RFB NO. 313056

CONSTRUCTION DOCUMENTS
PROJECT MANUAL

DANE COUNTY DEPARTMENT OF PUBLIC WORKS,
HIGHWAY AND TRANSPORTATION

PUBLIC WORKS ENGINEERING DIVISION
1919 ALLIANT ENERGY CENTER WAY
MADISON, WISCONSIN 53713

REQUEST FOR BIDS NO. 313056
MECHANICAL, ELECTRICAL & PIPING INFRASTRUCTURE IMPROVEMENTS
BID PACKAGE 3 - MECHANICAL SYSTEMS
CITY-COUNTY BUILDING
210 MARTIN LUTHER KING JR BLVD
MADISON, WISCONSIN

Due Date / Time: **THURSDAY, APRIL 3, 2014 / 2:00 P.M.**

Location: **PUBLIC WORKS OFFICE**

Performance / Payment Bond: **100% OF CONTRACT AMOUNT**

Bid Deposit: **5% OF BID AMOUNT**

FOR INFORMATION ON THIS REQUEST FOR BIDS, PLEASE CONTACT:

SCOTT CARLSON, PROJECT MANAGER
TELEPHONE NO.: 608/266-4179
FAX NO.: 608/267-1533
E-MAIL: CARLSON.SCOTT@COUNTYOFDANE.COM

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SEALS PAGE

BID NO. 313056
PROJECT: MECHANICAL, ELECTRICAL, & PIPING INFRASTRUCTURE IMPROVEMENTS - BID PACKAGE 3 - MECHANICAL SYSTEMS CITY-COUNTY BUILDING

MECHANICAL ENGINEER
I hereby certify that this drawing, specification or report was prepared by me or under my direct supervision and that I am a duly Registered Professional Engineer under the laws of the State of Wisconsin.

Matt Heil 3/13/14
Matt Heil - Registration No. 36013

Dated: 03/13/2014

ELECTRICAL ENGINEER
I hereby certify that this drawing, specification or report was prepared by me or under my direct supervision and that I am a duly Registered Professional Engineer under the laws of the State of Wisconsin.

Matt Heil 3/13/14
Matt Heil - Registration No. 36013

Dated: 03/13/2014

SEALS PAGE

BID NO. 313056
PROJECT: MECHANICAL, ELECTRICAL, & PIPING INFRASTRUCTURE IMPROVEMENTS - BID PACKAGE 3 - MECHANICAL SYSTEMS CITY-COUNTY BUILDING

PLUMBING ENGINEER

I hereby certify that this drawing, specification or report was prepared by me or under my direct supervision and that I am a duly Registered Professional Engineer under the laws of the State of Wisconsin.

Matt Heil 3/13/14

Matt Heil - Registration No. 36013

Dated: 03/13/2014

DOCUMENT INDEX FOR RFB NO. 313056

DIVISION 00 - PROCUREMENT AND CONTRACTING REQUIREMENTS

DIVISION 01 - GENERAL REQUIREMENTS

DIVISION 21 - FIRE SUPPRESSION

DIVISION 23 - HEATING, VENTILATING, AND AIR CONDITIONING (HVAC)

DIVISION 26 - ELECTRICAL

26 05 19 - Low-Voltage Electrical Power Conductors and Cables
26 05 26 - Grounding and Bonding for Electrical Systems
26 05 29 - Hangers and Supports for Electrical Systems
26 05 33 - Raceway and Boxes for Electrical Systems
26 24 16 - Panelboards
26 27 02 - Equipment Wiring Systems

DRAWINGS

Plot sheets on 22" x 34" (ANSI D) paper for correct scale or size.

P000	Plumbing - Fire Protection Symbols, Abbreviations and Notes
P202	Penthouse New Work Plan - Plumbing and Fire Protection
P500	Plumbing - Fire Protection Details
M000	Mechanical Symbols, Abbreviations and Notes
M101	First Floor Demolition Plan - Mechanical
M201	First Floor New Work Plan - Mehcanical
M300	Mechanical Sections and Enlarged Plans
M500	Mehcanical Details
M600	Mechanical Schedules and Control Sequences
E000	Electrical Symbols Abbreviations, and Notes
E201	Partial First Floor Plan - Electrical
E202	Partial Penthouse Plan - Electrical

LEGAL NOTICE

INVITATION TO BID

Dane County Public Works, Highway & Transportation Dept., 1919 Alliant Energy Center Way, Madison, WI 53713, will receive sealed Bids until:

2:00 P.M., THURSDAY, APRIL 3, 2014

REQUEST FOR BIDS NO. 313056

MECHANICAL, ELECTRICAL & PIPING INFRASTRUCTURE IMPROVEMENTS

BID PACKAGE 3 - MECHANICAL SYSTEMS

CITY-COUNTY BUILDING (CCB)

210 MARTIN LUTHER KING JR. BLVD.

MADISON, WISCONSIN

Dane County is inviting Bids for construction services for replacement of computer room HVAC units & associated distribution systems & controls. Only firms with capabilities, experience & expertise with similar projects should obtain this packet & submit Bids.

Request for Bids package may be obtained after **2:00 p.m. on Thursday, March 13, 2014** by downloading it from countyofdane.com/pwbids. Please call Scott Carlson, Project Manager, at 608/266-4179, or our office at 608/266-4018, for any questions or additional information.

All Bidders must be a registered vendor with Dane County & pay an annual registration fee & must be pre-qualified as a Best Value Contractor before award of Contract. Complete Vendor Registration Form at danepurchasing.com/registration or obtain one by calling 608/266-4131. Complete Pre-qualification Application for Contractors at countyofdane.com/pwht/BVC_Application.aspx or obtain one by calling 608/266-4018.

A facility tour for Bidders will be held Monday, March 24, 2014 at 10:00 a.m. at the CCB, starting in the entrance lobby. Bidders are required to attend this mandatory tour in order to bid on the work.

PUBLISH: MARCH 13 & 20, 2014 - WISCONSIN STATE JOURNAL

MARCH 13 & 20, 2014 - THE DAILY REPORTER

DANE COUNTY DEPARTMENT of PUBLIC WORKS, HIGHWAY and TRANSPORTATION

County Executive
Joseph T. Parisi

1919 Alliant Energy Center Way ◆ Madison, Wisconsin 53713
Phone: (608) 266-4018 ◆ FAX: (608) 267-1533

Commissioner / Director
Gerald J. Mandli

BEST VALUE CONTRACTING APPLICATION

CONTRACTORS / LICENSURE APPLICANTS

The Dane County Department of Public Works requires all contractors to be pre-qualified as a best value contractor with the County prior to being awarded a contract. In addition, the County pre-qualifies potential contractors and sub-contractors who wish to work on County contracts. Subcontractors must become pre-qualified ten (10) days prior to commencing work under any Dane County Public Works Contract. Potential subcontractors are urged to become pre-qualified as early as possible. This document shall be completed, properly executed, along with the necessary attachments and additional information that the County requires for the protection and welfare of the public in the performance of a County contract.

Contractors or subcontractors of any tier who attain pre-qualification status will retain that status for a period of two (2) years from the date of qualification. Contractors shall notify the Dane County Department of Public Works, Highway & Transportation within fifteen (15) days of any changes to its business or operations that are relevant to the pre-qualification application. Failure to do so could result in suspension, revocation of the contractor's pre-qualification, debarment from County contracts for up to three (3) years and / or other sanctions available under the law.

No contracts will be awarded for construction work performed on Dane County projects unless the contractor is currently approved as a Wisconsin Trade Trainer or has applied for approval as an Apprenticeship Trade Trainer to the Wisconsin Department of Workforce Development and agrees to an acceptable apprenticeship program. If you are not currently approved as a Wisconsin Trade Trainer, or have not applied for approval as an Apprenticeship Trade Trainer, please contact the Department of Workforce Development - Bureau of Apprenticeship Standards at 608/266-3133 or visit their web site at: dwd.wisconsin.gov/apprenticeship/.

EXEMPTIONS

- Contractors who employ less than five (5) apprenticeable trade workers are not required to pre-qualify.
- Contractors performing work that does not apply to an apprenticeable trade, as outlined in Appendix A.
- The contractor / subcontractor provides sufficient documentation to demonstrate one or more of the following:
    - apprentices are not available in a specific geographic area;
    - the applicable apprenticeship program is unsuitable or unavailable; or
    - there is a documented depression of the local construction market which prevents compliance.

SEC.	PROOF OF RESPONSIBILITY	CHECK IF APPLICABLE
1	Does your firm possesses all technical qualifications and resources, including equipment, personnel and financial resources, necessary to perform the work required for any project or obtain the same through the use of responsible, pre-qualified subcontractors?	Yes: ☐ No: ☐
2	Will your firm possess all valid, effective licenses, registrations or certificates required by federal, state, county, or local law, which are necessary for the type of work to be performed including, but not limited to, those for any type of trade work or specialty work?	Yes: ☐ No: ☐
3	Will your firm meet all bonding requirements as required by applicable law or contract specifications?	Yes: ☐ No: ☐
4	Will your firm meet all insurance requirements as required by applicable law or specifications, including general liability insurance, workers compensation insurance and unemployment insurance requirements?	Yes: ☐ No: ☐
5	Will your firm maintain a substance abuse policy for employees hired for public works contracts that comply with Wis. Stats. Sec. 103.503?	Yes: ☐ No: ☐
6	Does your firm acknowledge that it must pay all craft employees on public works projects the wage rates and benefits required under Section 66.0903 of the Wisconsin Statutes?	Yes: ☐ No: ☐
7	Will your firm fully abide by the equal opportunity and affirmative action requirements of all applicable laws, including County ordinances?	Yes: ☐ No: ☐
8	In the past three (3) years, has your firm had control or has another corporation, partnership or other business entity operating in the construction industry controlled it? If so, please attach a statement explaining the nature of the firm relationship?	Yes: ☐ No: ☐ If Yes, attach details.
9	In the past three (3) years, has your firm had any type of business, contracting or trade license, certification or registration revoked or suspended?	Yes: ☐ No: ☐ If Yes, attach details.
10	In the past three (3) years, has your firm been debarred by any federal, state or local government agency?	Yes: ☐ No: ☐ If Yes, attach details.
11	In the past three (3) years, has your firm defaulted or failed to complete any contract?	Yes: ☐ No: ☐ If Yes, attach details.
12	In the past three (3) years, has your firm committed a willful violation of federal, state or local government safety laws as determined by a final decision of a court or government agency authority.	Yes: ☐ No: ☐ If Yes, attach details.
13	In the past three (3) years, has your firm been in violation of any law relating to your contracting business where the penalty for such violation resulted in the imposition of a penalty greater than $10,000?	Yes: ☐ No: ☐ If Yes, attach details.
14	Is your firm Executive Order 108 precertified with the State of Wisconsin?	Yes: No: ☐
15	Is your firm an active Wisconsin Trade Trainer as determined by the Wisconsin Bureau of Apprenticeship Standards and listed at: dwd.wisconsin.gov/apprenticeship/executive_order108.htm?	Yes: ☐ No: ☐
16	Is your firm exempt from being pre-qualified with Dane County?	Yes: ☐ No: ☐ If Yes, attach reason for exemption.
17	Does your firm acknowledge that in doing work under any County Public Works Contract, it will be required to use as subcontractors only those contractors that are also pre-qualified with the County or become so ten days prior to commencing work?	Yes: ☐ No: ☐

SIGNATURE SECTION

Your firm's Officer, or the individual who would sign a bid and / or contract documents must sign this document.

I do hereby certify that all statements herein contained are true and correct to the best of my knowledge:

Signature _____ Date _____

Printed or Typed Name and Title _____

NAME AND ADDRESS OF CONTRACTOR	
Name of Firm:	
Address:	
City, State, Zip:	
Telephone Number:	
Fax Number:	
E-mail Address:	

REMEMBER!

Return all to forms and attachments, or questions to:

JAN NEITZEL KNOX
EMAIL: NEITZEL-KNOX@COUNTYOFDANE.COM
OFFICE: (608)266-4029, FAX: (608)267-1533

DANE COUNTY DEPARTMENT OF PUBLIC WORKS,
HGHWAY & TRANSPORTATION
1919 ALLIANT ENERGY CENTER WAY
MADISON, WI 53713

APPENDIX A

APPRENTICEABLE TRADES

Bricklayer
Carpenter
Cement Mason (Concrete Finisher)
Cement Mason (Heavy Highway)
Construction Craft Laborer
Data Communications Installer
Electrician
Elevator Mechanic / Technician
Environmental Systems Technician / HVAC Service Technician / HVAC Install & Service
Glazier
Heavy Equipment Operator / Operating Engineer
Insulation Worker (Heat & Frost)
Iron Worker (Assembler, Metal Buildings)
Painter / Decorator
Plasterer
Plumber
Roofer / Waterproofer
Sheet Metal Worker
Sprinkler Fitter
Steamfitter (Service & Refrigeration)
Taper & Finisher
Telecommunications (Voice, Data & Video) Installer / Technician
Tile Setter

INSTRUCTIONS TO BIDDERS

TABLE OF CONTENTS

1. GENERAL

A. Before submitting Bid, bidder shall thoroughly examine all Construction Documents. Successful Bidder shall be required to provide all the Work that is shown on Drawings, set forth in Specifications, or reasonably implied as necessary to complete Contract for this project.

B. Bidder shall visit site to become acquainted with adjacent areas, means of approach to site, conditions of actual site and facilities for delivering, storing, placing, and handling of materials and equipment.

C. Pre-bid meeting is scheduled on March 24, 2014 at 10:00 a.m. at the City County Building, 210 Martin Luther King Jr Blvd, Madison, in the entrance lobby. Attendance by all bidders is mandatory. Other subcontractors to bidders are encouraged to attend.

D. Failure to visit site or failure to examine any and all Construction Documents will in no way relieve successful Bidder from necessity of furnishing any necessary materials or equipment, or performing any work, that may be required to complete the Work in accordance with Drawings and Specifications. Neglect of above requirements will not be accepted as reason for delay in the Work or additional compensation.

2. DRAWINGS AND SPECIFICATIONS

A. Drawings and Specifications that form part of this Contract, as stated in Article 1 of General Conditions of Contact, are enumerated in Document Index of these Construction Documents.

B. Complete sets of Drawings and Specifications for all trades will be issued to all Bidders, irrespective of category of work to be bid on, in order that all Bidders may be familiar with work of other trades as they affect their bid.

3. INTERPRETATION

A. No verbal explanation or instructions will be given in regard to meaning of Drawings or Specifications before Bid Due Date. Bidders shall bring inadequacies, omissions or conflicts to Owner or Engineer's attention at least ten (10) days before Bid Due Date. Prompt clarification will be available to all bidders by Addendum.

B. Failure to so request clarification or interpretation of Drawings and Specifications will not relieve successful Bidder of responsibility. Signing of Contract will be considered as implicitly denoting that Contractor has thorough understanding of scope of the Work and comprehension of Construction Documents.

C. Owner or Engineer will not be responsible for verbal instructions.

4. QUALIFICATIONS OF BIDDER (CONTRACTOR AND SUBCONTRACTOR)

A. Before award of Contract can be approved, Owner shall be satisfied that Bidder involved meets following requirements:

1. Has completed at least one (1) project of at least fifty percent (50%) of size or value of Division of work being bid and type of work completed is similar to that being bid. If greater magnitude of experience is deemed necessary, other than size or value of work, such requirements will be described in appropriate section of Specifications.

2. Maintains permanent place of business.

3. Can be bonded for terms of proposed Contract.

4. Has record of satisfactorily completing past projects and supplies list of no more than three (3) most recent, similar projects, with architect or engineer's and owner's names, addresses and telephone numbers for each project. Submit to Public Works Project Manager with Bid. Criteria which will be considered in determining satisfactory completion of projects by bidder will include:

    a. Completed contracts in accordance with drawings and specifications.
    b. Diligently pursued execution of work and completed contracts according to established time schedule unless Owner grants extensions.
    c. Fulfilled guarantee requirements of construction documents.
    d. Is not presently on ineligible list maintained by County's Department of Administration for noncompliance with equal employment opportunities and affirmative action requirements.
    e. Authorized to conduct business in Wisconsin. By submitting Bid, bidder warrants that it has: complied with all necessary requirements to do business in State of Wisconsin; that persons executing contract on its behalf are authorized to do so; and, if corporation, that name and address of bidder's registered agent are as set forth in Contract. Bidder shall notify Owner immediately, in writing, of any change in its registered agent, their address, and bidder's legal status. For partnership, term "registered agent" shall mean general partner.

B. County's Public Works Project Manager will make such investigations as are deemed necessary to determine ability of bidder to perform the Work, and bidder shall furnish to County's Public Works Project Manager or designee all such information and data for this purpose as County's Public Works Project Manager may request. Owner reserves right to reject Bid if evidence submitted by, or investigation of, bidder fails to satisfy Owner that bidder is responsible and qualified to carry out obligations of Contract and to complete the Work contemplated therein.

5. BID GUARANTEE

A. Bank certified check, cashier's check or Bid Bond, payable to County in amount not less than five percent (5%) of maximum bid, shall accompany each Bid as guarantee that if Bid is accepted, Bidder will execute and return proposed Contract and Performance and Payment Bonds within ten (10) days after being notified of acceptance of Bid. Company issuing bonds must be licensed to do business in Wisconsin.

B. Any bid, which is not accompanied by bid guarantee, will be considered "No Bid" and will not be read at Bid Due Date.

C. If successful Bidder so delivers Contract, Certificate of Insurance, and Performance and Payment Bonds, check will be returned to Bidder. In case Bidder fails to deliver such Contract, insurance, and bond, amount of bid guarantee will be forfeited to County as liquidated damages.

D. All checks tendered as bid guarantee, except those of three (3) lowest qualified, responsible bidders, will be returned to their makers within three (3) days after Bid Due Date. All such retained checks will be returned immediately upon signing of Contract and Performance and Payment Bonds by successful Bidder.

6. WITHDRAWAL OF BIDS

A. Bids may be withdrawn by written request received from bidder or authorized representative thereof prior to time fixed for Bid Due Date, without prejudice to right of bidder to file new Bid. Withdrawn Bids will be returned unopened. Negligence on part of bidder in preparing their Bid confers no right for withdrawal of Bid after it has been opened.

B. No Bid may be withdrawn for period of sixty (60) days after Bid Due Date.

C. If Bid contains error, omission or mistake, bidder may limit liability to amount of bidder's guarantee by giving written Notice of Intent not to execute Contract to Owner within seventy-two (72) hours of Bid Due Date.

7. CONTRACT FORM

A. Sample copy of contract that successful Bidder will be required to enter into is included in these Construction Documents and bidders are required to familiarize themselves with all conditions contained therein.

8. CONTRACT INTERESTS BY COUNTY PUBLIC OFFICIALS

A. In accordance with Wisconsin Statute 946.13, county official may not bid for or enter into any contract involving receipts or disbursements of more than $15,000.00 in a year, in which

they have private pecuniary interest, direct or indirect if at same time they are authorized to take official action with respect to making of this Contract. Any contract entered into in violation of this Statute is void and County incurs no liability thereon. This subsection does not affect application and enforcement of Wisconsin Statute 946.13 by state prosecutors in criminal courts of this state.

9. EMERGING SMALL BUSINESS PROVISIONS

A. **Emerging Small Business Definition.** For purposes of this provision, ESB is defined as:

1. Independent business concern that has been in business minimum of one year;

2. Business located in State of Wisconsin;

3. Business comprised of less than twenty-five (25) employees;

4. Business must not have gross sales in excess of three million dollars ($3,000,000.00) over past three years; and

5. Business does not have history of failing to complete projects.

B. **Emerging Small Business (ESB) Involvement.** Bidder shall make good faith effort to award minimum of ten percent (10%) of the Work to ESBs. Bidder shall submit report to Dane County Contract Compliance Officer within twenty-four (24) hours after Bid Due Date demonstrating such efforts. Good faith efforts means significant contact with ESBs for purposes of soliciting bids from them. Failure to make or demonstrate good faith efforts will be grounds for disqualification.

C. **Emerging Small Business Report.** Emerging Small Business Enterprise Report is to be submitted by Bidder in separate envelope marked “Emerging Small Business Report”. This report is due by 2:00 p.m. following specified twenty-four (24) hours after Bid Due Date. Bidder who fails to submit Emerging Small Business Report shall be deemed not responsive.

D. **ESB Goal.** Goal of this project is ten percent (10%) ESB participation. ESB utilizations are shown as percentage of total Bid. If Bidder meets or exceeds specified goal, Bidder is only required to submit Form A - Certification, and Form B - Involvement. Goal shall be met if Bidder qualifies as ESB.

E. **Report Contents.** Following award of Contract, Bidder shall submit copies of executed contracts for all Emerging Small Businesses. Emerging Small Business Report shall consist of these:

1. Form A - Certification;

2. Form B - Involvement;

3. Form C - Contacts;

4. Form D - Certification Statement (if appropriate); and

5. Supportive documentation (i.e., copies of correspondence, telephone logs, copies of advertisements).

F. **ESB Listing.** Bidders will solicit bids from ESB listing provided by Dane County.

G. **ESB Certification.** All contractors, subcontractors and suppliers seeking ESB certification must complete and submit Emerging Small Business Certification Application to Dane County Contract Compliance Program.

H. **Certification Statement.** If ESB firm has not been certified by County as ESB prior to submittal of this Bid, ESB Report cannot be used to fulfill ESB goal for this project unless firm provides "Form D - Certification Statement". Certification statement must be completed and signed by ESB firm.

I. **Questions.** Questions concerning Emerging Small Business provisions shall be directed to:

Dane County Contract Compliance Officer
City-County Building, Room 421
210 Martin Luther King, Jr. Blvd.
Madison, WI 53703
608/266-5623

J. **Substituting ESBs.** In event of any significant changes in subcontract arrangements or if need arises to substitute ESBs, Bidder shall report such proposed changes to Contract Compliance Officer to making any official changes and request authorization to substitute ESB firm. Bidder further agrees to make every possible effort to replace ESB firm with another qualified ESB firm.

K. **Good Faith Efforts.** Good faith efforts can be demonstrated by meeting all of these obligations:

1. Selecting portions of the Work to be performed by ESBs in order to increase likelihood of meeting ESB goal including, where appropriate, breaking down Contract into smaller units to facilitate ESB participation.

2. Advertising in general circulation, trade associations and women / minority focus media concerning subcontracting opportunities.

3. Providing written notices to reasonable number of specific ESBs that their interest in Contract was being solicited in sufficient time to allow ESBs to participate effectively.

4. Following up on initial solicitations of interest by contacting ESBs within five (5) working days prior to Bid Due Date to determine with certainty whether ESB were interested, to allow ESBs to prepare bids.

5. Providing interested ESB with adequate information about Drawings, Specifications and requirements of Contract.

6. Using services of available minority, women and small business organizations and other organizations that provide assistance in recruitment of MBEs / WBEs / ESBs.

7. Negotiating in good faith with interested ESBs, not rejecting ESBs as unqualified without sound reason based on thorough investigation of their capabilities.

8. Submitting required project reports and accompanying documents to County's Contract Compliance Officer within twenty-four (24) hours after Bid Due Date.

L. **Appeals Disqualification of Bid.** Bidder who is disqualified may appeal to Public Works & Transportation Committee and Equal Opportunity Commission.

10. METHOD OF AWARD - RESERVATIONS

A. Following will be basis of award of Contract, providing cost does not exceed amount of funds then estimated by County as available to finance Contract(s):

1. Lowest dollar amount submitted by qualified responsible bidder on Base Bid for all work comprising project, combined with such additive Owner accepted alternates.

2. Owner reserves right to reject all bids or any bid, to waive any informality in any bid, and to accept any bid that will best serve interests of County.

3. Unit Prices and Informational Bids will not be considered in establishing low bidder.

11. SECURITY FOR PERFORMANCE AND PAYMENTS

A. Simultaneous with delivery of signed Contract, Bidder shall be required to furnish Performance and Payment Bonds as specified in Article 29 of General Conditions of Contract, "Contract Security". Surety Company shall be licensed to do business in Wisconsin. Performance and Payment Bonds must be dated same date or subsequent to date of Contract. Performance and Payment Bonds must emulate information in Sample Performance and Payment Bonds in Construction Documents.

B. Provide certified copy of power of attorney from Surety Company showing that agent who signs Bond has power of attorney to sign for Surety Company. Secretary or Assistant Secretary of company must sign this certification, not attorney-in-fact. Certification must bear same or later date as Bond. Power of Attorney must emulate model power of attorney information detailed in Sample Performance and Payment Bonds.

C. If Bidder is partnership or joint venture, State certified list, providing names of individuals constituting partnership or joint venture must be furnished. Contract itself may be signed by one partner of partnership, or one partner of each firm comprising joint venture, but Performance and Payment Bonds must be signed by all partners.

D. If Bidder is a corporation, it is necessary that current certified copy of resolution or other official act of directors of corporation be submitted showing that person who signs Contract is authorized to sign contracts for corporation. It is also necessary that corporate seal be affixed to resolution, contract, and performance and payment bonds. If your corporation has no seal, it is required that above documents include statement or notation to effect that corporation has no seal.

12. TAXES

A. Bidder shall include in Bid, all Sales, Consumer, Use and other similar taxes required by law.

B. In accordance with Wisconsin Statute 71.80(16)(a),successful nonresident bidder, whether incorporated or not, and not otherwise regularly engaged in business in this state, shall file surety bond with State of Wisconsin Department of Revenue payable to Department of Revenue, to guarantee payment of income taxes, required unemployment compensation contributions, sales and use taxes and income taxes withheld from wages of employees, together with any penalties and interest thereon. Amount of bond shall be three percent (3%) of Contract or subcontract price on all contracts of $50,000 or more.

13. SUBMISSION OF BIDS

A. All Bids shall be submitted on standard Bid Form bound herein and only Bids that are made on this Bid Form will be considered. Entire Bid Form and other supporting documents, if any, shall be removed or copied from Construction Documents, filled out, and submitted in manner specified hereinafter. Submit completed Bid Bond with Bid as well.

B. No bids for any subdivision or any sub-classification of this Work, except as indicated, will be accepted. Any conditional Bid, amendment to Bid Form or appended item thereto, or inclusion of any correspondence, written or printed matter, or details of any nature other than that specifically called for, which would alter any essential provision of Construction Documents, or require consideration of unsolicited material or data in determining award of Contract, will disqualify Bid. Telecommunication alterations to Bid will not be accepted.

C. Bidders must submit single Bid for all the Work.

D. Bid amounts shall be inserted in words and in figures in spaces provided on Bid Form; in case of conflict, written word amounts will govern.

E. Addenda issued after Bid Letting shall become part of Construction Documents. Bidders shall acknowledge receipt of such addenda in appropriate space provided on Bid Form. Bid may be rejected if receipt of any particular addendum applicable to award of Contract has not been acknowledged on Bid Form.

F. Bids shall be signed, placed in envelope, sealed and delivered before due time to place designated in Invitation to Bid, and identified with project name, bid number, location, category of work being bid upon, Bid Due Date, name and address of bidder.

G. Bidder shall be responsible for sealed Bid being delivered to place designated for Bid Due Date on or before date and time specified. Bids received after time of closing will be rejected and returned to bidder unopened.

H. Bid will be considered invalid and will be rejected if bidder has not signed it.

I. Faxed Bids will not be accepted.

J. Bidder's organization shall submit completed with Bid, Fair Labor Practices Certification form, included in these Construction Documents.

14. SUBCONTRACTOR LISTING

A. Bidders shall be required to submit list of major subcontractors for General Construction, Plumbing, HVAC, and Electrical work proposed for this project to include committed prices for each subcontractor. List shall be placed in separate sealed envelope that must be clearly identified as "Major Subcontractor List", for named project and name of Bidder submitting it. County must receive envelope no later than date by which successful Bidder is required to submit his or her signed Contract, as established in Construction Documents.

15. ALTERNATE BIDS

A. Not Applicable.

16. INFORMATIONAL BIDS

A. Not Applicable.

17. UNIT PRICES

A. Not Applicable.

18. COMMENCEMENT AND COMPLETION

A. Successful Bidder shall commence work when schedule and weather permit, but no later than stated in Bid Form. Contractor shall pursue the Work regularly and continuously at reasonable rate to insure completion of the Work within time stated in Bid.

B. Should it be found impossible to complete the Work on or before time specified for completion, written request may be submitted for extension of time setting forth reasons believed to justify granting of such request. Refer to Article 20 of General Conditions of Contract.

19. WORK BY OWNER

A. This work will be accomplished by Owner or will be let under separate contracts and will not be included under this Contract:

   1. Owner shall furnish three computer room cooling units shown in these Construction Documents. Successful Bidder for this Contract shall install, start-up & troubleshoot these units.

20. SPECIAL HAZARDS COVERAGE

A. Not Applicable.

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FORM A

DANE COUNTY
EMERGING SMALL BUSINESS REPORT - CERTIFICATION

In accordance with General Conditions of Contract, submit this Emerging Small Business Report within 24 hours after Bid Due Date.

PROJECT NAME: _____

_____

BID NO.: _____ BID DUE DATE: _____

BIDDER INFORMATION

COMPANY NAME: _____

ADDRESS: _____

_____

TELEPHONE NO.: _____

CONTACT PERSON: _____

FORM B

DANE COUNTY
EMERGING SMALL BUSINESS REPORT - INVOLVEMENT

Page ___ of ___
(Copy this Form as necessary to provide complete information)

COMPANY NAME: ____

PROJECT NAME: ______________________________ BID NO.: ______________

ESB NAME: ______________________ CONTACT PERSON: ______________________

ADDRESS: ______________________________ PHONE NO.: ______________

CITY: ______________________ STATE: __________ ZIP: __________

Indicate percentage of financial commitment to this ESB: ______________% Amount: $______________

ESB NAME: ______________________ CONTACT PERSON: ______________________

ADDRESS: ______________________________ PHONE NO.: ______________

CITY: ______________________ STATE: __________ ZIP: __________

Indicate percentage of financial commitment to this ESB: ______________% Amount: $______________

ESB NAME: ______________________ CONTACT PERSON: ______________________

ADDRESS: ______________________________ PHONE NO.: ______________

CITY: ______________________ STATE: __________ ZIP: __________

Indicate percentage of financial commitment to this ESB: ______________% Amount: $______________

FORM C

DANE COUNTY
EMERGING SMALL BUSINESS REPORT - CONTACTS

Page ___ of ___
(Copy this Form as necessary to provide complete information)

COMPANY NAME: _____

PROJECT NAME: _____ BID NO.: _____

	ESB FIRM NAME CONTACTED	DATE	PERSON CONTACTED	DID ESB BID?	DID YOU ACCEPT BID?	REASON FOR REJECTION
1)						
2)						
3)						
4)						
5)						
6)						
7)						

FORM D

DANE COUNTY
EMERGING SMALL BUSINESS REPORT - CERTIFICATION STATEMENT

I, _____ , _____ of
Name Title

_____ certify to best of my knowledge and
Company

belief that this business meets Emerging Small Business definition as indicated in Article 9 and that information contained in this Emerging Small Business Report is true and correct.

_____ _____
Bidder's Signature Date

Name of Bidding Firm: _____

BID FORM

BID NO. 313056
PROJECT: MECHANICAL, ELECTRICAL, & PIPING INFRASTRUCTURE IMPROVEMENTS - BID PACKAGE 3 - MECHANICAL SYSTEMS CITY-COUNTY BUILDING

TO: DANE COUNTY DEPARTMENT OF PUBLIC WORKS, HIGHWAY & TRANSPORTATION PROJECT MANAGER
1919 ALLIANT ENERGY CENTER WAY
MADISON, WISCONSIN 53713

BASE BID - LUMP SUM:
Dane County is inviting Bids for construction services for the addition of fire protection in the penthouse & phased replacement of existing computer room HVAC units & associated distribution systems & controls. All facility functions shall remain operational during construction & there can be no loss of cooling capabilities. Only firms with capabilities, experience & expertise with similar projects should obtain this packet & submit Bids. The undersigned, having examined the site where the Work is to be executed and having become familiar with local conditions affecting the cost of the Work and having carefully examined the Drawings and Specifications, all other Construction Documents and Addenda thereto prepared by Dane County Department of Public Works, Highway & Transportation hereby agrees to provide all labor, materials, equipment and services necessary for the complete and satisfactory execution of the entire Work, as specified in the Construction Documents, for the Base Bid stipulated sum of:

_____ and _____ /100 Dollars
Written Price

$_____
Numeric Price

Receipt of the following addenda and inclusion of their provisions in this Bid is hereby acknowledged:

Addendum No(s). _____ through _____

Dated _____

Dane County Public Safety Communications must have this project completed by June 20, 2014. Assuming this Work can be started by May 12, 2014, what dates can you commence and complete this job?

Commencement Date: _____ Completion Date: _____
(final, not substantial)

I hereby certify that all statements herein are made on behalf of:

_____

(Name of Corporation, Partnership or Person submitting Bid)

Select one of the following:

1. A corporation organized and existing under the laws of the State of _____, or

2. A partnership consisting of _____, or

3. A person conducting business as _____;

Of the City, Village, or Town of _____ of the State of _____.

I have examined and carefully prepared this Bid from the associated Construction Documents and have checked the same in detail before submitting this Bid; that I have full authority to make such statements and submit this Bid in (its) (their) (my) behalf; and that the said statements are true and correct. In signing this Bid, we also certify that we have not, either directly or indirectly, entered into any agreement or participated in any collusion or otherwise taken any action in restraint of free competition; that no attempt has been made to induce any other person or firm to submit or not to submit a Bid; that this Bid has been independently arrived at without collusion with any other bidder, competitor, or potential competitor; that this Bid has not been knowingly disclosed prior to the Bids Due Date to another bidder or competitor; that the above statement is accurate under penalty of perjury.

The undersigned further agrees to honor the Base Bid and the Alternate Bid(s) for 60 days from date of Award of Contract.

SIGNATURE: _____

(Bid is invalid without signature)

Print Name: _____ Date: _____

Title: _____

Address: _____

Telephone No.: _____ Fax No.: _____

Email Address: _____

Contact Person: _____

THIS PAGE IS FOR BIDDERS' REFERENCE AND NEED NOT BE SUBMITTED WITH BID FORM.

BID CHECK LIST:
These items **must** be included with Bid:
☐ Bid Form ☐ Bid Bond ☐ Fair Labor Practices Certification
☐ Project Experience / Reference Summary

BIDDERS SHOULD BE AWARE OF THE FOLLOWING:

DANE COUNTY VENDOR REGISTRATION PROGRAM

Any person bidding on any County contract must be registered with the Dane County Purchasing Division & pay an annual registration fee. A contract will not be awarded to an unregistered vendor. Obtain a *Vendor Registration Form* by calling 608/266-4131 or complete a new form or renewal online at:
www.danepurchasing.com/registration

DANE COUNTY BEST VALUE CONTRACTING PRE-QUALIFICATION

Contractors must be pre-qualified as a Best Value Contractor with the Dane County Public Works Engineering Division before the award of contract. Obtain a *Best Value Contracting Application* by calling 608/266-4018 or complete one online at:
www.countyofdane.com/pwht/BVC_Application.aspx

EQUAL BENEFITS REQUIREMENT

By submitting a Bid, the contractor acknowledges that a condition of this contract is to provide equal benefits as required by Dane County Code of Ordinances Chapter 25.016. Contractor shall provide equal benefits as required by that Ordinance to all required employees during the term of the contract. Equal Benefits Compliance Payment Certification shall be submitted with final pay request. For more information:
www.danepurchasing.com/partner_benefit.aspx

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FAIR LABOR PRACTICES CERTIFICATION

The undersigned, for and on behalf of the BIDDER, APPLICANT or PROPOSER named herein, certifies as follows:

A. That he or she is an officer or duly authorized agent of the above-referenced BIDDER, APPLICANT or PROPOSER, which has a submitted a proposal, bid or application for a contract with the county of Dane.

B. That BIDDER, APPLICANT or PROPOSER has (check one):

_____ not been found by the National Labor Relations Board ("NLRB") or the Wisconsin Employment Relations Commission ("WERC") to have violated any statute or regulation regarding labor standards or relations in the seven years prior to the signature date of this Certification.

_____ been found by the National Labor Relations Board ("NLRB") or the Wisconsin Employment Relations Commission ("WERC") to have violated any statute or regulation regarding labor standards or relations in the seven years prior to the signature date of this Certification.

Officer or Authorized Agent Signature _____ Date _____

Printed or Typed Name and Title _____

Printed or Typed Business Name _____

NOTE: You can find information regarding the violations described above at: www.nlrb.gov and werc.wi.gov.

For reference, Dane County Ordinance 25.11(28)(a) is as follows:

(28) BIDDER RESPONSIBILITY. (a) Any bid, application or proposal for any contract with the county, including public works contracts regulated under chapter 40, shall include a certification indicating whether the bidder has been found by the National Labor Relations Board (NLRB) or the Wisconsin Employment Relations Committee (WERC) to have violated any statute or regulation regarding labor standards or relations within the last seven years. The purchasing manager shall investigate any such finding and make a recommendation to the committee, which shall determine whether the conduct resulting in the finding affects the bidder's responsibility to perform the contract.

If you indicated that the NLRB or WERC have found you to have such a violation, you must include copies of any relevant information regarding such violation with your proposal, bid or application.

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COUNTY OF DANE

PUBLIC WORKS CONSTRUCTION CONTRACT

Contract No. _____ Bid No. 313056

Authority: Res. _____, 2013-14

THIS CONTRACT, made and entered into as of the date by which authorized representatives of both parties have affixed their signatures, by and between the County of Dane (hereafter referred to as "COUNTY") and _____ (hereafter, "CONTRACTOR"), and

W I T N E S S E T H :

WHEREAS, COUNTY, whose address is c/o Assistant Public Works Director, 1919 Alliant Energy Center Way, Madison, WI 53713, desires to have CONTRACTOR provide Mechanical, Electrical & Piping Infrastructure Improvements, Bid Package 3 - Mechanical Systems at the City County Building ("the Project"); and

WHEREAS, CONTRACTOR, whose address is _____ _____ is able and willing to construct the Project, in accordance with the Construction Documents;

NOW, THEREFORE, in consideration of the above premises and the mutual covenants of the parties hereinafter set forth, the receipt and sufficiency of which is acknowledged by each party for itself, COUNTY and CONTRACTOR do agree as follows:

1. CONTRACTOR agrees to construct, for the price of $_____ the Project and at the CONTRACTOR'S own proper cost and expense to furnish all materials, supplies, machinery, equipment, tools, superintendence labor, insurance, and other accessories and services necessary to complete the Project in accordance with the conditions and prices stated in the Bid Form, General Conditions of Contract, the drawings which include all maps, plats, plans, and other drawings and printed or written explanatory matter thereof, and the specifications therefore as prepared by Henneman Engineering, Inc. (hereinafter referred to as "the Engineer"), and as enumerated in the Project Manual Document Index, all of which are made a part hereof and collectively evidence and constitute the Contract.

2. COUNTY agrees to pay the CONTRACTOR in current funds for the performance of the Contract subject to additions and deductions, as provided in the General Conditions of Contract, and to make payments on account thereof as provided in Article entitled, "Payments to Contractor" of the General Conditions of Contract.

3. During the term of this Contract, CONTRACTOR agrees to take affirmative action to ensure equal employment opportunities. The CONTRACTOR agrees in accordance with Wisconsin Statute 111.321 and Chapter 19 of the Dane County Code of Ordinances not to discriminate on the basis of age, race, ethnicity, religion, color, gender, disability, marital status, sexual orientation, national origin, cultural differences, ancestry, physical appearance, arrest record or conviction record, military participation or membership in the national guard, state defense force

or any other reserve component of the military forces of the United States, or political beliefs. Such equal opportunity shall include, but not be limited to, the following: employment, upgrading, demotion, transfer, recruitment, advertising, layoff, termination, training, rates of pay, and any other form of compensation. CONTRACTOR agrees to post in conspicuous places, available to all employees and applicants for employment, notices setting forth the provisions of this paragraph.

4. CONTRACTOR shall file an Affirmative Action Plan with the Dane County Contract Compliance Officer in accord with Chapter 19 of the Dane County Code of Ordinances. CONTRACTOR must file such plan within fifteen (15) days of the effective date of this Contract. During the term of this Contract CONTRACTOR shall also provide copies of all announcements of employment opportunities to COUNTY'S Contract Compliance Office, and shall report annually the number of persons, by race, ethnicity, gender, and disability status, which apply for employment and, similarly classified, the number hired and number rejected.

5. During the term of this Contract, all solicitations for employment placed on CONTRACTOR'S behalf shall include a statement to the effect that CONTRACTOR is an "Equal Opportunity Employer."

6. CONTRACTOR agrees to comply with provisions of Chapter 25.016 of the Dane County Code of Ordinances, which pertains to domestic partnership benefits.

7. CONTRACTOR agrees to furnish all information and reports required by COUNTY'S Contract Compliance Officer as the same relate to affirmative action and nondiscrimination, which may include any books, records, or accounts deemed appropriate to determine compliance with Chapter 19, Dane County Code of Ordinances, and the provisions of this Contract.

8. CONTRACTOR agrees that all persons employed by CONTRACTOR or any subcontractor shall be paid no less than the minimum wage established under Chapter 40, Subchapter II, Dane County Code of Ordinances. CONTRACTOR agrees to abide by and comply with the provisions of Chapter 40, Subchapter II of the Dane County Code of Ordinances, and said Subchapter is fully incorporated herein by reference.

9. This Contract is intended to be a Contract solely between the parties hereto and for their benefit only. No part of this Contract shall be construed to add to, supplement, amend, abridge or repeal existing rights, benefits or privileges of any third party or parties including, but not limited to, employees of either of the parties.

10. The entire agreement of the parties is contained herein and this Contract supersedes any and all oral agreements and negotiations between the parties relating to the subject matter hereof. The parties expressly agree that the express terms of this Contract shall not be amended in any fashion except in writing, executed by both parties.

11. CONTRACTOR must be pre-qualified as a Best Value Contractor with Dane County Public Works Engineering Division before award of Contract. Subcontractors must be pre-qualified ten (10) days prior to commencing Work under this Contract.

IN WITNESS WHEREOF, COUNTY and CONTRACTOR, by their respective authorized agents, have caused this Contract and its Schedules to be executed, effective as of the date by which all parties hereto have affixed their respective signatures, as indicated below.

* * * * * * *

FOR CONTRACTOR:

Signature Date

Printed or Typed Name and Title

Signature Date

Printed or Typed Name and Title

NOTE: If CONTRACTOR is a corporation, Secretary should attest. In accordance with IRS Regulations, unincorporated entities are required to provide either their Social Security or Employer Number in order to receive payment for services rendered.

* * * * * * *

This Contract is not valid or effectual for any purpose until approved by the appropriate authority designated below, and no work is authorized until the CONTRACTOR has been given notice to proceed by COUNTY'S Assistant Public Works Director.

FOR COUNTY:

Joseph T. Parisi, County Executive Date

Scott McDonell, County Clerk Date

THE AMERICAN INSTITUTE OF ARCHITECTS

AIA Document A310

Bid Bond

Bond No.

KNOW ALL MEN BY THESE PRESENTS, that we

(Here insert full name and address or legal title of Contractor)

as Principal, hereinafter called the Principal, and

(Here insert full name and address or legal title of Surety)

a corporation duly organized under the laws of the State of WI as Surety, hereinafter called the Surety, are held and firmly bound unto

(Here insert full name and address or legal title of Owner)

as Obligee, hereinafter called Obligee, in the sum of ( ) Percent of total amount bid

Dollars ($ Percent of attached bid).

For the payment of which sum well and truly to be made, the said Principal and the said Surety, bind ourselves, our heirs, executors, administrators, successors and assigns, jointly and severally, firmly by these presents.

WHEREAS, the Principal has submitted a bid for Project No.:

(Here insert full name, address, and description of project)

NOW, THEREFORE, if the Obligee shall accept the bid of the Principal and the Principal shall enter into a Contract with the Obligee in accordance with the terms of such bid, and give such bond or bonds as may be specified in the bidding or Contract Documents with good and sufficient surety for the faithful performance of such Contract and for the prompt payment of labor and material furnished in the prosecution thereof, or in the event of the failure of the Principal to enter such Contract and give such bond or bonds, if the Principal shall pay to the Obligee the difference not to exceed the penalty hereof between the amount specified in said bid and such larger amount for which the Obligee may in good faith contract with another party to perform the Work covered by said bid, then this obligation shall be null and void, otherwise to remain in full force and effect.

Signed and sealed this day of , 20 .

(Principal) (Seal)

(Witness)

(Title)

(Surety) (Seal)

(Witness)

ATTORNEY-IN-FACT

THE AMERICAN INSTITUTE OF ARCHITECTS

Bond No.

AIA Document A312

Performance Bond

Any singular reference to Contractor, Surety, Owner or other party shall be considered plural where applicable.

CONTRACTOR (Name and Address):

SURETY (Name and Principal Place of Business):

OWNER (Name and Address):

CONSTRUCTION CONTRACT
Date:
Amount: **$**
Description (Name and Location):

BOND
Date (Not earlier than Construction Contract Date):
Amount: **$**
Modifications to this Bond: [ ] None [ ] See Page 3

CONTRACTOR AS PRINCIPAL
COMPANY: (Corporate Seal)

SURETY COMPANY:
(Corporate Seal)

Signature: _____
Name and Title:

Signature: _____
Name and Title:
Attorney-in-Fact

(Any additional signatures appear on page 3)

FOR INFORMATION ONLY-Name, Address and Telephone AGENT OR BROKER:

OWNER'S REPRESENTATIVE (Architect, Engineer or other party):

1. The Contractor and the Surety, jointly and severally, bind themselves, their heirs, executors, administrators, successors, and assigns to the Owner for the performance of the Construction Contract, which is incorporated herein by reference.

2. If the Contractor performs the Construction Contract, the Surety and the Contractor shall have no obligation under this Bond, except to participate in conferences as provided in Subparagraph 3.1.

3. If there is no Owner Default, the Surety's obligation under this Bond shall arise after:

3.1 The Owner has notified the Contractor and the Surety at its address described in Paragraph 10 below that the Owner is considering declaring a Contractor Default and has requested and attempted to arrange a conference with the Contractor and the Surety to be held not later than fifteen days after receipt of such notice to discuss methods of performing the Construction Contract. If the Owner, the Contractor and the Surety agree, the Contractor shall be allowed a reasonable time to perform the Construction Contract, but such an agreement shall not waive the Owner's right, if any, subsequently to declare a Contractor Default; and

3.2 The Owner has declared a Contractor Default and formally terminated the Contractor's right to complete the contract. Such Contractor Default shall not be declared earlier than twenty days after the Contractor and the Surety have received notice as provided in Subparagraph 3.1; and

3.3 The Owner has agreed to pay the Balance of the Contract Price to the Surety in accordance with the terms of the Construction Contract or to a contractor selected to perform the Construction Contract in accordance with the terms of the contract with the Owner.

4. When the Owner has satisfied the conditions of Paragraph 3, the Surety shall promptly and at the Surety's expense take one of the following actions:

4.1 Arrange for the Contractor, with consent of the Owner, to perform and complete the Construction Contract; or

4.2 Undertake to perform and complete the Construction Contract itself, through its agents or through independent contractors; or

4.3 Obtain bids or negotiated proposals from qualified contractors acceptable to the Owner for a contract for performance and completion of the Construction Contract, arrange for a contract to be prepared for execution by the Owner and the contractor selected with the Owner's concurrence, to be secured with performance and payment bonds executed by a qualified surety equivalent to the bonds issued on the Construction Contract, and pay to the Owner the amount of damages as described in Paragraph 6 in excess of the Balance of the Contract Price incurred by the Owner resulting from the Contractor's default; or

4.4 Waive its rights to perform and complete, arrange for completion, or obtain a new contractor and with reasonable promptness under the circumstances:

1. After investigation, determine the amount for which it may be liable to the Owner and, as soon as practicable after the amount is determined, tender payment therefor to the Owner; or

2. Deny liability in whole or in part and notify the Owner citing reasons therefor.

5. If the Surety does not proceed as provided in Paragraph 4 with reasonable promptness, the Surety shall be deemed to be in default on this Bond fifteen days after receipt of an additional written notice from the Owner to the Surety demanding that the Surety perform its obligations under this Bond, and the Owner shall be entitled to enforce any remedy available to the Owner. If the Surety proceeds as provided in Subparagraph 4.4, and the Owner refuses the payment tendered or the Surety has denied liability, in whole or in part, without further notice the Owner shall be entitled to enforce any remedy available to the Owner.

6. After the Owner has terminated the Contractor's right to complete the Construction Contract, and if the Surety elects to act under Subparagraph 4.1, 4.2, or 4.3 above, then the responsibilities of the Surety to the Owner shall not be greater than those of the Contractor under the Construction Contract, and the responsibilities of the Owner to the Surety shall not be greater than those of the Owner under the Construction Contract. To the limit of the amount of this Bond, but subject to commitment by the Owner of the Balance of the Contract Price to mitigation of costs and damages on the Construction Contract, the Surety is obligated without duplication for:

6.1 The responsibilities of the Contractor for correction of defective work and completion of the Construction Contract;

6.2 Additional legal, design professional and delay costs resulting from the Contractor's Default, and resulting from the actions or failure to act of the Surety under Paragraph 4; and

6.3 Liquidated damages, or if no liquidated damages are specified in the Construction Contract, actual damages caused by delayed performance or non-performance of the Contractor.

7. The Surety shall not be liable to the Owner or others for obligations of the Contractor that are unrelated to the Construction Contract, and the Balance of the Contract Price shall not be reduced or set off on account of any such unrelated obligations. No right of action shall accrue on this Bond to any person or entity other than the Owner or its heirs, executors, administrators, or successors.

8. The Surety hereby waives notice of any change, including changes of time, to the Construction Contract or to related subcontracts, purchase orders and other obligations.

9. Any proceeding, legal or equitable, under this Bond may be instituted in any court of competent jurisdiction in the location in which the work or part of the work is located and shall be instituted within two years after Contractor Default or within two years after the Contractor ceased working or within two years after the Surety refuses or fails to perform its obligations under this Bond, whichever occurs first. If the provisions of this Paragraph are void or prohibited by law, the minimum period of limitation available to sureties as a defense in the jurisdiction of the suit shall be applicable.

10. Notice to the Surety, the Owner or the Contractor shall be mailed or delivered to the address shown on the signature page.

11. When this Bond has been furnished to comply with a statutory or other legal requirement in the location where the construction was to be performed, any provision in this Bond conflicting with said statutory or legal requirement shall be deemed deleted here from and provisions conforming to such statutory or other legal requirement shall be deemed incorporated herein. The intent is that this Bond shall be construed as a statutory bond and not as a common law bond.

12 DEFINITIONS

12.1 Balance of the Contract Price: The total amount payable by the Owner to the Contractor under the Construction Contract after all proper adjustments have been made, including allowance to the Contractor of any amounts received or to be received by the Owner in settlement of insurance or other claims for damages to which the Contractor is entitled, reduced by all valid and proper payments made to or on behalf of the Contractor under the Construction Contract.

12.2 Construction Contract: The agreement between the Owner and the Contractor identified on the signature page, including all Contract Documents and changes thereto.

12.3 Contractor Default: Failure of the Contractor, which has neither been remedied nor waived, to perform or otherwise to comply with the terms of the Construction Contract.

12.4 Owner Default: Failure of the Owner, which has neither been remedied nor waived, to pay the Contractor as required by the Construction Contract or to perform and complete or comply with the other terms thereof.

MODIFICATIONS TO THIS BOND ARE AS FOLLOWS:

(Space is provided below for additional signatures of added parties, other than those appearing on the cover page.)

CONTRACTOR AS PRINCIPAL		SURETY	
Company:	(Corporate Seal)	Company:	(Corporate Seal)
Signature: _____		Signature: _____	
Name and Title:		Name and Title:	
Address:		Address:	

THE AMERICAN INSTITUTE OF ARCHITECTS

Bond No.

AIA Document A312

Payment Bond

Any singular reference to Contractor, Surety, Owner or other party shall be considered plural where applicable.

CONTRACTOR (Name and Address):

SURETY (Name and Principal Place of Business):

OWNER (Name and Address):

CONSTRUCTION CONTRACT
Date:
Amount: **$**
Description (Name and Location):

BOND
Date (Not earlier than Construction Contract Date):
Amount: **$**
Modifications to this Bond: [ ] None [ ] See Page 6

CONTRACTOR AS PRINCIPAL
COMPANY: (Corporate Seal)

SURETY COMPANY:
(Corporate Seal)

Signature: _____
Name and Title:

Signature: _____
Name and Title:
Attorney-in-Fact

(Any additional signatures appear on page 6)

FOR INFORMATION ONLY-Name, Address and Telephone
AGENT OR BROKER:

OWNER'S REPRESENTATIVE (Architect, Engineer or other party):

1. The Contractor and the Surety, jointly and severally, bind themselves, their heirs, executors, administrators, successors, and assigns to the Owner to pay for labor, materials and equipment furnished for use in the performance of the Construction Contract, which is incorporated herein by reference.

2. With respect to the Owner, this obligation shall be null and void if the Contractor:

2.1 Promptly makes payment, directly, or indirectly, for all sums due Claimants, and

2.2 Defends, indemnifies and holds harmless the Owner from claims, demands, liens or suits by any person or entity whose claim, demand, lien or suit is for the payment for labor, materials, or equipment furnished for use in the performance of the Construction Contract, provided the Owner has promptly notified the Contractor and the Surety (at the address described in Paragraph 12) of any claims, demands, liens, or suits and tendered defense of such claims, demands, liens or suits to the Contractor and the Surety, and provided there is no Owner Default.

3. With respect to Claimants, this obligation shall be null and void if the Contractor promptly makes payment, directly or indirectly, for all sums due.

4. The Surety shall have no obligation to Claimants under this Bond until:

4.1 Claimants who are employed by or have a direct contract with the Contractor have given notice to the Surety (at the address described in Paragraph 12) and sent a copy, or notice thereof, to the Owner, stating that a claim is being made under this Bond and, with substantial accuracy, the amount of the claim.

4.2 Claimants who do not have a direct contract with the Contractor:

1. Have furnished written notice to the Contractor and sent a copy, or notice thereof, to the Owner, within 90 days after having last performed labor or last furnished materials or equipment included in the claim stating, with substantial accuracy, the amount of the claim and the name of the party to whom the materials were furnished or supplied or for whom the labor was done or performed; and

2. Have either received a rejection in whole or in part from the Contractor, or not received within 30 days of furnishing the above notice any communication from the Contractor by which the Contractor has indicated the claim will be paid directly or indirectly; and

3. Not having been paid within the above 30 days, have sent a written notice to the Surety (at the address described in Paragraph 12) and sent a copy, or notice thereof, to the Owner, stating that a claim is being made under this Bond and enclosing a copy of the previous written notice furnished to the Contractor.

5. If a notice required by Paragraph 4 is given by the Owner to the Contractor or to the Surety, that is sufficient compliance.

6. When the Claimant has satisfied the conditions of Paragraph 4, the Surety shall promptly and at the Surety's expense take the following actions:

6.1 Send an answer to the Claimant, with a copy to the Owner, within 45 days after receipt of the claim, stating the amounts that are undisputed and the basis for challenging any amounts that are disputed.

6.2 Pay or arrange for payment of any undisputed amounts.

7. The Surety's total obligation shall not exceed the amount of this Bond, and the amount of this Bond shall be credited for any payments made in good faith by the Surety.

