefits Must Be Paid On All Hours Worked TRADE OR OCCUPATION	HOURLY BASIC RATE OF PAY $	HOURLY FRINGE BENEFITS $	TOTAL $
103	Bricklayer, Blocklayer or Stonemason	32.09	18.04	50.13
105	Carpenter Future Increase(s): Add $1.42/hr on 6/1/2015; Add $1.42/hr on 6/1/2016. Premium Increase(s): 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 Future Increase(s): Add $1.87 on 6/1/15; Add $1.75 on 6/1/16. 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 $1.40/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

CODE	Fringe Benefits Must Be Paid On All Hours Worked TRADE OR OCCUPATION	HOURLY BASIC RATE OF PAY $	HOURLY FRINGE BENEFITS $	TOTAL $
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

CODE	Fringe Benefits Must Be Paid On All Hours Worked TRADE OR OCCUPATION	HOURLY BASIC RATE OF PAY $	HOURLY FRINGE BENEFITS $	TOTAL $
201	Single Axle or Two Axle Future Increase(s): Add $1.15/hr on 6/1/2015. Premium Increase(s): 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	16.00	0.00	16.00
204	Articulated, Euclid, Dumptor, Off Road Material Hauler Future Increase(s): 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

CODE	Fringe Benefits Must Be Paid On All Hours Worked TRADE OR OCCUPATION	HOURLY BASIC RATE OF PAY $	HOURLY FRINGE BENEFITS $	TOTAL $
301	General Laborer	29.32	12.44	41.76
303	Landscaper Future Increase(s): Add $1.05/hr eff. 06/01/2015; Add $1.00/hr eff. 06/01/2016; Add $1.00/hr eff. 06/01/2017 Premium Increase(s):	30.13	15.14	45.27

CODE	Fringe Benefits Must Be Paid On All Hours Worked TRADE OR OCCUPATION	HOURLY BASIC RATE OF PAY $	HOURLY FRINGE BENEFITS $	TOTAL $
	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

CODE	Fringe Benefits Must Be Paid On All Hours Worked TRADE OR OCCUPATION	HOURLY BASIC RATE OF PAY $	HOURLY FRINGE BENEFITS $	TOTAL $
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. 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.	37.72	21.15	58.87

CODE	Fringe Benefits Must Be Paid On All Hours Worked TRADE OR OCCUPATION	HOURLY BASIC RATE OF PAY $	HOURLY FRINGE BENEFITS $	TOTAL $
542	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. 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.	37.22	21.15	58.37
543	Air Track, Rotary or Percussion Drilling Machine &/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. & 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 & 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; 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 & A-Frames.	35.72	17.85	53.57

CODE	Fringe Benefits Must Be Paid On All Hours Worked TRADE OR OCCUPATION	HOURLY BASIC RATE OF PAY $	HOURLY FRINGE BENEFITS $	TOTAL $
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 Sawer (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. 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.	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

CODE	Fringe Benefits Must Be Paid On All Hours Worked TRADE OR OCCUPATION	HOURLY BASIC RATE OF PAY $	HOURLY FRINGE BENEFITS $	TOTAL $
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. 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.	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. Future Increase(s): Add $1.60/hr on 6/2/2015; Add $1.60/hr on 6/3/2016.	33.69	19.78	53.47

CODE	Fringe Benefits Must Be Paid On All Hours Worked TRADE OR OCCUPATION	HOURLY BASIC RATE OF PAY $	HOURLY FRINGE BENEFITS $	TOTAL $
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 Sawer (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. 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.	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. 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.	36.17	21.15	57.32
556	Fiber Optic Cable Equipment.	27.89	17.20	45.09

RESIDENTIAL OR AGRICULTURAL CONSTRUCTION

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.

SKILLED TRADES

Fringe Benefits Must Be Paid On All Hours Worked

CODE	TRADE OR OCCUPATION	HOURLY BASIC RATE OF PAY $	HOURLY FRINGE BENEFITS $	TOTAL $
101	Acoustic Ceiling Tile Installer	33.07	16.07	49.14
102	Boilermaker	32.05	28.04	60.09
103	Bricklayer, Blocklayer or Stonemason Future Increase(s): Add $1.40 on 06/01/2015; Add $1.45 on 06/06/2016 Premium Increase(s): 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.	32.82	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 Future Increase(s): 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

CODE	Fringe Benefits Must Be Paid On All Hours Worked TRADE OR OCCUPATION	HOURLY BASIC RATE OF PAY $	HOURLY FRINGE BENEFITS $	TOTAL $
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	Roofer 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
140	Terrazzo Mechanic	30.71	16.52	47.23
141	Tile Finisher	23.85	17.18	41.03
142	Tile Setter Future Increase(s): 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

CODE	Fringe Benefits Must Be Paid On All Hours Worked TRADE OR OCCUPATION	HOURLY BASIC RATE OF PAY $	HOURLY FRINGE BENEFITS $	TOTAL $
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

CODE	Fringe Benefits Must Be Paid On All Hours Worked TRADE OR OCCUPATION	HOURLY BASIC RATE OF PAY $	HOURLY FRINGE BENEFITS $	TOTAL $
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

CODE	Fringe Benefits Must Be Paid On All Hours Worked TRADE OR OCCUPATION	HOURLY BASIC RATE OF PAY $	HOURLY FRINGE BENEFITS $	TOTAL $
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. Future Increase(s): Add $1.60/hr on 6/2/2015; Add $1.60/hr on 6/3/2016.	34.22	19.78	54.00

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. 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.	36.72	21.15	57.87

********** END OF RATES **********

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STATE OF WISCONSIN
DWD
Department of Workforce Development

Scott Walker, Governor
Reginald J. Newson, Secretary

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. For further assistance, call the Equal Rights Division at 608-266-6861 and ask for prevailing wage.