8. Amounts owed by the Owner to the Contractor under the Construction Contract shall be used for the performance of the Construction Contract and to satisfy claims, if any, under any Construction Performance Bond. By the Contractor furnishing and the Owner accepting this Bond, they agree that all funds earned by the Contractor in the performance of the Construction Contract are dedicated to satisfy obligations of the Contractor and the Surety under this Bond, subject to the Owner's priority to use the funds for the completion of the work.

9. The Surety shall not be liable to the Owner, Claimants or others for obligations of the Contractor that are unrelated to the Construction Contract. The Owner shall not be liable for payment of any costs or expenses of any Claimant under this Bond, and shall have under this Bond no obligations to make payments to, give notices on behalf of, or otherwise have obligations to Claimants under this Bond.

10. The Surety hereby waives notice of any change, including changes of time, to the Construction Contract or to related subcontracts, purchase orders and other obligations.

11. No suit or action shall be commenced by a Claimant under this Bond other than in a court of competent jurisdiction in the location in which the work or part of the work is located or after the expiration of one year from the date (1) on which the Claimant gave the notice required by Subparagraph 4.1 or Clause 4.2.3, or (2) on which the last labor or service was performed by anyone or the last materials or equipment were furnished by anyone under the Construction Contract, whichever of (1) or (2) first occurs. If the provisions of this Paragraph are void or prohibited by law, the minimum period of limitation available to sureties as a defense in the jurisdiction of the suit shall be applicable.

12. Notice to the Surety, the Owner or the Contractor shall be mailed or delivered to the address shown on the signature page. Actual receipt of notice by Surety, the Owner or the Contractor, however accomplished, shall be sufficient compliance as of the date received at the address shown on the signature page.

13. When this Bond has been furnished to comply with a statutory or other legal requirement in the location where the construction was to be performed, any provision in this Bond conflicting with said statutory or legal requirement shall be deemed deleted herefrom and provisions conforming to such statutory or other legal requirement shall be deemed incorporated herein. The intent is that this Bond shall be construed as a statutory bond and not as a common law bond.

14. Upon request by any person or entity appearing to be a potential beneficiary of this Bond, the Contractor

shall promptly furnish a copy of this Bond or shall permit a copy to be made.

15. DEFINITIONS

15.1 Claimant: An individual or entity having a direct contract with the Contractor or with a subcontractor of the Contractor to furnish labor, materials or equipment for use in the performance of the Contract. The intent of this Bond shall be to include without limitation in the terms "labor, materials or equipment" that part of water, gas, power, light, heat, oil, gasoline, telephone service or rental equipment used in the Construction Contract, architectural and engineering services required for performance of the work of the Contractor and the Contractor's subcontractors, and all other items for which a mechanic's lien may be asserted in the jurisdiction where the labor, materials or equipment were furnished.

15.2 Construction Contract: The agreement between the Owner and the Contractor identified on the signature page, including all Contract Documents and changes thereto.

15.3 Owner Default: Failure of the Owner, which has neither been remedied nor waived, to pay the Contractor as required by the Construction Contract or to perform and complete or comply with the other terms thereof.

MODIFICATIONS TO THIS BOND ARE AS FOLLOWS:

(Space is provided below for additional signatures of added parties, other than those appearing on the cover page.)

CONTRACTOR AS PRINCIPAL		SURETY	
Company:	(Corporate Seal)	Company:	(Corporate Seal)
Signature: _____		Signature: _____	
Name and Title:		Name and Title:	
Address:		Address:	

EQUAL BENEFITS COMPLIANCE PAYMENT CERTIFICATION

PURPOSE

25.016(8) of the Dane County Ordinance requires that each contractor receiving payment for contracted services must certify that he or she has complied fully with the requirements of Chapter 25.016 "Equal Benefits Requirement" of the Dane County Ordinances. Such certification must be submitted prior to the final payment on the contract.

This form should be included with a copy of the final contract invoice forwarded to your contract representative at Dane County.

CERTIFICATION

I, _____ certify that
Printed or Typed Name and Title

_____
Printed or Typed Name of Contractor

has complied fully with the requirements of Chapter 25.016 of the Dane County Ordinances "Equal Benefits Requirements".

Signed _____

Date _____

For questions on this form, please contact Chuck Hicklin at 608-266-4109 or your contract representative at Dane County.

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GENERAL CONDITIONS OF CONTRACT

TABLE OF CONTENTS

1. CONSTRUCTION DOCUMENTS

A. Construction Documents, listed in Table of Contents of this Specification volume shall form part of this Contract and provisions of Construction Documents shall be as binding upon parties as if they were fully set forth in Contract itself.

B. These shall also be considered as part of Construction Documents: Addenda, including additions and modifications incorporated in such addenda before execution of Contract; requests for information; construction bulletins; change orders; and written interpretations by Architect / Engineer or Public Works Project Manager that are made after execution of Contract.

C. Construction Documents are complementary, and what is required by one shall be as binding as if required by all. Intent of Construction Documents is to include all labor, materials and equipment necessary for proper execution of the Work.

2. DEFINITIONS

A. These terms as used in this Contract are respectively defined as follows:
   1. All uses of term "County" in Construction Documents shall mean Dane County.
   2. All uses of term "Department" in Construction Documents shall mean Department of Public Works, Highway & Transportation, which is a unit of Dane County government. Department is County agency overseeing Contract with Contractor.
   3. Public Works Project Manager is appointed by and responsible to Department. Public Works Project Manager has authority to act on behalf of Department and will sign change orders, payment requests and other administrative matters related to projects.
   4. Public Works Project Manager is responsible for supervision, administration and management of field operations involved in construction phase of this Work.
   5. Term "Work" includes all labor, equipment and materials necessary to produce project required by Construction Documents.
   6. Term "Substantial Completion" is date when project or specified area of project is certified by Architect / Engineer that construction is sufficiently completed, in accordance with Construction Documents, and as modified by any subsequent changes agreed to by parties, so that County may occupy project or specified area of project for use for which it was intended subject to permit approval for occupancy.
   7. Contractor is person, firm, or corporation with whom County makes Contract. Though multiple contracts may be involved, Construction Documents treat them throughout as if each were of singular number.

3. ADDITIONAL INSTRUCTIONS AND DRAWINGS

A. Contractor may be furnished additional instructions and detail drawings as necessary to carry out the Work included in Contract. Additional drawings and instructions thus supplied to Contractor will coordinate with Construction Documents and will be so prepared that they can be reasonably interpreted as part thereof. Contractor shall carry out the Work in accordance with additional detail drawings and instructions.

4. SHOP DRAWINGS, PRODUCT DATA AND SAMPLES

A. Unless otherwise specified, Contractor shall submit three (3) copies of all Shop Drawings for each submission, until receiving final approval. After final approval, provide five (5) additional copies for distribution and such other copies as may be required.

B. Contractor shall submit, on an on-going basis and as directed, Product Data such as brochures that shall contain catalog cuts and specifications of all furnished mechanical and electrical equipment. After Architect / Engineer's approval, one (1) copy shall remain in Architect / Engineer's file, one (1) kept at Department's office and one (1) kept at job site by Contractor for reference purposes.

C. Samples shall consist of physical examples furnished by Contractor in sufficient size and quantity to illustrate materials, equipment or workmanship, and to establish standards to compare the Work.
   1. Submit Samples in sufficient quantity (minimum of two (2)) to permit Architect / Engineer to make all necessary tests and of adequate size showing quality, type, color range, finish, and texture. Label each Sample stating material, type, color, thickness, size, project name, and Contractor's name.
   2. Submit transmittal letter requesting approval, and prepay transportation charges to Architect / Engineer's office on samples forwarded.
   3. Materials installed shall match approved Samples.

D. Contractor shall review Shop Drawings and place their dated stamp thereon to evidence their review and approval and shall submit with reasonable promptness and in orderly sequence to cause no delay in the Work or in work of any other contractor. At time of submission, Contractor shall inform Architect / Engineer in writing of any deviation in Shop Drawings or Samples from requirements of Construction Documents. Architect / Engineer will not consider partial lists.

E. Architect / Engineer will review and approve or reject Shop Drawings with reasonable promptness to cause no delay. Architect / Engineer's approval shall not relieve Contractor from responsibility for errors or omissions in Shop Drawings.

F. Contractor shall not commence any work requiring Shop Drawing, Product Data or Sample submission until Architect / Engineer has approved submission. All such work shall be in accordance with approved Shop Drawings, Product Data and Samples.

G. Contractor shall keep on site of the Work, approved or conformed copy of Shop Drawings and shall at all time give Department access thereto.

H. By stamping and submitting Shop Drawings, Product Data and Samples, Contractor thereby represents that he or she has or will determine and verify all field measurements, field construction criteria, materials, catalog numbers, and similar data and that he or she has checked and coordinated each Shop Drawing, Product Data and Sample with requirements of the Work and of Construction Documents. Architect / Engineer shall return without examination, Shop Drawings, Product Data and Samples not so noted.

I. All Shop Drawings from any one Contractor should be numbered consecutively and on cover sheet shall bear name and location of project, name of Contractor, date of submittal and date of each correction or revision and associated Specification section and page number.

5. CUTTING AND PATCHING

A. Contractor shall be responsible for all cutting, fitting or patching required to complete the Work or to make its parts fit together properly.

B. Contractor shall not damage or endanger portion of the Work or fully or partially completed construction of County or separate contractors by cutting, patching or otherwise altering such construction, or by excavation. Contractor shall not cut or otherwise alter such construction by County or separate contractor except with written consent of County and of such separate contractor; such consent shall not be unreasonably withheld. Contractor shall not withhold unreasonably from County or separate contractor, Contractor's consent to cutting or otherwise altering the Work.

6. CLEANING UP

A. Contractor shall keep premises and surrounding area free from accumulation of waste materials or rubbish caused by operations under Contract. Contractor shall remove from and about the Work waste materials, rubbish, Contractor's tools, construction equipment, machinery, and surplus materials at completion of the Work. Contractor shall maintain streets and sidewalks around the Work site in clean condition. Contractor shall remove all spillage and prevent tracking of spillage arising from performance of the Work, into, out of, and within the Work site. Contractor shall establish regular maintenance program of sweeping, vacuuming and / or hosing to minimize accumulation of dirt and dust upon such areas.

B. If Contractor fails to clean up as directed in Construction Documents, County may do so and shall charge Contractor cost thereof.

C. Contractor shall be responsible for broken windows and glass, and at completion of the Work shall replace such damaged or broken windows and glass. After replacing damaged or broken windows and glass, Contractor shall remove all labels, wash and polish both sides of all windows and glass.

D. In addition to general cleaning (sweeping, vacuuming and / or hosing, as is appropriate to work surface), Contractor shall perform following final cleaning for all trades at completion of the Work:
   1. Remove temporary protections;
   2. Remove marks, stains, fingerprints and other soil or dirt from painted, decorated and finished woodwork and wall surfaces;
   3. Remove spots, plaster, soil and paint from ceramic tile, marble and other finished materials, and wash or wipe clean;
   4. Clean fixtures, cabinet work and equipment, removing stains, paint, dirt and dust, and leave same in undamaged, new condition;
   5. Clean aluminum in accordance with recommendations of manufacturer; and
   6. Clean resilient floors thoroughly with well-rinsed mop containing only enough moisture to clean off any surface dirt or dust and buff dry by machine to bring surfaces to sheen.

7. USE OF SITE

A. Contractor shall provide County and Architect / Engineer access to the Work under all circumstances.

B. Contractor shall confine operations at site to areas permitted by County, law, ordinance, permits and Construction Documents and shall not unreasonably encumber site with materials or equipment. Contractor shall assure free, convenient, unencumbered, direct and safe access to all properties adjacent to the Work for County, its employees, invitees and guests.

8. MATERIALS AND WORKMANSHIP

A. Contractor shall perform all work and furnish all supplies and materials, machinery, equipment, facilities and means, necessary to complete the Work required by this Contract, within time specified, in accordance with provisions of Construction Documents.

B. All equipment and materials incorporated in the Work covered by this Contract are to be new; use recycled and / or recovered materials to extent that such use is technically and economically feasible. Recovered materials are products recovered from solid waste in form identical to original form for use that is same as, or similar to original use. Recycled materials are products manufactured from solid waste.

C. If requested, Contractor shall furnish satisfactory evidence as to kind and quality of construction materials proposed or used. Contractor shall furnish to Architect / Engineer, for approval, manufacturer name and model, performance capacities and other pertinent information of machinery, mechanical, electrical or other types of equipment, which Contractor plans to install.

D. If not otherwise provided, materials and labor called for in this Contract shall be provided and performed in accordance with established practice and standards recognized by Architects, Engineers, Department, and construction industry.

E. Reference to "Standard" specifications of any association or manufacturer, or codes of County authorities, intends most recent printed edition or catalog in effect on date that corresponds with date of Construction Documents.

F. Whenever reference is made in Specifications that work shall be "performed", "applied", in accordance with "manufacturer's directions or instructions", Contractor to whom those instructions are directed shall furnish three (3) printed copies of such instructions to Architect / Engineer before execution of the Work.

9. CONTRACTOR'S TITLE TO MATERIALS

A. Contractor or any subcontractor shall not purchase materials or supplies for the Work subject to any chattel mortgage or under conditional sale contract or other agreement by which seller retains interest. Contractor warrants that all materials and supplies used in the Work are free from all liens, claims or encumbrances and Contractor has good title to them.

10. "OR EQUAL" CLAUSE

A. Whenever equipment or materials are identified on Drawings or in Specifications by reference to manufacturer's or vendor's name, trade name, catalog number, and other identifying information, it is intended to establish standards; and any equipment or material of other manufacturers and vendors which will perform adequately duties imposed by

general design will be considered equally accepted provided equipment or material so proposed is, in opinion of Architect / Engineer, of equal substance and function. Architect / Engineer and Department shall provide written approval before Contractor may purchase or install it.

B. Equipment or materials of manufacturers, other than those named, may be used only upon following conditions:
   1. That, in opinion of Architect / Engineer and Department, proposed material or equipment item is fully equal or superior (in design, materials, construction, workmanship, performance, finish, etc.) to named item. No compromise in quality level, however small, is acceptable.
   2. That, in substituting materials or equipment, Contractor assumes responsibility for any changes in system or for modifications required in adjacent or related work to accommodate such substitution despite Architect / Engineer's and Department's approval, and all costs growing out of approval of "or equal" items shall be responsibility of Contractor. No extra costs resulting from such approval shall become responsibility of Department, Architect / Engineer or any other separate Contractor.
   3. It shall be understood that use of materials or equipment other than those specified, or approved equal by Architect / Engineer and Department, shall constitute violation of Contract, and that Architect / Engineer and Department shall have right to require removal of such materials or equipment and their replacement with specified materials or equipment at Contractor's expense.
   4. Product and manufacturer named first in Specifications or on information shown on Drawings is basis of selection of manufactured items and equipment, particularly mechanical equipment. In using other than first named products or manufacturers, including those specified as additionally approved or acceptable, Contractor assumes responsibility for any changes in system and for modifications in any work required to accommodate them. Architect / Engineer's approval of such additionally acceptable products or manufacturers, either in Specifications or in Addendum, does not relieve Contractor from obligation to coordinate such optional products with other Contractors, whose work may be affected by them, and to pay all additional costs resulting from their inclusion into the Work. Contractor's liability shall include payment of Architect / Engineer's fees for any additional services made necessary by or directly connected to such product changes. No extra costs resulting from such changes shall become responsibility of Department, Architect / Engineer or any other separate Contractor.

C. No request for approval of "or equal" materials will be entertained except from Contractor. Identify any request for substitution as substitution on Contractor's letter of transmittal and give reasons for substitution. Department may in its sole discretion allow substitutions of materials.

11. PATENTS AND ROYALTIES

A. If Contractor uses any design, device or material covered by letters, patent or copyright, it is mutually agreed and understood, that, without exception, contract prices shall include all royalties or costs arising from use of such design, device or materials, in any way involved in the Work.

B. Contractor shall indemnify and save harmless County from any and all claims for infringement by reason of use of such patent or copyright in connection with the Work agreed to be performed under this Contract, and shall indemnify County for any cost,

expense or damage which it may be obliged to pay by reason of such infringement at any time during prosecution of the Work or after completion of the Work.

12. SURVEYS, PERMITS, REGULATIONS AND TAXES

A. Department will furnish to Contractor all site, topography and property surveys necessary for execution of the Work.

B. Contractor shall procure all permits, licenses and approvals necessary for execution of this Contract.

C. Contractor shall give all notices and comply with all State of Wisconsin, Federal and local laws, codes, rules and regulations relating to performance of the Work, protection of adjacent property, and maintenance of passageways, guard fences or other protective facilities.

D. Contractor shall pay all Sales, Consumer, Use and other similar taxes required by law.

E. Contractor shall promptly notify Architect / Engineer of any variances of Drawings or Specifications with that of any State of Wisconsin, federal or local law, code, rule or regulation. Upon such notification, Architect / Engineer will require correction of variance to comply with applicable law, code, rule or regulation at no additional cost to Contractor.

F. Work under this Contract shall comply with all applicable State of Wisconsin, Federal and local laws, codes and regulations.

G. Contractor shall pay charges for water, sewer and other utility connections made by municipalities where required by Specifications.

13. CONTRACTOR'S OBLIGATIONS AND SUPERINTENDENCE

A. Contractor shall provide and pay for all materials, labor, tools, equipment, transportation and superintendence necessary to execute, complete and deliver the Work within specified time. Contractor agrees to secure at their own expense all personnel necessary to carry out the Work. Such personnel shall not be deemed County employees nor shall they have or be deemed to have any direct contractual relationship with County.

B. Performance of any work necessary after regular working hours, on Sundays or Legal Holidays shall be without additional expense to County. Performance of any work at site at other than normal working hours must be coordinated with Public Works Project Manager.

C. Contractor shall furnish, erect, maintain and remove such temporary works as may be required.

D. Contractor shall observe, comply with, and be subject to all terms, conditions, requirements and limitations of Construction Documents.

E. At the Work site, Contractor shall give personal superintendence to the Work or shall employ construction superintendent or foreman, experienced in character of work covered by Contract, who shall have full authority to act for Contractor. Understand that such superintendent or foreman shall be acceptable to Architect / Engineer and Department.

F. Remove from project or take other corrective action upon notice from Architect / Engineer or Department for Contractor's employees whose work is considered by Architect / Engineer or Department to be unsatisfactory, careless, incompetent, unskilled or otherwise objectionable.

G. Contractor and subcontractors shall be required to conform to Labor Laws of State of Wisconsin and various acts amendatory and supplementary thereto and to other laws, ordinances and legal requirements applicable to the Work.

H. Presence and observation of the Work by Architect / Engineer or Public Works Project Manager shall not relieve Contractor of any obligations.

14. WEATHER CONDITIONS

A. In event of temporary suspension of work, or during inclement weather, or whenever Architect / Engineer shall direct, Contractor shall, and shall cause subcontractors to protect carefully all work and materials against damage or injury from weather. If, in opinion of Architect / Engineer or Department, any work or materials that have been damaged or injured due to failure on part of Contractor or any subcontractors so to protect the Work, such materials shall be removed and replaced at expense of Contractor.

15. PROTECTION OF WORK AND PROPERTY

A. Contractor shall at all times safely guard County's property from injury or loss in connection with this Contract. Contractor shall at all times safely guard and protect the Work, and adjacent property, from damage. Contractor shall replace or make good any such damage, loss or injury unless such is caused directly by errors contained in Contract, or by County, or County's duly authorized representative.

B. Contractor may act diligently, without previous instructions from Architect / Engineer and / or Department, in emergency that threatens loss or injury of property, or safety of life. Contractor shall notify Architect / Engineer and / or Department immediately thereafter. Promptly submit any claim for compensation by Contractor due to such extra work to Architect / Engineer and / or Department for approval as provided for in Article 18 herein.

16. INSPECTION AND TESTING OF MATERIALS

A. Authorized representatives and agents of County government shall have access at all times to the Work wherever it is in preparation or progress and Contractor shall provide facilities for such access and for inspection.

B. Should it be considered necessary or advisable at any time before final acceptance of the Work to make examination of work already completed, by removing or tearing out same, Contractor shall upon request, promptly furnish all necessary facilities, labor and materials. If such work is found to be defective in any aspect, due to fault of Contractor or subcontractors thereof, Contractor shall assume all expenses of such examination and of satisfactory reconstruction. Contractor will be reimbursed for such examination and replacement in accordance with Article 18 - A.3., of these General Conditions of Contract if such work is found to meet requirements of Contract.

C. If Specifications, Architect / Engineer's, or Public Works Project Manager's instructions require any work to be specially tested or approved, Contractor shall give Architect /

Engineer and Public Works Project Manager timely notice of its readiness for testing or inspection. Test all materials and equipment requiring testing in accordance with accepted or specified standards, as applicable. Architect / Engineer shall recommend laboratory or inspection agency and Department will select and pay for all initial laboratory inspection services. Should retesting be required, due to failure of initial testing, cost of such retesting shall be borne by Contractor.

D. Cost of any testing performed by manufacturers or Contractor for substantiating acceptability of proposed substitution of materials and equipment, or necessary conformance testing in conjunction with manufacturing processes or factory assemblage, shall be borne by Contractor or manufacturer responsible.

17. REPORTS, RECORDS AND DATA

A. Contractor shall submit to Architect / Engineer and Public Works Project Manager such schedule of quantities and costs, progress schedules, payrolls, reports, estimates, invoices, records and other data as either may request concerning work performed or to be performed under this Contract.

18. CHANGES IN THE WORK

A. Make no changes, except in cases of emergency, in the Work covered by approved Construction Documents without having prior written approval of Department. Charges or credits for the Work covered by approved change shall be determined by one of these methods:
   1. Unit bid prices previously approved.
   2. Agreed lump sum based on actual cost of:
      a) Labor, including foremen, and all fringe benefits that are associated with their wages.
      b) Materials entering permanently into the Work.
      c) Ownership or rental cost of construction tools and equipment during time of use on extra work.
      d) Power and consumable supplies for operation of power equipment.
      e) Workmen's Compensation Insurance, Contractor's Public Liability and Property Damage Insurance, and Comprehensive Automobile Liability Insurance.
      f) Social Security and old age and unemployment contributions.
      g) Add to cost under (2), fixed fee to be agreed upon, but not to exceed fifteen percent (15%) of actual cost of work performed with their own labor force. Fee shall be compensation to cover cost of supervision, overhead, bond, profit and any other general expense.
      h) On that portion of the Work under (2) done under subcontract, Contractor may include not over seven and one-half percent (7½%) for supervision, overhead, bond, profit and any other general expense.
      i) Department may require correct amount of costs with supporting vouchers; Contractor shall keep and present in such form as directed.
   3. Cost-plus work, with not-to-exceed dollar limit, based on actual cost of:
      a) Labor, including foremen, and all fringe benefits that are associated with their wages.
      b) Materials entering permanently into the Work.

c) Ownership or rental cost of construction tools and equipment during time of use on extra work. Rental cost cannot exceed fifty percent (50%) replacement value of rented equipment.
d) Power and consumable supplies for operation of power equipment.
e) Workmen's Compensation Insurance, Contractor's Public Liability and Property Damage Insurance, and Comprehensive Automobile Liability Insurance.
f) Social Security and old age and unemployment contributions.
g) To cost under (3), there shall be added fixed fee to be agreed upon but not to exceed fifteen percent (15%) of actual cost of work performed with their own labor force. Fee shall be compensation to cover cost of supervision, overhead, bond, profit, and any other general expense.
h) On that portion of the Work under (3) done under subcontract, Contractor may include not over seven and one-half percent (7½%) for supervision, overhead, bond, profit, and any other general expense.
i) Contractor shall keep and present, in such form as directed, correct amount of cost together with such supporting vouchers as may be required by Department.

B. If Contractor claims that by any instructions given by Architect / Engineer, Department, by drawings or otherwise, regarding performance of the Work or furnishing of material under Contract, involves extra cost, Contractor shall give Department written notice of cost thereof within two (2) weeks after receipt of such instructions and in any event before proceeding to execute work, unless delay in executing work would endanger life or property.

C. No claim for extra work or cost shall be allowed unless it was done in pursuance of written Change Order from Architect / Engineer and approved by Department, as previously mentioned, and claim presented with payment request submitted after changed or extra work is completed.

D. Negotiation of cost for change in the Work shall not be cause for Contractor to delay prosecution of the Work if Contractor has been authorized in writing by Public Works Project Manager to proceed.

19. EXTRAS

A. Without invalidating Contract, Department may order extra work or make changes by altering, adding to or deducting from the Work, contract sum being adjusted in accordance with Article 18 herein.

20. TIME FOR COMPLETION

A. Contractor agrees that the Work shall be prosecuted regularly and diligently and complete the Work as stated in Construction Documents.

21. CORRECTION OF WORK

A. All work, all materials whether incorporated in the Work or not, and all processes of manufacture shall at all times and places be subject to inspection of Architect / Engineer and Public Works Project Manager who shall be judge of quality and suitability of the Work, materials, and processes of manufacture for purposes for which they are used. Should they fail to meet Architect / Engineer's and Public Works Project Manager's approval they shall

be reconstructed, made good, replaced or corrected, by Contractor at Contractor's expense. Immediately remove all rejected material from site.

B. If Contractor defaults or neglects to carry out the Work in accordance with Construction Documents or fails to perform any provision of Contract, Department may, after ten (10) days' written notice to Contractor and without prejudice to any other remedy County may have, make good such deficiencies. In such case, appropriate Change Order shall be issued deducting from Contractor's payments then or thereafter, cost of correcting such deficiencies, including cost of Architect / Engineer's additional services made necessary by such default, neglect or failure.

22. SUBSURFACE CONDITIONS FOUND DIFFERENT

A. If Contractor encounters subsurface or latent conditions at site materially differing from those shown on Drawings or indicated in Specifications, Contractor shall immediately give notice to Architect / Engineer and Public Works Project Manager of such conditions before they are disturbed. Architect / Engineer will thereupon promptly investigate conditions, and if Architect / Engineer finds that they materially differ from those shown on Drawings or indicated in Specifications, Architect / Engineer will at once make such changes as necessary, any increase or decrease of cost resulting from such changes to be adjusted in manner provided in above Article 18 entitled "Changes in the Work".

23. RIGHT OF DEPARTMENT TO TERMINATE CONTRACT

A. In event that any provisions of this Contract are violated by Contractor or by any subcontractors, County may serve written notice upon Contractor and Surety of its intention to terminate Contract, such notice to contain reasons for such intention to terminate Contract, and unless within ten (10) days after serving of such notice upon Contractor, such violation or delay shall cease and satisfactory arrangement or correction be made, Contract shall, upon expiration of said ten (10) days, cease and terminate.

B. In event of any such termination, County shall immediately serve notice thereof upon Surety and Contractor, and Surety shall have right to take over and perform Contract subject to County's approval; provided, however, that if Surety does not commence performance thereof within ten (10) days from date of mailing to such Surety of notice of termination, County may take over the Work and prosecute same to completion by contract, or by force account, at expense of Contractor; Contractor and Surety shall be liable to County for any excess cost occasioned County thereby, and in such event County may take possession of and utilize in completing the Work, such materials and equipment as may be on the Work site and therefore necessary.

24. CONSTRUCTION SCHEDULE AND PERIODIC ESTIMATES

A. Contractor shall be responsible for Construction Schedule and coordination. Immediately after execution and delivery of Contract and before making first payment, Contractor shall notify all subcontractors to furnish all required information to develop Construction Schedule. Contractor and all subcontractors associated with the Work shall furnish following information from each Division of Specifications:
   1. List of construction activities;
   2. Start, finish and time required for completion of each activity;
   3. Sequential relationships between activities;

4. Identify all long lead-time items, key events, meetings or activities such as required submittals, fabrication and delivery, procurement of materials, installation and testing;
5. Weekly definition of extent of work and areas of activity for each trade or Subcontract; and
6. Other information as determined by Public Works Project Manager.

B. In addition to above requested items, Contractor shall request delivery dates for all County-furnished equipment, materials or labor. This shall include any work handled by Department under separate contracts such as asbestos abatement, air and water balancing, etc. Indicate on Construction Schedule these associated delivery and installation dates.

C. Progress Reporting:
1. Contractor shall update and publish Construction Schedule on monthly basis. Revisions to Schedule shall be by Contractor and made in same detail as original Schedule and accompanied by explanation of reasons for revision; and shall be subject to approval by Department.
2. Failure of Contractor to keep Schedule in updated format shall result in County hiring firm specializing in construction schedule development and deducting those costs associated with updating process from payments due Contractor.
3. Contractor shall submit show actual percentage of each activity completed, estimated future progress, and anticipated completion time.

D. Responsibility for timely completion requires:
1. Contractor and subcontractors understand that performance of each is interdependent upon performance of others.
2. Whenever it becomes apparent from current schedule, that phasing or progress completion dates will not be met, Contractor must take some or all following actions at no additional cost to County:
   a) Increase construction labor in such quantities and crafts as will eliminate backlog of work.
   b) Increase number of working hours per shift, shifts per working day, working days per week, amount of construction equipment, or any combination of foregoing to eliminate backlog of work.
   c) Reschedule work (yet remain in conformance with Drawings and Specifications).
3. Prior to proceeding with any of above actions, Contractor shall notify Public Works Project Manager.

E. Maintain current Construction Schedule at all times. Revise Construction Schedule in same detail as original and accompany with explanation of reasons for revision. Schedule shall be subject to approval by Architect / Engineer and Public Works Project Manager.

25. PAYMENTS TO CONTRACTOR

A. Contractor shall provide:
1. Detailed estimate giving complete breakdown of contract price by Specification Division; and
2. Periodic itemized estimates of work done for purpose of making partial payments thereon.

Submit these estimates for approval first to Architect / Engineer, then to Public Works Project Manager. Costs employed in making up any of these schedules are for determining basis of partial payments and not considered as fixing basis for additions to or deductions from Contract price.

B. County will make partial payments to Contractor for value, proportionate to amount of Contract, of all labor and material incorporated in the Work during preceding calendar month upon receipt of Application and Certificate for Payment form from Architect / Engineer and approval of Department.

C. Contractor shall submit for approval first to Architect / Engineer, and then to Public Works Project Manager all Application and Certificate for Payment forms. If requested, Application and Certificate for Payment shall be supported by such additional evidence as may be required, showing Contractor's right to payment claimed.

D. Application and Certificate for Payment for preparatory work and materials delivered and suitably stored at site to be incorporated into the Work at some future period, will be given due consideration. Requesting payment for materials stored off site, may be rejected, however, if deemed essential for reasons of job progress, protection, or other sufficient cause, requests will be considered, conditional upon submission by Contractor of bills of sale, photographs and such other procedures as will adequately protect County's interest such as storage in bonded warehouse with adequate coverage. If there is any error in payment, Contractor is obligated to notify Department immediately, but no longer than ten (10) days from receipt of payment.

E. Payments by County will be due within forty-five (45) days after receipt by Department of Application and Certificate for Payment.

F. County will retain five percent (5%) of each Application and Certificate for Payment until final completion and acceptance of all the Work covered by Contract. However, anytime after fifty percent (50%) of the Work has been furnished and installed at site, County will make remaining payments in full if Architect / Engineer and Public Works Project Manager find that progress of the Work corresponds with Construction Schedule. If Architect / Engineer and Public Works Project Manager find that progress of the Work does not correspond with Construction Schedule, County may retain up to ten percent (10%) of each Application and Certificate for Payment for the Work completed.

G. All material and work covered by partial payments made shall become sole property of County, but this provision shall not be construed as relieving Contractor from sole responsibility for care and protection of materials and work upon which payments have been made, or restoration of any damaged work, or as waiver of right of County to require fulfillment of all of terms of Contract.

H. County will make final payment within sixty (60) days after final completion of the Work, and will constitute acceptance thereof. Submit Equal Benefits Compliance Payment Certification with final pay request. Payment may be denied if Certification is not included.

I. County may make payment in full, including retained percentages and less authorized deductions, upon completion and acceptance of each Division where price is stated separately in Contract.

J. Every contractor engaged in performance of any contract for Department of Public Works, Highway & Transportation shall submit to this Department, as requested and with final application for payment for work under said contract, affidavit(s) as required to prove that all debts and claims against this Work are paid in full or otherwise satisfied, and give final evidence of release of all liens against the Work and County. If Wisconsin Prevailing Wage

Rate Determination is required for this Work, use "Prime Contractor Affidavit of Compliance with Prevailing Wage Rate Determination" and "Agent or Subcontractor Affidavit of Compliance with Prevailing Wage Rate Determination" (if applicable). If Wisconsin Prevailing Wage Rate Determination is not required for this Work, use "Dane County, Wisconsin Contractor Wage Affidavit". Forms of such affidavits are included in Supplementary Conditions.

26. WITHHOLDING OF PAYMENTS

A. County, after having served written notice on said Contractor, may either pay directly any unpaid bills of which Department has written notice, or withhold from Contractor's unpaid compensation sum of money deemed reasonably sufficient to pay any and all such lawful claims until satisfactory evidence is furnished that all liabilities have been fully discharged; whereupon, payment to Contractor shall be resumed in accordance with terms of this Contract, but in no event shall these provisions be construed to impose any obligations upon County to either Contractor or Contractor's Surety.

B. In paying any unpaid bills of Contractor, County shall be deemed agent of Contractor, and any payment so made by County, shall be considered as payment made under Contract by County to Contractor and County shall not be liable to Contractor for any such payment made in good faith.

C. Contractor shall indemnify, hold harmless and defend Dane County, its boards, commissions, agencies, officers, employees and representatives from all claims growing out of lawful demands of subcontractors, laborers, workers, mechanics, material men, and furnishers of machinery and parts thereof, equipment, power tools, and all supplies, including commissary, incurred in performance of this Contract.

D. At Department's request, Contractor shall furnish satisfactory evidence that all obligations of nature designated above have been paid, discharged or waived.

27. ACCEPTANCE OF FINAL PAYMENT AS RELEASE

A. Making of final payment shall constitute waiver of all claims by County except those arising from:
   1. Unsettled lien;
   2. Faulty or defective work appearing after substantial completion;
   3. Failure of the Work to comply with requirements of Construction Documents; or
   4. Terms of any special guarantees required by Construction Documents.

B. Acceptance of final payment shall constitute waiver of all claims by Contractor.

28. PAYMENTS BY CONTRACTOR

A. Contractor shall pay following not later than fifth (5^{th}) day following each payment received from County:
   1. All transportation and utility services rendered;
   2. All materials, tools, and other expendable equipment that have been delivered at site of the Work to extent of ninety percent (90%) of cost thereof, and balance of cost thereof when said balance is paid to Contractor; and

3. Each subcontractor, respective amount allowed Contractor because of work performed by subcontractor to extent of subcontractor's interest therein.

29. CONTRACT SECURITY

A. Contractor shall furnish Performance and Payment Bonds in amount at least equal to one hundred percent (100%) of Contract price as security for faithful performance of this Contract and payment of all persons performing labor on project under this Contract and furnishing materials in connection with this Contract.

B. Sample Performance and Payment Bonds that Contractor will be required to execute is bound into these Construction Documents. Before construction Contract is consummated, completed Performance and Payment Bonds must be approved by Department.

30. ASSIGNMENTS

A. Contractor shall not assign whole or any part of this Contract or any moneys due or to become due hereunder without written consent of Department. In case Contractor assigns all or any part of any moneys due or to become due under this Contract, instrument of assignment shall contain clause substantially to effect that it is agreed that right of assignee in and to any moneys due or to become due to Contractor shall be subject to prior claims of all persons, firms and corporations for services rendered or materials supplied for performance of the Work called for in this Contract.

31. MUTUAL RESPONSIBILITY OF CONTRACTORS

A. If, through acts of neglect on part of Contractor or any subcontractor shall suffer loss or damage on the Work, Contractor agrees to settle with such subcontractor by agreement or arbitration if such other subcontractor will so settle. If such subcontractor shall assert any claim against County on account of any damage alleged to have been sustained, Department shall notify Contractor, who shall indemnify, hold harmless and defend Dane County, its boards, commissions, agencies, officers, employees and representatives against any such claim.

32. SEPARATE CONTRACTS

A. Department may award other contracts for the Work and all Contractors shall fully cooperate with each other and carefully adjust their work to that provided under other contracts as may be directed by Department. No Contractor shall commit or permit any act that will interfere with performance of the Work by any other Contractor.

B. Contractor shall coordinate the Work with those of other Contractors. Cooperation will be required in arrangement for storage of materials and in detailed execution of the Work. Contractor, including subcontractors, shall keep informed of progress and detail work of others and shall notify Architect / Engineer or Department immediately of lack of progress or defective workmanship on part of others. Failure of Contractor to keep informed of the Work progressing on site and failure to give notice of lack of progress or defective workmanship by others shall be construed as acceptance by Contractor of status of the Work as being satisfactory for proper coordination with Contractor's own work.

33. SUBCONTRACTS

A. Contractor may use services of specialty subcontractors on those parts of the Work that, under normal contracting practices, are performed by specialty subcontractors.

B. Contractor shall not award any work to any subcontractor without prior approval of Department. Qualifications of subcontractors shall be same as qualifications of Contractor. Request for subcontractor approval shall be submitted to Department fifteen (15) days before start of subcontractor's work. If subcontractors are changed or added, Contractor shall notify Department in writing.

C. Contractor shall be as fully responsible to County for acts and omissions of subcontractors, and of persons either directly or indirectly employed by them, as Contractor is for acts and omissions of persons directly employed by Contractor.

D. Contractor shall cause appropriate provisions to be inserted in all subcontracts relative to the Work to bind subcontractors to Contractor by terms of General Conditions of Contract and other Construction Documents insofar as applicable to work of subcontractors and to give Contractor same power as regards terminating any subcontract that Department may exercise over Contractor under any provision of Construction Documents.

E. Nothing contained in this Contract shall create any contractual relation between any subcontractor and County.

F. Contractor shall insert in all subcontracts, Articles 26, 33, 43 and 45, respectively entitled: "Withholding of Payments", "Subcontracts", "Affirmative Action Provision and Minority / Women / Disadvantaged Business Enterprises", and "Minimum Wages", and shall further require all subcontractors to incorporate physically these same Articles in all subcontracts.

34. PUBLIC WORKS PROJECT MANAGER'S AUTHORITY

A. Public Works Project Manager shall:
   1. Administer and ensure compliance with Construction Documents;
   2. Provide responsible on-site observations of construction and have authority to request work and to stop work whenever necessary to insure proper enforcement of Construction Documents;
   3. Convene and chair project meetings and foreman's coordination meetings when necessary to coordinate resolution of conflicts between Contractors, Architects, Engineers, Consultants, and Department; and
   4. Check and inspect material, equipment and installation procedures of all trades for proper workmanship and for compliance with Drawings, Specifications and Shop Drawings, permit no material on project site that is not satisfactory and reject work not in compliance with Construction Documents.

35. ARCHITECT / ENGINEER'S AUTHORITY

A. Architect / Engineer is retained by, and is responsible to Department acting for County.

B. Architect / Engineer shall determine amount, quality, acceptability, and fitness of several kinds of work and materials that are provided under this Contract and shall decide all questions that may arise in relation to said work and construction thereof.

C. Architect / Engineer shall decide meaning and intent of any portion of Specifications and of any Drawings where they may be found obscure or be in dispute.

D. Architect / Engineer shall provide responsible observation of construction. Architect / Engineer has authority to stop the Work whenever such stoppage may be necessary to insure proper execution of Construction Documents.

E. Architect / Engineer shall be interpreter of conditions of Construction Documents and judge of its performance.

F. Within reasonable time, Architect / Engineer shall make decisions on all matters relating to progress of the Work or interpretation of Construction Documents.

G. Architect / Engineer's decisions are subject to review by Public Works Project Manager.

36. STATED ALLOWANCES

A. Stated allowances enumerated in Instructions to Bidders shall cover net cost of materials or equipment, and all applicable taxes. Contractor's cost of delivery and unloading at site, handling costs on site, labor, installation costs, overhead, profit and any other incidental costs shall be included in Contractor's bid, but not as part of cash allowance.

B. Department will solicit at least two (2) bids on materials or equipment for which allowance is stated and select on basis of lowest qualified responsible bid. Contractor will then be instructed to purchase "Allowed Materials". If actual price for purchasing "Allowed Materials", including taxes, is more or less than "Cash Allowance", Contract price shall be adjusted accordingly. Adjustment in Contract price shall not contain any cost items excluded from cash allowance.

37. ESTIMATES OF QUANTITIES

A. Whenever estimated quantities of work to be done and materials to be furnished under this Contract are shown in any of Construction Documents, they are given for use in comparing bids and right is especially reserved to increase or diminish them as they may be deemed reasonably necessary or desirable by Department to complete the Work included in this Contract, and cost for such increase or diminution shall be adjusted in manner provided for in General Conditions of Contract Article 18 entitled "Changes in the Work".

38. LANDS AND RIGHTS-OF-WAY

A. Prior to start of construction, County shall furnish all land and rights-of-way necessary for carrying out and completion of the Work to be performed under this Contract.

39. GENERAL GUARANTEE

A. Neither final certificate of payment nor any provision in Construction Documents nor partial or entire occupancy of premises by County shall constitute acceptance of work not done in accordance with Construction Documents or relieve Contractor of liability in respect to any expressed warranties or responsibility for faulty materials or workmanship.

1. In no event shall making of any payment required by Contract constitute or be construed as waiver by County of any breach of covenants of Contract or waiver of any default of Contractor and making of any such payment by County while any such default or breach shall exist shall in no way impair or prejudice right of County with respect to recovery of damages or other remedy as result of such breach or default.

B. Contractor shall remedy and make good all defective workmanship and materials and pay for any damage to other work resulting there from, which appear within period of one (1) year from date of substantial completion, providing such defects are not clearly due to abuse or misuse by County. Department will give notice of observed defects with reasonable promptness.

C. Guarantee on work executed after certified date of substantial completion will begin on date when such work is inspected and approved by Architect / Engineer and Public Works Project Manager.

D. Where guarantees or warrantees are required in sections of Specifications for periods in excess of one (1) year, such longer terms shall apply; however, Contractor's Performance and Payment Bonds shall not apply to any guarantee or warranty period in excess of one (1) year.

40. CONFLICTING CONDITIONS

A. Any provision in any of Construction Documents which may be in conflict or inconsistent with any Articles in these General Conditions of Contract or Supplementary Conditions shall be void to extent of such conflict or inconsistency.

B. In case of ambiguity or conflict between Drawings and Specifications, Specifications shall govern.

C. Printed dimensions shall be followed in preference to measurements by scale. Large-scale drawings take precedence over small-scale drawings. Dimensions on Drawings and details are subject to field measurements of adjacent work.

41. NOTICE AND SERVICE THEREOF

A. Any notice to Contractor from Department relative to any part of this Contract shall be in writing and considered delivered and service thereof completed, when said notice is posted, by certified or registered mail, to Contractor at Contractor's last given address, or delivered in person to said Contractor, or Contractor's authorized representative on the Work.

42. PROTECTION OF LIVES AND HEALTH

A. In order to protect lives and health of Contractor's employees under Contract, Contractor shall comply with all pertinent provisions of Wisconsin Administrative Code, Rules of Department of Commerce, relating to Safety and Health.

B. Contractor alone shall be responsible for safety, efficiency and adequacy of Contractor's tools, equipment and methods, and for any damage that may result from their failure or their improper construction, maintenance or operation.

43. AFFIRMATIVE ACTION PROVISION AND MINORITY / WOMEN / DISADVANTAGED BUSINESS ENTERPRISES

A. Affirmative Action Provisions.
   1. During term of their Contract, Contractor agrees not to discriminate on basis of race, religion, color, sex, handicap, age, sexual preference, marital status, physical appearance, or national origin against any person, whether recipient of services (actual or potential), employee, or applicant for employment. Such equal opportunity shall include but not be limited to following: employment, upgrading, demotion, transfer, recruitment, advertising, layoff, termination, training, rates of pay, and any other form of compensation or level of service(s). Contractor agrees to post in conspicuous places, these affirmative action standards so as to be visible to all employees, service recipients and applicants for this paragraph. Listing of prohibited bases for discrimination shall no be construed to amend in any fashion state or federal law setting forth additional bases and exceptions shall be permitted only to extent allowable in state or federal law.
   2. Contractor is subject to this Article only if Contractor has ten (10) or more employees and receives $10,000.00 or more in annual aggregate contracts with County. Contractor shall file and Affirmative Action Plan with Dane County Contract Compliance Officer in accord with Chapter 19 of Dane County Code of Ordinances. Such plan must be filed within fifteen (15) days of effective date of this Contract and failure to do so by said date shall constitute ground for immediate termination of Contract by County. Contractor shall also, during term of this Contract, provide copies of all announcements of employment opportunities to County's Contract Compliance Office, and shall report annually number of persons, by race, sex and handicap status, who apply for employment, and, similarly classified, number hired and number rejected.
   3. Contact Dane County Contract Compliance Officer at Dane County Contract Compliance Office, 210 Martin Luther King, Jr. Blvd., Room 421, Madison, WI 53703, 608/266-4114.
   4. In all solicitations for employment placed on Contractor's behalf during term of this Contract, Contractor shall include statement to affect Contractor is "Equal Opportunity Employer". Contractor agrees to furnish all information and reports required by County's Contract Compliance Officer as same relate to affirmative action and nondiscrimination, which may include any books, records, or accounts deemed appropriate to determine compliance with Chapter 19, Dane County Code of Ordinances, and provision of this Contract.

B. Minority / Women / Disadvantaged / Emerging Small Business Enterprises.
   1. Chapter 19.508 of Dane County Code of Ordinances is official policy of Dane County regarding utilization of, to fullest extent of, Minority Business Enterprises (MBEs), Women Business Enterprises (WBEs) Disadvantage Business Enterprises (DBEs) and Emerging Small Business Enterprises (ESBEs).
   2. Contractor may utilize MBEs / WBEs / DBEs / ESBEs as subcontractors or suppliers. List of subcontractors will be required of low bidder as stated in this Contract. List shall indicate which are MBEs / WBEs / DBEs / ESBEs and percentage of subcontract awarded, shown as percentage of total dollar amount of bid.

44. COMPLIANCE WITH FAIR LABOR STANDARDS

A. During term of this Contract, Contractor shall report to County Contract Compliance Officer, within ten (10) days, any allegations to, or findings by National Labor Relations Board (NLRB) or Wisconsin Employment Relations Commission (WERC) that Contractor has violated statute or regulation regarding labor standards or relations. If investigation by

Contract Compliance Officer results in final determination that matter adversely affects Contractor's responsibilities under this Contract, and which recommends termination, suspension or cancellation of this Contract, County may take such action.

B. Contractor may appeal any adverse finding by Contract Compliance Officer as set forth in Dane County Ordinance 25.015(11)(c) through (e).

C. Contractor shall post this statement in prominent place visible to employees: "As condition of receiving and maintaining contract with Dane County, this employer shall comply with federal, state and all other applicable laws prohibiting retaliation or union organizing."

45. DOMESTIC PARTNERSHIP BENEFITS

A. Contractor agrees to provide same economic benefits to all of its employees with domestic partners as it does to employees with spouses, or cash equivalent if such benefit cannot reasonably be provided. Contractor agrees to make available for County inspection Contractor's payroll records relating to employees providing services on or under this Contract or subcontract. If any payroll records of Contractor contain any false, misleading or fraudulent information, or if Contractor fails to comply with provisions of Chapter 25.016, Dane County Ordinances, contract compliance officer may withhold payments on Contract; terminate, cancel or suspend Contract in whole or in part; or, after due process hearing, deny Contractor right to participate in bidding on future County contracts for period of one year after first violation is found and for period of three years after second or subsequent violation is found.

46. USE AND OCCUPANCY PRIOR TO ACCEPTANCE

A. Contractor agrees to use and occupancy of portion or unit of the Work before formal acceptance by Department, provided Department:
   1. Secures written consent of Contractor; except when in opinion of Public Works Project Manager, Contractor is chargeable with unwarranted delay in final cleanup of punch list items or other Contract requirements.
   2. Secures endorsement from insurance carrier and consent of Surety permitting occupancy of building or use of the Work during remaining period of construction, or, secures consent of Surety.
   3. Assumes all costs and maintenance of heat, electricity and water.
   4. Accepts all work completed within that portion or unit of the Work to be occupied, at time of occupancy.

47. MINIMUM WAGES

A. Contractor shall post, at appropriate conspicuous point on site of project, schedule showing all determined minimum wage rates for various classes of laborers and mechanics to be engaged in the Work under this Contract and all deductions, if any, required by law to be made from unpaid wages actually earned by laborers and mechanics so engaged.

B. Supplementary Conditions section in Construction Documents lists wage determinations required by State Law.

C. If, after award of Contract, it becomes necessary to employ any person in trade or occupation not classified in wage determinations, such person shall be paid at not less than such rate as

shall be determined by Wisconsin Department of Workforce Development. Such approved minimum rate shall be retroactive to time of initial employment of such person in such trade or occupation. Contractor shall notify Department of Contractor's intention to employ persons in trades or occupations not so classified in sufficient time for Department to obtain approved rates for such trades or occupations.

D. Specified wage rates are minimum rates only, and Department will not consider any claims for additional compensation made by Contractor because of payment by Contractor of any wage rate in excess of applicable rate contained in this Contract. Contractor shall adjust any disputes in regard to payment of wages in excess of those specified in this Contract.

E. Submit required affidavit(s) to Department of Public Works, Highway & Transportation, as requested and with final application for payment for work under said contract. Affidavit(s) shall clearly indicate name, trade or occupation, and paid wages of every laborer, worker or mechanic employed by Contractor and all subcontractors during billing period including accurate record of number of hours worked by each employee and actual wages paid as stipulated in Wisconsin Statue 66.0903. If Wisconsin Prevailing Wage Rate Determination is required for this Work, use "Prime Contractor Affidavit of Compliance with Prevailing Wage Rate Determination" and "Agent or Subcontractor Affidavit of Compliance with Prevailing Wage Rate Determination" (if applicable). If Wisconsin Prevailing Wage Rate Determination is not required for this Work, use "Dane County, Wisconsin Contractor Wage Affidavit". Forms of such affidavits are included in Supplementary Conditions.

48. CLAIMS

A. No claim may be made until Department's Assistant Public Works Director has reviewed Architect / Engineer's decision as provided for in Article 35 of General Conditions of Contract. If any claim remains unresolved after such review by Department's Assistant Public Works Director the claim may be filed under Wisconsin Statute 893.80. Work shall progress during period of any dispute or claim. Unless specifically agreed between parties, venue will be in Dane County, Wisconsin.

49. ANTITRUST AGREEMENT

A. Contractor and County recognize that in actual economic practice, overcharges resulting from antitrust violations are in fact usually borne by County. Therefore, Contractor hereby assigns to County any and all claims for such overcharges as to goods and materials purchased in connection with this Contract, except as to overcharges which result from antitrust violations commencing after price is established under this Contract and any change order thereto.

50. INSURANCE

A. Contractor Carried Insurance:
   1. Contractor shall not commence work under this Contract until Contractor has obtained all insurance required under this Article and has provided evidence of such insurance to Risk Manager, 425 City-County Building, 210 Martin Luther King Jr. Blvd., Madison, WI 53703. Contractor shall not allow any subcontractor to commence work until insurance required of subcontractor has been so obtained and approved. Company providing insurance must be licensed to do business in Wisconsin.
   2. Worker's Compensation Insurance:

a) Contractor shall procure and shall maintain during life of this Contract, Worker's Compensation Insurance as required by statute for all of Contractor's employees engaged in work at site of project under this Contract and, in case of any such work sublet, Contractor shall require subcontractor similarly to provide Worker's Compensation Insurance for all of latter's employees to be engaged in such work unless such employees are covered by protection afforded by Contractor's Worker's Compensation Insurance.

b) If any claim of employees engaged in hazardous work on project under this Contract is not protected under Worker's Compensation Statute, Contractor shall provide and shall cause each subcontractor to provide adequate Employer's Liability Insurance for protection of such of Contractor's employees as are not otherwise protected.

3. Contractor's Public Liability and Property Damage Insurance:
   a) Contractor shall procure and maintain during life of this Contract, Contractor's Public Liability Insurance and Contractor's Property Damage Insurance in amount not less than $1,000,000 bodily injury, including accidental death, to any one person, and subject to same limit for each person, in amount not less than $1,000,000 on account of one accident, and Contractor's Property Damage Insurance in amount not less then $1,000,000 or combined single limit of at least $1,000,000 with excess coverage over and above general liability in amount not less than $5,000,000. Contractor shall add "Dane County" as additional insured for each project.
   b) Contractor's Public Liability and Property Damage Insurance shall include Products, Completed Operation, and Contractual Liability under Insurance Contract. "Contractor shall in all instances save, defend, indemnify and hold harmless County and Architect / Engineer against all claims, demands, liabilities, damages or any other costs which may accrue in prosecution of the Work and that Contractor will save, defend, indemnify and hold harmless County and Architect / Engineer from all damages caused by or as result of Contractor's operations" and each shall be listed as additional insured on Contractor's and sub-contractors' insurance policies.
   c) Obligations of Contractor under Article 48.A.2)b) shall not extend to liability of Architect / Engineer, agents or employees thereof, arising out of:
      1) Preparation or approval of maps, drawings, opinions, reports, surveys, change orders, designs or specifications; or
      2) giving of or failure to give directions or instructions by Architect / Engineer, agents or employees thereof provided such giving or failure to give is primary cause of injury or damage.
   d) Contractor shall procure and shall maintain during life of this Contract, Comprehensive Automobile Liability Insurance covering owned, non-owned and hired automobiles for limits of not less than $1,000,000 each accident single limit, bodily injury and property damage combined with excess coverage over and above general liability in amount not less than $5,000,000.
   e) Contractor shall either:
      1) Require each subcontractor to procure and to maintain during life of subcontract, subcontractor's Public Liability Property Damage Insurance, and Comprehensive Automobile Liability Insurance of type and in same amount specified in preceding paragraphs; or
      2) Insure activities of subcontractors in Contractor's own policy.
4. Scope of Insurance and Special Hazards: Insurance required under Article 48.A.2 hereof shall provide adequate protection for Contractor and subcontractors, respectively, against damage claims which may arise from operations under this Contract, whether such operation be by insured or by anyone directly or indirectly employed by insured and also against any of special hazards which may be encountered in performance of this Contract as enumerated in Supplementary Conditions.

5. Proof of Carriage of Insurance: Contractor shall furnish Risk Manager with certificates showing type, amount, class of operations covered, effective dates, dates of expiration of policies and "Dane County" listed as additional insured. Such certificates shall also contain (substantially) following statement: "Insurance covered by this certificate will not be canceled or materially altered, except after ten (10) days written notice has been received by Risk Manager."

B. Builder's Risk:
   1. County shall provide Builder's Risk policy. Terms of this policy will be made available by County's Risk Manager, upon Contractor's request. By executing this Contract, Contractor warrants it is familiar with terms of said policy.

C. Indemnification / Hold Harmless:
   1. Contractor shall indemnify, hold harmless and defend Dane County, its boards, commissions, agencies, officers, employees and representatives from and against all claims, damages, losses and expenses including attorneys' fees arising out of or resulting from performance of the Work, provided that any such claim, damage, loss or expense is attributable to bodily injury, sickness, disease or death, or to injury to or destruction of tangible property (other than the Work itself) including loss of use resulting therefrom, and is caused in whole or in part by any act or omission of Contractor, any subcontractor, anyone directly or indirectly employed by any of them or anyone for whose acts any of them may be liable, regardless of whether or not it is caused in part by part indemnified hereunder.
   2. In any and all claims against Dane County, its boards, commissions, agencies, officers, employees and representatives or by any employee of Contractor, any subcontractor, anyone directly or indirectly employed by any of them or anyone for whose acts any of them may be liable, indemnification obligation under this Contract shall not be limited in any way by any limitation on amount or type of damages, compensation or benefits payable by or for Contractor or any subcontractor under worker's compensation acts, disability benefits or other employee benefit acts.
   3. Obligations of Contractor under this Contract shall not extend to liability of Architect / Engineer, its agents or employees arising out of:
      a) Preparation or approval of maps, drawings, opinion, reports, surveys, change orders, designs or specifications; or
      b) Giving of or failure to give directions or instruction by Architect / Engineer, its agents or employees provided such giving or failure to give is primary cause of injury or damage.
   4. Dane County shall not be liable to Contractor for damages or delays resulting from work by third parties or by injunctions or other restraining orders obtained by third parties.

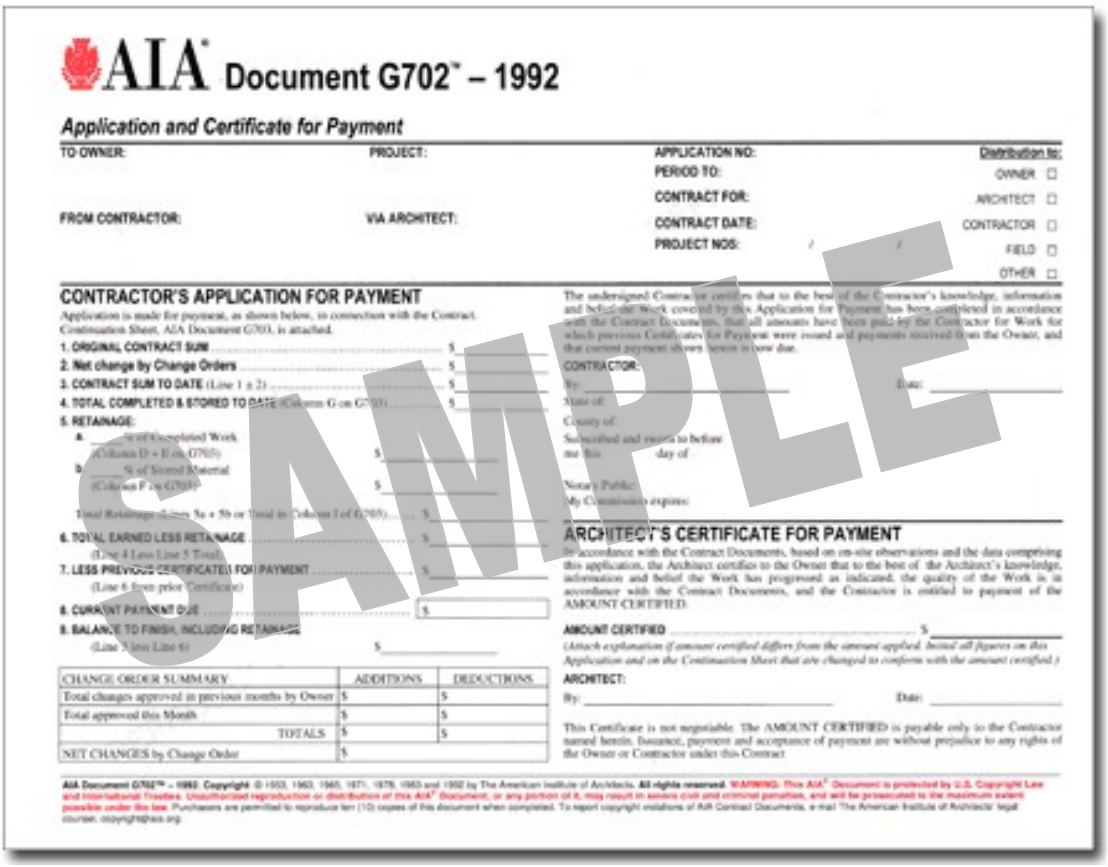
51. WISCONSIN LAW CONTROLLING

A. It is expressly understood and agreed to by parties hereto that in event of any disagreement or controversy between parties, Wisconsin law shall be controlling.

SUPPLEMENTARY CONDITIONS

1. APPLICATION & CERTIFICATE FOR PAYMENT

A. Every contractor engaged in performance of any contract for Department of Public Works, Highway & Transportation shall submit partial and final Application & Certificate for Payment for work under said contract. Form shall provide similar information as shown on AIA G702™ and G703™ forms (samples shown below). Forms shall be submitted to Public Works Project Manager for approval.



AIA Document G702™ – 1992

Application and Certificate for Payment

TO OWNER: PROJECT: APPLICATION NO: Distribution to:
PERIOD TO: OWNER ☐
CONTRACT FOR: ARCHITECT ☐
FROM CONTRACTOR: VIA ARCHITECT: CONTRACT DATE: CONTRACTOR ☐
PROJECT NOS: FIELD ☐
OTHER ☐

CONTRACTOR'S APPLICATION FOR PAYMENT

Application is made for payment, as shown below, in connection with the Contract. Continuation Sheet, AIA Document G703, is attached.

1. ORIGINAL CONTRACT SUM ..... $
2. Net change by Change Orders ..... $
3. CONTRACT SUM TO DATE (Line 1 ± 2) ..... $
4. TOTAL COMPLETED & STORED TO DATE (Column G on G703) ..... $
5. RETAINAGE:
   a. ____ % of Completed Work (Column D + E on G703) $
   b. ____ % of Stored Material (Column F on G703) $
   Total Retainage (Lines 5a + 5b or Total in Column I of G703) ..... $
6. TOTAL EARNED LESS RETAINAGE ..... $ (Line 4 Less Line 5 Total)
7. LESS PREVIOUS CERTIFICATES FOR PAYMENT ..... $ (Line 6 from prior Certificate)
8. CURRENT PAYMENT DUE ..... $
9. BALANCE TO FINISH, INCLUDING RETAINAGE (Line 3 less Line 6) $

CHANGE ORDER SUMMARY	ADDITIONS	DEDUCTIONS
Total changes approved in previous months by Owner	$	$
Total approved this Month	$	$
TOTALS	$	$
NET CHANGES by Change Order	$	

The undersigned Contractor certifies that to the best of the Contractor's knowledge, information and belief the Work covered by this Application for Payment has been completed in accordance with the Contract Documents, that all amounts have been paid by the Contractor for Work for which previous Certificates for Payment were issued and payments received from the Owner, and that current payment shown herein is now due.

CONTRACTOR:
By: Date:
State of:
County of:
Subscribed and sworn to before me this day of
Notary Public:
My Commission expires:

ARCHITECT'S CERTIFICATE FOR PAYMENT

In accordance with the Contract Documents, based on on-site observations and the data comprising this application, the Architect certifies to the Owner that to the best of the Architect's knowledge, information and belief the Work has progressed as indicated, the quality of the Work is in accordance with the Contract Documents, and the Contractor is entitled to payment of the AMOUNT CERTIFIED.

AMOUNT CERTIFIED ..... $
(Attach explanation if amount certified differs from the amount applied. Initial all figures on this Application and on the Continuation Sheet that are changed to conform with the amount certified.)

ARCHITECT:
By: Date:

This Certificate is not negotiable. The AMOUNT CERTIFIED is payable only to the Contractor named herein. Issuance, payment and acceptance of payment are without prejudice to any rights of the Owner or Contractor under this Contract.

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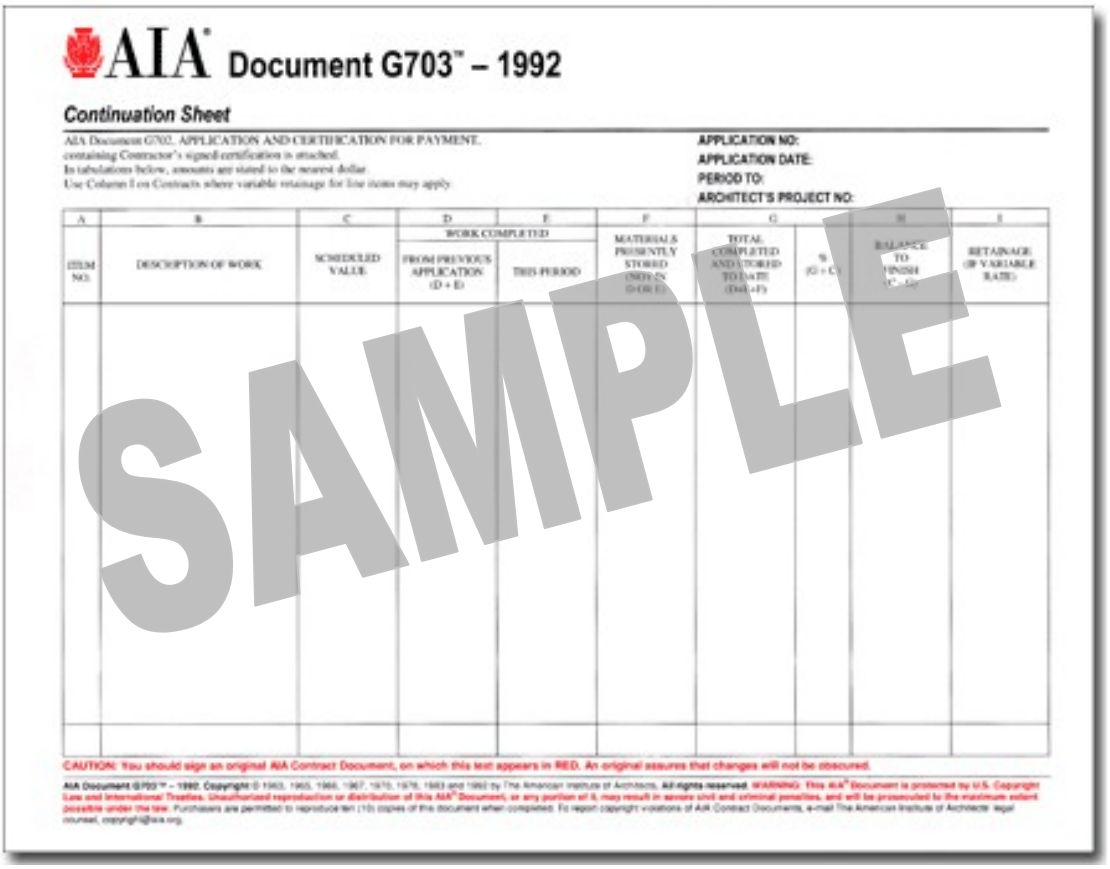
SAMPLE



AIA Document G703™ – 1992

Continuation Sheet

AIA Document G702, APPLICATION AND CERTIFICATION FOR PAYMENT, containing Contractor's signed certification is attached.
In tabulations below, amounts are stated to the nearest dollar.
Use Column I on Contracts where variable retainage for line items may apply.

APPLICATION NO:
APPLICATION DATE:
PERIOD TO:
ARCHITECT'S PROJECT NO:

A	B	C	D	E	F	G		H	I
ITEM NO.	DESCRIPTION OF WORK	SCHEDULED VALUE	WORK COMPLETED: FROM PREVIOUS APPLICATION (D + E)	WORK COMPLETED: THIS PERIOD	MATERIALS PRESENTLY STORED (NOT IN D OR E)	TOTAL COMPLETED AND STORED TO DATE (D+E+F)	% (G ÷ C)	BALANCE TO FINISH (C - G)	RETAINAGE (IF VARIABLE RATE)

SAMPLE

CAUTION: You should sign an original AIA Contract Document, on which this text appears in RED. An original assures that changes will not be obscured.

AIA Document G703™ – 1992. Copyright © 1963, 1965, 1966, 1967, 1970, 1978, 1983 and 1992 by The American Institute of Architects. All rights reserved. WARNING: This AIA® Document is protected by U.S. Copyright Law and International Treaties. Unauthorized reproduction or distribution of this AIA® Document, or any portion of it, may result in severe civil and criminal penalties, and will be prosecuted to the maximum extent possible under the law. Purchasers are permitted to reproduce ten (10) copies of this document when completed. To report copyright violations of AIA Contract Documents, e-mail The American Institute of Architects' legal counsel, copyright@aia.org.

2. PREVAILING WAGE RATE DETERMINATION

A. These supplements shall modify, delete, and / or add to General Conditions of Contract. Where any article, paragraph, or subparagraph in General Conditions of Contract is supplemented by one of these paragraphs, provisions of such article, paragraph, or subparagraph shall remain in effect and supplementary provisions shall be considered as added thereto. Where any article, paragraph, or subparagraph in General Conditions of Contract is amended, voided, or superseded by any of these paragraphs, provisions of such article, paragraph, or subparagraph not so amended, voided, or superseded shall remain in effect.
   1. General Conditions of Contract Article 47, "Minimum Wages", paragraph B. Following Prevailing Wage Rate Determination No. 201400703 is added to General Conditions of Contract.

B. These State of Wisconsin forms, hereinafter set forth in this section, shall be filled out and submitted to Department of Public Works, Highway & Transportation:
   1. Disclosure of Ownership (ERD-7777)
   2. Prime Contractor Affidavit of Compliance With Prevailing Wage Rate Determination (ERD-5724)
   3. List of Agents and Subcontractors (Page 2 - ERD-5724)
   4. Agent or Subcontractor Affidavit of Compliance With Prevailing Wage Rate Determination (ERD-10584)
   5. List of Agents and Subcontractors (Page 2 - ERD-10584)
   6. Request To Employ Subjourneyperson (ERD-10880)

C. At a minimum, these wage rates must be displayed in a place where all workers can access them, but not inside the job trailer. If this isn't easily done based on job conditions, the State requires they be displayed at a library or other public building.

State of Wisconsin Department of Workforce Development Equal Rights Division	**DEPARTMENTAL ORDER**

ISSUE DATE: 3/11/2014

PROJECT:

MECHANICAL, ELECTRICAL & PIPING INFRASTRUCTURE IMPROVEMENTS BID PACKAGE 3 - MECH
MADISON CITY, DANE COUNTY, WI
Determination No. 201400703 [Owner Project No. 313056]

PROJECT OWNER:	REQUESTER:
SCOTT CARLSON, PROJECT ENGINEER DANE COUNTY PUBLIC WORKS 1919 ALLIANT ENERGY CENTER WAY MADISON, WI 53713	SCOTT CARLSON, PROJECT ENGINEER DANE COUNTY PUBLIC WORKS 1919 ALLIANT ENERGY CENTER WAY MADISON, WI 53713
ADDITIONAL CONTACT:	**NOTE:** The Requester must provide a copy of this Project Determination and enclosures to the Project Owner and Additional Contact.

The department received an application for prevailing wage rate determination for the above-captioned project. The department conducted a survey to determine the prevailing wage rate for the trade(s) or occupation(s) needed to complete the project. The survey's findings appear in the attached project determination.

If you believe that the wage rate for any trade or occupation does not accurately reflect the prevailing wage rate in the city, village or town where the project is located, you may ask the department to conduct an administrative review of such wage rate. You must submit this request in writing within 30 days from the date indicated above. Additionally, your request must include wage rate information from at least three similar projects in the city, village or town where the proposed project is located and on which some work has been performed by the contested trade(s) during the current survey period and was previously considered by the department in issuing the attached determination. See DWD 290.10 of the Wisconsin Administrative Code and either s. 66.0903(3)(br), Stats., or s. 103.49(3)(c), Stats., for a complete explanation of the administrative review process.

Enclosures

It is hereby ordered that the prevailing wage rates set forth in the attached project determination shall only be applicable to the above referenced project. This order is a **FINAL ORDER** of the department unless a timely request for an administrative review is filed with the department.

ISSUED BY:

Equal Rights Division
Labor Standards Bureau
Construction Wage Standards Section
P.O. Box 8928, Madison, WI 53708-8928
(608)266-6861

Web Site: http://dwd.wisconsin.gov/er/

PREVAILING WAGE RATE DETERMINATION
Issued by the State of Wisconsin
Department of Workforce Development
Pursuant to s. 66.0903, Wis. Stats.
Issued On: 3/11/2014

DETERMINATION NUMBER: 201400703

EXPIRATION DATE: Prime Contracts MUST Be Awarded or Negotiated On Or Before 12/31/2014. If NOT, You MUST Reapply.

PROJECT NAME: MECHANICAL, ELECTRICAL & PIPING INFRASTRUCTURE IMPROVEMENTS BID PACKAGE 3 - MECH

PROJECT NO: 313056

PROJECT LOCATION: MADISON CITY, DANE COUNTY, WI

CONTRACTING AGENCY: DANE COUNTY PUBLIC WORKS

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	30.48	15.90	46.38
102	Boilermaker Future Increase(s): Add $1.50/hr on 1/01/2015; Add $1.50/hr. on 01/01/2016	32.05	28.04	60.09
103	Bricklayer, Blocklayer or Stonemason 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.	32.01	17.35	49.36
104	Cabinet Installer	30.48	15.90	46.38
105	Carpenter	30.48	15.90	46.38
106	Carpet Layer or Soft Floor Coverer	30.48	15.90	46.38
107	Cement Finisher	31.58	16.13	47.71
108	Drywall Taper or Finisher	24.80	16.60	41.40
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.	34.07	19.25	53.32
110	Elevator Constructor	42.86	23.84	66.70
111	Fence Erector	24.72	0.00	24.72
112	Fire Sprinkler Fitter	36.07	18.73	54.80
113	Glazier	38.03	13.42	51.45
114	Heat or Frost Insulator	33.68	24.31	57.99
115	Insulator (Batt or Blown)	15.00	9.50	24.50
116	Ironworker	31.25	19.46	50.71
117	Lather	30.48	15.90	46.38

CODE	Fringe Benefits Must Be Paid On All Hours Worked TRADE OR OCCUPATION	HOURLY BASIC RATE OF PAY $	HOURLY FRINGE BENEFITS $	TOTAL $
118	Line Constructor (Electrical)	38.25	17.31	55.56
119	Marble Finisher	26.89	19.18	46.07
120	Marble Mason	32.01	17.35	49.36
121	Metal Building Erector	22.00	10.00	32.00
122	Millwright	32.11	15.95	48.06
123	Overhead Door Installer	20.95	4.94	25.89
124	Painter	24.50	16.60	41.10
125	Pavement Marking Operator	30.00	0.00	30.00
126	Piledriver	30.98	15.90	46.88
127	Pipeline Fuser or Welder (Gas or Utility)	30.79	19.74	50.53
129	Plasterer	31.03	17.71	48.74
130	Plumber Future Increase(s): Add $1/hr on 6/1/2014.	36.42	16.87	53.29
132	Refrigeration Mechanic	41.60	16.71	58.31
133	Roofer or Waterproofer	29.40	6.25	35.65
134	Sheet Metal Worker	34.45	22.57	57.02
135	Steamfitter Future Increase(s): Add $1.70/hr on 6/1/2014.	42.95	17.81	60.76
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.	22.25	12.24	34.49
138	Temperature Control Installer	32.94	18.80	51.74
139	Terrazzo Finisher	26.89	19.18	46.07
140	Terrazzo Mechanic	30.20	18.42	48.62
141	Tile Finisher	23.85	17.18	41.03
142	Tile Setter	29.81	17.18	46.99
143	Tuckpointer, Caulker or Cleaner	35.25	13.15	48.40
144	Underwater Diver (Except on Great Lakes)	34.48	15.90	50.38
146	Well Driller or Pump Installer	25.32	15.65	40.97
147	Siding Installer	25.92	18.04	43.96

CODE	Fringe Benefits Must Be Paid On All Hours Worked TRADE OR OCCUPATION	HOURLY BASIC RATE OF PAY $	HOURLY FRINGE BENEFITS $	TOTAL $
150	Heavy Equipment Operator - ELECTRICAL LINE CONSTRUCTION ONLY	29.16	14.34	43.50
151	Light Equipment Operator -ELECTRICAL LINE CONSTRUCTION ONLY	30.60	14.86	45.46
152	Heavy Truck Driver - ELECTRICAL LINE CONSTRUCTION ONLY	26.78	13.63	40.41
153	Light Truck Driver - ELECTRICAL LINE CONSTRUCTION ONLY	24.86	12.97	37.83
154	Groundman - ELECTRICAL LINE CONSTRUCTION ONLY	21.75	12.70	34.45

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	32.39	18.46	50.85
203	Three or More Axle	18.00	22.88	40.88
204	Articulated, Euclid, Dumptor, Off Road Material Hauler	32.89	18.96	51.85
205	Pavement Marking Vehicle	18.00	22.88	40.88
207	Truck Mechanic	18.00	22.88	40.88

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 Premium Increase(s): Add $1.00/hr for certified welder; Add $.25/hr for mason tender	24.21	14.63	38.84
302	Asbestos Abatement Worker	24.36	14.44	38.80
303	Landscaper	21.01	9.37	30.38
310	Gas or Utility Pipeline Laborer (Other Than Sewer and Water)	21.01	13.63	34.64
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.	18.33	13.65	31.98
314	Railroad Track Laborer	23.46	3.30	26.76
315	Final Construction Clean-Up Worker	16.00	0.00	16.00

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).	33.42	18.96	52.38
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).	32.89	18.96	51.85
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.	30.82	18.96	49.78
504	Work Performed on the Great Lakes Including Diver; Wet Tender or Hydraulic Dredge Engineer.	38.80	20.17	58.97
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
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.	37.10	21.57	58.67

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.	34.50	20.04	54.54

HEAVY EQUIPMENT OPERATORS
EXCLUDING SITE PREPARATION, UTILITY, PAVING LANDSCAPING WORK

Fringe Benefits Must Be Paid On All Hours Worked

CODE	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. 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.	35.62	18.96	54.58
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).	36.35	6.95	43.30
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).	33.42	18.96	52.38
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).	32.89	18.96	51.85

CODE	Fringe Benefits Must Be Paid On All Hours Worked TRADE OR OCCUPATION	HOURLY BASIC RATE OF PAY $	HOURLY FRINGE BENEFITS $	TOTAL $
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.	30.82	18.96	49.78
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.	24.19	17.89	42.08
514	Gas or Utility Pipeline, Except Sewer & Water (Primary Equipment).	36.34	21.14	57.48
515	Gas or Utility Pipeline, Except Sewer & Water (Secondary Equipment). Future Increase(s): Add $1.60/hr on 06/01/2014; Add $1.65/hr on 06/01/2015.	32.32	18.55	50.87
516	Fiber Optic Cable Equipment Future Increase(s): Add $1.75/hr on 02/01/2014.	27.89	17.20	45.09

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	TRADE OR OCCUPATION Fringe Benefits Must Be Paid On All Hours Worked	HOURLY BASIC RATE OF PAY $	HOURLY FRINGE BENEFITS $	TOTAL $
103	Bricklayer, Blocklayer or Stonemason 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.	35.10	18.40	53.50
105	Carpenter Future Increase(s): Add $1.25/hr on 6/2/2014. 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.	33.68	19.81	53.49
107	Cement Finisher Future Increase(s): Add $1.87 on 6/1/14; 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.	33.51	16.13	49.64
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.	32.82	22.61	55.43
111	Fence Erector	24.72	0.00	24.72
116	Ironworker	31.25	19.46	50.71
118	Line Constructor (Electrical)	38.25	17.31	55.56
125	Pavement Marking Operator	16.00	7.35	23.35
126	Piledriver	30.98	15.90	46.88
130	Plumber	33.75	14.07	47.82
135	Steamfitter	42.45	16.71	59.16
137	Teledata Technician or Installer	21.89	11.85	33.74

CODE	Fringe Benefits Must Be Paid On All Hours Worked TRADE OR OCCUPATION	HOURLY BASIC RATE OF PAY $	HOURLY FRINGE BENEFITS $	TOTAL $
143	Tuckpointer, Caulker or Cleaner	35.25	13.15	48.40
144	Underwater Diver (Except on Great Lakes)	38.80	20.17	58.97
146	Well Driller or Pump Installer	25.32	15.65	40.97
150	Heavy Equipment Operator - ELECTRICAL LINE CONSTRUCTION ONLY	29.16	14.34	43.50
151	Light Equipment Operator -ELECTRICAL LINE CONSTRUCTION ONLY	30.60	14.86	45.46
152	Heavy Truck Driver - ELECTRICAL LINE CONSTRUCTION ONLY	26.78	13.63	40.41
153	Light Truck Driver - ELECTRICAL LINE CONSTRUCTION ONLY	24.86	12.97	37.83
154	Groundman - ELECTRICAL LINE CONSTRUCTION ONLY	21.75	12.70	34.45

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	30.00	15.00	45.00
203	Three or More Axle	16.00	7.35	23.35
204	Articulated, Euclid, Dumptor, Off Road Material Hauler	32.89	18.96	51.85
205	Pavement Marking Vehicle	16.00	7.35	23.35
207	Truck Mechanic	16.00	7.35	23.35

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 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.	25.60	14.62	40.22
303	Landscaper	25.28	11.46	36.74
304	Flagperson or Traffic Control Person	24.70	10.72	35.42
311	Fiber Optic Laborer (Outside, Other Than Concrete Encased)	18.31	12.67	30.98
314	Railroad Track Laborer	23.46	3.30	26.76

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. Premium Increase(s): Add $.25/hr for all >45 Ton lifting capacity cranes	34.62	18.96	53.58
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).	33.42	18.96	52.38
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).	32.89	18.96	51.85

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. Future Increase(s): Add $1.05/hr on 6/2/2014; Add $1.55/hr on 6/1/2015. Premium Increase(s): Add $.25/hr for operating tower crane.	35.11	19.45	54.56
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.	30.19	20.94	51.13
526	Boiler (Temporary Heat); Forklift; Greaser; Oiler.	24.19	17.89	42.08
527	Work Performed on the Great Lakes Including Diver; Wet Tender or Hydraulic Dredge Engineer.	38.80	20.17	58.97
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.	38.80	20.17	58.97
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.	34.50	20.04	54.54
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.	34.50	20.04	54.54

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	32.01	17.35	49.36
105	Carpenter	32.93	19.93	52.86
107	Cement Finisher	31.48	15.68	47.16
109	Electrician	31.27	22.81	54.08
111	Fence Erector	24.72	0.00	24.72
116	Ironworker	31.25	19.46	50.71
118	Line Constructor (Electrical)	38.25	17.31	55.56
124	Painter	24.50	16.60	41.10
125	Pavement Marking Operator	30.00	0.00	30.00
126	Piledriver	30.98	15.90	46.88
133	Roofer or Waterproofer	29.40	6.25	35.65
137	Teledata Technician or Installer	21.89	11.85	33.74
143	Tuckpointer, Caulker or Cleaner	35.25	13.15	48.40
144	Underwater Diver (Except on Great Lakes)	38.80	20.17	58.97
150	Heavy Equipment Operator - ELECTRICAL LINE CONSTRUCTION ONLY	34.43	15.24	49.67
151	Light Equipment Operator -ELECTRICAL LINE CONSTRUCTION ONLY	30.60	14.86	45.46
152	Heavy Truck Driver - ELECTRICAL LINE CONSTRUCTION ONLY	26.78	13.63	40.41
153	Light Truck Driver - ELECTRICAL LINE CONSTRUCTION ONLY	24.86	12.97	37.83
154	Groundman - ELECTRICAL LINE CONSTRUCTION ONLY	21.75	12.70	34.45

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	30.00	15.00	45.00

CODE	Fringe Benefits Must Be Paid On All Hours Worked TRADE OR OCCUPATION	HOURLY BASIC RATE OF PAY $	HOURLY FRINGE BENEFITS $	TOTAL $
203	Three or More Axle	17.00	0.00	17.00
204	Articulated, Euclid, Dumptor, Off Road Material Hauler	32.89	18.96	51.85
205	Pavement Marking Vehicle	17.00	0.00	17.00
206	Shadow or Pilot Vehicle	30.00	15.00	45.00
207	Truck Mechanic	17.00	0.00	17.00

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	28.07	13.25	41.32
303	Landscaper Future Increase(s): Add $1.60/hr on 6/1/14. 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).	29.04	14.63	43.67
304	Flagperson or Traffic Control Person	24.70	10.72	35.42
311	Fiber Optic Laborer (Outside, Other Than Concrete Encased)	18.31	12.67	30.98
314	Railroad Track Laborer	23.46	3.30	26.76

HEAVY EQUIPMENT OPERATORS
CONCRETE PAVEMENT OR BRIDGE WORK

Fringe Benefits Must Be Paid On All Hours Worked

CODE	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 $1.75/hr on 6/1/2014); 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	20.40	57.12
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 $1.75/hr on 6/1/2014); 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.	36.22	20.40	56.62

CODE	Fringe Benefits Must Be Paid On All Hours Worked TRADE OR OCCUPATION	HOURLY BASIC RATE OF PAY $	HOURLY FRINGE BENEFITS $	TOTAL $
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. Future Increase(s): Add $1.75/hr on 6/1/2014); 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.	35.72	20.40	56.12
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.	33.96	19.79	53.75
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.	30.32	18.46	48.78
546	Fiber Optic Cable Equipment.	26.69	16.65	43.34

CODE	Fringe Benefits Must Be Paid On All Hours Worked TRADE OR OCCUPATION	HOURLY BASIC RATE OF PAY $	HOURLY FRINGE BENEFITS $	TOTAL $
547	Work Performed on the Great Lakes Including Diver; Wet Tender or Hydraulic Dredge Engineer.	38.80	20.17	58.97
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.	38.80	20.17	58.97
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.	34.50	20.04	54.54
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.	34.50	20.04	54.54

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.	35.12	18.46	53.58
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 $1.75/hr on 6/1/2014); 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.	36.22	20.40	56.62

CODE	Fringe Benefits Must Be Paid On All Hours Worked TRADE OR OCCUPATION	HOURLY BASIC RATE OF PAY $	HOURLY FRINGE BENEFITS $	TOTAL $
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.	32.89	18.96	51.85
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.	33.67	19.48	53.15
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 $1.75/hr on 6/1/2014); 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.	35.17	20.40	55.57
556	Fiber Optic Cable Equipment.	26.69	16.65	43.34

********** END OF RATES **********

Department of Workforce Development
Equal Rights Division
P.O. Box 8928
Madison, WI 53708-8928
Telephone: (608) 266-6860
Fax: (608) 267-4592
TTY: (608) 264-8752

STATE OF WISCONSIN
DWD
Department of Workforce Development

Scott Walker, Governor
Reginald J. Newson, Secretary

The documents following the Prevailing Wage Rate Determination consist of seventeen pages (including this one) of various forms/documents that will be used throughout the completion of the project. The chart below lists the form number, form/document name, the party who uses the document, and the document's number of pages. If you have any questions regarding these forms please call the Prevailing Wage Office at (608)266-6861.

ERD Form Number	Form Name	Party Who Uses the Form	Pages
	Prevailing Wage - Public Entity Project Owners	Explanation of project owner responsibilities	2
16056	Post the White Sheet	Contracting agency	1
10908	Consolidated List of Debarred Contractors	Any party contracting someone to complete work on a prevailing wage project	2
	Prevailing Wage – Contractors	Explanation of contractor responsibilities	2
7777	Disclosure of Ownership	Contractors that meet the criteria set out in (3)(A)&(B) of the form	1
5724	Prime Contractor Affidavit of Compliance	Prime contractor files with contracting agency upon completion of the work before receiving final payment	2
10584	Agent or Subcontractor Affidavit of Compliance	Subcontractors file with their awarding contractor upon completion of their work on the project before receiving final payment	2
10880	Request to Employ Subjourneyperson	Contractors wishing to employ a subjourneyperson(s)	1
	Additional General Prevailing Wage Law Information	General information for public entity or any other interested party	3

02/19/2014

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STATE OF WISCONSIN
DWD
Department of Workforce Development

Scott Walker, Governor
Reginald J. Newson, Secretary

PREVAILING WAGE – Public Entity Project Owners

Any public works project that has a total estimated project cost that equals or exceeds single-trade or multiple-trade 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 law that applies to local governmental units is §66.0903, Wis. Stats. The prevailing wage law that applies to state agencies is §103.49, Wis. Stats. The applicable administrative rules for all public entities are DWD 290 and DWD 294, Wis. Adm. Code.

Thresholds

A "single-trade project of public works" means a project in which a single trade accounts for 85% or more of the total labor cost of the project. The single trade threshold is $48,000.

A "multiple-trade project of public works" means a project in which no single trade accounts for 85% or more of the total labor cost of the project.

(a) The multiple-trade threshold is $100,000, unless a municipality falls under the description in (b).

(b) The multiple-trade threshold of $234,000 applies to public works projects erected, constructed, repaired, remodeled, or demolished by a private contractor for •a city or village with a population less than 2500 or •a town.

A local governmental unit or state agency that has a public works project that equals or exceeds the prevailing wage thresholds must do all of the following:

- Request a prevailing wage rate determination for the project from DWD at least 30 days before soliciting bids or negotiating contracts. An Application for Prevailing Wage Rate Determination is available on the DWD website: http://dwd.wisconsin.gov/er/prevailing_wage_rate/default.htm
  To avoid waiting for a project determination use the on-line application system that permits the user to generate a determination immediately and save all documents in PDF form to the user's computer. Use this project determination on line application at the following address:

http://dwd.wisconson.gov/er/prevailing_wage_rate/pw_online_determinations.htm

- Tell potential contractors the project is subject to state prevailing wage law when soliciting bids.

- 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 prime contractor.

- Award contracts to contractors who do *not* appear on the "Consolidated List of Debarred Contractors."

- Notify contractors that they are required to have a written substance abuse testing program in place that fulfills the requirements of §103.503, Wis. Stats., before commencing work on the prevailing wage project.

- Post the prevailing wage rate determination on the project site. (This document is often referred to as "the white sheet.")

- Notify project contractors that if DWD finds that a contractor violated the prevailing wage law, DWD will assess liquidated damages of 100% of the wages owed to employees.

- Obtain an Affidavit of Compliance from each prime contractor before making final payment for the project.

If the total estimated cost of the project exceeds the prevailing wage thresholds, a local governmental unit or state agency also must obtain a prevailing wage rate determination under the following circumstances:

- when a completed facility is leased, purchased, lease-purchased or otherwise acquired by or dedicated to a public entity in lieu of the public entity contracting for the project,

- when one public entity does work for another public entity,

- when a *private* entity will construct a road, street, bridge, sanitary sewer or water main project and dedicate it to a local governmental unit or the state for its ownership or maintenance (except for some residential subdivisions).

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.

State of Wisconsin
Department of Workforce Development
Equal Rights Division
Labor Standards Bureau

POST THE WHITE SHEET

As the public entity receiving this prevailing wage rate determination, YOU ARE REQUIRED by law to post the prevailing wage rate determination (i.e., white sheet) in at least one conspicuous and easily accessible place on the project site that is available to all construction workers. The white sheet must remain posted from the onset of the project until all construction labor on the project has been completed.
[*See,* Wis. Admin. Code §DWD 290.12(1)]

Posting the white sheet inside the general contractor's trailer does not meet this requirement. That placement is not available/accessible to all workers and is not a location over which you have control.

If you have questions about posting, please call (608)266-6861 and ask for prevailing wage intake.

Consolidated List of Debarred Contractors
Prepared and Issued By
State of Wisconsin
Department of Workforce Development

This list has been prepared in accordance with the provisions of §§66.0903(12) and 103.49(7), Wis. Stats., and Chapter DWD 294 of the Wisconsin Administrative Code. All contractors on this list were found to have committed a "debarable offense" related to certain labor standard provisions determined or established for a state or local public works project. No state agency, local governmental unit or owner or developer may knowingly solicit bids from, negotiate with or award any contracts to or approve or allow any subcontracts with a debarred contractor, including all divisions, affiliates or other organizational elements of such contractor that are engaged in construction business activities, until the debarment is terminated. The name of each debarred contractor must remain on this list for a period of three (3) years from the termination date indicated below. The contractor is, however, only "debarred" from the "effective date" through the "termination date" indicated for that contractor. Questions regarding this list should be addressed to Julie Eckenwalder, Equal Rights Division, P. O. Box 8928, Madison, WI 53708 or call (608) 266-3148. Deaf, hearing or speech-impaired callers may contact the department by calling its TDD number (608) 264-8752.

Name of Contractor	Address	Effective Date	Termination Date	Cause Code	Date of Violation(s)	Limitations/ Deviations
Abel, Mike	*See,* Abel Electric, Inc					
Abel Electric, Inc	3385 Belmar Rd Green Bay, WI 54313	9/1/12	8/31/15	1	2011	None
Atkins, Scott	*See,* Freedom Insulation, Inc					
Boecker, Roger	*See,* R-Way Pumping, Inc					
Cargill Heating and Air Conditioning Company, Inc	3049 Edgewater La La Crosse, WI 54603	3/1/14	2/28/17	1 and 2	2011	None
Castlerock Commercial Construction, Inc	PO Box 11699 Milwaukee, WI 53211-0699	2/1/12	1/31/15	1, 2 and 4	2009 & 2010	None
Dem/Ex Group, Inc	805 S Adams St Manito, IL 61546	12/1/11	11/30/14	1 and 2	2010	None
Fisher, Ed &/or Fisher, Rhonda	*See*, Dem/Ex Group, Inc					

Name of Contractor	Address	Effective Date	Termination Date	Cause Code	Date of Violation(s)	Limitations/ Deviations
Freedom Insulation, Inc	117925 219th Ave Chippewa Falls, WI 54729	9/1/11	8/31/14	1	2008-2010	None
Galstad, Michael E (aka Michael Earl Galstad)	*See,* Cargill Heating and Air Conditioning Company, Inc					
JT Roofing, Inc	350 Tower Dr Saukville, WI 53080	6/1/12	5/31/15	1,2 and 4	2007 & 2008	None
Jinkins, Richard	*See,* Castlerock Commercial Construction, Inc					
Ofstie, Darin	*See*, Precision Excavating and Grading, LLC					
Precision Excavating and Grading, LLC or Precision Excavating Enterprises, LLC	2104 Pierce Saint Croix Rd Baldwin, WI 54002	5/1/11	4/30/14	1, 2 and 4	2006-2008	None
R-Way Pumping, Inc	3023 Lake Maria Rd Freeport, MN 56331	3/1/12	2/28/15	1, 2 and 4	2008	None
Thull, Gerald T	*See,* JT Roofing, Inc					

Cause Code: 1 = Failure to Pay Straight Time 2 = Failure to Pay Overtime 3 = Kickback 4 = Payroll Records.

Department of Workforce Development
Equal Rights Division
P.O. Box 8928
Madison, WI 53708-8928
Telephone: (608) 266-6860
Fax: (608) 267-4592
TTY: (608) 264-8752

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.

State of Wisconsin
Department of Workforce Development
Equal Rights Division

Disclosure of Ownership

The statutory authority for the use of this form is prescribed in Sections 66.0903(12)(d), 66.0904(10)(d) and 103.49(7)(d), Wisconsin Statutes.
The use of this form is mandatory. The penalty for failing to complete this form is prescribed in Section 103.005(12), Wisconsin Statutes.
Personal information you provide may be used for secondary purposes [Privacy Law, s. 15.04(1) (m), Wisconsin Statutes].

(1) On the date a contractor submits a bid to or completes negotiations with a state agency, local governmental unit, or developer, investor or owner on a project subject to Section 66.0903, 66.0904 or 103.49, Wisconsin Statutes, the contractor shall disclose to such state agency, local governmental unit, or developer, investor or owner, 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), 66.0904(2), 103.49(2) and 103.50(2), Wisconsin Statutes.

(3) This form must ONLY be filed, with the state agency project owner, local governmental unit project owner, or developer, investor or owner of a publicly funded private construction project 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; or
(2) 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

Business Name			
Street Address or P O Box	City	State	Zip Code
Business Name			
Street Address or P O Box	City	State	Zip Code
Business Name			
Street Address or P O Box	City	State	Zip Code
Business Name			
Street Address or P O Box	City	State	Zip Code

I hereby state under penalty of perjury that the information, contained in this document, is true and accurate according to my knowledge and belief.

Print the Name of Authorized Officer			
Authorized Officer Signature	Date Signed		
Corporation, Partnership or Sole Proprietorship Name			
Street Address or P O Box	City	State	Zip Code

If you have any questions call (608) 266-6861

State of Wisconsin
Department of Workforce Development
Equal Rights Division

Prime Contractor Affidavit of Compliance With Prevailing Wage Rate Determination

Authorization for this form is provided under Sections 66.0903(9)(c), 66.0904(7)(c) and 103.49(4r)(c) Wisconsin Statutes.
The use of this form is mandatory. The penalty for failing to complete this form is prescribed in Section 103.005(12), Wisconsin Statutes.
Personal information you provide may be used for secondary purposes [Privacy Law, s. 15.04(1)(m), Wisconsin Statutes].

This form must **ONLY** be filed with the **Awarding Agency** indicated below.

State Of))SS County Of)	Project Name	
	DWD Determination Number	Project Number (if applicable)
	Date Determination Issued	Date of Contract
	Awarding Agency	
	Date Work Completed	

After being duly sworn, the person whose name and signature appears below hereby states under penalty of perjury that

- **I am** the duly authorized officer of the corporation, partnership, sole proprietorship or business indicated below and have recently completed all of the work required under the terms and conditions of a contract with the above-named awarding agency and make this affidavit in accordance with the requirements set forth in Section 66.0903(9)(c), 66.0904(7)(c) or 103.49(4r)(c), Wisconsin Statutes and Chapter DWD 290 of the Wisconsin Administrative Code in order to obtain FINAL PAYMENT from such awarding agency.
- **I have** fully complied with all the wage and hour requirements applicable to this project, including all of the requirements set forth in the prevailing wage rate determination indicated above which was issued for such project by the Department of Workforce Development on the date indicated above.
- **I have** received the required affidavit of compliance from each of my agents and subcontractors that performed work on this project and have listed each of their names and addresses on page 2 of this affidavit.
- **I have** full and accurate records that clearly indicate the name and trade or occupation of every worker(s) that I employed on this project, including an accurate record of the hours worked and actual wages paid to such worker(s).
- **I will** retain the records and affidavit(s) described above and make them available for inspection for a period of at least three (3) years from the completion date indicated above at the address indicated below and shall not remove such records or affidavit(s) without prior notification to the awarding agency indicated above.

Name of Corporation, Partnership, Sole Proprietorship, Business, State Agency or Local Governmental Unit				
Street Address	City	State	Zip Code	Telephone Number
Print Name of Authorized Officer			Date Signed	
Signature of Authorized Officer				

List of Agents and Subcontractors

Name			Name		
Street Address			Street Address		
City	State	Zip Code	City	State	Zip Code
Telephone Number			Telephone Number		
Name			Name		
Street Address			Street Address		
City	State	Zip Code	City	State	Zip Code
Telephone Number			Telephone Number		
Name			Name		
Street Address			Street Address		
City	State	Zip Code	City	State	Zip Code
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Telephone Number			Telephone Number		
Name			Name		
Street Address			Street Address		
City	State	Zip Code	City	State	Zip Code
Telephone Number			Telephone Number		

If you have any questions call (608) 266-6861

State of Wisconsin
Department of Workforce Development
Equal Rights Division

Agent or Subcontractor Affidavit of Compliance With Prevailing Wage Rate Determination

Authorization for this form is provided under Sections 66.0903(9)(b), 66.0904(7)(b) and 103.49(4r)(9b), Wisconsin Statutes. The use of this form is mandatory. The penalty for failing to complete this form is prescribed in Section 103.005(12), Wisconsin Statutes.
Personal information you provide may be used for secondary purposes [Privacy Law, Section 15.04(1)(m), Wisconsin Statutes].

This form must **ONLY** be filed with the **Awarding Contractor** indicated below.

State Of _____))SS County Of _____)	Project Name	
	DWD Determination Number	Project Number (if applicable)
	Date Determination Issued	Date of Subcontract
	Awarding Contractor	
	Date Work Completed	

After being duly sworn, the person whose name and signature appears below hereby states under penalty of perjury that

- **I am** the duly authorized officer of the corporation, partnership, sole proprietorship or business indicated below. We have recently completed all of the work required under the terms and conditions of a subcontract with the above-named awarding contractor. We make this affidavit in accordance with the requirements set forth in Section 66.0903(9)(b), 66.0904(7)(b) or 103.49(4r)(b), Wisconsin Statutes and Chapter DWD 290 of the Wisconsin Administrative Code in order to obtain FINAL PAYMENT from such awarding contractor.
- **I have** fully complied with the entire wage and hour requirements applicable to this project, including all of the requirements set forth in the prevailing wage rate determination indicated above which was issued for such project by the Department of Workforce Development on the date indicated above.
- **I have** received the required affidavit of compliance from each of my agents and subcontractors that performed work on this project and have listed each of their names and addresses on page 2 of this affidavit.
- **I have** full and accurate records that clearly indicate the name and trade or occupation of every worker(s) that I employed on this project, including an accurate record of the hours worked and actual wages paid to such worker(s).
- **I will** retain the records and affidavit(s) described above and make them available for inspection for a period of at least three (3) years from the completion date indicated above at the address indicated below and shall not remove such records or affidavit(s) without prior notification to the awarding contractor.

Name of Corporation, Partnership, Sole Proprietorship, Business, State Agency or Local Governmental Unit				
Street Address or PO Box	City	State	Zip Code	Telephone Number ( )
Print Name of Authorized Officer			Date Signed	
Authorized Officer Signature				

List of Agents and Subcontractors

Name			Name		
Street Address			Street Address		
City	State	Zip Code	City	State	Zip Code
Telephone Number ( )			Telephone Number ( )		
Name			Name		
Street Address			Street Address		
City	State	Zip Code	City	State	Zip Code
Telephone Number ( )			Telephone Number ( )		
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Name			Name		
Street Address			Street Address		
City	State	Zip Code	City	State	Zip Code
Telephone Number ( )			Telephone Number ( )		

If you have any questions call (608) 266-6861

State of Wisconsin
Department of Workforce Development
Equal Rights Division
Labor Standards Bureau

Request to Employ Subjourneyperson

The use of this form is mandatory. The penalty for failing to complete this form is prescribed in Section 103.005(12), Wisconsin Statutes.
Personal information you provide may be used for secondary purposes (Privacy Law, s. 15.04(1)(m), Wisconsin Statutes].
The employer indicated below requests that the Department of Workforce Development (DWD) determine the prevailing wage rate(s) and related qualifications to enable such employer to use a subjourneyperson(s) on the following prevailing wage project, in accordance with the provisions of Section DWD 290.025, Wisconsin Administrative Code.

1. Name of Project Appearing on the Project Determination			
County	City, Village or Town		
DWD Project Determination Number	Project Number (if applicable)		
2. Job Classification(s) for which you request a subjourney rate (i.e., carpenter, electrician, plumber, etc.)			
a.	b.		
c.	d.		
3. Employer Name (Print)	Requester Name (Print)		
Address	City	State	Zip Code
Telephone Number ( )	Requester Title		
Email address (if you prefer to receive your response via email)	Fax Number (if you prefer to receive your response via fax) ( )		

READ CAREFULLY: I understand that this request is ONLY applicable to the project and job classification(s) listed above and that subjourney employees primarily work under the direction of and assist a skilled trade employee by frequently using the tools of a skilled trade and will NOT regularly perform the duties of a general laborer, heavy equipment operator or truck driver. If the subjourney employee regularly performs the work of a different trade or occupation, he/she will be compensated for such work at the applicable journeyperson prevailing wage rate. I agree to compensate subjourney employees in strict accordance with the directions received from the DWD.

Requester Signature	Date Signed

MAIL the completed request to:
EQUAL RIGHTS DIVISION, LABOR STANDARDS BUREAU
PO BOX 8928, MADISON WI 53708
OR
FAX the completed request to: (608) 267-4592 / **DO NOT e-mail your request.**
Call (608) 266-6861 for assistance in completing this form.

ADDITIONAL GENERAL PREVAILING WAGE LAW INFORMATION

(This document updated February 2014)

For prevailing wage laws and frequently asked questions, refer to the prevailing wage website at: http://dwd.wisconsin.gov/er/prevailing_wage_rate/default.htm

Topic	Who's affected?	Brief description of requirement under §66.0903 or §103.49
Non-applicability	All public entities	Prevailing wage rates do not apply to minor service or maintenance work, warranty work, or work under a supply and installation contract.
Non-applicability: Minor service or maintenance work	Local governmental units & Contractors	Minor service or maintenance work means a project of public works that is limited to • minor crack filling, chip or slurry sealing, or other minor pavement patching, not including overlays, that has a projected life span of no longer than 5 years or that is performed for a TOWN and is not funded under §86.31, regardless of projected life span; • the depositing of gravel on an existing gravel road applied solely to maintain the road; • road shoulder maintenance; • cleaning of drainage or sewer ditches or structures; or • any other limited, minor work on public facilities or equipment that is routinely performed to prevent breakdown or deterioration.
Non-applicability: Minor service or maintenance work	State agencies	Minor service or maintenance work means a project of public works that is limited to • minor crack filling, chip or slurry sealing, or other minor pavement patching, not including overlays, that has a projected life span of no longer than 5 years; • cleaning of drainage or sewer ditches or structures; or • any other limited, minor work on public facilities or equipment that is routinely performed to prevent breakdown or deterioration.
Non-applicability: Supply & installation contract	All public entities	Supply and installation contract means a contract under which the material is installed by means of simple fasteners or connectors such as screws or nuts and bolts and no other work is performed on the site of the project of public works, and the total labor cost to install the material does not exceed 20 percent of the total cost of the contract.
Non-applicability: Work which a contractor or individual donates to a public entity	All public entities	Prevailing wage laws §§66.0903 & 103.49, Stats., do not apply to work performed on a project of public works for which the local governmental unit or the state or the state agency contracting for the project is not required to compensate any contractor, subcontractor, contractor's or subcontractor's agent, or individual for performing the work.

Topic	Who's affected?	Brief description of requirement under §66.0903 or §103.49
Non-applicability: Residential	All public entities	A prevailing wage rate determination is not required for the erection, construction, repair, remodeling, or demolition of a residential property containing 2 dwelling units or less.
Non-applicability: Residential subdivision infrastructure	All public entities	A prevailing wage rate determination is not required for a road, street, bridge, sanitary sewer, or water main project that is a part of a development in which at least 90 percent of the lots contain or will contain 2 dwelling units or less, as determined by the local governmental unit at the time of approval of the development, and that, on completion, is acquired by, or dedicated to, a local governmental unit (including under §236.13(2), Stats.), or the state, for ownership or maintenance by the local governmental unit or the state.
Electronic certified payroll record	Contractors	The requirement that every contractor on a prevailing wage project submit to DWD monthly a certified record of employees who worked on the project and that DWD post these certified records on its Internet website was discontinued effective July 1, 2011. Contractors are still required to maintain payroll records and provide them upon request from DWD &/or the project owner.
Payroll record inspection request by any person	Contractors & Complainants	Any person may request DWD to inspect the payroll records of any contractor working on a prevailing wage project. On receipt of such a request, the contractor must submit to DWD a certified record of its payroll records, other than personally identifiable information relating to an employee of the contractor, for no longer than a 4-week period. DWD may request records from a contractor under this provision no more than once per calendar quarter for each project of public works on which the contractor is performing work. The department may not charge a requester a fee for obtaining that information. DWD must make these certified records available for public inspection.
Statewide uniformity	Local govern-mental units	A local governmental unit may not enact & administer a prevailing wage ordinance/provision for public works or publicly funded private construction projects. Any extant laws to that effect are void.
Substance Abuse Testing	Contractors & Workers	Before commencing work on a prevailing wage project, a contractor must have a written substance abuse testing program in place that complies with §103.503, Wis. Stats. No employee may use, possess, attempt to possess, distribute, deliver, or be under the influence of a drug or under the influence of alcohol while performing work on a prevailing wage project.

Topic	Who's affected	Brief description of requirement under §66.0903 or §103.49
Covered employees	Truck drivers & Other workers & Contractors	A laborer, worker, mechanic, or truck driver who is employed to process, manufacture, pick up, or deliver materials or products from a commercial establishment that has a fixed place of business from which the establishment supplies processed or manufactured materials or products or from a facility that is not dedicated exclusively, or nearly so, to a project of public works is NOT entitled to receive the prevailing wage rate UNLESS any of the following applies: 1) the laborer, worker, mechanic, or truck driver is employed to go to the source of mineral aggregate such as sand, gravel, or stone and deliver that mineral aggregate to the site of a project of public works by depositing the material directly in final place, from the transporting vehicle or through spreaders from the transporting vehicle. 2) the laborer, worker, mechanic, or truck driver is employed to go to the site of a project of public works, pick up excavated material or spoil from the site of the project, and transport that excavated material or spoil away from the site of the project.

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SECTION 01 00 00

BASIC REQUIREMENTS

PART 1 GENERAL

1.1 SECTION SUMMARY

A. Section Includes:

1. Section Summary
2. Summary of the Work
3. Contractor Use of Premises
4. Applications for Payment
5. Coordination
6. Cutting and Patching
7. Conferences
8. Progress Meetings
9. Submittal Procedures
10. Proposed Products List
11. Shop Drawings
12. Product Data
13. Samples
14. Manufacturers' Instructions
15. Manufacturers' Certificates
16. Quality Assurance / Quality Control of Installation
17. References
18. Interior Enclosures
19. Protection of Installed Work
20. Parking
21. Staging Areas
22. Occupancy During Construction and Conduct of Work
23. Protection
24. Progress Cleaning
25. Products
26. Transportation, Handling, Storage and Protection
27. Product Options
28. Substitutions
29. Starting Systems
30. Demonstration and Instructions
31. Contract Closeout Procedures
32. Final Cleaning
33. Adjusting
34. Operation and Maintenance Data
35. Spare Parts and Maintenance Materials
36. As-Built and Record Drawings and Specifications

1.2 SUMMARY OF THE WORK

A. Project Description: Perform the Work as specified and detailed in Construction Documents package. Contractor to provide all construction services for addition of fire protection in the penthouse & phased replacement of existing computer room HVAC units & associated distribution systems & controls. All facility functions shall remain operational during construction & there can be no loss of cooling capabilities.

B. Work by Owner:
   1. Furnish three (3) computer room cooling units. Installation by this contractor. Units purchased by Dane County in Bid Package No. 2. Equipment delivery to be to the CCB.

C. Permits: Prior to commencement of the Work, Contractor to secure any and all necessary permits for completion of the Work and facility occupancy.

1.3 CONTRACTOR USE OF PREMISES

A. Limit use of premises to allow work by others and work by Owner.

1.4 APPLICATIONS FOR PAYMENT

A. Submit three (3) copies of each application on AIA G702™ and G703™ forms or approved contractors invoice form.

B. Content and Format: Utilize Schedule of Values for listing items in Application for Payment.

C. Payment Period: Monthly.

1.5 COORDINATION

A. Coordinate scheduling, submittals, and work of various sections of Specifications to assure efficient and orderly sequence of installation of interdependent construction elements.

B. Verify utility requirement characteristics of operating equipment are compatible with building utilities.

C. Coordinate space requirements and installation of mechanical and electrical work that are indicated diagrammatically on Drawings.

1.6 CUTTING AND PATCHING

A. Employ a skilled and experienced installer to perform cutting and patching new work; restore work with new Products.

B. Submit written request in advance of cutting or altering structural or building enclosure elements.

C. Fit work tight to adjacent elements. Maintain integrity of wall, ceiling, or floor construction; completely seal voids.

D. Refinish surfaces to match adjacent finishes.

1.7 CONFERENCES

A. Owner will schedule a preconstruction conference after Award of Contract for all affected parties.

B. When required in individual Specification section, convene a pre-installation conference at project site prior to commencing work of the section.

1.8 PROGRESS MEETINGS

A. Schedule and administer meetings throughout progress of the Work at minimum of one (1) per week.

B. Preside at meetings, record minutes, and distribute copies within two (2) days to those affected by decisions made.

1.9 SUBMITTAL PROCEDURES

A. Submittal form to identify Project, Contractor, Subcontractor or supplier; and pertinent Construction Documents references.

B. Apply Contractor's stamp, signed or initialed, certifying that review, verification of Products required, field dimensions, adjacent construction work, and coordination of information is in accordance with requirements of the Work and Construction Documents.

C. Identify variations from Construction Documents and Product or system limitations that may be detrimental to successful performance of completing the Work.

D. Revise and resubmit submittals as required; identify all changes made since previous submittal.

1.10 PROPOSED PRODUCTS LIST

A. Within fifteen (15) days after date of Award of Contract, submit complete list of major Products proposed for use, with name of manufacturer, trade name, and model number of each Product.

1.11 SHOP DRAWINGS

A. Submit number of copies that Contractor requires, plus two (2) copies that shall be retained by Public Works Project Manager.

1.12 PRODUCT DATA

A. Submit number of copies that Contractor requires, plus two (2) copies that shall be retained by Public Works Project Manager.

B. Mark each copy to identify applicable products, models, options, and other data. Supplement manufacturer's standard data to provide information unique to this Project.

1.13 SAMPLES

A. Submit samples to illustrate functional and aesthetic characteristics of the Product.

B. Submit samples of finishes from the full range of manufacturers' standard colors, textures, and patterns for Public Works Project Manager's selection.

1.14 MANUFACTURERS' INSTRUCTIONS

A. When specified in individual Specification sections, submit manufacturers' printed instructions for delivery, storage, assembly, installation, start-up, adjusting, and finishing, in quantities specified for Product Data.

1.15 MANUFACTURERS' CERTIFICATES

A. When specified in individual Specification sections, submit manufacturers' certificate to Public Works Project Manager for review, in quantities specified for Product Data.

B. Indicate material or Product conforms to or exceeds specified requirements. Submit supporting reference data, affidavits, and certifications as appropriate.

1.16 QUALITY ASSURANCE / QUALITY CONTROL OF INSTALLATION

A. Monitor quality control over suppliers, manufacturers, Products, services, site conditions, and workmanship, to produce work of specified quality.

B. Comply fully with manufacturers' instructions.

C. Comply with specified standards as minimum quality for the Work except when more stringent tolerances, codes, or specified requirements indicate higher standards or more precise workmanship.

1.17 REFERENCES

A. Conform to reference standard by date of issue current as of date for receiving bids.

B. Should specified reference standard conflict with Construction Documents, request clarification from Public Works Project Manager before proceeding.

1.18 INTERIOR ENCLOSURES

A. Provide temporary partitions as required to separate work areas from Owner occupied areas, to prevent distribution of dust and moisture into Owner occupied areas, and to prevent damage to existing materials and equipment.

1.19 PROTECTION OF INSTALLED WORK

A. Protect installed work and provide special protection where specified in individual Specification sections.

1.20 PARKING

A. Arrange for temporary parking areas to accommodate construction personnel. Limited parking shall be available at the Work site.

1.21 STAGING AREAS

A. Coordinate staging areas with Public Works Project Manager & Facilities Management Division prior to starting the Work.

B. On-site space for use as staging areas and storage of materials is limited and will be apportioned among the various Contractors as their needs dictate with due regard for storage requirements of each Contractor. Each Contractor shall be responsible for safety of equipment and materials that are stored on site.

1.22 OCCUPANCY DURING CONSTRUCTION AND CONDUCT OF WORK

A. Areas of existing facility will be occupied during period when the Work is in progress. Work may be done during normal business hours (8:00 am to 4:30 pm), but confer with Owner, schedule work and store materials so as to interfere as little as possible with normal use of premises. Notify Owner when coring or similar noise making work is to be done and obtain Owner's written approval of schedule. If schedule is not convenient for Owner, reschedule and resubmit new times for Owner approval. Coring of floor along with other noisy work may have to be done on second and third shifts.

B. Work shall be done and temporary facilities furnished so as not to interfere with access to any occupied area and so as to cause least possible interference with normal operation of facility or any essential service thereof.

C. Contractor shall, at all times, provide approved, safe walkways and facility entrances for use by Owner, employees and public.

D. Contractor shall provide adequate protection for all parts of facility, its contents and occupants wherever the Work under this Contract is to be performed.

E. Each Contractor shall arrange with Owner to make necessary alterations, do new work, make connections to all utilities, etc., at such times as will not cause interruption of utility services to facility. Contractor doing this work shall protect, cap, cut off and / or replace

and relocate existing pipes, electrical work and other active utilities encountered which may interfere with new construction work.

F. New work in extension of existing work shall correspond in all respects with that to which it connects or similar existing work unless otherwise indicated or specified.
   1. Existing work shall be cut, altered, removed or replaced as necessary for performance of Contract obligations.
   2. Work remaining in place, damaged or defaced by reason of work done under this Contract shall be restored equal to its condition at time of Award of Contract.
   3. If removal of work exposes discolored or unfinished surfaces or work out of alignment, such surfaces shall be refinished or materials replaced as necessary to make continuous work uniform and harmonious.

1.23 PROTECTION

A. Contractor shall protect from injury all trees, shrubs, hedges, walks and driveways and pay for any damage to same resulting from insufficient or improper protection.

B. Guard Light: Contractor shall provide and maintain guard lights at all barricades, railings, obstructions in streets, roads or sidewalks and at all trenches adjacent to public walks or roads.

1.24 PROGRESS CLEANING

A. Maintain areas free of waste materials, debris, and rubbish. Maintain site in clean and orderly condition.

1.25 PRODUCTS

A. Products: Means new material, machinery, components, equipment, fixtures, and systems forming the Work, but does not include machinery and equipment used for preparation, fabrication, conveying and erection of the Work. Products may also include existing materials or components specifically identified for reuse.

B. Do not use materials and equipment removed from existing premises, except as specifically identified or allowed by Construction Documents.

1.26 TRANSPORTATION, HANDLING, STORAGE AND PROTECTION

A. Transport, handle, store and protect Products in accordance with manufacturer's instructions.

1.27 PRODUCT OPTIONS

A. Where definite material is specified, it is not intentional to discriminate against "equal" product made by another manufacturer. Intention is to set definite standard of material quality. Should bidder choose to bid materials other than those specified, bidder shall submit said materials specifications to Public Works Project Manager & Engineer for approval at least seven (7) days prior to Bid Due Date.

B. Products and materials that are not specified, but have been approved for use by Public Works Project Manager shall be identified in addenda to all bidding contractors.

C. Requests for material or product substitutions submitted after Bid Due Date shall not be considered. Owner reserves right to approve or reject substitutions based on Specification requirements and intended use.

1.28 SUBSTITUTIONS

A. Public Works Project Manager shall consider requests for Substitutions only up to seven (7) days prior to date of Bid Due Date.

B. Document each request with complete data substantiating compliance of proposed Substitution with Construction Documents.

C. Submit three (3) copies of requests for Substitution for consideration. Limit each request to one (1) proposed Substitution.

D. Substitutions shall not change contract price established at Bid Due Date.

1.29 STARTING SYSTEMS

A. Provide written notification prior to start-up of each equipment item or system.

B. Ensure that each piece of equipment or system is ready for operation.

C. Execute start-up under supervision of responsible persons in accordance with manufacturers' instructions.

D. Submit written report that equipment or system has been properly installed and is functioning correctly.

1.30 DEMONSTRATION AND INSTRUCTIONS

A. Demonstrate operation and maintenance of Products to Owner's personnel prior to date of final inspection.

B. Demonstrate start-up, operation, control, adjustment, trouble-shooting, servicing, maintenance, and shutdown of each item of equipment at agreed-upon times, at designated location.

C. Owner may choose to videotape demonstration session; demonstration and demonstrator shall be to level of satisfaction of Owner.

1.31 CONTRACT CLOSEOUT PROCEDURES

A. Submit written certification that Construction Documents have been reviewed, the Work has been inspected, and the Work is complete in accordance with Construction Documents and ready for Public Works Project Manager's inspection.

B. Submit final Application for Payment identifying total adjusted Contract Sum / Price, previous payments, and amount remaining due.

1.32 FINAL CLEANING

A. Execute final cleaning prior to final inspection.

B. Clean interior and exterior surfaces exposed to view.

C. Remove waste and surplus materials, rubbish, and construction facilities from site.

1.33 ADJUSTING

A. Adjust operating Products and equipment to ensure smooth and unhindered operation.

1.34 OPERATION AND MAINTENANCE MANUAL

A. Provide operation and maintenance manual for all mechanical and electrical equipment and systems supplied and installed in the Work.

1.35 SPARE PARTS AND MAINTENANCE MATERIALS

A. Provide Products, spare parts, maintenance and extra materials in quantities specified in individual Specification Sections.

B. Deliver to the Work site and place in location as directed.

1.36 AS-BUILT AND RECORD DRAWINGS AND SPECIFICATIONS

A. Contractor-produced Drawings and Specifications shall remain property of Contractor whether Project for which they are made is executed or not. Contractor shall furnish Engineer with original marked up redlines of drawings and specifications that shall include all Addendums, Change Orders, Construction Bulletins, on-site changes, field corrections, etc. These are the project As-Built Drawings & Specifications.

B. Engineer shall update the original Construction Documents to include all Addendums & any other changes including those provided by the Contractor in the As-Built Drawings & Specifications. These updates are the project Record Drawings & Specifications.

C. Engineer shall furnish the Public Works Project Manager with Record Drawings as detailed in the Professional Services Agreement.

PART 2 PRODUCTS

Not Used.

PART 3 EXECUTION

Not Used.

END OF SECTION

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SECTION 01 74 19

RECYCLING

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
1. Waste Management Goals
2. Waste Management Plan
3. Reuse
4. Recycling
5. Materials Sorting and Storage On Site
6. Lists of Recycling Facilities Processors and Haulers
7. Waste Management Plan Form

B. Related Sections:
1. Section 01 00 00 - Basic Requirements
2. Section 01 50 00 - Temporary Facilities and Controls
3. Section 02 40 00 - Demolition & Structure Moving
4. Section 02 41 13 - Selective Site Demolition

1.2 WASTE MANAGEMENT GOALS

A. Dane County requires that as many waste materials as possible produced as result of this project be salvaged, reused or recycled in order to minimize impact of construction waste on landfills and to minimize expenditure of energy and cost in fabricating new materials. Additional information may be found in The Dane County Green Building Policy, Resolution 299, 1999-2000.

B. Contractor shall develop, with assistance of Public Works Project Manager and Engineer, Waste Management Plan (WMP) for this project. Outlined in RECYCLING section of this specification are examples of materials that can be recycled or reused as well as recommendations for waste sorting methods.

1.3 WASTE MANAGEMENT PLAN

A. Contractor shall complete WMP and include cost of recycling / reuse in Bid. WMP will be submitted to Public Works Project Manager within fifteen (15) days of Notice to Proceed date. Copy of blank WMP form is in this Section. Submittal shall include cover letter and WMP form with:
1. Information on:
a. Types of waste materials produced as result of work performed on site;
b. Estimated quantities of waste produced;
c. Identification of materials with potential to be recycled or reused;
d. How materials will be recycled or reused;
e. On-site storage and separation requirements (on site containers);

f. Transportation methods; and
g. Destinations.

1.4 REUSE

A. Contractors and subcontractors are encouraged to reuse as many waste materials as possible. Salvage should be investigated for materials not reusable on site.

1.5 RECYCLING

A. These materials can be recycled in Dane County area:
1. Wood.
2. Wood Pallets.
3. Foam Insulation & Packaging (extruded and expanded).
4. PVC Plastic (pipe, siding, etc.).
5. Corrugated Cardboard.
6. Metal.

1.6 MATERIALS SORTING AND STORAGE ON SITE

A. Contractor shall provide separate containers for recyclable materials. Number of containers will be dependent upon project and site conditions.

B. Contractor shall provide on-site locations for subcontractors supplied recycling containers to help facilitate recycling.

1.7 LISTS OF RECYCLING FACILITIES PROCESSORS AND HAULERS

A. Web site www.countyofdane.com/pwht/recycle/categories.aspx lists current information for Dane County Recycling Markets. Contractors can also contact Dane County's Special Projects & Materials Manager at 608/266-4990, or local city, village, town recycling staff listed at site www.countyofdane.com/pwht/recycle/contacts.aspx. Statewide listings of recycling / reuse markets are available from UW Extension at www4.uwm.edu/shwec/wrmd/search.cfm.

1.8 WASTE MANAGEMENT PLAN FORM

A. Contractor Information:
Name: _____
Address: _____
_____
Phone No.: _____ Recycling Coordinator: _____

MATERIAL	ESTIMATED QUANTITY	DISPOSAL METHOD (CHECK ONE)	RECYCLING / REUSE COMPANY OR DISPOSAL SITE
Salvaged & reused building materials	_____ cu. yds. _____ tons	_____ Recycled _____ Reused _____ Landfilled _____ Other	Name:_____
Wood	_____ cu. yds. _____ tons	_____ Recycled _____ Reused _____ Landfilled _____ Other	Name:_____
Wood Pallets	_____ units	_____ Recycled _____ Reused _____ Landfilled _____ Other	Name:_____
PVC Plastic	_____ cu. ft. _____ lbs.	_____ Recycled _____ Reused _____ Landfilled _____ Other	Name:_____
Corrugated Cardboard	_____ cu. ft. _____ lbs.	_____ Recycled _____ Reused _____ Landfilled _____ Other	Name:_____
Metals	_____ cu. yds. _____ tons	_____ Recycled _____ Reused _____ Landfilled _____ Other	Name:_____
Other	_____	_____ Recycled _____ Reused _____ Landfilled _____ Other	Name:_____
Other	_____	_____ Recycled _____ Reused _____ Landfilled _____ Other	Name:_____

PART 2 PRODUCTS

Not Used.

PART 3 EXECUTION

Not Used.

END OF SECTION

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SECTION 21 05 00
COMMON WORK RESULTS FOR FIRE SUPPRESSION

PART 1 – GENERAL

1.01 SCOPE OF WORK

A. Base Bid: It is the intent of these specifications to provide complete and workable fire protection systems as shown on the accompanying plans and as specified herein except such parts as are specifically exempted herein. Provide all necessary supervision, coordination, labor, materials, equipment, fixtures, drayage, hoisting, tools, transportation, plant services and facilities, machinery and connections to utilities for the installation of complete and operable fire protection systems. If details or special conditions are required in addition to those shown on drawings, provide all material and equipment usually furnished with such systems or required to complete their installation, whether noted in plans and specification or not.

B. Materials and labor shall be new (unless noted otherwise), first class and workmanlike and shall be subject at all times to the A/E's inspections, tests and approval from the commencement until the acceptance of the completed work.

C. The layout shown on the drawings is necessarily diagrammatic but shall be followed as closely as other work will permit. The drawings provide design intent. The Contractor shall verify all dimensions at the site and be responsible for their accuracy.

D. Because of the scale of the Drawings, certain basic items, such as, pipe fittings and sleeves, may not be shown. Where such items are required by Code or by other Sections, or where required for proper installation of the Work, such items shall be included, whether shown or not.

E. In the event of any inconsistencies between the specifications, drawings, contract documents, applicable laws, statutes, ordinances, building codes, rules and regulations, the contractor shall provide the better quality or greater quantity of work and comply with or conform its work to the most stringent legal or contractual requirements.

F. Changes from these drawings required to make this work conform to the building construction shall be made only with prior written approval of the Architect/Engineer. All proposed changes shall be shown on shop drawings. All measurements shall be verified by actual observation and all work shall fit in place meeting the approval of the Architect/Engineer.

G. Equipment specification may not deal individually with minute items required, such as components, parts, controls, and devices which may be required to produce the equipment performance specified or as required to meet the equipment warranties. Where such items are required to make the system operational, they shall be included by the supplier of the equipment at no additional cost, whether or not specifically called for.

1.02 SECTION INCLUDES

A. This section includes information common to two or more technical fire suppression specification sections or items that are of a general nature, not conveniently fitting into other technical sections.

1. Submittals
2. Reference Standards
3. Quality Assurance
4. Design Criteria
5. Guarantee
6. Operation And Maintenance Instructions
7. Record Documents
8. Continuity Of Existing Services
9. Protection Of Finished Surfaces
10. Sealing And Firestopping
11. Off Site Storage
12. Regulatory Requirements
13. Certificates And Inspections
14. Coordination

15. Request And Certification For Payment
16. Sleeves And Openings
17. Omissions
18. Definitions
19. Project/Site Conditions
20. Work Sequence And Scheduling
21. Identification
22. Cutting And Patching
23. Building Access
24. Equipment Access
25. Lubrication
26. Housekeeping And Clean Up

1.03 RELATED WORK

A. Applicable provisions of Division 0 and 1 govern work under this section.
B. This section applies to all Division 21 sections of fire suppression.

1.04 SUBMITTALS

A. Submit shop drawings for equipment under each section per requirements listed in that section, as well as per Division 0 and 1.
B. Submit for all equipment and systems as indicated in the respective specification sections, marking each submittal with that specification section number. Mark general catalog sheets and drawings to indicate specific items being submitted and proper identification of equipment by name and/or number, as indicated in the contract documents. Failure to do this may result in the submittal(s) being returned to the Contractor for correction and resubmission. Do not submit hard copies of web pages. Failing to follow these instructions does not relieve the Contractor from the requirement of meeting the project schedule.
C. On request from the A/E, the successful bidder shall furnish additional drawings, illustrations, catalog data, performance characteristics, etc.
D. 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.
E. The submittals must be approved before fabrication is authorized.
F. Provide electronic copies of all submittals for review.
G. Before submitting electrically powered equipment, verify that the electrical power and control requirements for the equipment are in agreement with the motor starter schedule on the electrical drawings. Include a statement on the shop drawing transmittal to the architect/engineer that the equipment submitted and the motor starter schedule is in agreement or indicate any discrepancies.
H. Not more than two weeks after award of contract but before any product submittals or shop drawings are submitted, contractor to submit the following fire protection system data sheet. List piping material types, ASTM number, schedule or pressure class, joint type, manufacturer and model number where appropriate. List valves, specialties and equipment with manufacturer and model number. The approved fire suppression system data sheet(s) will be made available to the Owner's Project Representative for their use on this project.
    1. Fire Suppression System Data Sheet:

Item	Pipe Service/Sizes	Manufacturer/Model No.	Remarks
Pipe			
Fittings			
Hangers & Supports			
Sprinklers			
Valves			
Specialties			
Equipment			

I. Product submittals are to be bound, labeled, contain the project manual cover page and a material index list page showing item designation, manufacturer and additional items supplied with the installation. Submit for all equipment and systems as indicated in the respective specification sections, marking each submittal with that specification section number. Mark general catalog sheets and drawings to indicate specific items being submitted and proper identification of equipment by name and/or number, as indicated in the contract documents. Include wiring diagrams of electrically powered equipment.

1. Submit working plans indicating water supply location and size, piping layout and size, sprinkler locations and type, hanger locations and type, equipment locations and type, valve locations and type occupancy classes hydraulic reference points, design areas and discharge densities per NFPA 13.
2. Submit hydraulic calculations for water supply and sprinkler systems. Include summary sheet, detailed work sheets and a graphic representation of the complete hydraulic calculation plotted on semi-exponential graph paper per NFPA 13
3. Submit working plans and hydraulic calculations for automatic sprinkler systems to the Architect/Engineer for approval prior to submittal to the local Fire Department.
4. Submit plan approval application, working plans and hydraulic calculation for automatic sprinkler systems to the owner's insurance underwriter or local AHJ for approval. Submit copy of approval letter from local Fire Department to Architect/Engineer.
5. Submit sufficient quantities of data sheets and shop drawings to allow the following distribution:
   a. Operating and Maintenance Manuals 2 copies
   b. Architect/Engineer 1 copy
   c. Local Fire Chief or Marshal 1 copy

1.05 REFERENCE STANDARDS

A. Abbreviations of standards organizations referenced in this and other sections are as follows:

1. ANSI American National Standards Institute
2. ASME American Society of Mechanical Engineers
3. ASTM American Society for Testing and Materials
4. AWWA American Water Works Association
5. AWS American Welding Society
6. EPA Environmental Protection Agency
7. FM FM Global (Factory Mutual Insurance Company)
8. FS Federal Specifications, Superintendent of Documents, U.S. Gov. Printing Office
9. IEEE Institute of Electrical and Electronics Engineers
10. ISA Instrument Society of America
11. DSPS State of Wisconsin, Department of Safety & Professional Services
12. MSS Manufacturer's Standardization Society of the Valve & Fitting Industry, Inc.
13. NBS National Bureau of Standards
14. NEC National Electric Code
15. NEMA National Electrical Manufacturers Association
16. NFPA National Fire Protection Association
17. UL Underwriters Laboratories Inc.

1.06 QUALITY ASSURANCE

A. Substitution of Materials: Refer to Division 0 and 1 for equals and substitutions.

1. Where the following conflicts with Division 0 and 1, the requirements of Division 0 and 1 shall govern.
2. If the Contractor wishes to submit an alternate to the named manufacturers for any equipment, he may submit a voluntary alternative minimum 7 days prior to bid, stating the manufacturer's name, model number, written, detailed product data.

3. Where materials or equipment are specified by name the proposed material or equipment must be identical to the specified material or equipment in all characteristics of quality, function and serviceability, regardless of application in the Project and, in addition, when the Architect deems that aesthetic significance is important, the equal material or equipment must be identical in all characteristics of visual appearance, design, color and texture. Any proposed equal shall be submitted to Architect/Engineer for prior approval, which Architect/Engineer may approve or disapprove in its sole discretion. Work performed or constructed with unapproved equals is at Contractor's risk and any required correction of work incorporating unapproved equals shall be at Contractor's sole cost and expense.
4. In all instances, Contractor shall assume full responsibility for proof of equality of the statute to the equipment hereinafter specified. All data and information necessary for proof of equality, function and space requirements shall be prepared and accompany the submittal of the substitution to the Architect/Engineer. Approval by the Architect/Engineer of equipment other than the specified does NOT relieve Contractor of this responsibility.

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, including, but not limited to, coordination with other trades and any required changes by other trades and for obtaining the intended performance from the system into which these items are placed.

1.07 DESIGN CRITERIA

A. Design fire protection systems in accordance with codes, standards and regulations noted above.

B. The fire protection systems consist of:
1. Double interlocked pre-action dry pipe sprinkler system.

C. Water Demand Requirements:
1. Hydraulically design automatic sprinkler systems for the hydraulically most remote area based on the following:

Location	Occupancy Classification	Area (Sq. Ft.)	Density (GPM/Sq. Ft.)
Penthouse	Ordinary Hazard (Group 1)	1500	0.15

D. Available water supply data for system design is as follows:
1. Existing wet pipe sprinkler system.

1.08 GUARANTEE

A. Refer to Division 0 and 1 for guarantees and warranties. In addition to the requirements in Division 0 and 1, this Contractor shall meet the following requirements.

B. In entering into a contract covering this work, the contractor accepts the specifications and guarantees that the work will be carried out in accordance with the requirements of this specification or such modifications as may be made under the contract documents.

C. Contractor further guarantees that the workmanship and material will be of the best procurable and that none but experienced workmen familiar with each particular class of work will be employed.

D. Contractor further guarantees to replace and make good at his own expense, including travel time, all defects, which may develop within 1 year after final payment and acceptance by the Architect/Engineer, due to faulty workmanship or material, upon, receipt of written notification from the Owner.

1.09 OPERATION AND MAINTENANCE INSTRUCTIONS

A. Refer to Division 0 and 1 for operating and maintenance instructions.

B. In addition to the general content specified under Division 0 and 1 supply the following additional documentation:

1. Copies of all approved submittals along with approval letters.
2. Manufacturer's wiring diagrams for electrically powered equipment.
3. Records of tests performed to certify compliance with system requirements.
4. Certificates of inspection by regulatory agencies.
5. Parts lists for equipment and specialties.
6. Manufacturer's installation, operation and maintenance recommendations for equipment and specialties.
7. Valve schedules
8. Lubrication instructions, including list/frequency of lubrication
9. Warranties
10. Copy of NFPA 25 – Standard for Inspection, Testing & Maintenance of Water-Based Fire Protection, latest edition
11. Additional information as indicated in the technical specification sections

1.10 RECORD DOCUMENTS

A. Refer to Division 0 and 1 for record documents.

B. In addition to the general content specified under Division, follow the following procedures.

1. During the progress of the work, Contractor shall maintain a current (daily) record set of the drawings and specifications, indicating thereon all work installed at variance with such Contract Documents including, without limitation, work covered by Addenda, Field Work Orders, Change Orders and Engineers additional instructions, interpretations and clarification. All changes or deviations from the original layout of the work and all critical dimensions of buried or concealed work shall be recorded. It shall be Contractor's responsibility to assure that said record sets are complete, accurate and up-to-date, Engineer shall have the right to inspect and review such record sets.
2. At the completion of the work, Contractor shall indicated on record sets all record changes and such additional details necessary or appropriate to provide a complete reference document for use by Engineer. If variations and details cannot be shown clearly thereon, the Contractor shall prepare supplemental drawings adequate to impart the information. The foregoing drawings collectively shall constitute the "Record" drawings for the work.
3. All indication on "Record" drawings shall be executed in a legible manner at Contractor's cost, using methods and legend presentations compatible with the overall scheme of the record drawings with respect to scale, drawing sheet sizes and sequential indexing. All changes shall be marked clearly in red and clouded.
4. Engineer may review Contractor's "Record" drawings and notify Contractor of observed discrepancies or deviations. Contractor shall promptly correct discrepancies, deviations or illegible markups at Contractor's expense and resubmit revised drawings for Engineer review.
5. Select one of the following two paragraphs depending on who is responsible for final electronic record drawings. This may be decided in our contract with the client.
6. Contractor shall provide final electronic record drawings to the Owner through the Engineer.
7. Engineer will provide final electronic record drawings to the Owner based on Contractor's markups.

C. In addition to the data indicated in Division 0 and 1, maintain fire protection layout record drawings and hydraulic calculations on originals prepared by the installing contractor/subcontractor. Include copies of these record drawings and calculations with the Operating and Maintenance manuals.

1.11 CONTINUITY OF EXISTING SERVICES

A. Do not interrupt or change existing services without prior written approval from the Owner's Project Representative. When interruption is required, coordinate scheduling of down-time with the Owner to minimize disruption to his activities. Unless specifically stated, all work involved in interrupting or changing existing services is to be done during normal working hours.

B. Each Contractor shall thoroughly familiarize himself with existing systems which will affect and be affected by installation of new lines and equipment. They shall plan installation of their work so that interruptions of services to any building or portion thereof will be a minimum and such interruptions shall occur only when system is not required, if possible. If not possible, each Contractor shall insure the operation of services by whatever means possible, such as, installing bypasses, capping of services or providing temporary service. Each interruption shall be for as short a duration as possible.

C. No extra costs will be paid to the Contractor for such outages which must occur outside of regular weekly working hours.

D. This Contractor shall restore any circuit interruption as a result of this work to proper operation as soon as possible. Note that institutional operations are on a seven day week schedule.

1.12 PROTECTION OF FINISHED SURFACES

A. Refer to Division 0 and 1 for protection of finished surfaces.

1.13 SEALING AND FIRESTOPPING

A. Sealing and firestopping of sleeves/openings between piping, etc. and the sleeve or structural opening shall be the responsibility of the contractor whose work penetrates the opening. The contractor responsible shall hire individuals skilled in such work to do the sealing and fireproofing. These individuals hired shall normally and routinely be employed in the sealing and fireproofing occupation.

B. Contractor shall request current life safety drawings from the Architect/Owner.

1.14 OFF SITE STORAGE

A. If payment will be requested for approved offsite stored material, then the Contractor shall complete an "Offsite Storage Agreement" which is available from the Owner. Prior approval by Owner's personnel for offsite storage will be needed. No material will be accepted for offsite storage unless submittals for the material have been approved.**REGULATORY REQUIREMENTS**

A. Comply with requirements of Wisconsin Administrative Code, Department of Safety & Professional Services, NFPA Standards and local Authority Having Jurisdiction (AHJ) regarding design, materials and installation.

1.16 CERTIFICATES AND INSPECTIONS

A. Refer to Division 0 and 1 for permits, regulations, utilities and taxes.

B. Obtain and pay for all required State or local installation inspections except those provided by the Architect/Engineer in accordance with State Code. Deliver originals of these certificates to the Owner. Include copies of the certificates in the Operating and Maintenance Instructions.

C. Coordinate and provide inspections as required by the authority having jurisdiction over the site.

1.17 COORDINATION

A. Refer to Division 0 and 1 for coordination. In addition to the requirements specified under Division 0 and 1, the following requirements apply.

B. It shall be the responsibility of each Contractor to coordinate and consult with each other to determine space requirements and to determine that adequate space for servicing is provided for all equipment whether furnished by the Contractor or others. The General Contractor shall have final decision on all space priority conflicts among Contractors. All space priority conflicts shall be brought to the attention of the Architect/Engineer and Owner's Representative.

C. Each Contractor shall thoroughly familiarize himself with existing systems which will affect and be affected by relocation of existing equipment and installation of new lines and equipment. They shall plan installation of their work so that interruptions of services to any building or portion thereof will be a minimum, and such interruptions shall occur only when system is not required, if possible. If not possible, each Contractor shall insure the operation of services by whatever means possible, such as, installing bypasses, capping of services, or providing temporary service. Each interruption shall be for as short a duration as possible.

D. Cooperation among all Contractors shall be required. Any Work that is installed without cooperating or coordinating with other Contractors and is in conflict shall be removed and reinstalled at that particular Contractor's cost. No cost additions to the Project will be considered due to a Contractor's lack of participation in the cooperation and coordination process. The following list of items of Work shall be the priority of order for all Contractors:
   1. Structure
   2. Recessed light fixtures
   3. Gravity-flow systems for sanitary, storm, steam and steam condensate piping
   4. Ductwork and appurtenances
   5. Electrical and low voltage cable tray
   6. Plumbing vent piping
   7. Fire protection (sprinkler system)
   8. HVAC piping
   9. Gas piping, process piping and domestic water
   10. Electrical conduit and low voltage conduit
   11. Control air lines or conduit

E. The above list, in descending order, is the precedence assigned the Work items for space priority. Gravity-flow systems have first priority.

F. Plumbing lines below or behind plumbing fixtures shall have precedence over all other work. Electrical conduit above or below switchgear, panelboards and control panels shall have precedence over all other work. Do not install any fluid conveying piping over electrical or elevator equipment.

G. In the case of interconnection of the work of two or more contractors, verify at the site or on shop drawings all dimensions relating to such work. All errors due to the failure to so verify any such dimensions shall be promptly rectified.

H. Any installed work that is not coordinated and interferes with another contractor's work shall be removed or relocated at the installing contractor's expense.

1.18 REQUEST AND CERTIFICATION FOR PAYMENT

A. Within 10 days after Notice to Proceed, the successful bidder will submit to the Owner's Project Representative in a form prescribed by Division 0 and 1, a cost breakdown of the proposed values for work performed which, if approved by the owner, will become the basis for construction progress and monthly payments. The cost breakdown items shall reflect actual work progress stages as closely as feasible.

B. In addition, if payment is requested for approved off-site stored material, then that material shall be listed as a line item in the request and certification for payment cost breakdown.

1.19 SLEEVES AND OPENINGS

A. Openings required in new or existing construction that may be necessary for the installation of new work shall be provided by the respective contractor and all patching and repairing shall be done by workmen competent in the trade required, at the expense of the respective contractor. The respective contractor shall be responsible for arranging the work so that minimum cutting will be required. All rubbish and excess materials involved in such cutting shall be promptly removed from the site and disposed of by the contractor. Cutting through the floor or roof systems or load bearing walls shall be done only with the prior written approval of the Architect/Engineer so as to avoid damaging the structural system.

1.20 OMISSIONS

A. No later than ten (10) days before bid opening, the Contractor shall call the attention of the A/E to any materials or apparatus the Contractor believes to be inadequate and to any necessary items of work omitted.

1.21 DEFINITIONS

A. Wherever the words "the Contractor", "this Contractor" or "Fire Protection Contractor" appear in this division, they refer to the Contractor for Fire Protection work.

B. The term “provide” includes such labor, methods, materials, equipment and transportation or other facilities required to complete the Contract and the performance of all duties thereby upon the Contractor.

1.22 PROJECT/SITE CONDITIONS

A. Install Work in locations shown on Drawings, unless prevented by Project conditions.
B. Prepare drawings showing proposed rearrangement of Work to meet Project conditions, including changes to Work specified in other Sections. Obtain permission of A/E before proceeding.
C. Tools, materials and equipment shall be confined to areas designated by the Owner’s project representative.

1.23 WORK SEQUENCE AND SCHEDULING

A. Install work in phases to accommodate Owner's occupancy requirements. During the construction period coordinate schedule and operations with Owner's Construction Representatives.

1.24 SALVAGE MATERIALS

A. No materials removed from this project shall be reused (except as specifically indicated). All materials removed shall become the property of and shall be disposed of by the Contractor.

PART 2 – PRODUCTS

2.01 IDENTIFICATION

A. Adhesive Labels: Pressure-sensitive, adhesive backed, vinyl pipe markers with applicable labeling, ¾” min. size for lettering and surrounding tape on both ends. With flow arrows on piping. Conforming to ANSI, ANSI and NFPA standards.
B. Snap-Around Markers: One-piece, pre-formed, vinyl construction, snap-around or strap-around pipe markers with applicable labeling, ¾” min. size for lettering. Provide nylon ties on each end of pipe marker.
C. Signs: Permanently marked weatherproof metal or rigid plastic sign conforming to NFPA 13, secured with corrosion-resistant wire, chain, or other means.
D. Valve Tags: Round brass tags with 1/2 inch numbers, 1/4 inch system identification abbreviation, 1¼” minimum diameter, with brass jack chains with brass "S" hooks or one piece nylon ties around the valve stem.

2.02 SLEEVES AND OPENINGS

A. General:
   1. Pipe sleeves shall be constructed of standard weight ASTM A53 or ASME B36.10 steel with an anchor plate constructed of A36/A36M steel welded to the pipe. The entire assembly shall be hot-dip galvanized after fabrication.

2.03 SEALING AND FIRESTOPPING

A. Fire And/or Smoke Rated Penetrations:
   1. Manufacturers: 3M, Hilti, STI/SpecSeal, Tremco
   2. All firestopping systems shall be provided by the same manufacturer.
   3. Fire stop systems shall be UL listed or tested by an independent testing laboratory approved by the Authority Having Jurisdiction (AHJ).
   4. 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 judgment can be based upon.
   5. Use a product that has a rating not less than the rating of the wall or floor being penetrated. Reference architectural drawings for identification of fire and/or smoke rated walls and floors.

6. Use firestop putty, caulk sealant, intumescent wrapstrips, intumescent firestop collars, 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.
7. All sealants shall meet the intent of LEED® VOC requirements, <250 g/L VOC contents (less H_20 and exempt solvents).

B. Non-Rated Penetrations:
1. Pipe Penetrations: At pipe penetrations of non-rated interior partitions, floors and exterior walls above grade use urethane caulk in annular space between pipe and sleeve. For non-rated drywall, plaster or wood partitions where sleeve is not required use urethane caulk in annular space between pipe insulation and wall material.

PART 3 – EXECUTION

3.01 CUTTING AND PATCHING

A. Refer to Division 0 and 1 for cutting and patching. In addition to the requirements in Division 0 and 1:

B. Each Contractor shall coordinate the placing of openings in the new structure as required for the installation of each Contractor's work.

C. Each Contractor shall furnish to the General Contractor the accurate locations and sizes for required openings in the new work, but this shall not relieve each Contractor of the responsibility of checking to assure that properly sized openings are provided. When additional patching is required due to the Contractor's failure to inspect this work, then the Contractor shall make arrangements for the patching required to properly close the openings to include patch painting, and the Contractor shall pay any additional cost incurred in this respect.

D. If cutting and patching of the new structure is made necessary due to the Contractor's failure to install piping, sleeves, or equipment on schedule, or due to the Contractor's failure to furnish on schedule the information required for the leaving of openings, then it shall be the Contractor's responsibility to make arrangements and obtain approval from the General Contractor and Architect/Engineer for this cutting and patching, and the Contractor shall pay any additional cost incurred in this respect. The Contractor shall also reimburse the Owner for any additional costs incurred to the Architect/Engineer for additional services caused by the Contractor in this respect.

E. The Contractor shall provide cutting and patching and patch painting in the existing structure as required for the installation of his Work and shall furnish supports as required for openings. Cutting of structural support members will not be permitted without prior approval of the Architect/Engineer. Extent of cutting shall be minimized; use core drills, power saws, or other machines which will provide neat, minimum openings. Patching shall match adjacent materials and surfaces and shall be performed by craftsmen skilled in the respective craft required.

3.03 BUILDING ACCESS

A. 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.

3.04 EQUIPMENT ACCESS

A. Install all piping, conduit and accessories to permit access to equipment for maintenance and service.

3.05 COORDINATION

A. Coordinate all work with other contractors prior to installation. Any work that is not coordinated and that interferes with other contractor's work shall be removed or relocated at the installing contractor's expense.

B. Verify that all devices are compatible for the type of construction and surfaces on which they will be used.

3.06 IDENTIFICATION

A. Identify interior piping mains 2½" and larger not less than once every 25 feet, not less than once in each room, adjacent to each access door or panel, and on both sides of the partition where exposed piping passes through walls or floors. Place flow directional arrows at each pipe identification location.

B. Provide hydraulic design information sign of permanently marked weatherproof metal or engraved nameplate material. Secure to system risers. Information to include location of the design areas, discharge densities, required flow and residual pressure at the base of riser, hose stream demand and sprinkler demand.

3.07 LUBRICATION

A. 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 the 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.

3.08 SLEEVES AND OPENINGS

A. General:
   1. Sleeves are not required for piping and ducts passing through interior non-rated drywall, plaster, or wood partitions and interior poured concrete walls that have been saw cut or core drilled.
   2. Pack annular space between sleeves and pipe or ducts with fiberglass insulation and seal.
   3. Piping sleeves that pass through fire rated floors, walls, or ceilings shall be provided with a UL listed fire stop material meeting UL 1479 to seal the opening between the pipe and the pipe sleeve to maintain the fire rating.
   4. Provide escutcheon plates on piping to cover sleeve and insulation in finished areas.
   5. Refer to Division 1 for additional information on sleeves and openings.

3.09 SEALING AND FIRESTOPPING

A. The Contractor shall refer to building life safety drawings for all smoke and fire rates in addition to the mechanical drawings. Any discrepancies shall be brought to the attention of the Architect/Engineer before final addendum.

B. Fire And/or Smoke Rated Penetrations:
   1. Install approved product in accordance with the manufacturer's instructions where a pipe penetrates a fire/smoke rated surface.

C. Non-Rated Partitions:
   1. At all interior partitions and exterior walls, pipe penetrations are required to be sealed. Apply sealant to both sides of the penetration in such a manner that the annular space between the pipe sleeve or cored opening and the pipe is completely blocked.

3.10 HOUSEKEEPING AND CLEAN UP

A. The Contractor shall clean up and remove from the premises, on a daily basis, all debris and rubbish resulting from its work 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.

END OF SECTION

SECTION 21 05 29
HANGERS AND SUPPORTS FOR FIRE-SUPPRESSION PIPING AND EQUIPMENT

PART 1 – GENERAL

1.01 SCOPE OF WORK
A. Base Bid: Unless noted otherwise, the Fire Protection Contractor shall provide all labor and materials for a complete system in this specification section.

1.02 SECTION INCLUDES
A. This section includes specifications for supports of all fire suppression equipment and materials.
Pipe Hangers And Supports
Pipe Hanger Rods
Beam Clamps
Concrete Inserts
Equipment Stands
Corrosive Atmosphere Coatings

1.03 RELATED WORK
A. Applicable provisions of Division 0 and 1 shall govern work under this section.
B. Section 21 05 00 – Common Work Results for Fire Suppression
C. Section 21 10 00 – Water-Based Fire-Suppression Systems

1.04 SUBMITTALS
A. Refer Section 21 05 00 – Common Work Results for Fire Suppression, Submittals. In addition to the general content specified under Section 21 05 00 supply the following submittals:
Pipe Hangers And Supports
Pipe Hanger Rods
Beam Clamps
Concrete Inserts
Equipment Stands
Corrosive Atmosphere Coatings
B. Schedule of all hanger and support devices indicating attachment methods and type of device for each pipe size and type of service. Provide details on the working drawings submitted for approval with all pertinent information listed.

1.05 REFERENCE STANDARDS
A. MSS SP-58
B. MSS SP-69
C. NFPA 13 Installation of Sprinkler Systems (Latest edition)
D. UL Underwriters' Laboratories Listed.
E. FM FM Global

1.06 QUALITY ASSURANCE
A. Substitution of Materials Refer to Division 0 and 1 for equals and substitutions.

1.07 DESIGN CRITERIA
A. Materials and application of pipe hangers and supports shall be in accordance with MSS Standard Practice SP-58 and SP-69 unless noted otherwise.
B. Materials and application of pipe hangers and supports shall be in accordance with NFPA and be UL/FM listed and approved.

1.08 DESCRIPTION

A. Provide all supporting devices as required for the installation of equipment and materials. All supports and installation procedures are to conform to the latest requirements of the ANSI Code for building piping.

B. Do not hang any fire suppression item directly from a metal deck or run piping so its rests on the bottom chord of any truss or joist.

C. Fasteners depending on soft lead for holding power or requiring explosive powder actuation will not be accepted.

D. 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.

PART 2 - PRODUCTS

2.01 PIPE HANGERS AND SUPPORTS

A. Manufacturers: Cooper/B-Line, Anvil, Pate, Piping Technology, Roof Products & Systems.

B. Hangers for Pipe Sizes 1/2" through 4":
Carbon steel, adjustable swivel ring with 3/8" min. UL/FM approved hanger rods.
Carbon steel, adjustable clevis, standard, with UL/FM approved size hanger rods.

C. Hangers for Pipe Sizes 4" Through 8":
Carbon steel adjustable swivel ring with ½" min. UL/FM approved hanger rods.
Carbon steel, adjustable clevis, standard with UL/FM approved size hanger rods.

D. Wall Support:
Carbon steel welded bracket with hanger.
Steel channels with pipe clamps.

E. Floor Support:
Carbon steel pipe saddle, stand and bolted floor flange.

2.02 PIPE HANGER RODS

A. Steel Hanger Rods:
Threaded both ends, threaded one end, or continuous threaded, complete with adjusting and lock nuts.

B. Size rods for individual hangers and trapeze support as indicated in the following schedule:

Pipe Size	Diameter of Rod
4" and Smaller	3/8" (9.5mm) min.

2.03 BEAM CLAMPS

A. MSS SP-69 Types 19 & 23 malleable black iron clamp for attachment to beam flange to 0.62 inches thick with a retaining ring and threaded rod of 3/8, 1/2, and 5/8 inch diameter. Furnish with a hardened steel cup point set screw.

B. MSS SP-69 Type 28 or Type 29 forged steel jaw type clamp with a tie rod to lock clamp in place, suitable for rod sizes to 1-1/2 inch diameter.

2.04 CONCRETE INSERTS

A. Drilled Fasteners:
Carbon steel expansion anchors, vibration resistant, with ASTM B633 zinc plating. Use drill bit of same manufacturer as anchor.

2.05 EQUIPMENT STANDS

A. Use structural steel members welded to and supported by pipe supports. Clean, prime and coat with three coat rust inhibiting alkyd paint or one coat epoxy mastic. Where exposed to weather, treat with corrosive atmosphere coatings.

2.06 CORROSIVE ATMOSPHERE COATINGS

A. Factory coat supports and anchors used in corrosive atmospheres with hot dip galvanizing after fabrication, ASTM A123, 1.5 ounces/square foot of surface each side. Mechanical galvanize threaded products, ASTM B695 Class 50, 2.0 mil coating. Field cuts and damaged finishes to be field covered with zinc rich paint of comparable thickness to factory coating.

B. Corrosive atmospheres include the following locations:
Exterior locations

PART 3 - EXECUTION

3.01 INSTALLATION

A. Size, apply and install supports in compliance with manufacturer's recommendations.

B. Install supports to provide for free expansion of the piping system. 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.

C. Coordinate hanger and support installation to properly group piping of all trades.

D. Perform welding in accordance with standards of the American Welding Society.

3.02 HANGER AND SUPPORT SPACING

A. Use hangers with minimum vertical adjustment.

B. Support riser piping independently of connected horizontal piping.

C. Adjust hangers to obtain the slope specified in the piping section of these specifications.

D. Space hangers for pipe as follows:

Pipe Material	Pipe Size	Max. Horiz. Spacing	Max. Vert. Spacing
Steel	1" through 1-1/4"	12'-0"	15'-0"
Steel	1-1/2" through 8"	15'-0"	15'-0"

E. Unsupported length from the last hanger and an end sprinkler shall be as follows:

1" piping	Not greater than 36"
1-1/4" piping	Not greater than 48"
1-1/2" piping or larger	Not greater than 60"

END OF SECTION

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SECTION 21 10 00
WATER-BASED FIRE-SUPPRESSION SYSTEMS

PART 1 – GENERAL

1.01 SCOPE OF WORK

A. Base Bid: Unless noted otherwise, the Fire Protection Contractor shall provide all labor and materials for a complete system in this specification section.

1.02 SECTION INCLUDES

A. This section contains specifications for fire suppression pipe, pipe fittings, sprinklers, valves, switches and related items for automatic sprinkler systems in this project.
   1. Fire Protection Piping
   2. Unions and Flanges
   3. Mechanical Grooved Pipe Connections
   4. Sprinklers
   5. Switches
   6. Pressure Gauges
   7. Valves
   8. Specialties
   9. Pre-action System (Double Interlocked)
   10. Deluge Valves
   11. Deluge/Pre-action Control
   12. Air Compressor

1.03 RELATED WORK

A. Applicable provisions of Division 0 and 1 govern work under this section.
B. Section 21 05 00 – Common Work Results for Fire Suppression
C. Section 21 05 29 – Hangers and Supports for Fire-Suppression Piping and Equipment

1.04 SUBMITTALS

A. Refer Section 21 05 00 – Common Work Results For Fire Suppression, Submittals. In addition to the general content specified under Section 21 05 00 supply the following submittals:
   1. Fire Protection Piping
   2. Unions and Flanges
   3. Mechanical Grooved Pipe Connections
   4. Sprinklers
   5. Switches
   6. Pressure Gauges
   7. Valves
   8. Specialties
   9. Pre-Action System (Double Interlocked)
   10. Deluge Valves
   11. Deluge/Pre-action Control
   12. Air Compressor

B. Schedule from the contractor indicating the ANSI/ASTM specification number of the pipe being proposed along with its type and grade, if known at the time of submittal, and sufficient information to indicate the type and rating of fittings for each service.

1.05 REFERENCE STANDARDS

A. ANSI A21.4
B. ANSI A21.11
C. ANSI A21.51
D. ANSI B16.1 Cast Iron Pipe Flanges and Flanged Fittings

E. ANSI B16.3 Malleable Iron Threaded Fittings
F. ANSI B16.4 Cast Iron Threaded Fittings
G. ANSI B16.5 Pipe Flanges and Flanged Fittings
H. ANSI B16.9 Factory Made Wrought Steel Buttweld Fittings
I. ANSI B16.11 Forged Steel Fittings, Socket Welded and Threaded
J. ASTM A53 Pipe, Steel, Black and Hot-Dipped, Zinc Coated Welded and Seamless
K. ASTM A105 Forgings, Carbon Steel, for Piping Components
L. ASTM A126 Gray Cast Iron Castings for Valves, Flanges, and Pipe Fittings
M. ASTM A135 Electric Resistance Welded Steel Pipe
N. ASTM A181 Forgings, Carbon Steel for General Purpose Piping
O. ASTM A234 Pipe Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and Elevated Temperatures
P. ASTM A536 Ductile Iron Castings
Q. ASTM A795 Black and Hot Dipped Zinc Coated (Galvanized) Welded and Seamless Steel Pipe for Fire Protection Use
R. NFPA 13 Installation of Sprinkler Systems (Latest edition)
S. UL Underwriters' Laboratories
T. FM FM Global

1.06 QUALITY ASSURANCE

A. Substitution of Materials: Refer to Division 0 and 1 for equals and substitutions.
B. Order all pipe with each length marked with the name or trademark of the manufacturer and type of pipe; with each shipping unit marked with the purchase order number, metal or alloy designation, temper, size, and name of supplier.
C. Any installed material not meeting the specification requirements must be replaced with material that meets these specifications without additional cost to the Owner.

1.07 DESIGN CRITERIA

A. Use only new material, free of defects, rust and scale, and meeting the latest revision of ASTM specifications as listed in this specification.
B. Construct all piping systems for the highest pressures and temperatures in the respective system but not less than 175 psig.
C. Where ASTM A53 or A795 type F pipe is specified, grade A type E or S, or grade B type E or S may be substituted at Contractor's option. Where ASTM A135 grade A pipe is specified, grade B pipe may be substituted at Contractor's option. Where the grade or type is not specified, Contractor may choose from those commercially available.

1.08 DELIVERY, STORAGE AND HANDLING

A. Promptly inspect shipments to insure that the material is undamaged and complies with specifications.
B. Cover pipe to prevent corrosion or deterioration while allowing sufficient ventilation to avoid condensation. Do not store materials directly on grade. Protect pipe, tube, and fitting ends so they are not damaged. Where end caps are provided or specified, take precautions so the caps remain in place. Protect fittings, flanges, and unions by storage inside or by durable, waterproof, above ground packaging.
C. Storage and protection methods must allow inspection to verify products.

PART 2 – PRODUCTS

2.01 FIRE PROTECTION PIPING

A. Steel Pipe:
1. Black steel pipe welded and seamless, Type F, Grade A, ASTM A53; black welded and seamless steel pipe for fire protection use, Type F, ASTM A795; electric resistance welded steel pipe, Grade A, ASTM A135.
2. Unscheduled specialty steel pipe is not acceptable.

3. Pipe Wall Thickness: Schedule 40 for welded, cut groove and threaded. Schedule 10 for rolled groove and welded.
4. Fittings: 2" and smaller - Cast iron threaded fittings, Class 125 or 250, ASTM A126/ANSI B16.4. Malleable iron threaded fittings, Class 150 or 300, ASTM A197/ANSI B16.3. Standard weight seamless carbon steel weld fittings, ASTM A234 grade, ANSI B16.9. Mechanical grooved fittings with EPDM gaskets, ASTM A536 ductile iron, ASTM A47 malleable iron or ASTM A53 fabricated steel.
5. Finish: Hot dipped zinc coated (galvanized) finish on piping and fittings shall be used in dry sprinkler pre-action systems, piping exposed to weather and piping exposed to corrosive environments where indicated. Thread or cut groove hot dipped zinc coated pipe ends for fitting connections.

2.02 UNIONS AND FLANGES

A. 2" and Smaller Steel: 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.

B. 2½" and Larger: ASTM A181 or A105, Class 150, grade 1 hot forged steel flanges of threaded pattern on galvanized steel. ANSI B16.1 or ANSI B16.5, Class 150 cast iron threaded flanges. Use raised face flanges ANSI B16.5 for mating with other raised face flanges or equipment with flat ring or full face gaskets. Use ANSI B16.1 flat face flanges with full face gaskets for mating with other flat face flanges on equipment.

2.03 MECHANICAL GROOVED PIPE CONNECTIONS

A. Manufacturers: Victaulic, Anvil, Star Fittings.

B. All mechanical grooved pipe material including gaskets, couplings, fittings and flange adapters to be from the same manufacturer. Mechanical grooved components and assemblies to be rated for minimum 175 psi working pressure unless noted otherwise.

C. Couplings and fittings to be malleable iron, ASTM A47 or ductile iron A536 with painted finish. Fittings used on galvanized steel pipe to have galvanized finish, ASTM A153.

D. Gaskets to be EPDM, ASTM D2000. Gaskets for dry systems to be flush seal design. Heat treated carbon steel oval neck track bolts and nuts, ASTM A-183, with zinc electroplated finish.

E. Flange adapters to be ductile iron, ASTM A536; except at lug type butterfly valves where standard threaded flanges shall be used.**SPRINKLERS**

A. Manufacturers: Grinnell, Reliable, Tyco, Viking

B. Fusible link or glass bulb type, cast brass or bronze construction. Provide sprinklers with minimum nominal ½" discharge orifice.
   1. Quick Response Upright: Brass finish
   2. Standard Response Upright: Brass finish

2.05 SWITCHES

A. Manufacturers: Potter Electric Signal, System Sensor, Notifier

B. Flow Switches: Vane type waterflow switch with metal enclosure, adjustable pneumatic retard and electrical characteristics compatible with alarm system.

C. Supervisory Switches for O S & Y gate valve installations: UL/FM listed/approved, to monitor position of valve, tamper resistant cover screws, single or double SPDT switch contacts, corrosion resistant, for indoor or outdoor use, NEMA 4 & 6P enclosures.

D. Pressure Switches: Pressure actuated switch with field adjustable settings, metal enclosure and electrical characteristics compatible with alarm system.

2.06 PRESSURE GAUGES

A. Manufacturer: Ametek/U. S. Gauge Division, Ashcroft, Marsh, Taylor, H. O. Trerice, Weiss, Weksler.

B. Cast aluminum, stainless steel or brass case of not less than 3.5 inches in diameter, double strength glass window, black lettering on a white background, phosphor bronze bourdon tube with bronze bushings, recalibration from the front of the dial, 99% accuracy over the middle half of the scale, 98.5% accuracy over the remainder of the scale. Include bronze 3-way globe valve with plugged outlet for Fire Inspector's test gauge.

2.07 VALVES

A. Manufacturers: Kennedy, Milwaukee, Nibco, Stockham, Viking, Watts
B. Gate Valves
   1. 2" and smaller: Outside screw and yoke gate valves, 175 psig, bronze body, bronze mounted, screwed bonnet, rising stem, solid wedge.
   2. 2½" and larger: Outside screw and yoke gate valves, 175 psig, cast iron body, bronze mounted, bolted bonnet, rising stem, solid wedge.
C. Butterfly Valves
   1. 2" and smaller: Bronze body butterfly valve, 175 psig, geared operator, visible position indicator, normally open tamper switch with double wire leads, Buna or Viton seat, stainless steel disc and stem.
   2. 2½" and larger: Cast or ductile iron body butterfly valve, lug style or grooved, 175 psig, geared operator, visible position indicator, normally open supervisory/tamper switch with double wire leads, EPDM resilient seat, EPDM seals, nickel plated ductile iron disc. Valve assembly to be bubble tight to 175 psig with no downstream flange/pipe attached.
D. Check Valves
   1. 2" and smaller: Bronze body, threaded end, Y-pattern, regrindable bronze seat, renewable bronze disc, 175 psig, suitable for installation in a horizontal or vertical line with flow upward.
   2. 2½" and larger: Cast or ductile iron body, flanged or grooved ends, bronze trim, bolted cap, renewable bronze seat and disc, 175 psig, suitable for installation in a horizontal or vertical line with flow upward.
E. Drain valves
   1. ¾" minimum two piece bronze body ball valve with threaded ends, chrome plated bronze ball, glass filled Teflon seat, Teflon packing and threaded packing nut, blowout-proof stem, 400 psig WOG, and capped hose thread outlet.

2.08 SPECIALTIES

A. Manufacturer: Reliable, Tyco, Victaulic, Viking
B. Air Pressure Maintenance Device
   1. Automatic control capable of maintaining system air pressure, rated for 175 psig, adjustable air pressure range of 15 to 60 psig, complete with isolation valves, bypass fill valve, pressure regulator or pressure switch and strainer.
C. Emergency Pull Box
   1. ½" ball valve in metal enclosure with ½" pipe nipple, "Manual Emergency Station" label and breakaway door

2.09 PRE-ACTION SYSTEM (DOUBLE INTERLOCKED)

A. Manufacturers: Reliable, Tyco, Viking
B. Double interlocked pre-action system shall include the following components:
   1. Deluge Valve
   2. Check Valve
   3. Pressure Operated Relief Valve
   4. Diaphragm Bypass
   5. Shuttle Valve and Required Release Trim
   6. Pressure Switches
   7. Chemetron 7596 Heat Detector
   8. Maintenance Device

9. Relief Valve
10. Tester for C1 Release
11. Strainers
12. Drain Cup and Drip Check
13. Test Drain and Auxiliary Drain Valve
14. Drain Cups
15. Alarm Test Shut Off Valve
16. Priming Valve
17. Emergency Release
18. Priming Pressure Gauges and Valve
19. Water Supply Pressure Gauges and Valve
20. Water Supply Control Valve
21. Control Panel Including All Wiring
22. Air Compressor, Dehydrator, Air Supervisory Pressure Switch, Starter and Disconnect Switch
23. All Piping Shall be ASTM A-120, Galvanized

C. See Division 26 & 28 for wiring and conduit.
1. Power to panel by E.C.
2. Wiring from panel to devices by F.P.C.

D. Cable Protector Ramp
1. Manufacturer/Model No.: Labelmaster KLIN125DB
2. Provides protection for drain piping installed on floor from drip funnel to existing floor drain
3. Cable Protector Ramp over drain piping provided by F.P.C.

2.10 DELUGE VALVES

A. Cast or ductile iron body, flanged or grooved ends, 175 psig, bronze grooved seat with o-ring seal. Provide trim for bypass, drain, electric sprinkler alarm switch, pressure gages, drip cup assembly piped to floor or hub drain, fill line attachment with strainer and push rod chamber assembly. Include dry pilot trim consisting of actuator, air and water pressure gages, low air warning switch, air relief valve and diaphragm actuation device with replaceable bronze seat and resilient diaphragm.

2.11 DELUGE/PREACTION CONTROL

A. Single area type in NEMA 1 enclosure with detector, alarm, power supply, battery charger, standby battery, electrically supervised solenoid valves, polarized fire alarm, lamp test, wiring terminal strip, auxiliary alarm contacts.

2.12 AIR COMPRESSOR

A. Manufacturer: Gast, Quincy, Ingersoll Rand, Viking

B. Single zone and small systems: Floor or riser mounted air compressor installation. Electric motor driven, air cooled, oil-less, adjustable, single stage compressor. With check valve, pressure switch, pressure relief valve, mounting bracket kit and air filter assembly. Equal to Viking model E-1.–

PART 3 EXECUTION

3.01 GENERAL

A. Install pipe and fittings in accordance with reference standards, manufacturer's recommendations and recognized industry practices.

B. Install all piping parallel to building walls and ceilings and at heights which do not obstruct any portion of a window, doorway, stairway, or passageway. Where interferences develop in the field, offset or reroute piping as required to clear such interferences. Coordinate locations of fire protection piping with piping, ductwork, conduit and equipment of other trades to allow sufficient clearances. In all cases, consult drawings for exact location of pipe spaces, ceiling heights and light fixtures before installing piping.

C. Where piping is embedded in masonry or concrete, provide protective sleeve covering of elastomeric pipe insulation.

D. Maintain piping in clean condition internally during construction.
E. Provide clearance for access to valves and piping specialties.
F. Install piping so that system can be drained. Where possible, slope to main drain valve. Slope dry pipe and pre-action systems subject to freezing at minimum 1/4"/10' on mains and 1/2"/10' on branches. Where piping not susceptible to freezing cannot be fully drained, install nipple and cap for drainage of less than 5 gallons or ball valve with hose thread outlet and cap for drainage over 5 gallons. Pipe main drain valve to building exterior.
G. Mitered ells, notched tees, and orange peel reducers are not acceptable. On threaded piping, bushings are not acceptable.
H. Do not route piping within exterior walls.
I. Do not route piping through transformer vaults or above transformers, panelboards or switchboards, including the required service space for this equipment, unless the piping is serving this equipment.**T**

3.02 THREADED PIPE JOINTS

A. Use a thread lubricant or Teflon tape when making joints; no hard setting pipe thread cement or caulking will be allowed.

3.03 MECHANICAL GROOVED PIPE CONNECTIONS

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

3.04 UNIONS AND FLANGES

A. Install a union, flange or grooved coupling combination at each connection to each piece of equipment and at other items which may require removal for maintenance, repair, or replacement. Where a valve is located at a piece of equipment, locate the flange or union or grooved coupling combination connections on the equipment side of the valve.

3.05 INSTALLATION OF FIRE SUPPRESSION SYSTEM COMPONENTS

A. Install fire suppression system components in accordance with NFPA, product listings and manufacturer’s recommendations. Locate where accessible for servicing and replacement.
B. Sprinkler Heads: Locate sprinklers as indicated on drawings maintaining minimum clearances from obstructions, ceilings and walls. Install sprinklers level in locations not subject to spray pattern interference. Provide sprinkler installations below ductwork, soffits, etc.
C. Select sprinkler temperature rating to not exceed maximum ambient temperature rating allowed under normal conditions at installed location. Provide intermediate temperature (nominally 200 degrees F.) sprinklers.
D. Spare Sprinklers: Provide quantity of spare sprinklers as noted below and 1 wrench for each type and temperature range installed. Provide 6 spares per 300 or less installed sprinklers. Provide steel cabinet for storage of sprinklers and wrenches.
E. Pipe riser drains, test connections and auxiliary drains, where required, to building exterior or as indicated on drawings. Discharge to plumbing fixtures is not allowed.
F. Gauges: Provide a valved pressure gauge in main system riser and elsewhere as indicated.
G. Valves: Properly align piping before installation of valves. Do not support weight of piping system on valve ends. Mount valves in locations which allow access for operation, servicing and replacement. Install all valves with the stem in the upright or horizontal position. Valves installed with the stems down will not be accepted. Provide capped hose thread drain valves to allow draining of each trapped portion of piping.
H. Specialties: Install trim recommended by manufacturer including drain and test valves. Pipe drains to hub or floor drains. Test and adjust operation of valves, alarms, pressure maintenance devices, emergency pull boxes and deluge/pre-action controls.
I. Air Compressor: Attached to system riser or installed on floor, leveled and bolted in place. Pipe automatic drain discharge piping to floor drain. Install line size ball valve and check valve in discharge line. Install pressure gauge upstream of ball valve.

3.06 PIPING SYSTEM LEAK TESTS

A. Conduct pressure test with test medium of water. If leaks are found, repair the area with new materials and repeat the test; caulking will not be acceptable.

B. Test piping in sections or entire system as required by sequence of construction. If required for the additional pressure load under test, provide temporary restraints at fittings. Entire test must be witnessed by the owner's project representative.

C. Use clean water and remove air from the piping being tested where possible. Measure and record test pressure at the high point in the system.

D. Test system at 200 psi for 2 hours showing no leakage. Where system design is in excess of 150 psig, test at a pressure 50 psig above system design pressure.

E. All pressure tests are to be documented on NFPA contractor's material and test certificate forms.

END OF SECTION

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SECTION 23 05 00
COMMON WORK RESULTS FOR HVAC

PART 1 – GENERAL

1.01 SCOPE OF WORK

A. It is the intent of these specifications to provide complete and workable mechanical systems as shown on the accompanying plans and as specified herein except such parts as are specifically exempted herein. Provide all necessary supervision, coordination, labor, materials, equipment, fixtures, dryage, hoisting, tools, transportation, plant services and facilities, machinery and connections to utilities for the installation of complete and operable mechanical systems. If details or special conditions are required in addition to those shown on drawings, provide all material and equipment usually furnished with such systems or required to complete their installation, whether noted in plans and specification or not.

B. Materials and labor shall be new (unless noted otherwise), first class and workmanlike and shall be subject at all times to the Engineer's inspections, tests and approval from the commencement until the acceptance of the completed work.

C. The layout shown on the drawings is necessarily diagrammatic but shall be followed as closely as other work will permit. The drawings provide design intent. The Contractor shall verify all dimensions at the site and be responsible for their accuracy.

D. Because of the scale of the Drawings, certain basic items, such as, pipe fittings, duct fittings, access panels, and sleeves, may not be shown. Where such items are required by Code or by other Sections, or where required for proper installation of the Work, such items shall be included, whether shown or not.

E. In the event of any inconsistencies between the specifications, drawings, contract documents, applicable laws, statutes, ordinances, building codes, rules and regulations, the contractor shall provide the better quality or greater quantity of work and comply with or conform its work to the most stringent legal or contractual requirements.

F. Changes from these drawings required to make this work conform to the building construction shall be made only with prior written approval of the Engineer. All proposed changes shall be shown on shop drawings. All measurements shall be verified by actual observation and all work shall fit in place meeting the approval of the Engineer.

G. Equipment Specification may not deal individually with minute items required, such as, components, parts, controls, and devices which may be required to produce the equipment performance specified or as required to meet the equipment warranties. Where such items are required to make the system operational, they shall be included by the supplier of the equipment at no additional cost, whether or not specifically called for.

1.02 SECTION INCLUDES

A. This section includes information common to two or more technical specification sections or items that are of a general nature, not conveniently fitting into other technical sections.
   1. Submittals
   2. Reference Standards
   3. Quality Assurance
   4. Guarantee
   5. Operation And Maintenance Instructions
   6. Record Documents
   7. Continuity Of Existing Services
   8. Protection Of Finished Surfaces
   9. Sealing And Firestopping
   10. Off Site Storage
   11. Regulatory Requirements
   12. Certificates And Inspections
   13. Coordination

14. Demolition And Existing Requirements
15. Request And Certification For Payment
16. Sleeves And Openings
17. Omissions
18. Definitions
19. Project/Site Conditions
20. Work Sequence And Scheduling
21. Salvage Materials
22. Training
23. Access Panels And Doors
24. Identification
25. Demolition
26. Cutting And Patching
27. Building Access
28. Equipment Access
29. Lubrication
30. Housekeeping And Clean Up

1.03 RELATED WORK

A. Applicable provisions of Division 0 and 1 govern work under this section.
B. This section applies to all Division 23 sections.

1.04 SUBMITTALS

A. Submit shop drawings for equipment under each section per requirements listed in that section, as well as per Division 0 and 1.
B. Submit for all equipment and systems as indicated in the respective specification sections, marking each submittal with that specification section number. Mark general catalog sheets and drawings to indicate specific items being submitted and proper identification of equipment by name and/or number, as indicated in the contract documents. Failure to do this may result in the submittal(s) being returned to the Contractor for correction and resubmission. Do not submit hard copies of web pages. Failing to follow these instructions does not relieve the Contractor from the requirement of meeting the project schedule.
C. On request from the Engineer, the successful bidder shall furnish additional drawings, illustrations, catalog data, performance characteristics, etc.
D. 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.
E. The submittals must be approved before fabrication is authorized.
F. Provide electronic copies of all submittals for review.
G. Before submitting electrically powered equipment, verify that the electrical power and control requirements for the equipment are in agreement with the motor starter schedule on the electrical drawings. Include a statement on the shop drawing transmittal to the architect/engineer that the equipment submitted and the motor starter schedule is in agreement or indicate any discrepancies. See related comments in Section 23 05 13 in Part 1 under Electrical Coordination.**REFERENCE STANDARDS**

A. Abbreviations of standards organizations referenced in other sections are as follows:
   1. AABC Associated Air Balance Council
   2. ADC Air Diffusion Council
   3. AMCA Air Movement and Control Association
   4. ANSI American National Standards Institute
   5. AHRI Air-Conditioning, Heating and Refrigeration Institute
   6. ASHRAE American Society of Heating, Refrigerating and Air Conditioning Engineers
   7. ASME American Society of Mechanical Engineers
   8. ASTM American Society for Testing and Materials
   9. AWWA American Water Works Association
   10. EPA Environmental Protection Agency

11.	ETL	Edison Testing Laboratories
12.	FM	Factory Mutual Insurance Company
13.	ICC	International Code Council
14.	IEEE	Institute of Electrical and Electronics Engineers
15.	IRI	Industrial Risk Insurers
16.	ISA	Instrument Society of America
17.	ISO	International Organization for Standardization
18.	MCAA	Mechanical Contractors Association of America
19.	MICA	Midwest Insulation Contractors Association
20.	MSS	Manufacturer's Standardization Society of the Valve & Fitting Industry, Inc.
21.	NBS	National Bureau of Standards
22.	NEBB	National Environmental Balancing Bureau
23.	NEC	National Electric Code
24.	NEMA	National Electrical Manufacturers Association
25.	NFPA	National Fire Protection Association
26.	OSHA	Occupational Safety and Health Administration
27.	SMACNA	Sheet Metal and Air Conditioning Contractors' National Association. Inc.
28.	TABB	Testing, Adjusting and Balancing Bureau
29.	UL	Underwriters Laboratories Inc.
30.	ASTM E814	Standard Test Method for Fire Tests of Through-Penetration Fire Stops
31.	ASTM E84	Standard Test Method for Surface Burning Characteristics of Building Materials
32.	UL1479	Fire Tests of Through-Penetration Firestops
33.	UL723	Surface Burning Characteristics of Building Materials

1.06 QUALITY ASSURANCE

A. Substitution of Materials: Refer to Division 0 and 1 for equals and substitutions.
   1. Where the following conflicts with Division 0 and 1, the requirements of Division 0 and 1 shall govern.
   2. If the Contractor wishes to submit an alternate to the named manufacturers for any equipment, he may submit a voluntary alternative minimum 7 days prior to bid, stating the manufacturer’s name, model number, written, detailed product data.
   3. Where materials or equipment are specified by name the proposed material or equipment must be identical to the specified material or equipment in all characteristics of quality, function and serviceability, regardless of application in the Project. Any proposed equal shall be submitted to Architect/Engineer for prior approval, which Engineer may approve or disapprove in its sole discretion. Work performed or constructed with unapproved equals is at Contractor’s risk and any required correction of work incorporating unapproved equals shall be at Contractor’s sole cost and expense.
   4. In all instances, Contractor shall assume full responsibility for proof of equality of the statute to the equipment hereinafter specified. All data and information necessary for proof of equality, function and space requirements shall be prepared and accompany the submittal of the substitution to the Engineer. Approval by the Engineer of equipment other than the specified does NOT relieve Contractor of this responsibility.

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/electrical or accessories into the system, including but not limited to, coordination with other trades and any required changes by other trades 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.

1.07 WARRANTY

A. Refer to Division 0 and 1 for Warranties. In addition to the requirements in Division 0 and 1, this Contractor shall meet the following requirements.

B. In entering into a contract covering this work, the contractor accepts the specifications and guarantees that the work will be carried out in accordance with the requirements of this specification or such modifications as may be made under the contract documents.
C. Contractor further guarantees that the workmanship and material will be of the best procurable and that none but experienced workmen familiar with each particular class of work will be employed.
D. Contractor further guarantees to replace and make good at his own expense, including travel time, all defects, which may develop within 1 year after final payment and acceptance by the Architect/Engineer, due to faulty workmanship or material, upon, receipt of written notification from the Owner.

1.08 OPERATION AND MAINTENANCE INSTRUCTIONS

A. Refer to Division 0 and 1 for all operations and maintenance instructions.
B. In addition to the general content specified under Division 0 and 1 supply the following additional documentation:
   1. Copies of all approved shop drawings along with approval letters.
   2. Manufacturer's wiring diagrams for electrically powered equipment
   3. Records of tests performed to certify compliance with system requirements
   4. Certificates of inspection by regulatory agencies
   5. Temperature control record drawings and control sequences
   6. Parts lists for manufactured equipment
   7. Valve schedules
   8. Lubrication instructions, including list/frequency of lubrication done during construction
   9. Warranties
   10. Additional information as indicated in the technical specification sections

1.09 RECORD DOCUMENTS

A. Refer to Division 0 and 1 for record documents.
B. In addition to the general content specified under Division, follow the following procedures.
   1. During the progress of the work, Contractor shall maintain a current (daily) record set of the drawings and specifications, indicating thereon all work installed at variance with such Contract Documents including, without limitation, work covered by Addenda, Field Work Orders, Change Orders and Engineers additional instructions, interpretations and clarification. All changes or deviations from the original layout of the work and all critical dimensions of buried or concealed work shall be recorded. It shall be Contractor's responsibility to assure that said record sets are complete, accurate and up-to-date, Engineer shall have the right to inspect and review such record sets.
   2. At the completion of the work, Contractor shall indicated on record sets all record changes and such additional details necessary or appropriate to provide a complete reference document for use by Engineer. If variations and details cannot be shown clearly thereon, the Contractor shall prepare supplemental drawings adequate to impart the information. The foregoing drawings collectively shall constitute the "Record" drawings for the work.
   3. All indication on "Record" drawings shall be executed in a legible manner at Contractor's cost, using methods and legend presentations compatible with the overall scheme of the record drawings with respect to scale, drawing sheet sizes and sequential indexing. All changes shall be marked clearly in red and clouded.
   4. Engineer may review Contractor's "Record" drawings and notify Contractor of observed discrepancies or deviations. Contractor shall promptly correct discrepancies, deviations or illegible markups at Contractor's expense and resubmit revised drawings for Engineer review.
   5. Engineer will provide final electronic record drawings to the Owner.
C. In addition to the data indicated in the Division 0 and 1, maintain temperature control record drawings on originals prepared by the installing contractor/subcontractor. Include copies of these record drawings with the Operating and Maintenance manuals.

1.10 CONTINUITY OF EXISTING SERVICES

A. Each Contractor shall thoroughly familiarize himself with existing systems which will affect and be affected by relocation of existing equipment and installation of new lines and equipment. They shall plan installation of their work so that interruptions of services to any building or portion thereof will be a minimum and such interruptions shall occur only when system is not required, if possible. If not possible, each Contractor shall insure the operation of services by whatever means possible, such as, installing bypasses, capping of services or providing temporary service. Each interruption shall be for as short a duration as possible. Coordinate scheduling of down-time with the Owner

B. No extra costs will be paid to the Contractor for such outages which must occur outside of regular weekly working hours.

C. This Contractor shall restore any circuit interruption as a result of this work to proper operation as soon as possible. Note that institutional operations are on a seven day week schedule.

1.11 PROTECTION OF FINISHED SURFACES

A. Refer to Division 0 and 1 for protection of finished surfaces.

1.12 SEALING AND FIRESTOPPING

A. Sealing, fireproofing patching, fire caulking and firestopping of sleeves/openings between ductwork, piping, etc. and the sleeve, structural or partition opening shall be the responsibility of the contractor whose work penetrates the opening. The contractor responsible shall hire individuals skilled in such work to do the sealing and fireproofing. These individuals hired shall normally and routinely be employed in the sealing and fireproofing occupation.

B. Contractor shall request current life safety drawings from the Owner’s representative.

1.13 OFF SITE STORAGE

A. If payment will be requested for approved offsite stored material, then the Contractor shall complete an "Off-site Storage Agreement" which is available from the Owner. Prior approval by Owner’s personnel for offsite storage will be needed. No material will be accepted for offsite storage unless submittals for the material have been approved.

1.14 REGULATORY REQUIREMENTS

A. Comply with requirements of Wisconsin Administrative Code and local Authority Having Jurisdiction (AHJ) regarding materials and installation.

1.15 CERTIFICATES AND INSPECTIONS

A. Refer to Division 0 and 1 for permits, regulations, utilities and taxes.

B. Obtain and pay for all required State or local installation inspections except those provided by the Engineer in accordance with State Code. Deliver originals of these certificates to the Owner. Include copies of the certificates in the Operating and Maintenance Instructions.

C. Coordinate and provide inspections as required by the Authority Having Jurisdiction over the site.

1.16 DEMOLITION AND EXISTING REQUIREMENTS

A. Existing active services: water, ventilation, sanitary waste, sanitary vent, storm, electric, and any other building systems when encountered shall be protected against damage. Where existing services are to be abandoned, the services shall be removed back to the point of origin and removed from the site unless otherwise directed by the Owner's Representative.

B. Bidders should inspect the site to become familiar with conditions of the site which will affect the Work. Bidders should verify points of connection with utilities, routing of outside piping to include required clearances from any existing structures, or other obstacles.

C. Extra payment will not be allowed for changes in the Work required because of the successful bidder's failure to make this inspection.

1.17 REQUEST AND CERTIFICATION FOR PAYMENT

A. Within 10 days after Notice to Proceed, the successful bidder will submit to the Owner's Project Representative in a form prescribed by Division 0 and 1, a cost breakdown of the proposed values for work performed which, if approved by the owner, will become the basis for construction progress and monthly payments. The cost breakdown items shall reflect actual work progress stages as closely as feasible.

B. In addition, if payment is requested for approved off-site stored material, then that material shall be listed as a line item in the request and certification for payment cost breakdown.

1.18 SLEEVES AND OPENINGS

A. Openings required in new or existing construction that may be necessary for the installation of new work shall be provided by the respective contractor and all patching and repairing shall be done by workmen competent in the trade required, at the expense of the respective contractor. The respective contractor shall be responsible for arranging the work so that minimum cutting will be required. All rubbish and excess materials involved in such cutting shall be promptly removed from the site and disposed of by the contractor. Cutting through the floor or roof systems or load bearing walls shall be done only with the prior written approval of the Engineer so as to avoid damaging the structural system.

1.19 OMISSIONS

A. No later than ten (10) days before bid opening, the Contractor shall call the attention of the Engineer to any materials or apparatus the Contractor believes to be inadequate and to any necessary items of work omitted.

1.20 DEFINITIONS

A. The term "provide" includes such labor, methods, materials, equipment and transportation or other facilities required to complete the Contract and the performance of all duties thereby upon the Contractor.

1.21 PROJECT/SITE CONDITIONS

A. Install Work in locations shown on Drawings, unless prevented by Project conditions.

B. Prepare drawings showing proposed rearrangement of Work to meet Project conditions, including changes to Work specified in other Sections. Obtain permission of Engineer before proceeding.

C. Tools, materials and equipment shall be confined to areas designated by the Owner's project representative.

1.22 WORK SEQUENCE AND SCHEDULING

A. Install work in phases to accommodate Owner's occupancy requirements. During the construction period coordinate schedule and operations with Owner's Construction Representatives.

1.23 SALVAGE MATERIALS

A. No materials removed from this project shall be reused (except as specifically noted below). All materials removed shall become the property of and shall be disposed of by the Contractor.

1.24 TRAINING

A. The contractor shall have the following responsibilities:

1. Provide a training plan sixty days before the planned training covering the following elements:
    a. Equipment
    b. Intended audience
    c. Location of training
    d. Objectives
    e. Subjects covered (description, duration of discussion, special methods, etc.)
    f. Duration of training on each subject
    g. Instructor for each subject
    h. Methods (classroom lecture, manufacturer's quality video, site walk-through, actual operational demonstrations, written handouts, etc.).

2. Provide designated owner personnel with comprehensive orientation and training in the understanding of the systems and the operation and maintenance of each piece of equipment that makes up the system.
3. Training shall normally start with classroom sessions followed by hands-on demonstration/training on each piece of equipment.
4. During any demonstration, should the system fail to perform in accordance with the requirements of the O&M manual or sequence of operations, the system shall be repaired or adjusted as necessary and the demonstration repeated at another scheduled time, if necessary.
5. The appropriate trade or manufacturer's representative shall provide the instructions 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 are required. More than one party may be required to execute the training.
6. The controls contractor shall attend sessions other than the controls training, as specified, to discuss the interaction of the controls system as it relates to the equipment being discussed.
7. The training sessions shall 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.
8. Training shall include:
    a. Use of the printed installation, operation and maintenance instruction material included in the O&M manuals.
    b. A review of the written O&M instructions emphasizing safe and proper operating requirements, preventative maintenance, special tools needed and spare parts inventory suggestions. The training shall include startup, operation in all modes possible, shutdown, seasonal changeover and any emergency procedures.
    c. Discussion of relevant health and safety issues and concerns.
    d. Discussion of warranties and guarantees.
    e. Common troubleshooting problems and solutions.
    f. Explanatory information included in the O&M manuals.
    g. Discussion of any peculiarities of equipment installation or operation.
    h. Classroom sessions shall include the use of overhead projections, slides, video/audio-taped material as might be appropriate.
    i. Hands-on training shall include startup, operation in all modes possible, including manual, shut-down, alarms, power failure and any emergency procedures, and preventative maintenance for all pieces of equipment.
9. The contractor shall fully explain and demonstrate the operation, function and overrides of any local packaged controls not controlled by the central control system.

B. Provide a minimum of 8 hours of instruction.
C. Provide additional training as specified in other specification sections for specific equipment.

PART 2 - PRODUCTS

2.01 ACCESS PANELS AND DOORS

A. Lay-In Ceilings:
    1. Removable lay-in ceiling tiles in 2 X 2 foot or 2 X 4 foot configuration are to be reused and reinstalled, all damaged tiles are to be replaced; no additional access provisions are required unless specifically indicated.

2.02 IDENTIFICATION

A. Stencils:
    1. Not less than 1 inch high letters/numbers for marking pipe and equipment.
B. Snap-On Pipe Markers:
    1. Cylindrical self-coiling plastic sheet that snaps over piping insulation and is held tightly in place without the use of adhesive, tape or straps. Not less than 1 inch high letters/numbers and flow direction arrows for piping marking. W. H. Brady, Seton, Marking Services.
C. Engraved Name Plates:

1. 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 Marking Services, or W. H. Brady.

D. Valve Tags:
1. Round brass tags with 1/2 inch numbers, 1/4 inch system identification abbreviation, 1-1/4 inch minimum diameter, with brass jack chains or brass "S" hooks around the valve stem, available from EMED Co., Seton Name Plate Company, Marking Services, or W. H. Brady.

2.03 SLEEVES AND OPENINGS

A. General:
1. Pipe sleeves shall be constructed of standard weight ASTM A53 or ASME B36.10 steel with an anchor plate constructed of A36/A36M steel welded to the pipe. The sleeve shall be sized a minimum of 1" larger than piping insulation diameter. The entire assembly shall be hot-dip galvanized after fabrication.
2. Duct sleeves and piping sleeves passing through interior walls shall be constructed of 24 gauge galvanized steel minimum thickness.

2.04 SEALING AND FIRESTOPPING

A. Non-Rated Penetrations:
1. Pipe Penetrations: At pipe penetrations of non-rated interior partitions, floors and exterior walls above grade, use urethane caulk in annular space between pipe insulation and sleeve. For non-rated drywall, plaster or wood partitions where sleeve is not required use urethane caulk in annular space between pipe insulation and wall material.
2. Duct Penetrations:
a. Annular space between duct (with or without insulation) and the non-rated partition or floor opening shall not be larger than 2". Where existing openings have an annular space larger than 2", the space shall be patched to match existing construction to within 2" around the duct.

PART 3 - EXECUTION

3.01 DEMOLITION

A. Perform all demolition as indicated on the drawings to accomplish new work. Where demolition work is to be performed adjacent to existing work that remains in an occupied area, construct temporary dust partition to minimize the amount of contamination of the occupied space. 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 the owner to minimize disruption to the existing building occupants.

B. 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. All piping and ductwork specialties are to be removed from the site by the Contractor unless they are dismantled and removed or stored by the owner. All designated equipment is to be turned over to the owner for their use at a place and time so designated. Maintain the condition of material and/or equipment that is indicated to be reused equal to that existing before work began.

C. All contractors requiring the personnel/ material hoist and or temporary construction elevator (i.e. new elevators, temporarily protected) at times other than outlined in the temporary facilities specifications will make arrangements directly with the general contractor. The general contractor is responsible for all coordination and scheduling of the use of any hoisting equipment so the flow of the project is smoothly maintained and all workers have access to the work areas to perform their work and deliver material to the areas needed according to the project schedule.

D. If any contractor's work requires the removal and replacement of any finished materials including but not limited to such materials as ceiling tiles, wall finishes, cabinets, doors, flooring, windows, etc. after those items are installed, each contractor will be responsible, at no additional cost to the owner, to replace any damaged, soiled or lost materials with new materials to match the existing materials and those materials damaged.

3.02 CUTTING AND PATCHING

A. Refer to Division 0 and 1 for cutting and patching. In addition to the requirements in Division 0 and 1:

B. Each Contractor shall coordinate the placing of openings in the new structure as required for the installation of each Contractor's work.

C. Each Contractor shall the accurate locations and sizes for required openings in the new work, but this shall not relieve each Contractor of the responsibility of checking to assure that properly sized openings are provided. When additional patching is required due to the Contractor's failure to inspect this work, then the Contractor shall make arrangements for the patching required to properly close the openings to include patch painting, and the Contractor shall pay any additional cost incurred in this respect.

D. The Contractor shall provide cutting and patching and patch painting in the existing structure as required for the installation of his Work and shall furnish lintels and supports as required for openings. Cutting of structural support members will not be permitted without prior approval of the Engineer. Extent of cutting shall be minimized; use core drills, power saws, or other machines which will provide neat, minimum openings. Patching shall match adjacent materials and surfaces and shall be performed by craftsmen skilled in the respective craft required.

3.03 BUILDING ACCESS

A. 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.

3.04 EQUIPMENT ACCESS

A. Install all piping, conduit, ductwork, and accessories to permit access to equipment for maintenance and service. Coordinate the exact location of wall and ceiling access panels and doors, making sure that access is available for all equipment and specialties. Access doors in general construction are to be furnished and installed by the Mechanical Contractor.

B. Provide color coded thumb tacks or screws, depending on the surface, for use in accessible ceilings which do not require access panels.

3.05 COORDINATION

A. Verify that all devices are compatible for the surfaces on which they will be used. This includes, but is not limited to, diffusers, register, grilles, and recessed or semi-recessed heating and/or cooling terminal units installed in/on architectural surfaces.

B. Coordinate all work with other contractors prior to installation. Any installed work that is not coordinated and that interferes with other contractor's work shall be removed or relocated at the installing contractor's expense.

C. Cooperate with the test and balance agency in ensuring compliance with Section 23 05 93 – Testing, Adjusting and Balancing for HVAC. Verify system completion to the test and balance agency (flushing, pressure testing, chemical treatment, filling of liquid systems, proper pressurization and air venting of hydronic systems, clean filters, clean strainers, duct and pipe systems cleaned, controls adjusted and calibrated, controls cycled through their sequences, etc.), ready for testing, adjusting and balancing work. Install dampers, shutoff and balancing valves, flow measuring devices, gauges, temperature controls, etc., required for functional and balanced systems. Demonstrate the starting, interlocking and control features of each system so the test and balance agency can perform its work.

3.06 IDENTIFICATION

A. Identify equipment in mechanical equipment rooms by stenciling equipment number and service with one coat of black enamel against a light background or white enamel against a dark background. Use a primer where necessary for proper paint adhesion. Do not label equipment such as cabinet heaters and ceiling fans in occupied spaces.

B. Where stenciling is not appropriate for equipment identification, engraved name plates may be used.

C. Identify piping not less than once every 30 feet, not less than once in each room, adjacent to each access door or panel, and on both side of the partition where exposed piping passes through walls, floors or roofs. Place flow directional arrows at each pipe identification location. Use one coat of black enamel against a light background or white enamel against a dark background for stenciling, or provide snap-on pipe markers as specified in Part 2 – Products.

D. Identify valves with brass tags bearing a system identification and a valve sequence number. Valve tags are not required at a terminal device unless the valves are greater than ten feet from the device or located in another room not visible from the terminal unit. Provide a typewritten valve schedule indicating the valve number and the equipment or areas supplied by each valve; locate schedules in the Operating and Maintenance manual.

E. 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.

3.07 LUBRICATION

A. 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.

3.08 SLEEVES AND OPENINGS

A. General:
   1. Sleeves are not required for piping and ducts passing through interior non-rated drywall, plaster, or wood partitions and interior poured concrete walls that have been saw cut or core drilled.
   2. Pack annular space between sleeves and pipe or ducts with fiberglass insulation and seal.
   3. Piping sleeves that pass through fire rated floors, walls, or ceilings shall be provided with a UL listed fire stop material meeting UL 1479 to seal the opening between the pipe and the pipe sleeve to maintain the fire rating.
   4. Provide escutcheon plates on piping to cover sleeve and insulation in finished areas.
   5. Refer to Division 0 and 1 for additional information on sleeves and openings.

3.09 SEALING AND FIRESTOPPING

A. The Contractor shall refer to Owner's building life safety drawings for all smoke and fire rates in addition to the mechanical drawings. Any discrepancies shall be brought to the attention of the Engineer before final addendum.

B. Non-Rated Partitions:
   1. At all interior partitions and exterior walls, pipe penetrations are required to be sealed. Apply sealant to both sides of the penetration in such a manner that the annular space between the pipe sleeve or cored opening and the pipe or insulation is completely blocked.
   2. Duct penetrations through non-rated partitions shall require sheet metal escutcheons with fiberglass or mineral wool insulation fill for spaces that include laboratories, clean rooms, animal rooms, kitchens, cart wash rooms, janitor closets, toilet rooms, mechanical rooms, conference rooms, private consultation rooms, and where noted on drawings elsewhere.

3.10 HOUSEKEEPING AND CLEAN UP

A. The Contractor shall clean up and remove from the premises, on a daily basis, all debris and rubbish resulting from its work 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.

END OF SECTION

SECTION 23 05 13
COMMON MOTOR REQUIREMENTS FOR HVAC EQUIPMENT

PART 1 – GENERAL

1.01 SECTION INCLUDES

A. Section includes general requirements for single-phase and poly-phase general purpose squirrel-cage induction motors for use on AC powers systems up to 600 Volts. Included are the following sections:
   1. Single Phase Motors
   2. Polyphase Motors
   3. Motors with Variable Frequency Drives

1.02 RELATED WORK

A. Applicable provisions of Division 0 and 1 govern work under this section.
B. Section 23 81 23 – Computer Room Air Conditioners

1.03 REFERENCE STANDARDS

A. The following Standards are referenced herein. Utilize the current edition of the referenced Standards unless otherwise noted:
   1. ANSI/IEEE 112 Test Procedure for Polyphase Induction Motors and Generators.
   2. ANSI/IEEE 841 Standard for Petroleum and Chemical Industry-Premium-Efficiency, Severe-Duty, Totally Enclosed Fan-Cooled (TEFC) Squirrel Cage Induction Motors-Up to and Including 500 hp.
   3. ANSI/NEMA MG-1 Motors and Generators
   4. ANSI/NFPA 70 National Electric Code

1.04 COORDINATION

A. Coordinate features of motors, installed units and accessory devices to be compatible with:
   1. Motor controllers.
   2. Torque, speed and horsepower requirements of the load.
   3. Rating and characteristics of the supply circuit and required control sequence.
   4. Ambient and environmental conditions of the installation location.

B. All starters, overload relay heater coils, disconnect switches, fuses, relays, power wiring, power wiring conduit, push buttons, pilot lights and other devices for the control of motors or electrical equipment are furnished and installed by the Division 26 Contractor unless otherwise noted elsewhere in this Division of Specifications.

PART 2 – PRODUCTS

2.01 GENERAL MOTOR REQUIREMENTS

A. Comply with the requirements of this Section unless stricter requirements are specified in HVAC equipment schedules or Sections.
B. Comply with ANSI/NEMA MG-1 requirements unless otherwise noted.
C. Comply with ANSI/IEEE 841 requirements for all severe-duty motors unless otherwise noted.

2.02 MOTOR CHARACTERISTICS

A. Motors shall be continuous duty at ambient temperature of 40°C and an altitude of 3,300 feet above sea level.
B. Capacity and torque characteristics shall be suitable to start, accelerate and operate the connected loads at the designated speeds, as the installed altitude and environment with the indicated operating sequence without exceeding the nameplate ratings or considering the service factor of the motor.

C. Perform dynamic balancing and test motors after manufacture. Self-excited vibration velocity of motors shall not exceed limits set forth in NEMA MG-1, Part 7.

2.03 SINGLE PHASE MOTORS

A. Motors 1/20 horsepower and smaller shall be shaded-pole type.
B. Motors larger than 1/20 horsepower through 1/3 horsepower shall be one of the following to suit the starting torque and other requirements of the specific motor application:
   1. Permanent-split capacitor.
   2. Capacitor start, capacitor run.
C. Multi-speed motors shall be variable torque, permanent-split capacitor type.
D. Bearings shall be pre-lubricated, anti-friction ball bearing or sleeve bearing type suitable for radial and thrust loading.
E. Thermal protection shall be internal protection to automatically open power supply circuit to motor when winding temperature exceeds a safe value calibrated to the temperature rating of the motor insulation. Thermal-protection device shall automatically reset when the motor temperature returns to a normal range.

2.04 POLYPHASE MOTORS

A. Motors ½ horsepower and larger shall be NEMA MG-1, Design B medium induction polyphase motors unless otherwise noted. Motors shall random wound squirrel cage copper bar rotors.
B. Motors shall be 460 volt motors unless otherwise noted.
C. Motors shall be premium efficiency, meeting the requirements of NEMA MG-1.
D. Motors shall be 4-pole (nominal 1800 rpm) unless otherwise noted.
E. Service factor of motor shall be 1.15 unless otherwise noted.
F. Motors windings and leads shall be copper.
G. Motor insulation shall be Class F unless otherwise noted. Motor temperature rise shall match the motor insulation.
H. Motors 15 horsepower and larger shall be NEMA Starting Code F or Starting Code G.
I. Motors smaller than 15 horsepower shall utilize the manufacturer's starting characteristics.
J. Motor enclosures shall be open drip-proof unless totally enclosed fan-cooled, total enclosed non-ventilated, explosion-proof or encapsulated motors are specified in other Sections.
K. Motor enclosures for motor frame sizes 324T and larger shall be cast iron.
L. Motor enclosures for motor frame sizes smaller than 324T shall be rolled steel or cast iron.
M. Bearings shall be regreasable, shielded, anti-friction ball bearing type suitable for radial and thrust loading. Bearings shall be rated for a minimum AFBMA 9, L10 life of 80,000 hours. Stamp the bearing sizes on the motor nameplate.
N. Bearings on motors serving belt driven equipment shall utilize a bearing load calculated with NEMA minimum v-belt pulley with centerline at the end of the NEMA standard shaft extension.

2.05 POLYPHASE MOTORS WITH ADDITIONAL REQUIREMENTS

A. Motors used with Variable Frequency Drives (VFDs):
   1. Motors shall be inverter duty rated motors, suitable for use on variable frequency drives, including but not limited to motor cooling. Motors shall be rated for variable torque with a 4:1 speed range.
   2. Motors shall be Class F temperature rise with Class H insulation.
   3. Motors shall comply with NEMA MG-1 Part 31 to provide windings capable of withstanding 1600 peak volts with a rise time of 0.1 μs.
   4. Provide bearing protection grounding rings to bleed current from the motor shaft to the motor casing for all motors 5 horsepower or more.
   5. Comply with NEMA MG-1 requirements for thermally protected motors.
   6. Motors shall not have any carrier frequency or lead length restrictions. If restrictions cannot be eliminated, any required restrictions must be appropriate for the specified and scheduled motor applications.

PART 3 – EXECUTION

3.01 INSTALLATION

A. Mount motors on a rigid base designed to accept a motor, using metal shims as required under each mounting foot to obtain a secure installation.

B. Inspect and align each motor when direct coupled to the driven device. Alignment shall be within HVAC equipment manufacturer's limits.

C. Perform dynamic balancing and test motors for vibration after manufacture. Self-excited vibration velocity of motors shall not exceed 0.157/0.06 inches per second at bearing caps.

D. Inspect and align each motor when flexible coupled to the driven device. Use a dial indicator to check angular misalignment of the two shafts. Adjust the motor position as required so that the angular misalignment of the shafts does not exceed 0.002" per inch diameter of the coupling hub or the HVAC equipment manufacturer's limits, whichever is more stringent. Use a dial indicator to check the shaft for run-out to assure concentricity of the shafts. Adjust as required so that run-out does not exceed 0.002" per inch diameter of the coupling hub or the HVAC equipment manufacturer's limits, whichever is more stringent.

E. Inspect and align each motor when connected to the driven device by means of a belt drive. Mount motor sheaves on the appropriate shafts as recommended by the equipment and motor manufacturers. Use a straight edge to check alignment of the sheaves. Reposition the sheaves as required to obtain the proper alignment. After the sheaves are aligned, adjust the motor base as required so that the belt(s) can be added and then tighten the motor base so that the belt tension is in accordance with the drive manufacturers recommendations. Frequently check the belt tension during the first 24 hours of operation and again after 80 hours of operation for proper belt tension. Adjust belt tension as required.

3.02 START-UP

A. Test start each motor to verify proper rotation prior to operating system.

B. Lubricate all motors as recommended by motor manufacturer. Record lubrication material used and frequency of use. Include this lubrication log in the Operation and Maintenance manuals.

END OF SECTION

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SECTION 23 05 15
PIPING SPECIALTIES

PART 1 – GENERAL

1.01 SECTION INCLUDES
A. This section contains specifications for HVAC piping specialties for all piping systems. Included are the following topics:
   1. Hose Connection Caps
   2. Strainers

1.02 RELATED WORK
A. Applicable provisions of Division 0 and 1 govern work under this section.
B. Section 23 05 00 – Common Work Results for HVAC
C. Section 23 05 23 – General Duty Valves for HVAC Piping
D. Section 23 05 29 – Hangers and Supports for HVAC Piping and Equipment
E. Section 23 05 48 – Vibration and Seismic Controls for HVAC Piping and Equipment
F. Section 23 07 00 – HVAC Insulation
G. Section 23 09 14 – Pneumatic and Electric Instrumentation and Control Devices for HVAC
H. Section 23 21 13 – Hydronic Piping

1.03 SUBMITTALS
A. Refer Section 23 05 00 – Common Work Results for HVAC, Submittals. In addition to the general content specified under Section 23 05 00 – Common Work Results for HVAC, supply the following submittals:
   1. Hose Connection Caps
   2. Strainers
B. Required for all items in this section. Include materials of construction, dimensional data, ratings/capacities/ranges, pressure drop data where appropriate, and identification as referenced in this section and/or on the drawings.

1.04 REFERENCE STANDARDS
A. ASME B31 Standards of Pressure Piping
B. ASTM A53 Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless
C. ASTM B650 Standard Specification for Electrodeposited Engineering Chromium Coatings on Ferrous Substrates
D. ANSI/AWWA Standard C700 Cold-Water Meters – Displacement Type, Bronze Main Case

1.05 QUALITY ASSURANCE
A. Refer to Division 0 and 1 for equals and substitutions.

1.06 DESIGN CRITERIA
A. All piping specialties are to be rated for the highest pressures and temperatures in the respective system in accordance with ASME B31, but not less than 125 psig unless specifically indicated otherwise.

1.07 OPERATION AND MAINTENANCE DATA
A. All operations and maintenance data shall comply with the submission and content requirements specified in Section 23 05 00 – Common Work Results for HVAC.

PART 2 - PRODUCTS

2.01 HOSE CONNECTION CAPS

A. Hose connection caps shall be pressure rated for 150 psig at 180 deg F.

2.02 STRAINERS

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

B. Water Systems: Y type; cast iron body; stainless steel screens; bolted or threaded screen retainer tapped for a blowoff valve; threaded body in sizes through 2 inch and rated at not less than 175 psi WOG; flanged body in sizes over 2 inch and rated at not less than 125 psi WOG at 240°F. Screen to be 20 mesh for line sizes 2 inch and less, 0.125 inch perforations for line sizes 2-1/2 inch through 4 inch, and 0.25 inch perforations for line sizes 5 inch and larger.

PART 3 - EXECUTION

3.01 GENERAL

A. Install specialties in accordance with manufacturer's instructions to permit intended performance.

3.02 STRAINERS

A. Install all strainers where indicated on the project details, allowing sufficient space for the screens to be removed. Rotate screen retainer where required by the installation so blowdown can remove accumulated dirt from the strainer body.

B. Water Systems: Install a ball valve for blowdown in the tapped screen retainer; valve to be the same size as the tapping.

END OF SECTION

SECTION 23 05 23
GENERAL DUTY VALVES FOR HVAC PIPING

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. This section includes valve specifications for all HVAC systems except where indicated under Related Work. Included are the following topics:
   1. Water System Valves
      a. Gate Valves (Hydronic)
      b. Ball Valves (Hydronic)
      c. Globe Valves (Hydronic)
      d. Balance Valves
      e. Drain Valves (Hydronic)

1.02 RELATED WORK

A. Applicable provisions of Division 0 and 1 govern work under this section.
B. Section 23 05 00 – Common Work Results for HVAC
C. Section 23 05 15 – Piping Specialties
D. Section 23 09 14 – Pneumatic and Electric Instrumentation and Control Devices for HVAC
E. Section 23 15 13 – General Service Compressed Air Piping

1.03 SUBMITTALS

A. Refer to Section 23 05 00 – Common Work Results for HVAC. In addition to the general content specified under Section 23 05 00 – Common Work Results for HVAC, supply the following submittals:
   1. Water System Valves
      a. Ball Valves (Hydronic)
      b. Globe Valves (Hydronic)
      c. Balance Valves
      d. Drain Valves (Hydronic)
B. Contractors shall submit a schedule of all valves indicating type of service, dimensions, materials of construction, and pressure/temperature ratings for all valves to be used on the project. Temperature ratings specified are for continuous operation
C. Contractors shall submit critical flow capacity data supplied by the manufacturer for all steam pressure reducing valves. The calculation from the manufacturer shall be the largest obtainable by internal trim change of the reducing valve.

1.04 QUALITY ASSURANCE

A. Refer to Division 0 and 1 for equals and substitutions.

1.05 DESIGN CRITERIA

A. Where valves are specified for individual mechanical services (i.e. hot water heating, steam, etc.) all valves shall be of the same manufacturer unless prior written approval is obtained from owner.

1.06 OPERATION AND MAINTENANCE DATA

A. All operations and maintenance data shall comply with the submission and content requirements specified in Section 23 05 00 – Common Work Results for HVAC.

PART 2 – PRODUCTS

2.01 MANUFACTURERS

A. Anvil, Apollo, Armstrong, Bell & Gossett, Cash-Acme, Dresser Consolidated, Conval, Crane, Anderson Greenwood and Crosby, Danfoss-Flomatic, DeZurik, Durco, Fisher, Grinnell, Griswold, Hammond, Hancock, Hoffman, Jamesbury, Keystone, Kunkle, Leslie, Lunkenheimer/Cincinnati, Metraflex, Milwaukee, Mueller, Newco, Nexus, Nibco, Powell, RP&C, Sarco, Spence, Stockham, Taco, Tasco, Thrush-Amtrol, Vogt, Watts.

B. All valves shall be manufactured in the United States.

C. All valves shall be designed for operation with not less than 125 lbs. working pressure and of a type permitting repacking while under pressure. Rising stems shall be used wherever possible. Provide valves to allow control of all major branches. All valves 2 inches and larger installed 7 feet on centerline or higher above the floor shall have chain operators.

2.02 WATER SYSTEM VALVES

A. All water system valves to be rated at not less than 125 psig water working pressure at 240°F unless noted otherwise.

B. GATE VALVES:

1. Do not use gate valves.

C. BALL VALVES:

1. 2" and smaller: Two piece bronze body; threaded or soldered ends, as appropriate to the pipe material; stainless steel or chrome plated brass/bronze ball; conventional port; glass filled teflon seat; threaded packing gland follower; blowout-proof stem; 600 psig WOG.
2. Valve stems shall allow operators to clear insulation without interference. Provide stem extensions when valve operators interfere with pipe insulation.
3. Apollo 70-100/200 series, Hammond 8301/8311, Milwaukee BA100/150, Nibco T/S 585-70, Stockham S206/216.
4. 2-1/2" and over: Ball valves will not be accepted in sizes over 2 inch.

D. GLOBE VALVES:

1. Do not use globe valves for water service, except in temperature control applications.

E. BALANCE VALVES:

1. 2" and smaller: Bronze or copper alloy body with calibrated ball, globe or venturi/valve arrangement, integral pointer and calibrated scale to register degree of valve opening, memory stop, drain tapping, threaded or soldered ends, with or without integral unions, P/T or Shraeder pressure taps with integral check valves and seals, adjustable memory stop, protective Yoke, and suitable for 200 psig water working pressure at 250°F.
2. Armstrong CBV, Bell & Gossett Circuit Setter Plus, Griswold Quickset, Nexus Orturi, Nibco 1710 Series, Taco Accu-Flo, Tour & Anderson STAS/STAD, Victaulic series 786/787, Hays Fluid Controls.

F. DRAIN VALVES:

1. Use 3/4 inch ball valve with threaded hose adapter except strainer blowdown valves to be the same size as the blowdown connection.

PART 3 – EXECUTION

3.01 GENERAL

A. Properly align piping before installation of valves in an upright position; operators installed below the valves will not be accepted.

B. Install valves in strict accordance with valve manufacturer's installation recommendations. Do not support weight of piping system on valve ends.

C. Install all temperature control valves.

D. Install all valves with the stem in the upright position. Valves may be installed with the stem in the horizontal position only where space limitations do not allow installation in an upright position. Valves installed with the stems down, will not be accepted.

E. Install stem extensions when shipped loose from valve.

F. Prior to flushing of piping systems, place all valves in the full-open position.

3.02 SHUT-OFF VALVES

A. Install shut-off valves on both sides of all equipment, on major piping loops, at each branch take-off from mains, at vertical risers, at strainers, and at each automatic valve for isolation or repair. All shut-off valves shall be located to allow proper access for operation for servicing.

3.03 BALANCING VALVES

A. Provide balancing valves for all equipment, on major piping loops, at vertical risers, at each major branch takeoff, and at the discharge of each pump. Provide balancing valve at all terminal devices. Refer to drawings and details for additional locations.

3.04 CALIBRATED BALANCING VALVES

A. Install where indicated on the drawings and details for balancing of hydronic systems. Retain the shipping container for use as removable insulation.

3.05 DRAIN VALVES

A. Provide drain valves for complete drainage of all systems. Locations of drain valves include low points of piping systems, equipment locations specified or detailed including reheat coils, other locations required for drainage of systems.

END OF SECTION

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SECTION 23 05 29
HANGERS AND SUPPORTS FOR HVAC PIPING AND EQUIPMENT

PART 1 – GENERAL

1.01 SECTION INCLUDES

A. This section includes specifications for supports of all HVAC equipment and materials as well as piping system anchors. Included are the following topics:
   1. Pipe Hanger and Support Manufacturers
   2. Pipe Hangers and Supports
   3. Concrete Inserts

1.02 RELATED WORK

A. Applicable provisions of Division 0 and 1 shall govern work under this section.
B. Section 23 05 00 – Common Work Results for HVAC
C. Section 23 05 48 – Vibration and Seismic Controls for HVAC Piping and Equipment
D. Section 23 07 00 – HVAC Insulation

1.03 SUBMITTALS

A. Refer to Section 23 05 00 – Common Work Results for HVAC, Submittals. In addition to the general content specified under Section 23 05 00 – Common Work Results for HVAC, supply the following submittals:
   1. Pipe Hanger and Support Manufacturers
   2. Pipe Hangers and Supports
   3. Concrete Inserts
B. Schedule of all hanger and support devices indicating shields, attachment methods, and type of device for each pipe size and type of service.
C. All submittals are to comply with submission and content requirements specified in this specification.

1.04 REFERENCE STANDARDS

A. MSS SP-58 Pipe Hangers and Supports - Materials, Design and Manufacture.
B. MSS SP-69 Pipe Hangers and Supports - Selection and Application.

1.05 QUALITY ASSURANCE

A. Refer to Division 0 and 1 for equals and substitutions.

1.06 DESIGN CRITERIA

A. Materials and application of pipe hangers and supports shall be in accordance with MSS Standard Practice SP-58 and SP-69 unless noted otherwise.
B. Piping connected to base mounted pumps, compressors, or other rotating or reciprocating equipment is to have vibration isolation supports for a distance of one hundred pipe diameters or three supports away from the equipment, whichever is greater. Standard pipe hangers/supports as specified in this section are required beyond the 100 pipe diameter/3 support distance.
C. Piping flexible connections and vibration isolation supports are required for piping connected to coils that are in a fan assembly where the entire assembly is mounted on vibration supports; the vibration isolation supports are required for a distance of one hundred pipe diameters or three supports away from the equipment, whichever is greater. Piping flexible connection and vibration isolation supports are not required when the fan section is separately and independently isolated by means of vibration supports and duct flexible connections. Standard pipe hangers/supports as specified in this section are required when there are no vibration isolation devices in the piping and beyond the 100 pipe diameter/3 support distance.
D. Piping supported by laying on the bottom chord of joists or trusses will not be accepted.
E. Fasteners depending on soft lead for holding power or requiring powder actuation will not be accepted.
F. Allow sufficient space between adjacent pipes and ducts for insulation, valve operation, routine maintenance, etc.

1.07 DESCRIPTION

A. 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 pressure piping.
B. Do not hang any mechanical item directly from a metal deck or run piping so it rests on the bottom chord of any truss or joist.
C. 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.
D. Protect insulation at all hanger points; see Related Work above.

PART 2 – PRODUCTS

2.01 PIPE HANGER AND SUPPORT MANUFACTURERS

A. Anvil, B-Line, Fee and Mason, Kindorf, Michigan Hanger, Unistrut. Anvil figure numbers are listed below; equivalent material by other manufacturers is acceptable.

2.02 PIPE HANGERS AND SUPPORTS

A. HANGERS FOR STEEL PIPE SIZES 1/2" THROUGH 2":
   1. Carbon steel, adjustable, clevis, black finish. Anvil figure 65 or 260.
B. MULTIPLE OR TRAPEZE HANGERS:
   1. Steel channels with welded spacers and hanger rods if calculations are submitted.
C. WALL SUPPORT:
   1. Welded steel bracket with hanger. B-Line 3068 Series, Anvil 194 Series.
   2. Perforated epoxy painted finish, 16-12 gauge min., steel channels securely anchored to wall structure with interlocking, split type, bolt secured, galvanized pipe/tubing clamps. B-Line type S channel with B-2000 series clamps, Anvil type AS200 H with AS 1200 clamps. When copper piping is being supported, provide flexible elastomeric/thermoplastic isolation cushion material to completely encircle the piping and avoid contact with the channel or clamp, equal to B-Line B1999 Vibra Cushion or provide manufacturers clamp and cushion assemblies, B-Line BVT series, Anvil cushion clamp assembly.
D. COPPER PIPE SUPPORT:
   1. Carbon steel ring, adjustable, copper plated or polyvinylchloride coated.
E. INSULATION PROTECTION SHIELDS:
   1. Galvanized carbon steel of not less than 18 gauge for use on insulated pipe 2-1/2 inch and larger. Minimum shield length is 12 inches. Equal to Anvil figure 167.
F. STEEL HANGER RODS:
   1. Threaded both ends, threaded one end, or continuous threaded, black finish.
   2. Size rods for individual hangers and trapeze support as indicated in the following schedule.
   3. Total weight of equipment, including valves, fittings, pipe, pipe content, and insulation, are not to exceed the limits indicated.

Maximum Load (Lbs.) (650°F Maximum Temp.)	Rod Diameter (inches)
610	3/8
1130	1/2
1810	5/8
2710	3/4
3770	7/8
4960	1
8000	1-1/4

   4. Provide rods complete with adjusting and lock nuts.

2.03 CONCRETE INSERTS

A. Carbon steel expansion anchors, vibration resistant, with ASTM B633 zinc plating. Use drill bit of same manufacturer as anchor. Approved manufacturers: Hilti, Rawl, Redhead.

PART 3 – EXECUTION

3.01 INSTALLATION

A. Install supports to provide for free expansion of the piping and duct system. 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. Piping shall be supported independently from ductwork and all other trades.
C. Where piping can be conveniently grouped to allow the use of trapeze type supports, use standard structural shapes for the supporting steel.
D. Perform all welding in accordance with standards of the American Welding Society. Clean surfaces of loose scale, rust, paint or other foreign matter and properly align before welding. Use wire brush on welds after welding. Welds shall show uniform section, smoothness of weld metal and freedom from porosity and clinkers. Where necessary to achieve smooth connections, joints shall be dressed smooth.

3.02 HANGER AND SUPPORT SPACING

A. Place a hanger within 12 inches of each horizontal elbow, valve, strainer, or similar piping specialty item.
B. Where several pipes can be installed in parallel and at the same elevation, provide multiple or trapeze hangers.
C. Support riser piping independently of connected horizontal piping.
D. Adjust hangers to obtain the slope specified in the piping section of this specification.
E. Space hangers for pipe as follows:

Pipe Material	Pipe Size	Max. Spacing
Steel	1/2" through 1-1/4"	6'-6"
Steel	1-1/2" through 6"	10'-0"
Steel	8" through 12"	14'-0"
Steel	14" and over	20'-0"
Copper	1/2" through 1-1/4"	5'-0"
Copper	1-1/2" and larger	8'-0"
Thermoplastic	All sizes	6'-0" or manufacturer's recommendations, whichever is more stringent

END OF SECTION

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SECTION 23 05 93
TESTING, ADJUSTING AND BALANCING FOR HVAC

PART 1 – GENERAL

1.01 SCOPE OF WORK

A. Contractor provide:
   1. Personnel to accompany and assist Engineer and air balancer during test, adjust and balancing of piping system(s).
   2. Have the temperature control manufacturer's representative set and adjust automatically operated devices to achieve specified sequence of operations.
   3. Have the temperature control manufacturer's representative accompany and assist Engineer and Air Balancer during test, adjust and balancing of piping system(s).
   4. The balancing will be performed by a subcontractor retained by the Mechanical Contractor

1.02 SECTION INCLUDES

A. This section includes air and water testing, adjusting and balancing for the entire project. Included are the following topics:
   1. Performing Testing, Adjusting and Balancing

1.03 RELATED WORK

A. Applicable provisions of the General Conditions, Supplementary General Conditions and General Requirements in Division 0 and 1 govern work under this section.
B. Section 23 05 00 – Common Work Results for HVAC
C. Section 23 05 23 – General Duty Valves for HVAC Piping
D. Section 23 07 00 – HVAC Insulation
E. Section 23 09 14 – Pneumatic and Electric Instrumentation and Control Devices for HVAC
F. Section 23 09 23 – Direct Digital Control System for HVAC

1.04 SUBMITTALS

A. Refer to Division 0 and 1 for submittals. At a minimum, provide submittals for the following items:
   1. Testing, Adjusting and Balancing Report
B. Submit testing, adjusting and balancing reports bearing the seal and signature of the NEBB or AABC Certified Test and Balance Supervisor. The reports certify that the systems have been tested, adjusted and balanced in accordance with the referenced standards; are an accurate representation of how the systems have been installed and are operating; and are an accurate record of all final quantities measured to establish normal operating values of the systems.
C. Submission: Distribute electronic copies of the Report to the Contractor, the Project Coordinator, Architect/Engineer, and the owner.
D. Format: Cover page identifying project name, project number and descriptive title of contents. Divide the contents of the report into the below listed divisions:
   1. General Information
   2. Summary
   3. Air Systems
   4. Hydronic Systems
E. Contents: Provide the following minimum information, forms and data:
   1. General Information: Inside cover sheet identifying Test and Balance Agency, Contractor, Architect, Engineer, Project Name and Project Number. Include addresses, contact names and telephone numbers. Also include a certification sheet containing the seal and signature of the Test and Balance Supervisor.
   2. Summary: Provide summary sheet describing mechanical system deficiencies. Describe objectionable noise or drafts found during testing, adjusting and balancing. Provide recommendations for correcting unsatisfactory performances and indicate whether modifications required are within the scope of the contract, are design related or installation related. List instrumentation used during testing, adjusting and balancing procedures.

3. The remainder of the report to contain the appropriate standard NEBB or AABC forms for each respective item and system. Fill out forms completely. Where information cannot be obtained or is not applicable indicate same.
4. Instruments:
    a. Air balance instruments - Ranges shown are guides. Actual ranges used are subject to Engineer approval
    b. Velometer with probes and Pitot tube.
    c. Rotating vane anemometer.
    d. ASHRAE Standard Pitot tubes, stainless steel 5/16 outside diameter, lengths 18" and 36".
    e. Magnehelic Differential Air Pressure Gauges, 0 to 0.5", 0 to 1.0" and 0 to 5.0" water pressure ranges, each arranged as a portable unit for use with a standard Pitot tube.
    f. Combination inclined-vertical portable manometer, range 0 to 5.0" water.
    g. Portable type hook gage, range 0 to 12" water.
    h. Portable flexible U-tube manometer, magnetic mounting clips, range 0 to 18" water.
    i. Conical or pyramidal shaped hood.
5. System performance measuring instruments:
    a. Insertion thermometers, with graduations at 0.5° F.
    b. Sling Psychrometer.
    c. Tachometer, Centrifugal Type
    d. Revolution Counter
    e. Clamp-On Volt-Ammeter
    f. Recorders, Portable Type for temperature and humidity.

1.05 REFERENCE STANDARDS

A. AABC National Standards for Total System Balance, Sixth Edition, 2002.

B. ASHRAE ASHRAE Handbook, 2007 HVAC Applications, Chapter 37, Testing Adjusting and Balancing.

C. NEBB Procedural Standards for Testing Adjusting Balancing of Environmental Systems, Seventh Edition, 2005.

1.06 QUALITY ASSURANCE

A. Qualifications:
1. An independent Firm specializing in the Testing and Balancing of HVAC systems for a minimum of 3 years. A Firm not engaged in the commerce of furnishing or providing equipment or material generally related to HVAC work other than that specifically related to installing Testing and Balancing components necessary for work in this section such as, but not limited to sheaves, pulleys, and balancing dampers.
2. A certified member of AABC or certified by NEBB in the specific area of work performed. Maintain certification for the entire duration of the project. If certification of firm or any staff performing work is terminated or expires during the duration of the project, contact owner immediately.
3. Technicians on this project must have satisfactorily completed work on a minimum of (3) three projects of at least 50% in size, and of similar complexity. Size is defined as the quantity of each specific individual item requiring testing and balancing such as, but not limited to, equipment, devices, terminal devices, and grilles and diffusers.
4. Submit Qualifications of firm and project staff to the owner upon request.

1.07 DESCRIPTION

A. The Contractor will separately contract with an independent test and balance agency to perform all testing, adjusting, and balancing of air and hydronic systems required for this project. Work related to the testing, adjusting, and balancing that must be performed by the installing mechanical contractor is specified in other section of these specifications.

B. Provide total mechanical systems testing, adjusting and balancing. Requirements include the balance of air and water distribution, adjustment of new and existing systems and equipment to provide design requirements indicated on the drawings, electrical measurement and verification of performance of all mechanical equipment, all in accordance with standards published by AABC or NEBB.

C. Test, adjust and balance all air and hydronic systems so that each room, piece of equipment or terminal device meets the design requirements indicated on the drawings and in the specifications.
D. Accomplish testing, adjusting and balancing work in a timely manner that allows partial occupancy and completion of the entire project in the time stated in the Instruction to Bidders and in accordance with the completion schedule established for this project.
E. Verify that provisions are being made to accomplish the specified testing, adjusting and balancing work. If problems are found, handle as specified in Part 3 under Deficiencies.

1.08 PRE-INSTALLATION MEETING AND SCHEDULING

A. The test and balance agency is required to attend a pre-installation meeting with all other project contractors before the construction process is started. The test and balance agency shall give the Lead Contractor a detailed schedule of testing and balancing tasks for incorporation into the project schedule. Reference General Conditions Division 0 and 1 for Lead Contractor responsibilities for scheduling.

1.09 PRE-BALANCE CONFERENCE

A. 90 days prior to beginning testing, adjusting and balancing, schedule and conduct a conference with the owner and the mechanical system and temperature control system installing Contractors. Provide a complete copy of the TAB plan for the project. The objective is final coordination and verification of system operation and readiness for testing, adjusting and balancing procedures and scheduling procedures with the above mentioned parties. Indicate work required to be completed prior to testing, adjusting, and balancing and identify the party responsible for completion of that work.

PART 2 – PRODUCTS

2.01 INSTRUMENTATION

A. Provide all required instrumentation to obtain proper measurements. Application of instruments and accuracy of instruments and measurements to be in accordance with the requirements of NEBB or AABC Standards and instrument manufacturer's specifications.
B. All instruments used for measurements shall be accurate, and calibration histories for each instrument to be available for examination by owner upon request. Calibration and maintenance of all instruments to be in accordance with the requirements of NEBB or AABC Standards.
C. Air balance instruments - Ranges shown are guides. Actual ranges used are subject to Engineer approval.
    1. Velometer with probes and Pitot tube.
    2. Rotating vane anemometer.
    3. ASHRAE Standard Pitot tubes, stainless steel 5/16 outside diameter, lengths 18” and 36”.
    4. Magnehelic Differential Air Pressure Gauges, 0 to 0.5”, 0 to 1.0” and 0 to 5.0” water pressure ranges, each arranged as a portable unit for use with a standard Pitot tube.
    5. Combination inclined-vertical portable manometer, range 0 to 5.0” water.
    6. Portable type hook gage, range 0 to 12” water.
    7. Portable flexible U-tube manometer, magnetic mounting clips, range 0 to 18” water.
    8. Conical or pyramidal shaped hood.
D. System performance measuring instruments:
    1. Insertion thermometers, with graduations at 0.5oF.
    2. Sling Psychrometer.
    3. Tachometer, Centrifugal Type
    4. Revolution Counter
    5. Clamp-On Volt-Ammeter
    6. Recorders, Portable Type for temperature and humidity.

PART 3 – EXECUTION

3.01 DAILY REPORTS

A. Submit to owner daily work activity reports for each day on which testing and balancing work is performed. Reports shall include description of day's activities and description of any system deficiencies.

3.02 PRELIMINARY PROCEDURES

A. Review preconstruction meeting report, applicable construction bulletins, applicable change orders and approved shop drawings of equipment, outlets/inlets and temperature controls.

B. Identify and list size, type and manufacturer of all equipment to be tested, including air terminals. Inspect all systems components for proper installation and operation. Use manufacturer's ratings for all equipment to make calculations except where field test shows ratings to be impractical. Verify that all instruments are accurately calibrated and maintained.

C. Check filters for cleanliness, dampers and valves for correct positioning, equipment for proper rotation and belt tension, temperature controls for completion of installation and hydronic systems for proper charge and purging of air.

D. Notify owner on a daily basis during balancing. Identify deficiencies preventing completion of testing, adjusting and balancing procedures. Do not proceed until systems are fully operational with all components necessary for complete testing, adjusting and balancing. Installing Contractors are required to provide personnel to check and verify system completion, readiness for balancing and assist Balancing Agency in providing specified system performance.

3.03 PERFORMING TESTING, ADJUSTING AND BALANCING

A. Perform testing, adjusting and balancing procedures on each system identified, in accordance with the detailed procedures outlined in the referenced standards except as may be modified below.

B. In areas containing ceilings, remove ceiling tile to accomplish balancing work; replace tile when work is complete and provide new tile for any tile that are damaged by this procedure. If the ceiling construction is such that access panels are required for the work of this section and the panels have not been provided, inform the owner.

C. Cut insulation, ductwork and piping for installation of test probes to the minimum extent necessary for adequate performance of procedures. Patch using materials identical to those removed, maintaining vapor barrier integrity and pressure rating of systems.

D. In air systems employing filters, blank off sufficient filter area to simulate a pressure drop that is midway between that of a clean filter and that of a dirty filter.

E. Measure and record system measurements at the fan to determine total flow. Adjust equipment as required to yield specified total flow at terminals. Proceed taking measurements in mains and branches as required for final terminal balancing. Test and record motor full load amperes and current draw. Test and record system static pressure suction and discharge. Perform terminal balancing to specified flows balancing branch dampers, deflectors, extractors and valves prior to adjustment of terminals.

F. Check and record the following items at each heating and cooling coil:
   1. Inlet water and air temperature.
   2. Leaving water and air temperatures.
   3. Pressure drop of each coil.
   4. Pressure drop across bypass valve.
   5. Pump operating suction and discharge and final total dynamic head.

G. Measure and record static air pressure conditions across fans, coils and filters. Indicate in report if cooling coil measurements were made on a wet or dry coil and if filter measurements were made on a clean or dirty filter. Spot check static air pressure conditions directly ahead of terminal units.

H. Adjust register, grille and diffuser vanes and accessories to achieve proper air distribution patterns and uniform space temperatures free from objectionable noise and drafts within the capabilities of the installed system.

I. Provide fan and motor drive sheave adjustments necessary to obtain design performance. Provide drive changes specifically noted on drawings, if any. If work of this section indicates that any drive or motor is inadequate for the application, advise the engineer by giving the engineer properly sized motor/drive information (in accordance with manufacturers original service factor and installed motor horsepower requirements); Confirm any change will keep the duct/piping system within its design limitations with respect to speed of the device and pressure classification of the distribution system.

J. Final air system measurements to be within the following range of specified cfm:
   1. Fans 0% to +10%
   2. Supply grilles, registers, diffusers 0% to +10%
   3. Return/exhaust grilles, registers 0% to -10%

K. Final water system measurements must be within the following range of specified gpm:
   1. Heating flow rates 0% to -10%
   2. Cooling flow rates -5% to +5%

L. Contact the temperature control contractor for assistance in operation and adjustment of controls during testing, adjusting and balancing procedures. Cycle controls and verify proper operation and setpoints. Include in report description of temperature control operation and any deficiencies found.

M. Permanently mark equipment settings, including damper and valve positions, control settings, and similar devices allowing settings to be restored. Set and lock memory stops.

N. Leave systems in proper working order, replacing belt guards, closing access doors and electrical boxes, and restoring temperature controls to normal operating settings.

O. Coordinate and assist commissioning agent with all verification activities defined within this specification including providing all required sampling data necessary for the commissioning process.

3.04 DEFICIENCIES

A. Division 23 00 00 contractor to correct any installation deficiencies found by the test and balance agency that were specified and/or shown on the Contract Documents to be performed as part of that division of work. Test and balance agency will notify the owner and engineer of these items and instructions will be issued to the Division 23 00 00 contractor for correction of the deficient work. All corrective work to be done at no cost to the owner. Retest mechanical systems, equipment, and devices once corrective work is complete as specified.

END OF SECTION

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SECTION 23 07 00
HVAC INSULATION

PART 1 – GENERAL

1.01 SECTION INCLUDES

A. This section includes insulation specifications for heating, ventilating and air conditioning piping, ductwork and equipment. Included are the following topics:
   1. Insulation Types
      a. Flexible Fiberglass Insulation
      b. Rigid Fiberglass Insulation
      c. Extruded Polystyrene Insulation
      d. Polyisocyanurate Insulation
   2. Metal Covering and Jackets
      a. PVC Fitting Covers And Jackets (PFJ)
      b. All Service Jackets (ASJ)
      c. Foil Scrim All Service Jackets (FSJ)
      d. Protective Metal Jackets (PMJ)
      e. Self-Adhering Jackets (SAJ)
      f. Fabric Reinforced Mastic Jackets (FMJ)
      g. Vapor Retarding Jackets (VRJ)
      h. Vapor Retarding Tape
   3. Insulation Inserts and Pipe Shields
   4. Accessories

1.02 RELATED WORK

A. Applicable provisions of Division 0 and 1 govern work under this section.
B. Section 23 05 00 – Common Work Results for HVAC
C. Section 23 05 15 – Piping Specialties
D. Section 23 05 29 – Hangers and Supports for HVAC Piping and Equipment
E. Section 23 21 13 – Hydronic Piping
F. Section 23 31 00 – HVAC Ducts and Casings

1.03 SUBMITTALS

A. Refer to Division 0 and 1 for submittals. At a minimum, provide submittals for the following items:
   1. Insulation Types
      a. Flexible Fiberglass Insulation
      b. Rigid Fiberglass Insulation
      c. Semi-Rigid Fiberglass Insulation
      d. Elastomeric Insulation
      e. Extruded Polystyrene Insulation
      f. Polyisocyanurate Insulation
      g. Fire-Stop Insulation
   2. Metal Covering and Jackets
      a. PVC Fitting Covers And Jackets (PFJ)
      b. All Service Jackets (ASJ)
      c. Foil Scrim All Service Jackets (FSJ)
      d. Self-Adhering Jackets (SAJ)
      e. Fabric Reinforced Mastic Jackets (FMJ)
      f. Vapor Retarding Jackets (VRJ)
      g. Vapor Retarding Tape
   3. Insulation Inserts and Pipe Shields
   4. Expansion Joint and Valve Insulation Blankets
   5. Accessories

B. Submit a schedule of all insulating materials to be used on the project, including adhesives, fastening methods, fitting materials along with material safety data sheets and intended use of each material. Include manufacturer's technical data sheets indicating density, thermal characteristics, jacket type, and manufacturer's installation instructions.

1.04 REFERENCE STANDARDS

A. ASTM B209 Aluminum and Aluminum Alloy Sheet and Plate
B. ASTM C165 Test Method for Compressive Properties of Thermal Insulations
C. ASTM C177 Heat Flux and Thermal Transmission Properties
D. ASTM C195 Mineral Fiber Thermal Insulation Cement
E. ASTM C240 Cellular Glass Insulation Block
F. ASTM C302 Density of Preformed Pipe Insulation
G. ASTM C303 Density of Preformed Block Insulation
H. ASTM C355 Test Methods for Test for Water Vapor Transmission of Thick Materials
I. ASTM C449 Mineral Fiber Hydraulic Setting Thermal Insulation Cement
J. ASTM C518 Heat Flux and Thermal Transmission Properties
K. ASTM C533 Calcium Silicate Block and Pipe Thermal Insulation
L. ASTM C534 Preformed Flexible Elastomeric Thermal Insulation
M. ASTM C547 Mineral Fiber Preformed Pipe Insulation
N. ASTM C552 Cellular Glass Block and Pipe Thermal Insulation
O. ASTM C553 Mineral Fiber Blanket and Felt Insulation
P. ASTM C578 Preformed, Block Type Cellular Polystyrene Thermal Insulation
Q. ASTM C591 Unfaced Preformed Rigid Cellular Polyisocyanurate Thermal Insulation
R. ASTM C610 Expanded Perlite Block and Thermal Pipe Insulation
S. ASTM C612 Mineral Fiber Block and Board Thermal Insulation
T. ASTM C921 Properties of Jacketing Materials for Thermal Insulation
U. ASTM C1136 Flexible Low Permeance Vapor Retarders for Thermal Insulation
V. ASTM D412 Standard Test Methods for Vulcanized Rubber and Thermoplastic Elastomers-Tension
W. ASTM D1000 Methods for Pressure-Sensitive Adhesive-Coated Tapes Used for Electrical and Electronic Applications
X. ASTM D1621 Standard Test Method for Compressive Properties Of Rigid Cellular Plastics
Y. ASTM D1622 Standard Test Method for Apparent Density of Rigid Cellular Plastics
Z. ASTM D1940 Method of Test for Porosity of Rigid Cellular Plastics
AA. ASTM D2126 Method for Response of Rigid Cellular Plastics to Thermal and Humid Aging
BB. ASTM D2240 Standard Test Method for Rubber Property—Durometer Hardness
CC. ASTM E84 Surface Burning Characteristics of Building Materials
DD. ASTM E814 Standard Test Method for Fire Tests of Penetration Firestop Systems
EE. ASTM E2336 Standard Test Methods for Fire Resistive Grease Duct Enclosure Systems
FF. MICA National Commercial & Industrial Insulation Standards
GG. NFPA 225 Surface Burning Characteristics of Building Materials
HH. UL 723 Surface Burning Characteristics of Building Materials

1.05 QUALITY ASSURANCE

A. Refer to Division 0 and 1 equals and substitutions
B. Label all insulating products delivered to the construction site with the manufacturer's name and description of materials.
C. Insulation systems shall be applied by experienced contractors. Within the past five (5) years, the contractor shall be able to document the successful completion of a minimum of three (3) projects of at least 50% of the size and similar scope of the work specified in this section.

1.06 OPERATION AND MAINTENANCE DATA

A. All operations and maintenance data shall comply with the submission and content requirements specified in Section 23 05 00 – Common Work Results for HVAC.

1.07 DESCRIPTION

A. Furnish and install all insulating materials and accessories as specified or as required for a complete installation. The following types of insulation are specified in this section:
   1. Pipe Insulation
   2. Duct Insulation

B. Install all insulation in accordance with the latest edition of MICA (Midwest Insulation Contractors Association) Standard and manufacturer's installation instructions. Exceptions to these standards will only be accepted where specifically modified in these specifications, or where prior written approval has been obtained from the Owner.

1.08 DEFINITIONS

A. Concealed: shafts, furred spaces, space above finished ceilings, utility tunnels and crawl spaces. All other areas, including walk-through tunnels, shall be considered as exposed.

1.09 ENVIRONMENTAL REQUIREMENTS

A. Do not store insulation materials on grade or where they are at risk of becoming wet. Do not install insulation products that have been exposed to water.

B. Protect installed insulation work with plastic sheeting to prevent water damage.

C. Delivery, Storage And Handling:
   1. Deliver field applied material to site in factory fabricated containers with manufacturer’s stamp or label showing fire hazard rating of products.
   2. Store in original wrappings and protect from weather and construction traffic.
   3. Protect against dirt, water, chemical and mechanical damage.
   4. Remove damaged insulation from project site, do not install.

PART 2 – PRODUCTS

2.01 MATERIALS

A. Manufacturers: Armacell, Certainteed, Manson, Childers, Dow, Extol, Fibrex, Halstead, H.B. Fuller, Imcoa, Johns Manville, Knauf, Owens-Corning, Partek, Pittsburgh Corning, Rubatex, VentureTape.

B. Materials or accessories containing asbestos will not be accepted.

C. Use composite insulation systems (insulation, jackets, sealants, mastics, and adhesives) that have a flame spread rating of 25 or less and smoke developed rating of 50 or less when tested in accordance with ASTM E84, NFPA 255 or UL 723, with the following exceptions:

D. Pipe insulation which is not located in an air plenum may have a flame spread rating not over 25 and a smoke developed rating no higher than 450 when tested in accordance with UL 723 and ASTM E84.

2.02 INSULATION TYPES

A. Insulating materials shall be fire retardant, moisture and mildew resistant, and vermin proof. Insulation shall be suitable to receive jackets, adhesives and coatings as indicated.

B. Flexible Fiberglass Insulation: Minimum nominal density of 0.75 lbs. per cu. ft., and thermal conductivity of not more than 0.3 at 75 degrees F, rated for service to 250 degrees F.

C. Rigid Fiberglass Insulation: Minimum nominal density of 3 lbs. per cu. ft., and thermal conductivity of not more than 0.23 at 75 degrees F, minimum compressive strength of 25 PSF at 10% deformation, rated for service to 450 degrees F.

D. Extruded Polystyrene Insulation: Rigid closed cell, minimum nominal density of 1.6 lbs. per cu. ft., thermal conductivity of not more than 0.285 at 75 degrees F, minimum compressive strength of 20 psi, maximum water vapor permeability of 1.5 perm inch, maximum water absorption of .5 % by volume, rated for service range of -290 degrees F to 165 degrees F.

E. Polyisocyanurate Insulation: Rigid closed cell polyisocyanurate, minimum nominal density of 2.0 lbs. per cu. ft., thermal conductivity of not more than 0.19 at 75 degrees F aged 180 days, minimum compressive strength of 24 psi parallel and 13 psi perpendicular, maximum water vapor permeability of 4 perm inch, maximum water absorption of 2% by volume, rated for service range of -290 degrees F to 300 degrees F.

2.03 JACKETS

A. PVC Fitting Covers And Jackets (PFJ):
   1. White PVC film, gloss finish one side, semi-gloss other side, FS LP-535D, Composition A, Type II, Grade GU. Ultraviolet inhibited indoor/outdoor grade to be used where exposed to high humidity, ultraviolet radiation, in kitchens or food processing areas or installed outdoors. Jacket thickness to be minimum .03" for piping 12" and smaller, .04" for piping 15" and larger. All Service Jackets (ASJ): Heavy duty, fire retardant material with white kraft reinforced foil vapor barrier, factory applied to insulation with a self-sealing pressure sensitive adhesive lap, maximum permeance of .02 perms and minimum beach puncture resistance of 50 units.

C. Foil Scrim All Service Jackets (FSJ): Glass fiber reinforced foil kraft laminate, factory applied to insulation. Maximum permeance of .02 perms and minimum beach puncture resistance of 25 units.

D. Self-Adhering Jackets (SAJ):
   1. 5-ply, self-adhering multiple laminated waterproofing material with reflective aluminum foil, high density polymer films and cold weather acrylic adhesive providing zero (0.0) permeability. Minimum 6 mils material thickness, 35lb puncture resistance when tested in accordance with ASTM D1000 and flame spread/smoke developed rating of 10/20 when tested in accordance with UL 723.
   2. Vapor retarding tape shall be specifically designed and manufactured for use with the self-adhering jacket specified above. Tape shall be provided by the same manufacturer that provides jacketing. Vapor retarding tapes used with self-adhering jackets shall have a maximum permeance of 0.0 perms.

E. Fabric Reinforced Mastic Jackets (FMJ): Glass fiber reinforcing fabric imbedded in weather barrier mastic as per manufacturer's recommended procedure for 2 coat application.

F. Vapor Retarding Jackets (VRJ): Polyvinylidene chloride (PVDC) vapor retarding jacket material with minimum 6 mils material thickness and maximum permeance of 0.01 perms. Material shall not support the growth of mold or mildew. Dow Saran or equivalent.

G. Vapor Retarding Tape: Vapor retarding tape shall be specifically designed and manufactured for use with the vapor retarding jacket specified above. Tape shall be provided by the same manufacturer that provides jacketing. Vapor retarding tapes used with vapor retarding jackets shall have a maximum permeance of 0.01 perms.

2.04 INSULATION INSERTS AND PIPE SHIELDS

A. Manufacturers: B-Line, Pipe Shields, Value Engineered Products

B. Construct inserts with calcium silicate or polyisocyanurate (service temperatures below 300 degrees F only), minimum 140 psi compressive strength. Piping 12" and larger, supplement with high density 600 psi structural calcium silicate insert. Provide galvanized steel shield. Insert and shield to be minimum 180 degree coverage on bottom supported piping and full 360 degree coverage on clamped piping. On roller mounted piping and piping designed to slide on support, provide additional load distribution steel plate.

C. Where contractor proposes shop/site fabricated inserts and shields, submit schedule of materials, thicknesses, gauges and lengths for each pipe size to demonstrate equivalency to pre-engineered/premanufactured product described above. On low temperature systems, high density rigid polyisocyanurate may be substituted for calcium silicate provided insert and shield length and shield gauge are increased to compensate for lower insulation compressive strength.

D. Calcium Silicate Insulation: Rigid hydrous calcium silicate, ASTM C533, Type I, minimum dry density of 12.5 lbs. per cu. ft., thermal conductivity of not more than 0.44 at 300 degrees F, maximum water absorption of 90% by volume, minimum compressive strength 140 psi at 5% deformation, rated for service range of 0 degrees F to 1,200 degrees F,. Material to be visually coded or marked to indicate it is asbestos free.

E. Polyisocyanurate Insulation: Rigid closed cell polyisocyanurate, minimum nominal density of 2.0 lbs. per cu. ft., thermal conductivity of not more than 0.19 at 75 degrees F aged 180 days, minimum compressive strength of 24 psi parallel and 13 psi perpendicular, maximum water vapor permeability of 4 perm inch, maximum water absorption of 2% by volume, rated for service range of -290 degrees F to 300 degrees F.

F. Precompressed 20# density molded fiberglass blocks, Hamfab or equal, of the same thickness as adjacent insulation may be substituted for calcium silicate inserts with one 1"x6" block for piping through 2-1/2" and three 1"x6" blocks for piping through 4". Submit shield schedule to demonstrate equivalency to pre-engineered/premanufactured product described above.
G. Wood blocks will not be accepted.

2.05 ACCESSORIES

A. All products shall be compatible with surfaces and materials on which they are applied, and be suitable for use at operating temperatures of the systems to which they are applied.
B. Adhesives, sealants, and protective finishes shall be as recommended by insulation manufacturer for applications specified.
C. Insulation bands to be 3/4 inch wide, constructed of aluminum or stainless steel. Minimum thickness to be .015 inch for aluminum and .010 inch for stainless steel.
D. Tack fasteners to be stainless steel ring grooved shank tacks.
E. Staples to be clinch style.
F. Insulating cement to be ANSI/ASTM C195, hydraulic setting mineral wool.
G. Finishing cement to be ASTM C449.
H. Fibrous glass or canvas fabric reinforcing shall have a minimum untreated weight of 6 oz./sq. yd.
I. Bedding compounds to be non-shrinking and permanently flexible.
J. Vapor barrier coatings to have maximum applied water vapor permeance of .05 perms.
K. Fungicidal water base coating (Foster 40-20 or equal) to be compatible with vapor barrier coating.

PART 3 – EXECUTION

3.01 EXAMINATION

A. Verify that all piping, equipment, and ductwork are tested and approved prior to installing insulation. Do not insulate systems until testing and inspection procedures are completed.
B. Verify that all surfaces are clean, dry and without foreign material before applying insulation materials.

3.02 INSTALLATION

A. All materials shall be installed by skilled labor regularly engaged in this type of work. All materials shall be installed in strict accordance with manufacturer's recommendations, building codes, and industry standards. Do not install products when the ambient temperature or conditions are not consistent with the manufacturer's recommendations. Surfaces to be insulated must be clean and dry. Maintain ambient temperatures and conditions required by manufacturers of adhesives, mastics and insulation cements. Maintain temperature during and after installation for minimum period of 24 hours.
B. Locate insulation and cover seams in the least visible location. All surface finishes shall be extended in such a manner as to protect all raw edges, ends and surfaces of insulation.
C. Install insulation with smooth and even surfaces. Poorly fitted joints or use of filler in voids will not be accepted. Provide neatly beveled and coated terminations at all nameplates, uninsulated fittings, or at other locations where insulation terminates.
D. Install fabric reinforcing without wrinkles. Overlap seams a minimum of 2 inches.
E. Use full length material (as delivered from manufacturer) wherever possible. Scrap piecing of insulation or pieces cut undersize and stretched to fit will not be accepted.
F. Existing or new insulation damaged and/or removed by the Contractor during remodeling work shall be repaired or replaced with new insulation as directed by the Owner.
G. All pipe and duct insulation shall be continuous through walls, ceiling or floor openings and through sleeves except where firestop or firesafing materials are required. Vapor barriers shall be maintained continuous through all penetrations.
H. Provide a continuous unbroken moisture vapor barrier on insulation applied to systems noted below. Attachments to cold surfaces shall be insulated and vapor sealed to prevent condensation.
I. Provide a complete vapor barrier for insulation on the following systems:
    1. Cold Water Make-Up
    2. Chilled Water

3. Insulated Duct
4. Equipment, ductwork or piping with a surface temperature below 65 degrees F

3.03 PROTECTIVE JACKET INSTALLATION

A. Self-Adhering Jackets (SAJ):
   1. Install according to manufacturer's recommendations. Cut allowing minimum 4" overlap on ends and 6" on longitudinal joints. Align parallel to surface. Remove release paper and press flat to surface to avoid wrinkles. Rub entire surface for full adhesion and sealing at joint overlaps. On exterior applications, provide a bead of compatible caulk along exposed edges.
   2. Piping with self-adhering (SAJ) jackets shall have elbows, fittings, valves and butt joints wrapped with 2 layers of vapor retarding tape. Piping with a PVC jacket (PFJ) installed over the self-adhering (SAJ) jacket may be provided with a single, lapped layer of vapor retarding tape for elbows, fittings and valves under the PVC jacket. Vapor retarding tape shall be compatible with the jacket material used.

B. Vapor Retarding Jackets (VRJ): Piping with vapor retarding (VRJ) jackets shall have elbows, fittings, valves and butt joints wrapped with 2 layers of vapor retarding tape. Piping with a PVC jacket (PFJ) installed over the vapor retarding (VRJ) jackets may be provided with a single, lapped layer of vapor retarding tape for elbows, fittings and valves under the PVC jacket. Vapor retarding tape shall be compatible with the jacket material used.

C. PVC Fitting Covers And Jackets (PFJ): Lap seams and joints a minimum of 2 inches and continuously seal PVC with welding solvent recommended by jacket manufacturer. Lap slip joint ends 4" without fasteners where required to absorb expansion and contraction. For sections where vapor barrier is not required and jacket requires routine removal, tack fasteners may be used. Secure PVC fitting covers with tack fasteners. For systems requiring a vapor barrier, apply a 1-1/2" band of mastic over ends, throat, seams and penetrations.

D. Fabric Reinforced Mastic Jackets (FMJ): Glass fiber fabric shall be fitted without wrinkles. Glass fiber fabric shall be sized immediately upon application with lagging adhesive and shall be capable of drying within 6 hrs. Apply adhesive and coating in accordance with manufacturer's recommendations. All seams shall overlap not less than 2".

3.04 PIPING, VALVE AND FITTING INSULATION

A. General:
   1. Install insulation with butt joints and longitudinal seams closed tightly. Provide minimum 2" lap on jacket seams and 2" tape on butt joints, firmly cemented with lap adhesive unless otherwise noted. Additionally secure with staples along seams and butt joints. Coat staples, longitudinal and transverse seams with vapor barrier mastic on systems requiring vapor barrier.
   2. Install insulation continuous through pipe hangers and supports with hangers and supports on the exterior of insulation. Where a vapor barrier is not required or where roller hangers are not being used, hangers and supports may be attached directly to piping with insulation completely covering hanger or support and jacket sealed at support rod penetration. Where riser clamps are required to be attached directly to piping requiring vapor barrier, extend insulation and vapor barrier jacketing/coating around riser clamp.
   3. Where insulated piping is installed on hangers and supports, the insulation shall be installed continuous through the hangers and supports. High density inserts shall be provided as required to prevent the weight of the piping from crushing the insulation. Pipe shields are required at all support locations. The insulation shall not be notched or cut to accommodate the supporting channels.

B. Fully insulate all reheat coil piping, fittings and valves (with the exception of unions) up to coil connection to prevent condensation when coil is inactive during cooling season. Provide a vapor proof seal between the pipe insulation and the insulated coil casing.

C. Insulation Inserts And Pipe Shields:
   1. Provide pipe shields at all hanger and support locations. Rigid insulation inserts shall be installed between the pipe and the insulation shields. Quantity and placement of inserts shall be according to the manufacturer's installation instructions, however the inserts shall be no less than 12" in length. Inserts shall be of equal thickness to the adjacent insulation and shall be vapor sealed as required for system.

2. Provide insulation inserts and pipe shields at all hanger and support locations. Inserts may be omitted on 3/4" and smaller copper piping provided 12" long 22 gauge pipe shields are used.

D. Fittings And Valves: Fittings, valves, unions, flanges, couplings and specialties may be insulated with factory molded or built up insulation of the same thickness as adjoining insulation. Where the ambient temperature exceeds 150 degrees F, cover insulation with fabric reinforcing and mastic. Where the ambient temperatures do not exceed 150 degrees, furnish and install PVC fitting covers.

E. Extruded Polystyrene And Polyisocyanurate:

1. Fittings, valves, unions, flanges, couplings and specialties shall be insulated with factory molded insulation of the same thickness as adjoining insulation. Secure insulation sections with two wraps of nylon filament tape 9"-12" on center. On single insulation layer systems and on the outer layer of double insulation layer systems, apply a thin coat of elastomeric joint sealant rated for system operating temperatures to all longitudinal and butt insulation joints covering entire face of joint. Allow sealant to fully cure before applying protective covering. For piping service below 0°F, use two layers of insulation with inner and outer butt and longitudinal joints staggered and offset 90 degrees. Where two layers of insulation are used, do not use sealant on the inner layer or adhere the inner layer to the outer layer. Apply vapor stop bead of joint sealant between pipe and insulation on both sides of valves, expansion/contraction joints, flanges, thermometers/gauges, attached vent and drain lines. Insulate attached non-circulated lines, control lines, vents, etc. for a minimum distance of 6" from pipe. Cover insulation with a protective jacket as specified below. Do not penetrate protective covering or insulation with mechanical fasteners.

3.05 PIPING PROTECTIVE JACKETS

A. In addition to the jackets specified in the pipe insulation schedule below the following protective jackets are required:

1. Provide a protective PVC (PFJ) or Fabric Reinforced Mastic (FMJ) jacket for the following insulated piping: All piping within mechanical rooms

3.06 PIPE INSULATION SCHEDULE

A. Provide insulation on new and existing remodeled piping as indicated in the following schedule:

Service	**Insulation**	**Jacket**	**Insulation Thickness by Pipe Size**				
			≤ 1¼"	**1½"**	**2" to <4"**	**4" to 6"**	**8" and larger**
Heating Hot Water	Rigid Fiberglass	ASJ	1.5"	1.5"	2"	2"	2"
Chilled Water	Polyiso./Polysty.	VRJ or SAJ	1.5"	1.5"	1.5"	1.5"	1.5"
Makeup Water	Polyiso./Polysty.	VRJ or SAJ	1.5"	1.5"	1.5"	1.5"	1.5"
Cooling Coil Condensate Drain	Rigid Fiberglass	ASJ	0.5"	0.5"	1"	1"	1"

B. The following piping and fittings are not to be insulated:

1. Piping unions for systems not requiring a vapor barrier

C. For systems with fluid temperatures 65° F or less, furnish and install removable elastomeric insulation covers, plugs or caps for all mechanical equipment and devices that require access by balancing contractors or service and maintenance personnel. Examples include but are not limited to: flow sensing devices, circuit setters, manual ball valve air vents, drain valves, blowdown valves, pressure/temperature test plugs, grease fittings, pump bearing caps, equipment labels, etc. Covers shall be tight fitting to ensure a complete vapor barrier

3.07 DUCT INSULATION

A. General:

1. Secure flexible duct insulation on sides and bottom of ductwork over 24" wide and all rigid duct insulation with weld pins. Space fasteners 18" on center or less as required to prevent sagging.
2. Secure rigid board insulation to ductwork with weld pins. Apply insulation with joints firmly butted as close as possible to the equipment surface. Pins shall be located a maximum of 3" from each edge and spaced no greater than 12" on center.

3. Install weld pins without damage to the interior galvanized surface of the duct. Clip pins back to washer and cover penetrations with tape of same material as jacket. Firmly butt seams and joints and cover with 4" tape of same material as jacket. Seal tape with plastic applicator and secure with staples. All joints, seams, edges and penetrations to be fully vapor sealed.
4. Stop and point insulation around access doors and damper operators to allow operation without disturbing insulation or jacket material.
5. Where insulated ductwork is supported by trapeze hangers, the insulation shall be installed continuous through the hangers. Drop the supporting channels required to facilitate the installation of the insulation. Where rigid board or flexible insulation is specified, install high density inserts to prevent the weight of the ductwork from crushing the insulation.

3.08 DUCT INSULATION SCHEDULE

A. Provide duct insulation on new and existing remodeled ductwork in the following schedule:

Service	**Insulation Type**	**Jacket**	**Insulation Thickness**
Concealed supply ducts	Flexible Fiberglass	FSJ	2"

END OF SECTION

SECTION 23 09 14
PNEUMATIC AND ELECTRIC INSTRUMENTATION AND CONTROL DEVICES FOR HVAC

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. This section includes pneumatic control system specifications for all HVAC work as well as related pneumatic control for systems found in other specification sections. Included are the following topics:
   1. Control Dampers
   2. Control Valves
   3. Duct Smoke Detector and Fire Alarm Interface Modules
   4. Temperature Sensors
   5. Humidity Sensors

1.02 RELATED WORK

A. Applicable provisions of Division 0 and 1 govern work under this section.
B. Section 23 05 00 – Common Work Results for HVAC
C. Section 23 05 93 – Testing, Adjusting, and Balancing for HVAC - Coordination
D. Section 23 09 23 – Direct Digital Control System for HVAC
E. Section 23 09 93 – Sequence of Operations for HVAC Controls
F. Section 23 15 00 – Piping Specialties
G. Section 23 31 00 – HVAC Ducts
H. Section 23 33 00 – Ductwork Accessories - for control damper installation
I. Division 23 - HVAC - Equipment provided to be controlled or monitored
J. Division 26 – Electrical – Installation requirements & Equipment provided to be controlled or monitored
K. Division 28 - Electronic Safety and Security

1.03 SUBMITTALS

A. Refer Section 23 05 00 – Common Work Results for HVAC, Submittals. In addition to the general content specified under Section 23 05 00 – Common Work Results for HVAC, supply the following submittals:
   1. Control Dampers
   2. Control Valves
   3. Duct Smoke Detector and Fire Alarm Interface Modules
   4. Temperature Sensors
   5. Humidity Sensors

B. Include the following information:
   1. Manufacturer's data sheets indicating model number, pressure/temperature ratings, capacity, methods and materials of construction, installation instructions, and recommended maintenance. General catalog sheets showing a series of the same device is not acceptable unless the specific model is clearly marked.
   2. Schematic flow diagrams of systems showing fans, pumps, coils, dampers, valves, and other control devices. Label each device with setting or adjustable range of control. Indicate all wiring, clearly, differentiating between factory and field installed wiring. Wiring should be shown in schematics that detail contact states, relay references, etc. Diagrammatic representations of devices alone are not acceptable.
   3. Schedule of control dampers indicating size, leakage rating, arrangement, pressure drop at design airflow, and number and size of operators required.
   4. Schedule of control valves indicating system in which the device is to be used, rated capacity, flow coefficient, flow required by device served, actual pressure drop at design flow, size of operator required, close-off pressure, and locations where valves are to be installed.

5. A complete description of each control sequence for equipment that is not controlled by direct digital controls. Direct digital controlled equipment control sequences will be provided by the DDC control contractor.
6. Calculations completed to determine size of control air compressor(s) and dryer (s).

C. Prior to request for final payment, submit record documents which accurately record actual location of control components including panels, thermostats, wiring, and sensors. Incorporate changes required during installation and start-up.

1.04 REFERENCE STANDARDS

A.	ANSI B16.22	Wrought Copper and Wrought Copper Alloy Solder Joint Pressure Fittings
B.	ANSI/ASTM B32	Specification for Solder Metal
C.	ASTM B75	Seamless Copper Tube
D.	ASTM D1693	Environmental Stress-Cracking of Ethylene Plastics
E.	ASTM D 635	Standard Test Method for Rate of Burning and/or Extent and Time of Burning of Plastics in a Horizontal Position
F.	UL 94	Tests for Flammability of Plastic Materials for Parts in Devices and Appliances
G.	AMCA 500-D	Laboratory Method of Testing Dampers for Rating
H.	ASHRAE Guideline 16-2010	Selecting Outdoor, Return and Relief Dampers for Air-Side Economizer Systems

1.05 QUALITY ASSURANCE

A. Manufacturers: ESI – Contact Jerry Gitlowski – Environmental System, Inc.

1.06 DESIGN CRITERIA

A. Size all control apparatus to properly supply and/or operate and control the apparatus served. For example damper and valve actuators shall have sufficient power to operate their respective valve or damper from 0 to 100% under load smoothly, without jerking or hysteresis.

B. Provide control devices subject to corrosive environments with corrosion protection or construct them so they are suitable for use in such an environment.

C. Provide devices exposed to outside ambient conditions with weather protection or construct them so they are suitable for outdoor installation.

D. Use only UL labeled products that comply with NEMA Standards. Electrical components and installation to meet all requirements of the electrical sections (Division 26) of project specifications.

1.07 OPERATION AND MAINTENANCE DATA

A. All operations and maintenance data shall comply with the submission and content requirements specified in Section 23 05 00 – Common Work Results for HVAC.

1.08 DELIVERY, STORAGE AND HANDLING

A. Provide factory shipping cartons for each piece of equipment and control device. This contractor is responsible for storage of equipment and materials inside and protected from the weather.

1.09 SYSTEM DESCRIPTION

A. System is to be electric/electronic.

1.10 DEMOLITION

A. Where existing control devices, piping, or wiring are discontinued from use, remove and turn over to owner. If owner does not want them remove from premises. Remove any previously abandoned control devices in a similar manner.

PART 2 – PRODUCTS

2.01 CONTROL DAMPERS

A. Provide control dampers shown on the plans and as required to perform the specified functions. Dampers shall be rated for velocities that will be encountered at maximum system design and rated for pressure equal to or greater than the ductwork pressure class of the ductwork where the damper is installed, as specified in Section 23 31 00 – HVAC Ducts and Casings.

B. Use only factory fabricated dampers with mechanically captured replaceable resilient blade seals, stainless steel jamb seals and with entire assembly suitable for the maximum temperature and air velocities encountered in the system.

C. Dampers in galvanized ductwork shall be constructed of galvanized steel and/or aluminum.

D. All dampers, unless otherwise specified, to be rated at a minimum of 180º F working temperature. Leakage testing shall be certified to be based on latest edition of AMCA Standard 500-D and all dampers, unless otherwise specified, shall have leakage ratings as follows:

Damper Class	Differential Pressure	Leakage
Class IA	1" w.g.	$\leq$3 CFM/ft^2
Class I	4" w.g.	$\leq$8 CFM/ft^2
Class I	8" w.g.	$\leq$11 CFM/ft^2
Class I	12" w.g.	$\leq$14 CFM/ft^2

E. Leakage rate dampers for differential pressures that they will encounter at maximum system design pressures.

F. Steel framed dampers: Nailor models 2010 & 2020; Greenheck models VCD-33 & VCD-42; Johnson Controls model V-1330; Ruskin Models CD60 & CD40.

G. Aluminum frame and blade dampers: Nailor models 2010EAF & 202EAF; Greenheck model VCD-43; Ruskin model CD50; Arrow model AFD-20.

H. Dampers for applications to have frames of not less than 16 gauge galvanized steel or 12 gauge extruded aluminum. Blades to be two-ply steel airfoil of not less than 2 x 20 gauge galvanized steel (14 gauge equivalent) or extruded aluminum airfoil, with stainless steel, acetal, Celcon, bronze, or nylon bearings. Maximum allowable blade width is 8 inches. Use plated steel linkage hardware.

I. Maximum damper width is 48 inches; where required width exceeds 48 inches, use multiple damper sections. Inside frame free area shall be a minimum of 90% of total inside duct area.

J. Multiple width damper sections shall utilize jack shaft linkages unless noted below. Sections over 144 inches wide shall be actuated from two locations on the jack shaft. Double width damper sections for two-position operation may be actuated without jack shafts if each damper section is actuated separately. Dampers that have multiple width and multiple vertical sections shall have a jackshaft for each vertically stacked set of dampers and be provided with crossover linkages between jack shafts to transfer uneven loading.

K. Jack shafts shall be extended outside of the ductwork for external actuator mounting. Provide bearings on the point of exit for support of damper shafts to prevent wear on the shaft and the ductwork. If locating actuators out of the air stream is impossible, obtain mounting location approval from the A/E unless the contract documents indicate in air stream mounting is acceptable.

L. Size operators for smooth and positive operation of devices served, and with sufficient torque capacity to provide tight shutoff against system temperatures and pressure encountered.
   1. For two-position electric actuation use 24 VAC for DDC controlled actuators, 120 VAC actuators may be used for hardwire interlocking.

M. Actuator stroke times shall match the requirements of the DDC controllers provided under Section 23 09 23 – Direct Digital Control System for HVAC and/or the specific system requirements for proper operation. All electric actuators will be provided with overload protection to prevent motor from damage when stall condition is encountered. Equip operators with spring return or stored energy fail-safe return for applications involving fire, freeze protection, moisture protection or specified normally open/closed operation.

N. All power required for electric actuation shall be provided by this contractor if it is not able to be directly provided from the DDC controller.

O. Provide operators with linkages and brackets for mounting on device served.

2.02 CONTROL VALVES

A. Provide all control valves as shown on the plans/details and as required to perform functions specified. Spring ranges must be selected to prevent overlap of operation and simultaneous heating and cooling.

B. Valve Selection Criteria:
   1. Submit engineering calculations for sizing modulating control valves unless valves are scheduled. Control valves serving terminal devices may be sized based on flow ranges for each pump system.
   2. Calculations for sizing modulating valves shall be based on actual characteristics of equipment and system in which valves are installed. Valve calculations shall include information such as pump head or available pressure
   3. Temperature Control Contractor is responsible for obtaining adequate system information necessary for sizing.
   4. Select control valves to meet their intended service without cavitation. Provide cavitation calculations for modulating globe control valves over 250°F and all modulating butterfly valves over 60°F.
   5. Select control valves and actuators for 100% shut-off against system's maximum differential pressure.
   6. Provide valve trim to limit audible sound levels to 85 dBA or less when measured at 5 feet.

C. Size operators to allow smooth and positive operation of devices served and to provide sufficient torque capacity for tight shutoff against system temperatures and pressure encountered.
   1. For electric modulating actuation, use fully proportional actuators with 0-10VDC inputs and zero and span adjustments unless specified otherwise in the chart below.

D. Electric actuators, for applications other than terminal units, shall be provided with a manual override capability. All electric actuators shall be provided with a visible position indicator.

E. All power required for electric actuation shall be provided by this contractor if it is not able to be directly provided from the DDC controller.

F. Provide operators that are full proportioning or two-position, as required for specified sequence of operation. Provide spring-return for applications involving fire, freeze protection, moisture protection or specified normally open/closed operation. Valves shall move to their fail positions on loss of electrical power or air pressure to the actuator.

G. Provide operators with linkages and brackets for mounting on device served.

H. All valves unless specifically noted on the plans or indicated below shall be globe style valves.

I. See plan details, notes, and schedules for where two-way and three-way valves should be used.
   1. Equivalent Cv butterfly valves may be used where 3" and larger globe valves would be required.

J. WATER SYSTEMS:
   1. Use equal percentage valves for two-way control valves; size for a pressure drop not less than 4 psi or more than 6 psi. Select control valves based upon pressure drop calculations and Cv values at 100% stroke. Note: For low flows, the required minimum Cv size will result in lower pressure drop than 4 psi.
   2. Select control valves based upon pressure drop calculations and Cv values at 100% stroke
   3. Use three-way valves sized for a maximum pressure drop of 5 psi and that have linear characteristics so that the valve pressure drop remains constant regardless of the valve position.
   4. Globe valves 2" and smaller: Cast bronze or forged brass body, brass plug and brass or stainless steel seat, stainless steel stem, screwed ends, suitable for use on water systems at 150 psig and 240° F. Seat leakage with actuator supplied will meet ANSI class IV leakage (0.01%). Only the following globe valve will be acceptable for terminal unit control: Belimo.
   5. Characterized Ball Valves: The following manufacturers are acceptable: Belimo. For use on terminal units only where specified above. Forged brass or bronze body, <u>stainless steel shaft and ball</u>, reinforced Teflon or PTFE ball seals, double O-ring stem seals, characterized disk, maximum of ANSI Class IV (0.01%) leakage, suitable for use on water systems at 150 psig and 212° F. Minimum size for ball valves shall be 1.0 Cv.
   6. <u>Analog Electronic:</u> Actuators shall be hydraulic or electric motor/gear drives that respond proportionally to analog voltage or current input. Stroke time for major equipment shall be 90 seconds or less for 90° rotation. Stroke time for terminal equipment shall be compatible with associated local controller, but no more than 6 minutes. Provide spring return feature for fail open or closed positions, as required by control sequence, for critical applications such as outside,

return, or exhaust dampers, heating and cooling coils on major air handling units, humidifiers, heat exchangers, flow control for major equipment items such as chillers, cooling towers, boilers, etc. Provide position feedback potentiometers connected to controller for closed loop control on major equipment analog control loops. Actuators for terminal heating/cooling equipment do not require spring return feature. Manufacturers: Belimo, Honeywell, Johnson Controls, Siemens Building Technologies or Invensys Building Systems.

2.03 DUCT SMOKE DETECTOR AND FIRE ALARM INTERFACE MODULES

A. Detectors with auxiliary contacts or fire alarm control modules will be provided by Division 28. Provide wiring, conduit, and necessary interface with fire alarm system to perform specified sequence of operation.

2.04 TEMPERATURE SENSORS

A. Thermistor temperature sensor manufacturers: PreCon, BAPI, and ACI

B. Use thermistor or RTD type temperature sensing elements constructed so accuracy and life expectancy is not affected by moisture, physical vibration, or other conditions that exist in each application.

C. RTD's shall be of nickel or platinum construction and have a base resistance of 1000Ω at 70°F and 77°F respectively. 100Ω platinum RTD's are acceptable if used with temperature transmitters.

D. The temperature sensing device used must be compatible with the DDC controllers used on the project.

RTD	
Accuracy (Room Sensor Only)	minimum ± 1.0°F
Accuracy (Averaging)	minimum ± 1.2°F
Accuracy (Other than Room Sensor or Averaging)	minimum ± 0.65°F
Range	minimum -40 - 220°F
Thermistor	
Accuracy (All)	minimum ± 0.36°F
Range	minimum -30 - 230°F
Heat Dissipation Constant	minimum 2.7 mW/°C
Temperature Transmitter	
Accuracy	minimum ± 0.1°F or ±0.2% of span
Output	4-20 mA

E. Provide limited range or extended range sensors if required to sense the range expected for a respective point. Use RTD type sensors for extended ranges beyond -30 to 230°F. If RTD's are incompatible with DDC controller direct temperature input use temperature transmitters in conjunction with RTD's.

F. Use wire size appropriate to limit temperature offset due to wire resistance to 1.0°F. If offset is greater than 1.0°F due to wire resistance, use temperature transmitter. If feature is available in DDC controller, compensate for wire resistance in software input definition.

G. Provide sensors in occupied spaces with brushed aluminum or brushed nickel covers unless otherwise noted or features specified will not allow for this. Provide sensors in unoccupied spaces shall have metal enclosure. Terminal unit sensors with setpoint adjustments and digital displays may use plastic covers. Provide information to the AE on sensor colors offered by the manufacturer and obtain approval on what color should be provided on the project.

H. Terminal unit sensors shall be provided with digital displays that indicate room temperature and setpoint and have a manual occupancy override and indication of occupancy status. Provide setpoint adjustment as specified in the control diagram and sequence of operation.

I. Use averaging elements on duct sensors when the ductwork is ten square feet or larger. All mixed air and heating coil discharge sensors shall have averaging elements regardless of duct size.

J. In piping systems use temperature sensors with separable wells designed to be used with temperature element.

2.05 HUMIDITY SENSORS

A. Use capacitive thin-film polymer sensor types with a range of 0-100% RH. Accuracy to be no less than ±2% in the range of 20% RH to 80% RH with a response time of 120 seconds or less. Provide covers for room humidity sensors as specified for temperature sensors.

2.06 POWER SUPPLIES

A. Provide all required power supplies for transducers, sensors, transmitters and relays. All low voltage transformers shall have a resettable secondary circuit breaker and be listed as class 2 power supplies.

PART 3 – EXECUTION

3.01 INSTALLATION

A. Install system with trained mechanics and electricians employed by the control equipment manufacturer or an authorized representative of the manufacturer. Where installing contractor is an authorized representative of the control manufacturer, such authorization shall have been in effect for a period of no less than three years.

B. Install all control equipment, accessories, wiring, and piping in a neat and workmanlike manner. All control devices must be installed in accessible locations. This contractor shall verify that all control devices furnished under this Section are functional and operating the mechanical equipment as specified in Section 23 09 93 – Sequence of Operations for HVAC Controls.

C. Label all control devices with the exception of dampers, valves, and terminal unit devices with permanent printed labels that correspond to control drawings. Temperature control junction and pullboxes shall be identified utilizing spray painted green covers. Other electrical system identification shall follow the Division 26 identification specification requirements.

D. All control devices and electrical boxes mounted on insulated ductwork shall be mounted over the insulation. Provide mounting stand-offs where necessary for adequate support. Cutting and removal of insulation to mount devices directly on ductwork is not acceptable. This contractor shall coordinate with the insulation contractor to provide for continuous insulation of ductwork.

E. Provide all electrical relays and wiring, line and low voltage, for control systems, devices and components. Install all high voltage and low voltage wiring (includes low voltage cable) in metal conduit, Electrical Non-metallic Tubing (ENT), or Electrical Metallic Tubing (EMT), as scheduled below and hereafter referred to generically as conduit. See Wire and Air Piping Conduit Installation Schedule below for specific conduit or tubing to be used. All conduit must be installed in accordance with electrical sections (Division 26) of this specification and the National Electrical Code.

F. Conduit shall be a minimum of 1/2 " for low voltage control provided the pipe fill does not exceed 40%.

G. Minimum low voltage wiring gauge to be 18 AWG for outputs and 20 AWG for inputs. All low voltage wiring to be stranded.

H. Low voltage wiring can be run without conduit above accessible lay-in tile ceilings. All wiring in mechanical rooms, above inaccessible hard ceilings, exterior locations, and in any exposed areas, and in all other locations should be in conduit. Wire for wall sensors must be run in conduit. Wiring for radiation valves shall be run in conduit where routed through walls.

I. Where wiring is installed free-air, installation shall consider the following:
   1. Wiring shall utilize the cable tray wherever possible.
   2. Wiring shall run at right angles and be kept clear of other trades work.
   3. Wiring shall be supported utilizing "J" or "Bridal-type" steel mounting rings anchored to ceiling concrete, piping supports, walls above ceiling or structural steel beams. Mounting rings shall be of open design (not a closed loop) to allow additional wire to be strung without being threaded through the ring. For mounting rings that do not completely surround the wire, attach the wire to the mounting ring with a strap.
   4. Supports shall be spaced at a maximum 4-foot interval unless limited by building construction. If wiring "sag" at mid-span exceeds 6-inches; another support shall be used.
   5. Wiring shall never be laid directly on the ceiling grid or attached in any manner to the ceiling grid wires.
   6. Wall penetrations shall be sleeved.

J. Wiring shall not be attached to existing cabling, existing tubing, piping, ductwork, ceiling supports or electrical or communications conduit.

K. Control panels serving equipment fed by emergency power shall also be served by emergency power. This contractor shall be responsible for all 120VAC power, not provided in the Division 26 specifications, required for equipment provided under this section.
L. After completion of installation, test and adjust control equipment. Submit data showing set points and final adjustments of controls.

3.02 WIRE AND AIR PIPING CONDUIT AND TUBING INSTALLATION SCHEDULE

A. The following conduit schedule shall apply to both polyethylene tubing and wire in conduit where conduit is specified for air tubing or wiring. Conduit and tubing referenced below shall meet specifications in Division 26 and as defined below.
B. Conduit other than that specified below for specific applications shall not be used.
C. Concealed Dry Interior Locations: Rigid steel conduit. Intermediate metal conduit. Electrical metallic tubing.
D. Exposed Dry Interior Locations: Rigid steel conduit. Intermediate metal conduit. Electrical metallic tubing.

3.03 CONTROL DAMPERS

A. All control dampers furnished by the control manufacturer are to be installed by the Mechanical Contractor under the coordinating control and supervision of the Temperature Control Contractor in locations shown on plans or where required to provide specified sequence of control.
B. Coordinate installation with the sheetmetal installer to obtain smooth duct transitions where damper size is different than duct size. Blank off plates will not be accepted. Blank-off plates or transitions required to facilitate dampers shall be provided by Mechanical Contractor.
C. Each operator shall serve a maximum damper area of 36 square feet. Where larger dampers are used, provide multiple operators.
D. Furnish control dampers as shown on drawings and/or as required to perform control sequences specified, except those furnished with other equipment.
E. Control dampers furnished by Temperature Control Contractor shall be installed by Mechanical Contractor under coordinating control and supervision of Temperature Control Contractor.

3.04 CONTROL VALVES

A. All temperature control valves furnished by the control manufacturer are to be installed by the Mechanical Contractor under the coordinating control and supervision of the Temperature Control Contractor in locations shown on plans or where required to provide specified sequence of control.

3.05 ROOM THERMOSTATS AND TEMPERATURE SENSORS

A. Check and verify location of thermostats, humidistats, and other exposed control sensors with plans and room details before installation. Align with light switches and humidistats. For drywall installations, thermostat mounting shall use a back-box attached to a wall stud, drywall anchors are not acceptable.
B. Any room thermostats or sensors mounted on an exterior wall shall be mounted on a thermally insulated sub-base. Subbase to provide a minimum of one half inch of insulation.
C. Where thermostats or sensors are mounted on exterior walls or in any location where air transfer will affect the measured temperature or humidity seal the conduit and any other opening that will affect the measurement.
D. Provide guards on thermostats in entrance hallways, other public areas, or in locations where thermostat is subject to physical damage.

3.06 TRAINING

A. See Section 23 05 00 – Common Work Results for HVAC for general training requirments.
B. Contractor to provide factory authorized representative and/or field personnel knowledgeable with the operations, maintenance and troubleshooting of the system and/or components defined within this section.

C. Provide one training session per shift of building operating engineers at two times:
   1. At the start of the warranty period.
   2. After completion of 9 months of warranty period.

END OF SECTION

SECTION 23 09 23
DIRECT DIGITAL CONTROL SYSTEM FOR HVAC

PART 1 – GENERAL

1.01 SECTION INCLUDES

A. Work in this section includes Direct Digital Control (DDC) panels, main communication trunk, software programming, and other equipment and accessories necessary to constitute a complete Direct Digital Control (DDC) system. This system interfaced with pneumatic/electric controls (Section 23 09 14 – Pneumatic and Electric Instrumentation and Control Devices for HVAC) utilizing Direct Digital Control signals to operate actuated control devices shall meet, in every respect, all operational and quality standards specified herein.
   1. Direct Digital Controls (DDC)
   2. Networking/Communications
   3. BACnet Requirements

B. Provide all labor and software updates required so that the manufacturer's current software is provided for a period of 3 years after date of substantial completion.

1.02 RELATED WORK

A. Applicable provisions of Division 0 and 1 govern work under this section.
B. Section 23 05 00 – Common Work Results for HVAC
C. Section 23 05 93 – Testing, Adjusting, and Balancing for HVAC - Coordination
D. Section 23 09 14 – Pneumatic and Electric Instrumentation and Control Devices for HVAC
E. Section 23 09 93 – Sequence of Operation for HVAC Controls
F. Section 23 81 23 – Computer Room Air Conditioner
G. Division 23 – HVAC - Equipment provided to be controlled or monitored
H. Division 26 – Electrical - Equipment provided to be controlled or monitored

1.03 SUBMITTALS

A. Refer to Section 23 05 00 – Common Work Results for HVAC, Submittals. In addition to the general content specified under Section 23 05 00 – Common Work Results for HVAC, supply the following submittals:
   1. DDC Controls

B. Include the following information:
C. Details of construction, layout, and location of each temperature control panel within the building, including instruments location in panel and labeling. Indicate which piece of mechanical equipment is associated with each controller and what area within the building is being served by that equipment. For terminal unit control, provide a room schedule that lists mechanical equipment tag, room number of space served, address of DDC controller, and any other pertinent information required for service.
D. Product Data: Submit manufacturer's specifications for each control device furnished, including installation instructions and startup instructions. General catalog sheets showing a series of the same device is not acceptable unless the specific model is clearly marked. Annotated software program documentation shall be submitted for system sequences, along with descriptive narratives of the sequence of operation of the entire system involved. Submit wiring diagram for each electrical control device along with other details required to demonstrate that the system has been coordinated and will function as a system.
E. Maintenance Data: Submit maintenance data and spare parts lists for each control device. Include this data in maintenance manual.
F. Record Drawings: Prior to request for final payment provide complete composite record drawings to incorporate the DDC and Pneumatic/Electric fieldwork. All software addressing for device communication shall be noted for all devices provided under this section and the communication addressing required for devices provided by others that are integrated into the direct digital control system provided under this section. Coordinate with the supplier of the equipment specified to be interfaced through digital communications for communication addressing. Provide circuit number of

120VAC panel power circuit(s) feeding each control panel on record drawings. Label circuit number(s) inside the panel served.

1.04 REFERENCE STANDARDS

A. FCC Part 15, Subpart J, Class A - Digital Electronic Equipment to Radio Communication Interference

1.05 QUALITY ASSURANCE

A. Manufacturers: ESI – Contact Jerry Gitlewski – Environmental Systems, Inc.
B. Response Time: During warrantee period, four (4) hours or less, 24-hours/day, 7 days/week.
C. Electrical Standards: Provide electrical products, which have been tested, listed and labeled by Underwriters' Laboratories (UL) and comply with NEMA standards.
D. DDC Standards: DDC manufacturer shall provide written proof with shop drawings that the equipment being provided is in compliance with FCC rules governing the control of interference caused by Digital Electronic Equipment to Radio Communications (Part 15, Subpart J, Class A).

1.06 OPERATION AND MAINTENANCE DATA

A. All operations and maintenance data shall comply with the submission and content requirements specified in Section 23 05 00 – Common Work Results for HVAC.

1.07 DELIVERY. STORAGE AND HANDLING

A. Provide factory-shipping cartons for each piece of equipment and control device. This contractor is responsible for storage of equipment and materials inside and protected from the weather.

PART 2 – PRODUCTS

2.01 GENERAL

A. Provide DDC control products in sizes and of capacities as required, conforming to manufacturer's standard materials and components as published in their product information, designed and constructed as recommended by the manufacturer and as required for application indicated.
B. System shall be capable of operating with 120 VAC power supply, fully protected with a shutdown-restart circuit, and associated hardware and software.

2.02 DIRECT DIGITAL CONTROLS

A. System to be capable of integrating multiple building functions, including equipment supervision and control, alarm management, energy management, and trend data collection.
B. DDC to consist of Supervisory Controllers, Programmable Controllers, stand-alone Application Specific Controllers (ASC's), Operators Terminals, Operator Workstations, DDC system servers, and other operator interface devices.
C. The system shall be modular in nature, and shall permit expansion of both capacity and functionality through the addition of sensors, actuators, ASC's, and operator devices.
D. The failure of any single component or network connection shall not interrupt the execution of control strategies at other operational devices.

2.03 NETWORKING/COMMUNICATIONS

A. The design of the DDC shall be networked. The highest level networking shall use Ethernet and the sub-level networking shall use serial communications. Inherent in the system's design shall be the ability to expand or modify the highest network either via a local area network (LAN), wide area network (WAN), or a combination of the two schemes.
B. The highest level DDC communications network shall be capable of direct connection to and communication with a high-speed LAN or WAN utilizing an Ethernet connection. Communication protocol used shall be BACnet/IP.
C. Access to system data shall not be restricted by the hardware configuration of the DDC system.
D. Network design shall include the following provisions:
    1. Data transfer rates for alarm reporting and quick point status from multiple programmable controllers and ASC's. The minimum baud rate shall be 9600 baud.

2. Error detection, correction, and re-transmission to guarantee data integrity.
3. Use commonly available, multiple-sourced, networking components.
4. Use of an industry standard communication transport, such as ARCNET, Ethernet, and IEEE RS-485 communications interface.

2.04 BACNET REQUIREMENTS

A. New computer room units shall be connected to existing DDC system via BACnet. Temperature Control Contractor shall coordinate with unit manufacturer.

PART 3 – EXECUTION

3.01 GENERAL

A. This contractor shall provide all labor, materials, engineering, software permits, tools, check-out and certificates required to install a complete DDC system as herein specified.

3.02 INSTALLATION

A. All work and materials are to conform in every detail to the rules and requirements of the National Electrical Code and present manufacturing standards. All wiring and cable installation shall conform with the wiring installation as specified in the installation section of Section 23 09 14 – Pneumatic and Electric Instrumentation and Control Devices for HVAC. All material shall be UL approved.
B. Install system and materials in accordance with manufacturer's instructions, rough-in drawings and details on drawings.
C. Line voltage wiring to power the DDC Controllers, not provided by the Division 26 contractor, to be by this contractor.
D. Control panels serving equipment fed by emergency power shall also be served by emergency power.
E. Provide uninterruptable power supplies where necessary to provide proper startup of equipment or to accomplish power restart control sequences specified.
F. Mount control panels adjacent to associated equipment on vibration-free walls or freestanding angle iron supports. One cabinet may accommodate more than one system in same equipment room. Provide printed plastic tags for instruments and controls inside cabinet and on engraved plastic nameplates cabinet face.
G. Provide as-built control drawings of all systems served by each local panel in a location adjacent to or inside of panel cover. Provide a protective cover or envelope for drawings.
H. Where a new system is required to be extended to an existing owner Building Automation Network (BAN) (typically connected via the owner’s Local Area Network (LAN) or Wide Area Network (WAN)), extension of the data-net between DDC Controllers and to the BAN to be by this contractor.
I. Provide all necessary routers and or repeaters to accomplish connection to the LAN via the panel-mounted port provided.
J. All cables to the DDC panels shall be extended in the DDC panel with sufficient spare cable (minimum of 5') to allow termination.

3.03 TRAINING

A. See Section 23 05 00 – Common Work Results for HVAC for general training requirements.
B. Contractor to provide factory authorized representative and/or field personnel knowledgeable with the operations, maintenance and troubleshooting of the system and/or components defined within this section for a minimum period of 4 hours.
C. Provide two follow-up visits for troubleshooting and instruction, one six months after substantial completion and the other at the end of nine months of warranty period. Length of each visit to be not less than 4 hours or the time necessary to provide required information and complete troubleshooting and inspection activity for all controls installed under this section. Coordinate the visit with the owner and provide an inspection report to the owner of any deficiencies found.

END OF SECTION

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SECTION 23 09 93
SEQUENCE OF OPERATION FOR HVAC CONTROLS

PART 1 – GENERAL

1.01 SECTION INCLUDES
A. This section includes control sequences for HVAC equipment as well as equipment furnished by others that may need monitoring or control. Included are the following topics:
   1. General Control Sequence Items
   2. Equipment Specific Control Sequences

1.02 RELATED WORK
A. Applicable provisions of Division 0 and 1 govern work under this Section.
B. Section 23 05 00 – Common Work Results for HVAC
C. Section 23 05 14 – Variable Frequency Drives
D. Section 23 05 93 – Testing, Adjusting, and Balancing for HVAC – Coordination
E. Section 23 09 14 – Pneumatic and Electric Instrumentation and Control Devices for HVAC
F. Section 23 09 23 – Direct Digital Control System for HVAC
G. Division 23 – HVAC - Equipment provided to be controlled or monitored
H. Division 26 – Electrical - Equipment provided to be controlled or monitored
I. Division 28 – Electronic Safety and Security

1.03 SUBMITTALS
A. Refer to Division 0 and 1, Section 23 05 00 – Common Work Results for HVAC, Section 23 09 14 – Pneumatic and Electric Instrumentation and Control Devices for HVAC and Section 23 09 23 – Direct Digital Control System for HVAC for descriptions of what should be included in the submittals.
B. Provide a complete narrative of the sequence of operations for equipment that is controlled through the DDC system. Provide a complete narrative of the sequence of operation for equipment that is controlled directly from that equipment (without control logic through the DDC system). The narrative of the sequence of operation shall not be a verbatim copy of the sequences contained herein, but shall reflect the actual operation as applied by the contractor.

1.04 DESIGN CRITERIA
A. Reference Section 23 09 14 – Pneumatic and Electric Instrumentation and Control Devices for HVAC.

1.05 OPERATION AND MAINTENANCE DATA
A. All operations and maintenance data shall comply with the submission and content requirements specified in Section 23 05 00 – Common Work Results for HVAC.

1.06 REFERENCE
A. For the following work, refer to Section 23 09 14 – Pneumatic and Electric Instrumentation and Control Devices for HVAC.
   1. Furnishing and installing all field devices, including electronic sensors for the DDC of this section, equipment, and all related field wiring, interlocking control wiring between equipment, pneumatic tubing, sensor mounting, etc., that is covered in that section.
   2. Motorized control dampers and actuators, thermowells (temperature sensing wells), automatic control valves and their actuators.

1.07 DESCRIPTION OF WORK
A. Control sequences are hereby defined as the manner and method by which automatic controls function. Requirements for each type of operation are specified in this section.
B. Operation equipment, devices and system components required for automatic control systems are specified in other Division 23 control sections of these specifications.

C. All temperature, humidity, and pressure sensing, and all other control signal transportation for the control sequences shall be furnished under Section 23 09 14. All pneumatic, electronic, and electric input/output signals shall be extended under Section 23 09 14, with adequate lead length for termination within the appropriate control panel being provided under Section 23 09 23.
D. Sequences for equipment controlled by Direct Digital Controls (DDC) as specified are accomplished by hardware and software provided under Section 23 09 23. Sequences for equipment controlled by pneumatic or electric self-contained controls are accomplished by hardware provided under Section 23 09 14.

PART 2 – PRODUCTS

2.01 Not applicable to this section – reference Sections 23 09 23 and 23 09 14 for product descriptions.

PART 3 – EXECUTION

3.01 CONTROL SEQUENCES

A. General Control Sequence Items:
   1. Setpoints:
      a. All setpoints indicated in the control specification are to be adjustable
B. Alarms: Provide all alarmed points with adjustable time delays to prevent nuisance tripping under normal operation and on equipment start-up. For all commanded outputs that have status feedback, provide an alarm that will indicate the commanded output is not in its commanded state. Provide alarms on all points as indicated on point charts. For existing automations systems, add/delete what is called for on the point charts after consultation with Owner to provide consistent alarming throughout the automation system.
C. Equipment Start/Stop Failure States: All start/stop points for equipment shall utilize normally open contacts unless called out specifically in the individual control sequences.
D. Current Switch Setup: When current switches are used for proving fan or pump status, they shall be set up so that they will detect belt or coupling loss by the reduction in current draw on loss of coupled load. The current switch set up shall be redone by the Temperature Control Contractor after the balancer is complete.

3.02 EQUIPMENT SPECIFIC CONTROL SEQUENCES

A. Refer to the project drawings for control sequences.

END OF SECTION

SECTION 23 21 13
HYDRONIC PIPING

PART 1 – GENERAL

1.01 SECTION INCLUDES

A. This section contains specifications for all HVAC hydronic pipe and pipe fittings for this project. Included are the following topics:
   1. Heating Hot Water
   2. Chilled Water
   3. Makeup Water
   4. Cooling Coil Condensation Drains

1.02 RELATED WORK

A. Applicable provisions of Division 0 and 1 govern work under this section.
B. Section 23 05 00 – Common Work Results for HVAC
C. Section 23 05 15 - Piping Specialties
D. Section 23 05 23 - General-Duty Valves for HVAC Piping
E. Section 23 05 29 - Hangers and Supports for HVAC Piping and Equipment
F. Section 23 07 00 - HVAC Insulation
G. Section 23 25 00 - HVAC Water Treatment.

1.03 SUBMITTALS

A. Refer to Section 23 05 00 – Common Work Results for HVAC. In addition to the general content specified under Section 23 05 00 – Common Work Results for HVAC, supply the following submittals:
   1. Heating Hot Water
   2. Chilled Water
   3. Makeup Water
   4. Cooling Coil Condensation Drains
   5. Unions and Flanges
B. Contractor shall submit schedule indicating the ASTM specification number of the pipe being proposed along with its type and grade and sufficient information to indicate the type and rating of fittings for each service.
C. Type F Steel Pipe: Statement from manufacturer on their letterhead that the pipe furnished meets the ASTM specification contained in this section.
D. Type E Or S Steel Pipe: Mill certification papers, also known as material test reports, for the pipe furnished for this project, in English. Heat numbers on these papers to match the heat numbers stenciled on the pipe. Chemical analysis indicated on the mill certification papers to meet or exceed the requirements of the referenced ASTM specification.
E. Copper Tube: Statement from manufacturer on their letterhead that the pipe furnished meets the ASTM specification contained in this section.

1.04 REFERENCE STANDARDS

A. ANSI B16.3 Malleable Iron Threaded Fittings
B. ANSI B16.4 Cast Iron Threaded Fittings
C. ANSI B16.5 Pipe Flanges and Flanged Fittings
D. ANSI B16.22 Wrought Copper and Wrought Copper Alloy Solder Joint Pressure Fittings
E. ASTM A53 Pipe, Steel, Black and Hot-Dipped, Zinc Coated Welded and Seamless
F. ASTM A74 Cast Iron Soil Pipe and Fittings
G. ASTM A105 Forgings, Carbon Steel, for Piping Components
H. ASTM A126 Gray Cast Iron Castings for Valves, Flanges, and Pipe Fittings
I. ASTM A181 Forgings, Carbon Steel for General Purpose Piping
J. ASTM A197 Cupola Malleable Iron

K. ASTM A234 Pipe Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and Elevated Temperatures
L. ASTM A380 Practice for Cleaning and Descaling Stainless Steel Parts, Equipment, and Systems
M. ASTM B75 Seamless Copper Tube
N. ASTM B88 Seamless Copper Water Tube

1.05 QUALITY ASSURANCE

A. Order all Type E and Type S steel pipe with heat numbers rolled, stamped, or stenciled to each length or each bundle, depending on the size of the pipe, and in accordance with the appropriate ASTM specification.
B. Any installed material not meeting the specification requirements must be replaced with material that meets these specifications without additional cost to the Owner.
C. All hydronic piping shall be manufactured in the United States.

1.06 DESIGN CRITERIA

A. Use only new material, free of defects, rust and scale, and meeting the latest revision of ASTM specifications as listed in this specification.
B. Construct all piping for the highest pressures and temperatures in the respective system in accordance with ANSI B31, but not less than 125 psig unless specifically indicated otherwise.
C. Where weld fittings or mechanical grooved fittings are used, use only long radius elbows having a centerline radius of 1.5 pipe diameters.
D. Where ASTM A53 type F pipe is specified, ASTM A53 grade A type E or S, or ASTM A53 grade B type E or S may be substituted at Contractor's option. Where ASTM A53 grade A pipe is specified, ASTM A53 grade B pipe may be substituted at Contractor's option. Where the grade or type is not specified, Contractor may choose from those commercially available.
E. Where ASTM B88, type L hard temper copper tubing is specified, ASTM B88, type K hard temper copper tubing may be substituted at Contractor's option.

1.07 DELIVERY, STORAGE AND HANDLING

A. Promptly inspect shipments to insure that the material is undamaged and complies with specifications.
B. Cover pipe to eliminate rust and corrosion while allowing sufficient ventilation to avoid condensation. Do not store materials directly on grade. Protect pipe, tube, and fitting ends so they are not damaged. Where end caps are provided or specified, take precautions so the caps remain in place. Protect fittings, flanges, and unions by storage inside or by durable, waterproof, above ground packaging.
C. Offsite storage agreements will not relieve the contractor from using proper storage techniques.
D. Storage and protection methods must allow inspection to verify products.

1.08 WELDER QUALIFICATIONS

A. Before any metallic welding is performed, the Contractor shall submit his Standard Welding Procedure Specifications, Procedure Qualification Records and Qualification Test Records for each Welder along with associated continuity records to demonstrate compliance with ASME Section IX, paragraph QW-322.
B. The Contractor shall maintain a complete set of welder qualification documents at the jobsite, including Test Records and Continuity Records for each welder.
C. The A/E or owner reserves the right to test the work of any welder employed on the project, at the Contractor's expense. Testing will include a visual examination of the pipe and weld and may include radiography of any suspect welds. If the work of the welder is found to be unsatisfactory, the welder shall be prevented from doing further welding on the project. Any welds deemed unacceptable will be repaired at the contractor’s expense.

PART 2 – PRODUCTS

2.01 HEATING HOT WATER

A. 2" and Smaller: ASTM A53, type F, standard weight (schedule 40) black steel pipe with ASTM A126/ANSI B16.4, class 125, standard weight cast iron threaded fittings.

B. 2-1/2" and Larger: ASTM A53, standard weight (schedule 40) black steel pipe with ASTM A234 grade WPB/ANSI B16.9 standard weight, seamless, carbon steel weld fittings.

C. Contractor may use ASTM B88 seamless, type L, hard temper copper tube with ANSI B16.22 wrought copper solder-joint fittings in lieu of steel pipe for all sizes. Mechanically formed tee fittings may be used in lieu of wrought copper solder-joint tee fittings for branch takeoff up to one-half (1/2) the diameter of the main.

2.02 CHILLED WATER

A. 2" and Smaller: ASTM A53, type F, standard weight (schedule 40) black steel pipe with ASTM A126/ANSI B16.4, class 125, standard weight cast iron threaded fittings.

B. 2-1/2" and Larger: ASTM A53, standard weight (schedule 40) black steel pipe with ASTM A234 grade WPB/ANSI B16.9 standard weight, seamless, carbon steel weld fittings.

C. Contractor may use ASTM B88 seamless, type L, hard temper copper tube with ANSI B16.22 wrought copper solder-joint fittings in lieu of steel pipe for all sizes. Mechanically formed tee fittings may be used in lieu of wrought copper solder-joint tee fittings for branch takeoff up to one-half (1/2) the diameter of the main.

2.03 MAKEUP WATER

A. Extend from where left by the Plumbing Contractor with the same materials.

2.04 COOLING COIL CONDENSATION DRAINS

A. ASTM B88, type L hard temper copper tubing with ASTM B145/ANSI B16.23 cast red bronze or ASTM B75/ANSI B16.29 wrought solder-type drainage fittings.

PART 3 – EXECUTION

3.01 ERECTION

A. Carefully inspect all pipe, fittings, valves, equipment and accessories before installation. Any items that are unsuitable, cracked or otherwise defective shall be rejected and removed from the job site immediately. Excluding minor surface rust, piping that exhibits significant oxidation or corrosion will be rejected.

B. Exercise care at every stage of storage, handling, laying and erecting to prevent entry of foreign matter into piping, fittings, valves, equipment and accessories. Do not erect or install any item that is not clean.

C. Remove all lose dirt, scale, oil, chips, burrs and other foreign material from the internal and external surfaces of all pipe and piping components prior to assembly, including debris associated with cutting, threading and welding.

D. During fabrication and assembly, remove slag and weld spatter from internal pipe surfaces at all joints by peening, chipping and wire brushing.

E. During construction, until system is fully operational, keep all openings in piping and equipment closed except when actual work is being performed on that item of the system. Use plugs, caps, blind flanges or other items designed for this purpose.

F. Furnish and install all flanges, caps, bypasses, drains, valves, etc. required to facilitate flushing and draining all system piping.

G. Install all piping parallel to building walls and ceilings and at heights which do not obstruct any portion of a 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 all project drawings for location of pipe spaces, ceiling heights, door and window openings, or other architectural details before installing piping.

H. Provide anchors, expansion joints, swing joints and/or expansion loops so that piping may expand and contract without damage to itself, equipment, or building.
I. Mitered ells, notched tees, and orange peel reducers are not acceptable. On threaded piping, bushings are not acceptable.
J. "Weldolets" and "Threadolets" may be used for branch takeoffs up to one-half (1/2) the diameter of the main.
K. Install drains throughout the systems to permit complete drainage.
L. Unless written authorization by the A/E, do not route piping through transformer vaults or above transformers, panelboards, motor control centers or switchboards, including the required service space for this equipment, unless the piping is serving this equipment
M. 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 the specifications and drawings.

3.02 WELDED PIPE JOINTS

A. Make all welded joints by fusion welding in accordance with ASME Codes, ANSI B31, and State Codes where applicable.
B. All pipe welding shall be completed by Qualified Welders in accordance with the Contractor's Procedure Specifications.
C. Contractor will ensure that these steps are followed where pipe sections will be joined by welding:
   1. Cleaning – Welding surfaces will be clean and free of defects.
   2. Alignment – Inside diameter of piping components will be aligned as accurately as possible. Internal misalignment shall not exceed 1/16".
   3. Spacing – Pipe sections will be spaced to allow deposition of weld filler material through the entire weld joint thickness.
D. Girth Butt Welds:
   1. Girth butt welds shall be complete penetration welds.
   2. Concavity will not exceed 1/32"
   3. Under cuts will not exceed 1/32"
   4. As welded surfaces are permitted however surfaces will be free from coarse ripples, grooves, abrupt ridges and valleys.
E. Electrodes shall be manufactured in the U.S.A. with coating and diameter as recommended by the manufacturer for the type and thickness of work being done.

3.03 THREADED PIPE JOINTS

A. Use a Teflon based thread lubricant or Teflon tape when making joints; no hard setting pipe thread cement or caulking will be allowed.

3.04 COPPER PIPE JOINTS

A. Remove all slivers and burrs remaining from the cutting operation by reaming and filing both pipe surfaces. Clean fitting and tube with emery cloth or sandpaper. Remove residue from the cleaning operation, apply flux, and assemble joint. Use 95-5 solder or silver brazing alloy to secure joint as specified for the specific piping service.
B. 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. Use an adjustable collaring device. Notch and dimple the branch tube. Braze the joint, applying heat properly so that pipe and tee do not distort; remove distorted connections.

3.05 WATER SYSTEM

A. Run water mains level or pitch horizontal mains up 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, top 45 degree, side, and/or bottom 45 degree of the main provided that there are drain valves suitably located for complete system drainage and manual air vents are located at all top and top 45 degree connections. Bottom connections are not acceptable unless approved by the Owner's Mechanical Inspector.
C. Use top or top 45 degree connection to main for upfeed risers and bottom 45 degree connection to main for downfeed risers. Bottom connections are not acceptable unless approved by the Owner's Mechanical Inspector.
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 systems. 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.

3.06 MAKEUP WATER

A. Install where indicated and/or specified, including all valves, piping specialties and dielectric unions required for a functional system.

3.07 COOLING COIL CONDENSATION DRAINS

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 location. Construct trap with plugged tee for cleanout purposes as detailed.

3.08 GASKETS

A. Store horizontally in cool, dry location and protect from sunlight, water and chemicals. Inspect flange surfaces for warping, radial scoring or heavy tool marks. Inspect fasteners, nuts and washers for burrs or cracks. Replace defective materials.
B. Align flanges parallel and perpendicular with bolt holes centered without using excessive force. Center gasket in opening. Lubricate fastener threads, nuts and washers with lubricant formulated for application.
C. Draw flanges together evenly to avoid pinching gasket. Tighten fasteners in cross pattern sequence (12 – 6 o'clock, 3 – 9 o'clock, etc.), one pass by hand and four passes by torque wrench at 30% full torque, 60% full torque and two passes at full torque per ASME B16.5.

3.09 PIPING SYSTEM LEAK TESTS

A. Verify that the piping system being tested is fully connected to all components and that all equipment is properly installed, wired, and ready for operation. If required for the additional pressure load under test, provide temporary restraints at expansion joints or isolate them during the test. Verify that hangers can withstand any additional weight load that may be imposed by the test.
B. Provide all piping, fittings, blind flanges, and equipment to perform the testing.
C. Conduct pressure test with test medium of air or water unless specifically indicated. Minimum test time is indicated in the table below; additional time may be necessary to conduct an examination for leakage. Each test must be witnessed by the Owner's representative. If leaks are found, repair the area with new materials and repeat the test; caulking will not be acceptable.
D. Do not insulate pipe fittings or welds until test has been successfully completed.
E. For hydrostatic tests, use clean water and remove all air from the piping being tested by means of air vents or loosening of flanges/unions. Measure and record test pressure at the high point in the system.
F. 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. After testing is complete, slowly release the pressure in a safe manner.

System	Pressure	Medium	Duration
Heating hot water	100 psig	Water	8 hr.
Chilled water	100 psig	Water	8 hr.

G. All pressure tests are to be documented on attached form included in this specification.

H. On piping that cannot be tested because of connection to an active line, provide temporary blind flanges and hydrostatically test new section of piping. After completion of test, remove temporary flanges and make final connections to piping. Die penetrate test pass weld or x-ray the piping that was not hydrostatically tested up to the active system.

3.10 HYDRONIC PIPING SYSTEM FLUSHING

A. All new chilled water and heating hot water system piping shall be flushed thoroughly before the systems are put in to operation. Subsequent to executing the chemical cleaning processes specified in Section 23 25 00 – HVAC WATER TREATMENT, and prior to adding scale and corrosion inhibitors, flush all piping and components with a clean source of water until the discharge from the system is clean. Discharge shall be from drains provided at all low points in the piping, ends of headers and as otherwise necessary to flush and drain the entire system.

B. Project specific procedures shall be established prior to flushing. Before beginning flushing operations, submit proposed flushing procedures to the A/E and Owner's Project Representative for review and approval. Provide sufficient notice to the A/E and/or Owner to allow the flushing operations to be observed.

C. A clean water source shall be tapped into the system downstream of the main circulation pump(s). Provide minimum 2" connection between water source and hot water/chilled water systems including taps with ball valves (or line size tap and ball valve for piping systems smaller than 2"). Provide minimum 2" taps (or line size if mains are smaller than 2") at the ends of headers, the low pint of each of the mains on each floor and as otherwise necessary to flush and drain the entire system. Provide minimum 2" bypass with shut off valve (or line size if mains are smaller than 2") between the supply and return mains on each floor as where directed by the A/E and Owner's Project Representative or where shown on the drawings. Contractor shall identify proposed clean water source along with the method/location of drain discharge and review with the A/E and Owner's Project Representative prior to installing flushing connections to water source and drain outlets. Provide code required temporary backflow prevention for the clean water source if needed. Provide all temporary taps, valves, piping, bypasses and hoses as needed to accomplish flushing procedures.

D. The Owner's district chilled water system shall NOT be used as a source of water for flushing any piping.

E. Flush piping systems using the following procedure:
   1. Flushing sequence for hot water and chilled water systems is as follows:
   2. Close isolation valves at all coils and wall fin.
   3. Open the temporary bypasses that connect the ends of supply and return mains.
   4. Flush mains by turning on flushing water source and sequentially opening drains on mains on each floor until the discharge is clean. This will flush the mains without forcing water/debris into the branches and run out pipes.
   5. Close isolation valves located downstream of coils/wall fin.
   6. Open isolation valves located upstream of coils/wall fin.
   7. Open individual drain valves upstream of coils/wall fin until the discharge is clean. This will flush the supply branch and run out lines between the mains and the coils/wall fin without running water/debris through the TCV or coils/wall fin.
   8. Close the individual drain valves upstream of coils/wall fin.
   9. Open drain valves at low points in the return piping mains.
   10. Open the individual isolation valves located downstream of the coils/wall fin. This will flush the return branch and run out lines located between the coils/wall fin and the mains back into the mains and out the drains on the return mains. The water going through the coil/wall fin should be already be clean since this section was flushed previously.
   11. Repeat steps 1-3 to clean debris from the mains.

F. Isolate all coils while flushing risers and mains. Flush the mains on each floor individually, starting at the top of the building and working down towards the basement level. After risers and mains have been flushed clean, individually open the drain valves in each branch circuit to discharge any debris that may have accumulated in the branch piping.

G. As directed by Owner, the Contractor will be required to open drain valves at selected locations in the system to verify the effectiveness of flushing procedures. If sediment or debris is identified in the system, it will be flushed again and reinspected at no expense to the Owner.

H. After flushing operations are complete, drain and/or blow out any residual water, clean and replace all strainers, and add scale and corrosion inhibitors as specified in Section 23 25 00. Leave flushing connections/valves in place and cap.
I. All flushing procedures shall be documented by completing and submitting the report form included at the end of this Section.
J. Initial Fill And Vent:
    1. Fill hydronic systems with appropriate working fluids as specified. All system fluids shall be chemically treated as specified in Section 23 25 00 – HVAC WATER TREATMENT.
    2. For closed piping systems, all air trapped at high points shall be relieved through the manual air vents prior to notifying Owner that the systems are ready to be tested and balanced.

END OF SECTION

PIPING SYSTEM LEAKAGE TEST REPORT

Date Submitted: _____

Project Name: _____

Location: _____ **Project No:** _____

Contractor: _____

☐ **HVAC** ☐ **Refrigeration** ☐ **Controls**

☐ **Power Plant** ☐ **Plumbing** ☐ **Sprinkler**

Test Medium: ☐ **Air** ☐ **Water** ☐ **Other** _____

Test performed per specification section No. _____

Specified Test Duration _____ Hours **Specified Test Pressure** _____ **PSIG**

System Identification: _____

Describe Location: _____

_____

Test Date: _____

Start Test Time: _____ **Initial Pressure:** _____ **PSIG**

Stop Test Time: _____ **Final Pressure:** _____ **PSIG**

Tested By: _____ **Witnessed By:** _____

Title: _____ **Title:** _____

Signed: _____ **Signed:** _____

Date: _____ **Date:** _____

Comments: _____

_____

_____

_____

_____

_____

_____

PIPING SYSTEM FLUSHING REPORT

Date Submitted: _____

Project Name: _____

Location: _____ **Project No:** _____

Contractor: _____

System Identification (check one):

☐ **Chilled Water** ☐ **Process Chilled Water** ☐ **Heat Reclaim**

☐ **Heating Hot Water** ☐ **Other** _____

Describe procedure: _____

_____

_____

_____

_____

Flush Date: _____ **Start Time:** _____ **Stop Time:** _____

Pressure of Water Source: _____ **PSIG** **Describe water source and method of connection to source:**

_____

_____

_____

Flushed By: _____ **Witnessed By:** _____

Title: _____ **Title:** _____

Company: _____ **Agency:** _____

Signed: _____ **Signed:** _____

Date: _____ **Date:** _____

Describe results: _____

_____

_____

_____

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SECTION 23 25 00
HVAC WATER TREATMENT

PART 1 – GENERAL

1.01 SECTION INCLUDES
A. This section includes specifications for chemical treatment of all water systems. Included are the following topics:
   1. System Cleaner

1.02 RELATED WORK
A. Applicable provisions of Division 0 and 1 shall govern work under this Section.
B. Section 23 05 00 – Common Work Results for HVAC
C. Section 23 05 15 – Piping Specialties
D. Division 26 Electrical Specifications

1.03 SUBMITTALS
A. Refer to Section 23 05 00 – Common Work Results for HVAC, Submittals. In addition to the general content specified under Section 23 05 00 – Common Work Results for HVAC, supply the following submittals:
   1. System Cleaner
B. Chemical data to include the description of the chemical, its composition, its function, and the associated material safety data sheet.

1.04 QUALITY ASSURANCE
A. Refer to Division 0 and 1 for equals and substitutions.

1.05 DESIGN CRITERIA
A. Provide the initial chemical treatment for all systems based on a complete system fluid analysis prior to the equipment installation. The initial chemical treatment supply of chemicals for each system shall be adequate for the start-up and testing period, for the time the systems are being operated by the Contractor for temporary heating and cooling, and for one year after start-up of the system.

1.06 OPERATION AND MAINTENANCE DATA
A. Provide for the services of the manufacturer's trained representative to approve the installation and instruct the owner in the operation of each system.

PART 2 – PRODUCTS

2.01 MANUFACTURERS
A. Industrial Water Management – Contact Joe Wenn.

2.02 SYSTEM CLEANER
A. Blend of organic alkaline penetrants, emulsifiers, surfactants and corrosion inhibitors that remove grease and petroleum products from the interior of piping systems. Cleaners that contain trisodium phosphate are specifically not acceptable.

PART 3 – EXECUTION

3.01 PREPARATION
A. Prior to cleaning, verify that systems are operational, filled, started, and vented. Use water meter to record capacity in each system.
B. Place terminal control valves in the full-open position

3.02 CLEANING SEQUENCE

A. General:
   1. Systems are to be cleaned before they are used for any purpose except conduct pressure test before cleaning. Add cleaner to closed systems at concentrations as recommended by the manufacturer. Remove water filter elements from the system before starting circulation.
   2. Use neutralizer agents on recommendation of the system cleaner supplier and approval of the Architect/Engineer.
   3. Remove, clean, and replace strainer screens.
   4. Inspect, remove sludge, and flush low points with clean water after cleaning process is completed. Include disassembly of components as required.
   5. Use attached form to document system cleaning, flushing, and proper startup.

B. Hot Water Heating Systems: Add cleaner to the system water until the M alkalinity value is 250 above that of the initial fill water. Verify the M alkalinity level before and after the addition of the cleaner by means of chemical tests that are observed by the Owner's construction representative; include results of all tests in the Operating and Maintenance manuals. Apply heat while circulating, slowly raising temperature to 160°F and maintain for 12 hours minimum; vent all high points to assure 100% system circulation. Remove heat and circulate to 100°F or less; drain system as quickly as possible and refill with clean water. Circulate for 6 hours at design temperature, vent air at all high points, then drain. Refill with clean water and repeat until the system cleaner is removed and the M alkalinity level returns to normal. Remove and clean all strainers. Re-vent the system and install clean filter elements in water filters. Treat with scale and corrosion inhibitors before using the system for building heating or cooling.

C. Chilled Water Systems: Add cleaner to the system water until the M alkalinity value is 250 above that of the initial fill water. Verify the M alkalinity level before and after the addition of the cleaner by means of chemical tests that are observed by the Owner's construction representative; include results of all tests in the Operating and Maintenance manuals. Circulate for 48 hours, then drain system as quickly as possible. Refill with clean water, circulate for 24 hours, then drain. Refill with clean water and repeat until system cleaner is removed and the M alkalinity level returns to normal. Remove and clean all strainers. Re-vent the system and install clean filter elements in water filters. Treat with scale and corrosion inhibitors before using the system for building heating or cooling.

END OF SECTION

PIPE CLEANING AND TREATMENT REPORT

Project Number: _____

Date Submitted: _____

Project Name: _____
Location: _____
Contractor: _____

System Tested: **Hot Water**_____ **Glycol Water**_____ **Chilled Water**_____

Fuel Oil_____ **Condenser Water**_____ **Steam**_____ **Condensate**_____

System Volume:_____

Materials Used (Provide MSDS for each)

Cleaner:_____ **Quantity Used:**_____
Inhibitor:_____ **Quantity Used:**_____
Sequestering Agent:_____ **Quantity Used:**_____
Algaecide:_____ **Quantity Used:**_____
Neutralizer:_____ **Quantity Used:**_____
Glycol:_____ **Quantity Used:**_____
Glycol Solution Water Source:_____ **Percent glycol by volume:**_____

M Alkalinity

Prior to Cleaning:_____ **During Cleaning:**_____ **After Flushing:**_____

System Temperature

Prior to Cleaning:_____ **During Cleaning:**_____

Duration	Date/Time Start	Date/Time Stop
Initial Circulation		
Draindown		
System Refill		
Final Circulation		
Heating system Warmup		

Component Checklist (Describe procedures performed at each)

Strainers:_____
Filters:_____
Vents:_____
Drains:_____
Traps:_____
Branch Lines:_____
Terminal Units:_____
Boilers:_____
Chillers:_____

Comments:_____

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SECTION 23 31 00
HVAC DUCTS AND CASINGS

PART 1 – GENERAL

1.01 SECTION INCLUDES

A. This section includes specifications for all duct systems used on this project. Included are the following topics:
   1. Low Pressure Ductwork (Maximum 2 inch pressure class)
   2. Duct Sealant
   3. Gaskets

1.02 RELATED WORK

A. Applicable provisions of Division 0 and 1 govern work under this Section.
B. Section 23 05 00 – Common Work Results for HVAC
C. Section 23 05 93 - Testing, Adjusting, and Balancing for HVAC
D. Section 23 05 94 – HVAC Air Duct Cleaning
E. Section 23 33 00 – Air Duct Accessories

1.03 SUBMITTALS

A. Refer to Section 23 05 00 – Common Work Results for HVAC, Submittals. In addition to the general content specified under Section 20 05 00 – Common Work Results for HVAC, supply the following submittals:
   1. Low Pressure Ductwork (Maximum 2 inch pressure class)
   2. Duct Sealant
   3. Gaskets
B. Include manufacturer's data and/or Contractor data for the following:
C. Fabrication and installation drawings.
   1. Schedule of duct systems including material of construction, gauge, pressure class, system class, method of reinforcement, joint construction, fitting construction, and support methods, all with details as appropriate.
   2. Duct sealant and gasket material.

1.04 REFERENCE STANDARDS

A.	ANSI SS-EN 485-2	Aluminum and Aluminum Alloys-Sheet, Strip and Plate-Part 2: Mechanical Properties
B.	ASTM B209	Specification for Aluminum and Aluminum-Alloy Sheet and Plate
C.	ASTM A90	Test Method for Weight of Coating on Zinc-Coated (Galvanized) Iron or Steel Articles
D.	ASTM A167	Specification for Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip
E.	ASTM A623	Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) by the Hot-Dip Process
F.	ASTM A527	Specification for General Requirements for Steel Sheet, Zinc-Coated (Galvanized) by the Hot-Dip Process, Lock-Forming Quality
G.	ASTM 924	Standard Specification for General Requirements for Sheet Steel, Metallic-coated by the Hot-dip Method
H.	ASTM E 84	Test Method for Surface Burning Characteristics of Building Materials
I.	ASTM C 1338	Test Method for Determining Fungal Resistance of Insulation Materials and Facings
J.	ASTM G 21	Standard Practice for Determining Resistance of Synthetic Polymeric Materials to Fungi

K. ASTM C 916 Standard Specification for Adhesives for Duct Thermal Insulation NFPA 90A Standard for the Installation of Air Conditioning and Ventilating Systems
L. UL 181 Standard for Safety for Factory Made Air Ducts and Air Connectors.

1.05 QUALITY ASSURANCE

A. Refer to Division 0 and 1 for equals and substitutions.

1.06 DESIGN CRITERIA

A. Construct all ductwork to be free from vibration, chatter, objectionable pulsations and leakage under specified operating conditions.
B. Use material, weight, thickness, gauge, construction and installation methods as outlined in the following SMACNA publications, unless noted otherwise:
   1. HVAC Duct Construction Standards, Metal and Flexible, 3rd Edition, 2005
   2. HVAC Air Duct Leakage Test Manual, 1st Edition, 1985
   3. HVAC Systems - Duct Design, 4th Edition, 2006
   4. Rectangular Industrial Duct Construction Standard, 2nd Edition, 2004
   5. Round Industrial Duct Construction Standards, 2nd Edition, 1999
   6. Thermoplastic Duct (PVC) Construction Manual, 2nd Edition, 1995
C. Use products which conform to NFPA 90A, possessing a flame spread rating of not over 25 and a smoke developed rating no higher than 50.

1.07 DELIVERY, STORAGE AND HANDLING

A. Promptly inspect shipments to ensure that Ductwork is undamaged and complies with the specification.
B. Protect Ductwork against damage.
C. 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.
D. Offsite storage agreements do not relieve the contractor from using proper storage techniques.
E. Storage and protection methods must allow inspection to verify products.

PART 2 – PRODUCTS

2.01 GENERAL

A. All sheet metal used for construction of duct shall be 24 gauge or heavier except for round and spiral ductwork and spiral duct take-offs 12" and below may be 26 gauge where allowed in SMACNA HVAC Duct Construction Standards, Metal and Flexible, 3rd Edition, 2005.

2.02 DUCTWORK PRESSURE CLASS

A. Minimum acceptable SMACNA duct pressure class, for all ductwork except transfer ductwork, is 2 inch W.G. positive or negative, depending on the application. Transfer ductwork minimum acceptable duct pressure class is 1 inch W.G. positive or negative, depending on the application. Duct system pressure classes not indicated on the drawings to be as follows:

Supply duct	2 in. pressure class
Return ducts	2 in. negative pressure class

2.03 MATERIALS

A. Galvanized Steel Sheet: Use ASTM A 653 galvanized steel sheet of lock forming quality. Galvanized coating to be 1.25 ounces per square foot, both sides of sheet, G90 in accordance with ASTM A90. Provide "Paint Grip" finish or galvanneal sheetmetal for ductwork that will be painted.

2.04 LOW PRESSURE DUCTWORK (MAXIMUM 2 INCH PRESSURE CLASS)

A. Fabricate and install ductwork in sizes indicated on the drawings and in accordance with SMACNA recommendations, except as modified below.

B. Construct so that all interior surfaces are smooth. Use slip and drive or flanged and bolted construction when fabricating rectangular ductwork. Use spiral lock seam construction when fabricating round spiral ductwork. Sheet metal screws may be used on duct hangers, transverse joints and other SMACNA approved locations if the screw does not extend more than 1/2 inch into the duct.

C. Use elbows and tees with a center line radius to width or diameter ratio of 1.5 wherever space permits. When a shorter radius must be used due to limited space, install single wall sheet metal splitter vanes in accordance with SMACNA publications, Type RE 3. Where space will not allow and the C value of the radius elbow, as given in SMACNA publications, exceeds 0.31, use rectangular elbows with turning vanes as specified in Section 23 33 00 – Air Duct Accessories. Square throat-radius heel elbows will not be acceptable. Straight taps or bullhead tees are not acceptable.

D. Where rectangular elbows are used, provide turning vanes in accordance with Section 23 33 00 – Air Duct Accessories.

E. Provide expanded take-offs or 45 degree entry fittings for branch duct connections with branch ductwork airflow velocities greater than 700 fpm. Square edge 90-degree take-off fittings or straight taps will not be accepted.

F. Button punch snaplock construction will not be accepted on aluminum ductwork.

G. No variation of duct configuration or sizes permitted except by written permission of the Engineer. Substitution of round ducts for rectangular ducts will only be considered if sized in accordance with ASHRAE table of equivalent rectangular and round ducts.

H. 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.

2.05 DUCT SEALANT

A. Manufacturer: 3M 800, 3M 900, H.B. Fuller/Foster, Hardcast, Hardcast Peal & Seal, Lockformer cold sealant, Mon-Eco Industries, United Sheet Metal. Silicone sealants are not allowed in any type of ductwork installation.

B. Install sealants in strict accordance with manufacturer's recommendations, paying special attention to temperature limitations. Allow sealant to fully cure before pressure testing of ductwork, or before startup of air handling systems.

C. For plenums installations, use duct sealant with a flame spread index of not more than 25 and smoke-developed index of not more than 50. When tested in accordance with ASTME84 or UL 723.

2.06 GASKETS

A. 2 Inch Pressure Class And Lower: Soft neoprene or butyl gaskets in combination with duct sealant for flanged joints.
3 Inch Pressure Class And Higher: Butyl gaskets.

PART 3 – EXECUTION

3.01 INSTALLATION

A. Verify dimensions at the site, making field measurements and drawings necessary for fabrication and erection. Check plans showing work of other trades and consult with Architect in the event of any interference.

B. Make allowances for beams, pipes or other obstructions in building construction and for work of other contractors. Transform, divide or offset ducts as required, in accordance with SMACNA HVAC Duct Construction Standards, Figure 4-7, except do not reduce duct to less than six inches in any dimension and do not exceed an 8:1 aspect ratio. Where it is necessary to take pipes or similar obstructions through ducts, construct easement as indicated in SMACNA HVAC Duct Construction Standards, Figure 4-8, Fig. E. In all cases, seal to prevent air leakage. Pipes or similar obstructions may not pass through high pressure ductwork, fume exhaust ductwork or kitchen hood exhaust ductwork.

C. Test openings for test and balance work will be provided under Section 23 05 93 – Testing, Adjusting and Balancing for HVAC.
D. Provide frames constructed of angles or channels for coils, filters, dampers or other devices installed in duct systems, and make all connections to such equipment including equipment furnished by others. Secure frames with gaskets and screws or nut, bolts and washers.
E. Install duct to pitch toward outside air intakes and drain to outside of building. Solder or seal seams to form watertight joints.
F. Where two different metal ducts meet, the joint shall be installed in such a manner that metal ducts do not contact each other by using proper seal or compound.
G. Install all motor operated dampers and connect to or install all equipment furnished by others. Blank off all unused portions of louvers, as indicated on the drawings, with 1-1/2 inch board insulation with galvanized sheet metal backing on both sides.
H. Do not install ductwork through dedicated electrical rooms or spaces unless the ductwork is serving this room or space.
I. Locate ducts with sufficient space around equipment to allow normal operating and maintenance activities.
J. Provide adequate access to ductwork for cleaning purposes.
K. Provide temporary capping of ductwork openings on job site, both before and after installation, to prevent entry of dirt, dust and foreign material.
L. Protect diffusers, registers and grilles with plastic wrap or some other approved form of protection to maintain dirt and dust free and to prevent entry of dirt, dust and foreign material into the ductwork.
M. During construction provide temporary closures of metal or taped polyethylene on open ductwork to prevent construction dust from entering ductwork system.
N. All ductwork not welded, at a minimum, shall be sealed using duct sealant or gaskets on all seams, joints and penetrations.
O. Provide 45 degree entry fitting with a minimum throat length of 25% of the width of the branch duct takeoff or 4 inches, whichever is larger.

3.02 DUCTWORK SUPPORT

A. Support ductwork in accordance with the latest SMACNA HVAC Duct Construction Standards, Figure 5-5, except supporting ductwork with secure wire method is not allowed.
B. Support with 3/32 inch, 7 x 7, stainless steel air-craft cable, with matching fastener rated for 50% of actual load, will be allowed on round ductwork under 12 inches if installed as detailed, with cable double looped on duct and at point of support.
C. On ductwork sections exceeding 8', provide at least two supports.

3.03 LOW PRESSURE DUCT (MAXIMUM 2 INCH PRESSURE CLASS)

A. Seal all duct, with the exception of transfer ducts, in accordance with SMACNA seal class "A". All seams, joints, and penetrations shall be sealed using duct sealant or gaskets per Part 2 - Products.
B. Install a manual balancing damper in each branch duct and for each diffuser or grille. The use of splitter dampers, extractors, or grille face dampers will not be accepted for balancing dampers.
C. Hangers must be wrapped around bottom edge of duct and securely fastened to duct with sheetmetal screws or pop rivets. Trapeze hangers may be used at contractor's option.

3.04 CLEANING

A. Remove all dirt and foreign matter from the entire duct system and clean diffusers, registers, grilles and the inside of air-handling units before operating fans.
B. Clean duct systems with high power vacuum machines where systems have been used for temporary heat, air-conditioning, or ventilation purposes during construction. Protect equipment that may be harmed by excessive dirt with filters, or bypass during cleaning.

3.05 LEAKAGE TEST

A. Test all ductwork in accordance with test methods described in Section 5 of SMACNA HVAC Air Duct Leakage Test Manual. Do not insulate ductwork until it has been successfully tested. Test pressure shall be equal to the duct pressure class.

B. If excessive air leakage is found locate leaks, repair the duct in the area of the leak, seal the duct, and retest.
C. Leakage rate shall not exceed more than 5% of the system air quantity for low pressure ductwork, determined in accordance with Appendix C of the SMACNA HVAC Air Duct Leakage Test Manual.
D. Submit a signed report to the Owner, indicating test apparatus used, results of the leakage test, and any remedial work required to bring duct systems into compliance with specified leakage rates.

3.06 STRUCTURAL TEST

A. Random test all ductwork per owner's direction. Do not insulate ductwork until it has been successfully tested.
B. Deflection limits shall not exceed those listed in accordance with Chapter 11 of SMACNA HVAC Duct Construction Standards, 3.0 Performance Requirements.
C. Submit a signed report to the Owner, indicating test apparatus used, results of the structural test, and any remedial work required.

END OF SECTION

DUCT LEAKAGE TEST REPORT

Project Number: _____

Date Submitted: _____

Project Name: _____

Location: _____

Contractor: _____

System: **Fan No.:** _____ **Leakage Class (C_L):** _____

Data **Fan Design CFM:** _____ **Duct Pressure Class (P_c):** _____

Test Pressure (P_T): _____

Test Equipment: **Manufacturer:** _____

Model No.: _____ **Serial No.:** _____

For large systems, use the reverse side for a simple sketch of the entire duct system. Then use letter designations to indicate the various duct sections being tested at one time. Also use the reverse side for test comments.

Note that due to normal construction sequencing it is usually necessary to test risers separately prior to enclosing chases.

Design Data									Field Test Data			
			Allowable Leakage		Diameter		Pressure (in. wc.)					
Duct Section	Duct Shape	Duct Surface (Ft2)	Leakage Factor ($P^{.65}C_L$)	CFM for Section	Tube (D_1)	Orifice (D_2)	In Duct (P)	Across Orifice (P_{drop})	Date	Performed By	Observed By	Actual CFM
TOTAL												

DUCT STRUCTURAL TEST REPORT

Project Number: _____

Date Submitted: _____

Project Name: _____

Location: _____

Contractor: _____

System: **Fan No.:** _____

Description of Test Method: _____

_____

_____

Test Equipment: **Manufacturer:** _____

Model No.: _____ **Serial No.:** _____

For large systems, use the reverse side for a simple sketch of the entire duct system. Then use letter designations to indicate the various duct sections being tested at one time. Also use the reverse side for test comments.

Note that due to normal construction sequencing it is usually necessary to test risers separately prior to enclosing chases.

Design Data									Field Test Data					
Duct Test Location	Ductwork Shape		Duct Pressure Class	Allowable Ductwork Wall Deflection		Allowable Joint/ Reinforcement Deflection		Pressure (in. wc.) In Duct	Measured Ductwork Wall Deflection		Measured Joint/ Reinforcement Deflection		Perfor-med By/Date	Witnes-sed By/Date
	H	W		H	W	H	W		H	W	H	W		

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SECTION 23 33 00
AIR DUCT ACCESSORIES

PART 1 – GENERAL

1.01 SECTION INCLUDES

A. This section includes accessories used in the installation of duct systems. Included are the following topics:
   1. Manual Volume Dampers
   2. Turning Vanes
   3. Control Dampers
   4. Smoke Detectors
   5. Access Doors
   6. Flexible Duct
   7. Backdraft Dampers

1.02 RELATED WORK

A. Applicable provisions of Division 0 and 1 govern work under this Section.
B. Section 23 05 00 – Common Work Results for HVAC
C. Section 23 05 29 – Hanger and Supports for HVAC Piping and Equipment
D. Section 23 05 48 – Vibration and Seismic Controls for HVAC Piping and Equipment
E. Section 23 09 93 – Sequence of Operations for HVAC Controls
F. Section 23 31 00 – HVAC Ducts and Casings

1.03 SUBMITTALS

A. Refer to Section 23 05 00 – Common Work Results for HVAC, Submittals. In addition to the general content specified under Section 20 05 00 – Common Work Results for HVAC, supply the following submittals:
   1. Manual Volume Dampers
   2. Turning Vanes
   3. Control Dampers
   4. Smoke Detectors
   5. Access Doors
   6. Flexible Duct
B. Submit for all accessories and include dimensions, capacities, ratings, installation instructions, and appropriate identification.
C. Include certified test data on dynamic insertion loss, self-noise power levels, and aerodynamic performance of sound attenuators.

1.04 REFERENCE STANDARDS

A. NAIMA Fibrous Glass Duct Liner Standard
B. NFPA 90A Standard for Installation of Air Conditioning and Ventilating Systems
C. SMACNA HVAC Duct Construction Standards - Metal and Flexible, 2nd Edition, 1995
D. UL 214
E. UL 555 (6^{th} edition) Standard for Fire Dampers and Ceiling Dampers
F. UL 555S (4^{th} edition) Leakage Rated Dampers for Use in Smoke Control Systems

1.05 QUALITY ASSURANCE

A. Refer to Division 0 and 1 for equals and substitutions

1.06 OPERATION AND MAINTENANCE DATA

A. All operations and maintenance data shall comply with the submission and content requirements specified in Section 23 05 00 - Common Work Results for HVAC.

PART 2 – PRODUCTS

2.01 MANUAL VOLUME DAMPERS

A. Manufacturers: Ruskin, Vent Products, Air Balance.

B. Dampers must be constructed in accordance with SMACNA Fig. 2-12, Fig. 2-13, and notes relating to these figures, except as modified below.

C. Reinforce all blades to prevent vibration, flutter, or other noise. Construct dampers in multiple sections with mullions where width is over 48 inches. Use rivets or tack welds to secure individual components; sheet metal screws will not be accepted. Provide operators with locking devices and damper position indicators for each damper; use an elevated platform on insulated ducts. Provide end bearings or bushings for all volume damper rods penetrating ductwork constructed to a 3" w.c. pressure class or above.

2.02 TURNING VANES

A. Manufacturers: Aero Dyne, Anemostat, Barber-Colman, Hart & Cooley.

B. Construct turning vanes and runners for square elbows in accordance with SMACNA Fig. 2-3 and Fig. 2-4 except use only airfoil type vanes. Construct turning vanes for short radius elbows and elbows where one dimension changes in the turn in accordance with SMACNA Fig. 2-5 and Fig. 2-6.

2.03 CONTROL DAMPERS

A. Control dampers are specified in section 23 09 14.

2.04 SMOKE DETECTORS

A. Each duct smoke detector indicated on the contract documents shall be installed in cooperation with the electrical contractors. Duct detector locations shown are diagrammatic only and require pressure differential testing to insure proper smoke detector operation. Each duct detector housing and sampling tube kit installed shall be mounted and tested prior to the installation of the duct smoke detector. Air sampling tube installation shall be tested per the manufacturer's written instructions.

B. The Electrical contractor shall furnish the duct detector assembly and sampling tube kits sized for the installation locations indicated on the mechanical ductwork drawings. This contractor shall maintain possession of the duct detector smoke detection device.

C. The Electrical contractor shall provide smoke detector installation, interconnecting cabling, and testing of the smoke detection system in accordance with the specification.

D. Mechanical Contractor shall install detector housing and sampling tubes in accordance with the listing manufacturer's installation instructions, project documentation, and provide differential pressure testing and adjustments as described in Section 3 – Execution. **ACCESS DOORS**

A. Access door to be designed and constructed for the pressure class of the duct in which the door is to be installed. Doors in exposed areas shall be hinged type with cam sash lock. Hinges shall be steel full length continuous piano type. Doors in concealed spaces may be secured in place with cam sash latches. For both hinged and non-hinged doors provide sufficient number of camp sash latches to provide air tight seal when door is closed. Do not use hinged doors in concealed spaces if this will restrict access. Use minimum 1" deep 24 gauge galvanized steel double wall access doors with minimum 24 gauge galvanized steel frames. For non-galvanized ductwork, use minimum 1" deep double wall access door with frame that shall use materials of construction identical to adjacent ductwork. Provide double neoprene gasket that shall provide seals from the frame to the door and frame to the duct. When access doors are installed in insulated ductwork or equipment provide insulated doors with insulation equivalent to what is provided for adjacent ductwork or equipment. Access doors constructed with sheet metal screw fasteners will not be accepted.

B. Use insulated 1-1/2 hour UL 1978 listed and labeled access doors in kitchen exhaust ducts.

2.06 FLEXIBLE DUCT

A. Manufacturers: Anco Products, Clevaflex, Thermaflex, Flexmaster, Hart and Cooley.

B. Factory fabricated , UL 181 listed as a class 1 duct, and having a flame spread of 25 or less and a smoke developed rating of 50 or under in accordance with NFPA 90A.

C. Suitable for pressures and temperatures involved but not less than a 180°F service temperature and ±2 inch pressure class, depending on the application.

D. Duct to be composed of polyester film, aluminum laminate or woven and coated fiberglass fabric bonded permanently to corrosion resistant coated steel wire helix. Two-ply, laminated, and corrugated aluminum construction may also be used.
E. Where duct is specified to be insulated, provide a minimum 1 inch fiberglass insulation blanket with maximum thermal conductance of 0.23 K (75 degrees F.) and vapor barrier jacket of polyethylene or metalized reinforced film laminate. Maximum perm rating of vapor barrier jacket to be 0.1 perm.

2.07 BACKDRAFT DAMPERS

A. Manufacturers: Greenheck, Ruskin, Vert Products Company.
B. Description: Multiple-blade, parallel action gravity balanced, with center-pivoted blades of maximum 6-inch width, with sealed edges, assembled in rattle-free manner with 90-degree stop, steel ball bearings, and axles; adjustment device to permit setting for varying differential static pressure.
C. Frame: 0.063-inch thick extruded aluminum, with welded corners and mounting flange.
D. Blades: 0.050-inch thick aluminum sheet.
E. Blade Seals: Neoprene.
F. Blade Axles: Galvanized steel.
G. Tie Bars and Brackets: Galvanized steel.
H. Return Spring: Adjustable tension.

PART 3 UTION

3.01 MANUAL VOLUME DAMPERS

A. Install manual volume dampers in each branch duct and for each grille, register, or diffuser as far away from the outlet as possible while still maintaining accessibility to the damper. Install so there is no flutter or vibration of the damper blade(s).

3.02 TURNING VANES

A. Install turning vanes in all rectangular, mitered elbows in accordance with the latest SMACNA standards and/or manufacturer's recommendations.
B. Install double wall, airfoil, 2 inch radius vanes in ducts with vane runner length 18" or greater and air velocity less than 2000 fpm. Install double wall, airfoil, 4-1/2 inch radius vanes in ducts with vane runner length 18" or greater and air velocity 2000 fpm or greater.
C. If duct size changes in a mitered elbow, use single wall type vanes with a trailing edge extension. If duct size changes in a radius elbow or if short radius elbows must be used, install sheetmetal turning vanes in accordance with SMACNA Figure 2-5 and Figure 2-6.

3.03 CONTROL DAMPERS

A. Install dampers in locations indicated on the drawings, as detailed, and according to the manufacturer's instructions. Install blank-off plates or transitions where required for proper mixing of airstreams in mixing plenums. Provide adequate operating clearance and access to the operator. Install an access door adjacent to each control damper for inspection and maintenance.**SMOKE DETECTORS**

A. Duct smoke detector assemblies shall be tested and installed in accordance with the following:
   1. Post air system balancing – testing and adjusting for proper operation shall be done by the installing contractor with a pressure differential manometer.
   2. The differential pressure readings taken across the duct detector housing inlet and return tube shall be between 0.06 minimum and 1.28 maximum inches of water. Provide adjustment to sampling tube as needed to accomplish required pressure differential.
   3. Provide a written record of readings. Submit to the project engineer for review and acceptance prior to the final installation of the duct smoke detector.
   4. Initial tests shall be conducted to qualify installation location suitability. If initial testing concludes appropriate pressure differential may be available, contractor shall install the duct detector assembly complete in accordance with the installation details.

5. If acceptable differential pressure readings are not obtained, the inlet sampling tube may be rotated until the proper differential pressure readings are obtained. If inlet sampling tube rotation does not yield the proper differential pressure reading, the duct detector assembly shall be relocated further downstream at no additional cost to the owner.

B. Final installation wiring of the duct smoke detector shall not be completed by the electrical contractor until after the proper differential pressure reading has been obtained, documented, and approved.

C. Installation Requirements:

1. In addition to the manufactures instructions the following guidelines will be enforced:
   a. Duct detector may be installed in any wall of the duct unless otherwise restricted by the manufacturer's instructions.
   b. Cut inlet sampling tube length to suite dimension of duct. If duct is more than 18" wide drill an appropriate diameter hole directly opposite to support inlet sampling tube of lengths longer than 18". Sampling tube shall protrude no longer than 1" outside of duct wall.
   c. Contractor to note that air inlet sampling tubes are designed for differing duct widths employing air inlet holes in a quantity matching the duct width. Verify each inlet tube is appropriately sized for the duct width (typically 10 to 12 holes, each 0.193" diameter holes [#11 drill bit]).
   d. Angle cut return tube at a length as recommended by manufacturer if required. Support in accordance with manufacturer's recommendations.
   e. Position inlet holes facing upstream of airflow. This initial installation position shall be used as the starting point for differential pressure testing. If required adjust as stated in the testing/adjusting procedure above. Angle cut of return tube shall be orientated downstream of airflow.
   f. Once acceptable differential pressure readings are obtained, tubes shall be locked in place in accordance with the manufacturer's installation instructions.
   g. Duct detector assembly and sampling tubes shall be mounted rigidly to prevent noise, chatter, and mechanical fatigue. Any installation found unacceptable will be corrected at the installing contractor's expense.
   h. Inlet tubes installed protruding through duct walls greater in width of 18" shall have the sampling tube end plugged with the manufacturer furnished air stopper.
   i. Air leaks are unacceptable, the installing contractor shall provide gaskets, or duct sealant around inlet and outlet air tubes. Sealing around detector housing perimeter is not acceptable. Seal all duct wall penetration to pressure class rating of duct assembly.
   j. Once the detector is installed, verify correct differential pressure readings across sampling tubes and record. Install manufacturer furnished sampling tube filters.
   k. If duct is insulated, provide detector housing standoffs, equivalent in depth of the duct wall insulation, to rigidly support detector assembly. Seal any sampling tube air holes that are not inside duct wall and duct sealant and tape.
   l. At each duct detector installation location provide a service opening. Include a minimum 12" x 12" access door as specified in division 23.
2. After assembly is installed and tested, coordinate with electrical contractor and fire alarm vendor for smoke detector installation.**ACCESS DOORS**

A. Install access doors where specified, indicated on the drawings, and in locations where maintenance, service, cleaning or inspection is required. Examples include, but are not limited to motorized dampers, fire and smoke dampers, smoke detectors, fan bearings, heating and cooling coils, filters, valves, and control devices needing periodic maintenance.

B. Size and numbers of duct access doors to be sufficient to perform the intended service. Minimum access door size shall be 8 x 8 inch size for hand access, 18 x 18 inch size for shoulder access, or other size as indicated. Install access doors on both inlet and outlet sides of reheat coils as well as other duct mounted coils.

C. 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.

3.06 FLEXIBLE DUCT

A. Flexible duct may only be used for final connections of air inlets and outlets at diffuser, register, and grille locations. Where flexible duct is used, it shall be the minimum length required to make the final connections, but no greater than 6 feet in length, and have no more than one (1) 90 degree bend.
B. Secure inner jacket of flexible duct in place with stainless steel metal band clamp. Secure insulation vapor barrier jacket in place with steel or nylon draw band. Sheetmetal screws and/or duct tape will not be accepted.
C. Flexible duct used to compensate for misalignment of main duct or branch duct will not be accepted.
D. Individual sections of flexible ductwork shall be of one piece construction. Splicing of short sections will not be accepted.
E. Flexible ductwork used as transfer duct shall be sized for a maximum velocity of 300 fpm.
F. Penetration of any partition, wall, or floor with flexible duct will not be accepted.

3.07 TRAINING

A. See Section 23 05 00 – Common Work Results for HVAC for general training requirements.
B. In addition to the training provided in Section 23 05 00 – Common Work Results for HVAC, provide an additional 1 hours of training for each type of duct accessory provided on the project.

END OF SECTION

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SECTION 23 37 13
DIFFUSERS, REGISTERS & GRILLES

PART 1 - GENERAL

1.01 SCOPE OF WORK

A. Base Bid: Unless noted otherwise, the Ventilating Contractor shall provide all labor and materials for a complete system in this specification section.

1.02 SECTION INCLUDES

A. This section includes specifications for air terminal equipment. Included are the following topics:
   1. Linear Slot Diffusers
   2. Linear Bar Diffusers and Grilles
   3. Round Ceiling Diffusers
   4. Perforated Ceiling Diffusers
   5. Square Ceiling Diffusers - High Performance
   6. Square Ceiling Diffusers - Plaque
   7. Square Ceiling Diffusers
   8. Plenum Slot Diffusers - 180 Degree Adjustable
   9. Plenum Slot Diffusers – with Gasketed Blade
   10. Security Grille
   11. Side-Wall Registers and Grilles
   12. Eggcrate Grille
   13. Heavy Duty Side-wall Return/Exhaust Grille
   14. Door Grille
   15. Drum Diffuser
   16. Laboratory Supply Diffuser
   17. Perforated Duct Diffuser

1.03 RELATED WORK

A. Applicable provisions of Division 0 and 1 govern work under this section.
B. Section 23 05 00 – Common Work Results for HVAC
C. Section 23 05 93 – Testing, Adjusting and Balancing for HVAC
D. Section 23 31 00 – HVAC Ducts and Casings
E. Section 23 33 00 – Air Duct Accessories

1.04 SUBMITTALS

A. Refer to Section 23 05 00 – Common Work Results for HVAC, Submittals. In addition to the general content specified under Section 20 05 00 – Common Work Results for HVAC, supply the following submittals:
   1. Linear Slot Diffusers
   2. Linear Bar Diffusers and Grilles
   3. Round Ceiling Diffusers
   4. Perforated Ceiling Diffusers
   5. Square Ceiling Diffusers - High Performance
   6. Square Ceiling Diffusers - Plaque
   7. Square Ceiling Diffusers
   8. Plenum Slot Diffusers - 180 Degree Adjustable
   9. Plenum Slot Diffusers – with Gasketed Blade
   10. Security Grille
   11. Side-Wall Registers and Grilles
   12. Eggcrate Grille

13. Heavy Duty Side-wall Return/Exhaust Grille
14. Door Grille
15. Drum Diffuser
16. Laboratory Supply Diffuser
17. Perforated Duct Diffuser

B. Furnish submittal information including, but not limited to, the following:
1. Manufacturer's name and model number
2. Identification as referenced in the documents
3. Capacities/ratings
4. Materials of construction
5. Sound ratings
6. Dimensions
7. Finish
8. Color selection charts where applicable
9. Manufacturer's installation instructions
10. All other appropriate data

1.05 REFERENCE STANDARDS

A. NFPA 90A Installation of Air Conditioning and Ventilation Systems.
B. UL 181 Factory-Made Air Ducts and Connectors.
C. ARI-ADC Standard 880

1.06 QUALITY ASSURANCE

A. Refer to Division 0 and 1 for equals and substitutions.

1.07 DESIGN CRITERIA

A. All performance data shall be based on tests conducted in accordance with Air Diffusion Council (ADC) Test Code 1062 GRD 84.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Manufacturers: Carnes, Krueger, Titus, Metal-Aire, and E.H. Price, and United Sheet Metal.
B. Acceptable manufacturers for specific products are listed under each item.

2.02 LINEAR SLOT DIFFUSERS

A. Titus Series ML, Carnes Series CH, Metal Aire Series 6000, Price Series SDS
B. Extruded aluminum with frame type appropriate to installation with diffuser elements being removable from frame. Both air pattern and flow rate adjustment with air pattern having full 180-degree adjustment. Single slot diffuser vanes segmented on 2 or 3 foot centers. Refer to architectural plan for ceiling installation conditions types. It is the responsibility of the contractor to coordinate frame and border of diffusers with general contractor.
C. Diffuser lengths and slot sizes as shown on drawings and/or as scheduled.
D. White, baked enamel finish or powder coat finish, unless otherwise indicated. Flat black diffuser vanes and frame interior.
E. Provide diffusers with uninsulated galvanized steel plenum. Plenums constructed for specific diffuser frame & border type. Provide round or oval inlet collar designed to fit standard flexible duct sizes.

2.03 LINEAR BAR DIFFUSERS AND GRILLES

A. Titus Series CT, Carnes CC, CT or CW, Metal Aire Series 2000, Price series LBP.
B. Extruded aluminum with frame type appropriate to side wall, sill or ceiling installation as indicated.
C. Diffuser and grille lengths, blade spacing and blankoff strips as shown on drawings and/or as scheduled.
D. Refer to architectural plan for ceiling installation conditions types. It is the responsibility of the contractor to coordinate frame and border of diffusers with general contractor.

E. Where frame and border types allow provide diffusers used for supply air with straightening or equalizing vanes. Fixed blades at 0 or 15 degree deflection as scheduled. Bar support maximum 9" spacing.
F. White, anodized aluminum finish unless otherwise indicated
G. Provide alignment strips/wires for end-to-end joining of sections for a continuous appearance when scheduled lengths exceed standard manufacturer lengths.

2.04 ROUND CEILING DIFFUSERS

A. Titus Series TMRA, Carnes Series SSAA, Metal Aire Series 3100, Price Series RCDA
B. Refer to architectural plan for ceiling installation conditions types. It is the responsibility of the contractor to coordinate frame and border of diffusers with general contractor.
C. Spun aluminum or steel with uniform 360º discharge pattern.
D. Adjustable inner cones surrounded by a ceiling plate collar designed to reduce ceiling smudges.
E. Refer to architectural plan for ceiling installation conditions types. It is the responsibility of the contractor to coordinate frame and border of diffusers with general contractor.
F. Diffusers as shown on drawings and/or as scheduled.
G. White, baked enamel finish or powder coat finish, unless otherwise indicated.

2.05 PERFORATED CEILING DIFFUSERS

A. Titus model PSS, Carnes series SP or SL, Price series PDS, and Metal Aire series 7600
B. Aluminum unless otherwise indicated, and furnished with frame type appropriate to installation.
C. Field adjustable pattern controllers accessible through removable or hinged face plate. Pattern controller mounted directly under the neck of the diffuser and fully adjustable for either side blow or corner blow pattern.
D. Refer to architectural plan for ceiling installation conditions types. It is the responsibility of the contractor to coordinate frame and border of diffusers with general contractor.
E. Provide round or square neck duct adapters for each unit for top connection or side connection as appropriate to the space.
F. White, baked enamel finish or powder coat finish, unless otherwise indicated. Flat black diffuser vanes and frame interior.

2.06 SQUARE CEILING DIFFUSERS - HIGH PERFORMANCE

A. High performance type diffuser incorporating short throws and low NC levels. Titus model TMS, Carne series SF, Price model SCD, Metal Aire series 5800, and Krueger series 1400.
B. Diffusers to be aluminum unless otherwise indicated, louvered face furnished with frame type appropriate to installation. Refer to architectural plan for ceiling installation conditions types. It is the responsibility of the contractor to coordinate frame and border of diffusers with general contractor.
C. Diffuser shall have throw characteristics of a round diffuser having a 360º horizontal blow pattern.
D. Louver cones shall be one-piece construction with no corner joints.
E. White, baked enamel finish or powder coat finish, unless otherwise indicated.

2.07 SQUARE CEILING DIFFUSERS - PLAQUE

A. Titus model OMNI, Carnes series SFPA/SHPA, Price model SMDP, Metal Aire series 5750, and Krueger series PLQ/5PLQ.
B. Aluminum unless otherwise indicated, louvered face furnished with frame type appropriate to installation. Refer to architectural plan for ceiling installation conditions types. It is the responsibility of the contractor to coordinate frame and border of diffusers with general contractor.
C. Directional blow pattern as shown on the drawings and/or as scheduled.
D. One-piece removable square face plaque with one-piece backpan.
E. White, baked enamel finish or powder coat finish, unless otherwise indicated.

2.08 SQUARE CEILING DIFFUSERS

A. Titus model TDC/TDC-AA, Carnes series SK or SE, Price model SMD/AMD, Metal Aire series 5500 or 5500S, and Krueger series S.

B. Aluminum unless otherwise indicated, louvered face furnished with frame type appropriate to installation. Refer to architectural plan for ceiling installation conditions types. It is the responsibility of the contractor to coordinate frame and border of diffusers with general contractor.
C. Directional blow pattern as shown on the drawings and/or as scheduled.
D. One-piece construction louver cones with no corner joints.
E. White, baked enamel finish or powder coat finish, unless otherwise indicated.

2.09 PLENUM SLOT DIFFUSER – 180 DEGREE ADJUSTABLE

A. Titus model TBD-30, Carnes model DA, Price model TBD3, Metal Aire series 6600, and Krueger series PTBA, Raymon-Donco Series SAT/XC.
B. Steel, furnished with T-bars compatible with ceiling components. Vane air pattern and flow rate adjustment with air pattern having full 180-degree adjustment.
C. Refer to architectural plan for ceiling installation conditions types. It is the responsibility of the contractor to coordinate frame and border of diffusers with general contractor.
D. Provide 24 gauge galvanized steel uninsulated plenum. Provide round or oval inlet collar designed to fit standard flexible duct sizes.
E. Double metal thickness slot face.
F. White, baked enamel finish or powder coat finish, unless otherwise indicated. Flat black diffuser vanes and frame interior.

2.10 PLENUM SLOT DIFFUSER - WITH GASKETED BLADE

A. Titus model TBD-80, Carnes model DA, Price model TBD4, Metal Aire series PHP, and Krueger series PTBS, Raymon-Donco Series BA/BS.
B. Steel, furnished with T-bars compatible with ceiling components. Extruded aluminum pattern with a gasket on top edge to form a seal against the plenum wall or slot divider. Pattern control field adjustable from vertical to horizontal discharge.
C. Provide 24 gauge galvanized steel uninsulated plenum,. Provide round or oval inlet collar designed to fit standard flexible duct sizes.
D. Double metal thickness slot face.
E. White, baked enamel finish or powder coat finish, unless otherwise indicated. Flat black diffuser vanes and frame interior. Refer to architectural plan for ceiling installation conditions types. It is the responsibility of the contractor to coordinate frame and border of diffusers with general contractor.

2.11 SECURITY GRILLE

A. Titus model SG-PR, Carnes RSPA 25, Metal Aire model SG RP, Krueger model 310.
B. Steel 3/16" face plates with 5/16" diameter holes (maximum) on 7/16" staggered centers.
C. Steel 3/16" grille sleeve with welded seams. Sleeve length as shown on the drawings and/or as scheduled.
D. White, baked enamel finish or powder coat finish, unless otherwise indicated. Flat black diffuser vanes and frame interior. Refer to architectural plan for ceiling installation conditions types. It is the responsibility of the contractor to coordinate frame and border of diffusers with general contractor.

2.12 SIDE-WALL REGISTERS AND GRILLES

A. Titus series 300 (supply) and series 350 (return/exhaust), Carnes model R series, Price model 520 (Supply) or 530 (return/exhaust), Metal Aire series V4000 or H4000, Krueger series 880.
B. Aluminum unless otherwise indicated, with frame type appropriate to installation. Refer to architectural plan for ceiling installation conditions types. It is the responsibility of the contractor to coordinate frame and border of diffusers with general contractor.
C. Double deflection type blade supply registers and supply grilles allow deflection adjustment in all direction.
D. Opposed blade volume control damper supply registers, operable from face.
E. Fixed blade 0 degree core return and exhaust registers and grilles.
F. Opposed blade volume control damper return registers, operable from face.
G. Register and grille sizes as shown on drawings and/or as scheduled.
H. White, baked enamel finish or powder coat finish, unless otherwise indicated.
I. Screw holes on surface counter sunk to accept recessed type screws.

2.13 EGGCRATE GRILLE

A. Titus model 50, Carnes model RAE or RAT, Price model 80, Metal Aire model CC, Krueger model EGC.
B. Aluminum construction with frame type appropriate to installation.
C. Grille face 1/2" x 1/2" or 1" x 1" grid pattern 1" deep with a minimum of 85% free area.
D. Grille sizes and finishes as shown on drawings and/or as scheduled.
E. White, baked enamel finish or powder coat finish, unless otherwise indicated..
F. Refer to architectural plan for ceiling installation conditions types. It is the responsibility of the contractor to coordinate frame and border of diffusers with general contractor.
G. Screw holes on surface counter sunk to accept recessed type screws.

2.14 HEAVY DUTY SIDE-WALL RETURN/EXHAUST GRILLE

A. Titus model 30, Carnes Sturdicore, Price 91, Metal Aire series SBG, Krueger series 480, Price model 91.
B. Grille border 16-gauge steel and grille blades 14-gauge steel suitable for gymnasium applications.
C. Fixed blade 0 degree.
D. Grille sizes as shown on drawings and/or as scheduled.
E. Refer to architectural plan for ceiling installation conditions types. It is the responsibility of the contractor to coordinate frame and border of diffusers with general contractor.
F. White, baked enamel finish or powder coat finish, unless otherwise indicated.

2.15 DOOR GRILLE

A. Titus Series 700, Carnes Series RF or RG, Metal Aire Series DG, Price ATG/STG
B. Aluminum. Sight tight.
C. Grille sizes, frame types, and finishes as shown on drawings and/or as scheduled.
D. White, baked enamel finish or powder coat finish, unless otherwise indicated.

2.16 DRUM DIFFUSER

A. Krueger series DPL, Metal Aire RH, or Price HCD
B. Extruded aluminum with adjustable cylindrical drums and deflecting vanes. Minimum 60° angular adjustment of jet centerline rotating drum.
C. White, baked enamel finish or powder coat finish, unless otherwise indicated.

2.17 LABORATORY SUPPLY DIFFUSER

A. Krueger TAD, EH Price RFD (radial face type)
B. 304 stainless steel with opposed blade volume control damper. Volume dampers steel, adjustable from diffuser face.
C. Diffuser removable perforated face with directional blades. Non-aspirating radial air pattern. Configured with air supply plenums with inlet collars to assure uniform discharge velocity over faces of units.

2.18 PERFORATED DUCT DIFFUSER

A. United Sheet Metal Series SP.
B. Perforated, spiral, paintable galvanized steel (ASTM-A257), 24 gauge lock seam duct with standing rib. Perforations open area of 23 percent.
C. Duct sizes, types, and accessories as shown on drawings and/or as scheduled. Refer to architectural plan for ceiling installation conditions types. It is the responsibility of the contractor to coordinate frame and border of diffusers with general contractor.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Install grilles, registers and diffusers as shown on drawings and according to manufacturer's instructions.

B. Furnish diffusers with equalizing grids where it is not possible to maintain minimum 2 duct diameter straight duct into diffuser. Equalizing grids shall consist of individually adjustable vanes designed for equalizing airflow into diffuser neck and providing directional control of airflow.
C. Unless otherwise indicated, size ductwork drops to diffusers or grilles to match unit collar size.
D. Seal connections between ductwork drops and diffusers/grilles airtight.
E. Blank off unused portion of linear slot diffusers and linear bar diffusers and grilles.
F. Where diffusers, registers and grilles cannot be installed to avoid seeing inside duct, paint inside of duct with flat black paint to reduce visibility.
G. In clean rooms and animal holding rooms, caulk space between diffuser or grille and ceiling or wall to be air and watertight. User clear, non-hardening silicone sealant compatible with ceiling or wall surfaces. Sealant shall be resistant to microbiological growth.

END OF SECTION

SECTION 23 41 00
PARTICULATE AIR FILTRATION

PART 1 - GENERAL

1.01 SCOPE OF WORK
A. Base Bid: Unless noted otherwise or referenced from another specification section by a different contractor, the Ventilating Contractor shall provide all labor and materials for a complete system in this specification section.

1.02 SECTION INCLUDES
A. This section includes specifications for air system filters. Included are the following topics:
   1. MERV 8 Filters
   2. Housings for MERV 8 Filters

1.03 RELATED WORK
A. Applicable provisions of Division 0 and 1 govern work under this section.
B. Section 23 05 00 – Common Work Results for HVAC
C. Section 23 07 00 – HVAC Insulation
D. Section 23 81 23 – Computer Room Air-Conditioners

1.04 SUBMITTALS
A. Refer to Section 23 05 00 – Common Work Results for HVAC, Submittals. In addition to the general content specified under Section 20 05 00 – Common Work Results for HVAC, supply the following submittals:
   1. MERV 8 Filters
   2. Housings for MERV 8 Filters
B. Include data concerning dimensions, materials, efficiencies, installation instructions and appropriate identification.
C. Independent test reports verifying filter performance, test procedures and ratings.

1.05 REFERENCE STANDARDS
A. ASHRAE Standard 52
B. UL 181 – Standard for Factory-Made Air Ducts and Air Connectors
C. UL 586 – Standard for High Efficiency Particulate Air Filter Units
D. UL 900 – Standard for Air Filter Units

1.06 QUALITY ASSURANCE
A. Refer to Division 0 and 1 for equals and substitutions.

1.07 DESIGN CRITERIA
A. Use UL Class 1 or Class 2 filters unless noted otherwise.(Reference applicable UL standard referenced)
B. Efficiencies indicated in this section are based on ASHRAE Standard 52.
C. Fan motors have been selected to operate against the resistance of dirty filters as specified in this section.

1.08 OPERATION AND MAINTENANCE DATA
A. All operations and maintenance data shall comply with the submission and content requirements specified in Section 23 05 00 – Common Work Results for HVAC.

PART 2 – PRODUCTS

2.01 MANUFACTURERS

A. American Air Filter, Barnebey-Cheney, Cambridge, Continental, Flanders, Camil-Farr, Mine Safety Appliances, Research Products, BLC Industries.
B. Provide fixed filter blockoffs as required to prevent air bypass around filters. Blockoffs shall not need to be removed during filter replacement.

2.02 MERV 8 FILTERS

A. Use 4" thick, pleated panels, 100% synthetic, self-supported media fully bonded and sealed in cardboard frame.
B. Media nominal rating to be 500 FPM face velocity, 0.20 inch WG initial resistance, 1.0 inches WG recommended final resistance., Average arrestance of filter media shall be 90-92%
C. Furnish a side access housing or holding frame.

2.03 HOUSINGS FOR MERV 8 FILTERS

A. Housing or holding frame to be of the same manufacturer as filter media or provided by the air handling unit manufacturer. Contractor fabricated housings or filter racks will not be accepted. Casing and tracks constructed of galvanized or enameled steel or aluminum. Provide access to the media tracks from outside the casing so media and be readily changed.

PART 3 – EXECUTION

3.01 INSTALLATION

A. Where air handling equipment is to be used for temporary heating or ventilation of a facility, do not operate the equipment until specified filter media has been installed. Contractor shall be responsible for maintaining the cleanliness of air handling apparatus and air distribution systems during construction through regular inspection and changing of filter media throughout the construction period.
B. Where air handling apparatus is used during the construction period, install new filter media prior to start of air balancing. Additionally, deliver one new set of media to the owner prior to substantial completion.
C. Install units as shown on drawings and details according to manufacturer's instructions.
D. Reinforce filter holding frames per manufacturer's instructions.
E. Maintain necessary clearance for changing filters.

END OF SECTION

SECTION 23 81 23
COMPUTER ROOM AIR-CONDITIONERS

PART 1 - GENERAL

1.01 SUMMARY

A. The Owner will direct purchase the units. The manufacturer shall be responsible to deliver the units to the project site. Refer to general specifications for location. The installing Mechanical Contractor for Bid Package 3 shall install the units under separate contract. The Owner does not own the units until start up is complete to the Owner's satisfaction.

B. These specifications describe requirements for a precision environmental control system. The system shall be designed to maintain temperature conditions in the rooms containing electronic equipment.

C. The manufacturer shall design and furnish all equipment to be fully compatible with heat dissipation requirements of the room.

1.02 DESIGN REQUIREMENTS

A. The computer room air conditioner shall be a self-contained factory assembled unit with upflow air delivery and rear ducted return. The system shall have cooling capacity as scheduled based on an entering air temperature of 72 °F (°C) dry bulb and 60°F (°C) wet bulb. The unit is to be supplied with 460 volt 3 ph 60 Hz electrical service.

1.03 SUBMITTALS

A. Submittals shall be provided by unit manufacturer with the proposal and shall include: Single-Line Diagrams; Dimensional, Electrical, and Capacity Data; Piping and Electrical Connection Drawings.

B. Mechanical Contractor shall request a copy of the approved Submittal from the Owner or Engineer.

1.04 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

B. Energy-Efficiency Ratio: Equal to or greater than prescribed by ASHRAE/IESNA 90.1, "Energy Efficient Design of New Buildings except Low-Rise Residential Buildings."

C. Coefficient of Performance: Equal to or greater than prescribed by ASHRAE/IESNA 90.1, "Energy Efficient Design of New Buildings except Low-Rise Residential Buildings."

1.05 COORDINATION

A. Mechanical Contractor for Bid Package 3 shall coordinate layout and installation of computer-room air-conditioning units and suspension system with other construction that penetrates ceilings or is supported by them, including light fixtures, HVAC equipment, fire-suppression system, and partition assemblies.

1.06 WARRANTY

A. The manufacturer shall provide all parts warranties listed herein. The installing Mechanical Contractor shall provide all labor warranties listed herein.

B. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of computer-room air-conditioning units that fail in materials or workmanship within one year of start-up and extend parts warranty to cover five years.

C. Warranty Period for Humidifiers: Manufacturer's standard, but not less than three years from date of Substantial Completion.

D. Warranty Period for Control Boards: Manufacturer's standard, but not less than three years from date of Substantial Completion.

1.07 EXTRA MATERIALS

A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
   1. Fan Belts: One set for each belt-drive fan.
   2. Filters: One set of filters for each unit.

PART 2 PRODUCTS

2.01 FLOOR-MOUNTING UNITS 6 TONS AND LARGER

A. Manufacturers:
   1. Liebert Corporation.

B. Description and Assembly: Packaged, factory assembled, prewired, and prepiped; consisting of cabinet, fans, filters, and controls.
   1. Assembly: Up-flow air delivery, in draw-through configuration.

C. Cabinet and Frame: Welded steel, suitably braced for rigidity, supporting other mechanical equipment and fittings; with floor stand with adjustable legs and vibration isolation pads.
   1. Doors and Access Panels: Galvanized steel with polyurethane gaskets, hinges, and concealed fastening devices.
   2. Insulation: Thermally and acoustically insulate cabinet interior with 1-inch thick duct liner.
   3. Finish of Exterior Surfaces: Baked-on, textured vinyl enamel, color as selected from manufacturer's standard colors.

D. Filter Chamber
   1. Filter: Pleated, lofted, nonwoven, reinforced cotton fabric; supported and bonded to welded-wire grid; enclosed in cardboard frame with 2-inch thick, disposable, glass-fiber prefilter.
      a. Nominal Thickness: 2 inches.
      b. Dust-Spot Efficiency: 30 percent.
      c. Weight Arrestance: 90 to 92 percent.
      d. Initial Resistance at 500-FPM Face Velocity: 0.30-inch wg.
      e. Recommended Final Resistance: 1-inch wg.

E. Fan Section
   1. The fan shall be the centrifugal type, double width double inlet, and shall be factory-balanced as a completed assembly. The shaft shall be heavy duty steel with self-aligning ball bearings with a minimum life span of 100,000 hours. The fan motor shall be mounted on an adjustable slide base. The drive package shall be two-belt, variable speed, sized for 200% of the fan motor horsepower. The fans shall be located to draw air over the A-frame coil to ensure even air distribution and maximum coil performance.

F. Microprocessor Control With Large Graphic Display
   1. The system unit control shall be factory-set for Intelligent control which uses “fuzzy logic” and “expert systems” methods. Proportional and Tunable PID shall also be user selectable options. Internal unit component control shall include the following:
      a. System Auto Restart – The auto restart feature will automatically restart the system after a power failure. Time delay is programmable.
      b. Sequential Load Activation – On initial startup or restart after power failure, each operational load is sequenced with a minimum of one second delay to minimize total inrush current.
      c. Hot Water Flush Cycles – Hot water reheat coils and Econ-O-Coils are periodically flushed to prevent a buildup of contaminants.
      d. Predictive Humidity Control – calculates the moisture content in the room and prevents unnecessary humidification and dehumidification cycles by responding to changes in dew point temperature.
   2. The Microprocessor control processor shall be microprocessor based with a 320x240 dot matrix graphic front monitor display panel and control keys for user inputs mounted in an ergonomic, aesthetically pleasing housing.

3. System View - Status Overview: “System View” shall display a summary of operation for the total number of operating units within a Unit-to-Unit (U2U) configuration.
4. Spare Parts List: Menu shall include a list of critical spare parts, their quantity and part numbers.
5. Unit Diary: Menu shall include a free field area within the unit memory where unit history may be stored for reference.
6. Control
    a. The control system shall allow programming of the following room conditions:
        1) Temperature Setpoint: 65-85°F (18-29°C)
        2) Temperature Sensitivity: ±1° to 9.9°F (0.6 to 5.6°C) in 0.1°F (0.1°C) increments
    b. All setpoints shall be adjustable from the individual unit front monitor panel. Temperature and humidity sensors shall be capable of being calibrated using the front monitor panel controls to coordinate with other temperature and humidity sensors in the room.
    c. In addition, the system shall provide the following internal controls:
7. System Auto-Restart
    a. For startup after power failure, the system shall provide automatic restart with a programmable (up to 9.9 minutes in 6-second increments) time delay. Programming can be performed either at the unit or from the central site monitoring system.
8. Sequential Load Activation
    a. During startup or after a power failure, the control shall sequence operational load activation to minimize inrush current. Systems allowing multiple loads to start simultaneously are unacceptable.
9. Front Monitor Display Panel
    a. The control shall provide a front monitor LCD, backlit display panel with 4 rows of 20 characters with adjustable contrast. This display (along with nine front-mounted control keys) shall be the only operator interface required to obtain all available system information such as room conditions, operational status, alarms, control and alarm setpoints and all user selections including alarm delays, sensor calibration, DIP switch selections and diagnostics. All indicators shall be in language form. No symbols or codes shall be acceptable.
10. Alarms
    a. The Microprocessor control shall activate an audible and visual alarm in event of any of the following conditions:
        1) High Temperature
        2) Low Temperature
        3) High Humidity
        4) Low Humidity
        5) Main Fan Overload (opt)
        6) Change Filters
        7) Loss of Air Flow
        8) Loss of Power
        9) Custom Alarm (#1 to #4)
    b. Custom alarms are four customer accessible alarm inputs to be indicated on the front panel. Custom alarms can be identified with prepared (programmed) labels for the following frequently used inputs:
        1) Leak Under Floor
        2) Smoke Detected
        3) Loss of Water Flow
        4) Standby Unit On
    c. User customized text can be entered for two of the four custom alarms.
    d. Each alarm (unit and custom) can be separately enabled or disabled, selected to activate the common alarm, and programmed for a time delay of 0 to 255 seconds.
11. Audible Alarm
    a. The audible alarm shall annunciate any alarm that is enabled by the operator.

12. Common Alarm
    a. A programmable common alarm shall be provided to interface user selected alarms with a remote alarm device.
    b. Temperature Control Contractor in Bid Package 3 shall connect all alarms to the existing DDC system front end. Temperature Control Contractor shall maintain existing email notification to Owner personnel.
13. Remote Monitoring
    a. All alarms shall be communicated to the DDC system with the following information: date and time of occurrence, unit number and current temperature and humidity.
14. Diagnostics
    a. The control system and electronic circuitry shall be provided with self-diagnostics to aid in troubleshooting. The microcontroller board shall be diagnosed and reported as pass/not pass. Control inputs shall be indicated as on or off at the front monitor panel. Control outputs shall be able to be turned On or Off from the front monitor panel without using jumpers or a service terminal.
15. Data Collection
    a. The control system shall maintain accumulative operating hours of compressors, fan motor and Econ-O-Coil. The 10 most recent alarms shall be retained.
16. Communication
    a. The Microprocessor control shall be compatible with DDC remote monitoring and setpoint adjustment. Refers to Sheet M1.2.

G. Chilled Water Control Valve (by unit manufacturer)
    1. The water circuit shall include a 2-way modulating valve. The Microprocessor control positions the valve in response to room conditions.

H. A-Frame Chilled Water Coil
    1. The cooling coil shall be of A-frame design with a minimum of 11.66 sq. ft. (sq.m.) face area, 6 rows deep.
    2. The coil shall be controlled by a 3-way modulating control valve. It shall be constructed of copper tubes and aluminum fins and have a maximum face velocity of 494 ft. per minute (m/s) at 5500 CFM (CMH).
    3. The water circuit shall be designed to distribute water into the entire coil face area. The coil shall be supplied with 45 °F (°C) entering water temperature. The coil pressure drop shall not exceed 10 PSI (kPa). Coil water flow shall be as scheduled. The entire coil assembly shall be mounted in a stainless steel condensate drain pan.

I. Flow Switch
    1. The flow switch shall activate the alarm system should the chilled water supply be interrupted. The switch shall be factory mounted and wired.

J. Variable Speed Drive
    1. A variable speed drive (VSD) shall be provided to reduce energy consumption and provide dehumidification. The fan motor speed shall be varied from 100% to 60% of rated speed in response to damper control. This shall be controlled automatically by the Microprocessor control system control.

K. Disconnect Switch—Locking Type
    1. The manual disconnect switch shall be mounted in the high voltage section of the electrical panel. The switch shall be accessible from the outside of the unit with the door closed, and prevent access to the high voltage electrical components until switched to the "OFF" position.

L. High Temp Stat
    1. The high temperature adjustable stat shall immediately shut down the environmental control system when activated. On the immediate shut down, the unit's controls shall activate the back-up unit. Refer to controls sequence. The high temp stat shall be mounted in the electrical panel with the sensing element in the return air.

M. Hot Water Reheat
   1. The hot water reheat control valve shall be by the unit manufacturer. The hot water reheat system is factory piped with a two-way modulating control valve and cleanable Y-strainer. The reheat coil is of copper tube and aluminum fin construction.

PART 3 EXECUTION

3.01 INSTALLATION OF PRECISION COOLING UNITS

A. General
   1. Installing Mechanical Contractor in Bid Package 3 shall install precision cooling units in accordance with manufacturer's installation instructions. Install units plumb and level, firmly anchored in locations indicated, and maintain manufacturer's recommended clearances.

B. Electrical Wiring
   1. Installing Electrical Contractor in Bid Package 3 shall install and connect electrical devices furnished by manufacturer but not specified to be factory mounted. Furnish copy of manufacturer's electrical connection diagram submittal to electrical contractor.

C. Piping Connections
   1. Installing Mechanical Contractor in Bid Package 3 shall install and connect devices furnished by manufacturer but not specified to be factory-mounted. Furnish copy of manufacturer's piping connection diagram submittal to piping contractor.

D. Wiring communications to BAS shall be Temperature Control Contractor.

3.02 FIELD QUALITY CONTROL

A. Startup mainframe coolant units in accordance with manufacturer's startup instructions. Test controls and demonstrate compliance with requirements.

3.03 TRAINING

A. Provide technician for minimum of 16 hours to train owner's maintenance personnel.

END OF SECTION

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SECTION 23 82 00
HEATING AND COOLING TERMINAL UNITS

PART 1 **– GENERAL**

1.01 **SCOPE OF WORK**

A. Base Bid: Unless noted otherwise, the Mechanical Contractor shall provide all labor and materials for a complete system in this specification section.

1.02 **SECTION INCLUDES**

A. This section includes specification for heating and cooling terminal equipment using water and/or steam as the source. Included are the following topics:
   1. Unit Heaters

1.03 **RELATED WORK**

A. Applicable provisions of Division 0 and 1 govern work under this Section.
B. Section 23 05 00 – Common Work Results for HVAC
C. Section 23 05 13 – Common Motor Requirements for HVAC Equipment
D. Section 23 05 23 – General Duty Valves for HVAC Piping
E. Section 23 09 93 – Sequence of Operations for HVAC Controls

1.04 **SUBMITTALS**

A. Refer to Section 23 05 00 – Common Work Results for HVAC. In addition to the general content specified under Section 23 05 00 – Common Work Results for HVAC, supply the following submittals:
   1. Unit Heaters
B. Include dimensions, capacities, materials of construction, ratings, weights, wiring diagrams, and appropriate identification for all equipment in this section. Include color selection chart where applicable.

1.05 **REFERENCE STANDARDS**

A. ARI 210 Standard for Unitary Air-Conditioning Equipment
B. ARI 410 Standard for Forced-Circulation Air-Cooling and Air-Heating Coils
C. CS 140

1.06 **QUALITY ASSURANCE**

A. Refer to Division 0 and 1 for equals and substitutions

1.07 **DESIGN CRITERIA**

A. Forced Circulation Coils: Ratings certified in accordance with ARI 410.
B. Electrical Equipment and heaters shall be UL listed for the service specified.
C. Electrical components and work must be in accordance with National Electrical Code.

1.08 **OPERATION AND MAINTENANCE DATA**

A. All operations and maintenance data shall comply with the submission and content requirements specified in Section 23 05 00 – Common Work Results for HVAC.

PART 2 **– PRODUCTS**

2.01 **UNIT HEATERS**

A. Manufacturers: Modine, McQuay, Trane, Airtherm.
B. Construct casing of 18 gauge steel with baked enamel finish and heating elements of copper tubing with aluminum fins. Use aluminum fan blades, balanced for quiet operation. Provide safety guard for fan/drive assembly. Test coils units at 200 psig.

C. Furnish adjustable horizontal and vertical discharge louvers for units with horizontal discharge. Provide an adjustable cone diffuser for projection units with vertical discharge.
D. Furnish motors with characteristics as scheduled. Single phase, 120 volt motors to be permanently lubricated and provided with thermal overload protection.

PART 3 **– EXECUTION**

3.01 **INSTALLATION**

A. Install units in accordance with manufacturer's installation instructions.
B. Install branch water piping to each unit with a minimum of three elbows to allow for expansion and contraction of the piping system.
C. After installation, provide protective covers to prevent accumulation of dirt on units during balance of construction.

3.02 **UNIT HEATERS**

A. Suspend units from building structure and as high as possible to maintain headroom beneath units; supporting from piping systems will not be accepted.
B. Install a drain valve on the coil side of the shutoff valves for each hot water unit heater.

3.03 **TRAINING**

A. See Section 23 05 00 – Common Work Results for HVAC for general training requirements.
B. In addition to the training provided in Section 23 05 00 – Common Work Results for HVAC, provide an additional 1 hours of training for each type of heating and cooling terminal unit provided on the project.

END OF SECTION

SECTION 26 05 00
COMMON WORK RESULTS FOR ELECTRICAL

PART 1 **- GENERAL**

1.01 **SCOPE OF WORK**

A. Base Bid: Electrical Contractor provide: It is the intent of these specifications to provide complete and workable electrical systems as shown on the accompanying plans and as specified herein except such parts as are specifically exempted herein. Provide all necessary supervision, coordination, labor, materials, equipment, fixtures, dryage, hoisting, tools, transportation, plant services and facilities, machinery and connections to utilities for the installation of complete and operable electrical systems. If details or special conditions are required in addition to those shown on drawings, provide all material and equipment usually furnished with such systems or required to complete their installation, whether noted in plans and specification or not.

B. Materials and labor shall be new (unless noted otherwise), first class and workmanlike and shall be subject at all times to the A/E's inspections, tests and approval from the commencement until the acceptance of the completed work.

C. The layout shown on the drawings is necessarily diagrammatic but shall be followed as closely as other work will permit. The drawings provide design intent. The Contractor shall verify all dimensions at the site and be responsible for their accuracy.

D. All sizes as given are minimum except as noted.

E. Because of the scale of the Drawings, certain basic items, such as, pipe fittings, duct fittings, access panels, and sleeves, may not be shown. Where such items are required by Code or by other Sections, or where required for proper installation of the Work, such items shall be included, whether shown or not.

F. In the event of any inconsistencies between the specifications, drawings, contract documents, applicable laws, statutes, ordinances, building codes, rules and regulations, the contractor shall provide the better quality or greater quantity of work and comply with or conform its work to the most stringent legal or contractual requirements.

G. Changes from these drawings required to make this work conform to the building construction shall be made only with prior written approval of the Architect/Engineer. All proposed changes shall be shown on shop drawings. All measurements shall be verified by actual observation and all work shall fit in place meeting the approval of the Architect/Engineer.

H. Equipment Specification may not deal individually with minute items required, such as, components, parts, controls, and devices which may be required to produce the equipment performance specified or as required to meet the equipment warranties. Where such items are required to make the system operational, they shall be included by the supplier of the equipment at no additional cost, whether or not specifically called for.

1.02 **SECTION INCLUDES**

A. The work under this section includes basic electrical requirements, which are applicable to all Division 26 sections. This section includes information common to two or more technical specification sections or items that are of a general nature, not conveniently fitting into other technical sections.

1. Submittals
2. Reference Standards
3. Quality Assurance
4. Guarantee
5. Work By Owner
6. Equipment Furnished By Others
7. Operation And Maintenance Instructions
8. Record Documents
9. Continuity Of Existing Services
10. Protection Of Finished Surfaces
11. Sealing And Firestopping

12. Off Site Storage
13. Regulatory Requirements
14. Certificates And Inspections
15. Coordination
16. Demolition And Existing Requirements
17. Request And Certification For Payment
18. Temporary Electrical Work
19. Approved Electrical Testing Laboratories
20. Sleeves And Openings
21. Omissions
22. Definitions
23. Project/Site Conditions
24. Work Sequence And Scheduling
25. Work by Other Trades
26. Salvage Materials
27. Access Panels And Doors
28. Identification
29. Demolition
30. Cutting And Patching
31. Building Access
32. Equipment Access
33. Housekeeping And Clean Up

1.03 **RELATED WORK**

A. Applicable provisions of Division 0 and 1 govern work under this section. [Drawings and general provisions of the Contract, including supplementary conditions apply to this Section.]
B. The electrical work included in all other divisions is the responsibility of the contractor performing the Division 26 work unless noted otherwise.
C. Division 21 – Fire Suppression
D. Division 22 – Plumbing
E. Division 23 – Heating, Ventilating and Air Conditioning
F. Division 28 – Electronic Safety and Security

1.04 **SUBMITTALS**

A. Submit shop drawings for equipment under each section per requirements listed in that section, as well as per Division 0 and 1.
B. Submit for all equipment and systems as indicated in the respective specification sections, marking each submittal with that specification section number. Mark general catalog sheets and drawings to indicate specific items being submitted and proper identification of equipment by name and/or number, as indicated in the contract documents. Failure to do this may result in the submittal(s) being returned to the Contractor for correction and resubmission. Do not submit hard copies of web pages. Failing to follow these instructions does not relieve the Contractor from the requirement of meeting the project schedule.
C. On request from the A/E, the successful bidder shall furnish additional drawings, illustrations, catalog data, performance characteristics, etc.
D. 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.
E. The submittals must be approved before fabrication is authorized.
F. Provide electronic copies of all submittals for review.

1.05 **REFERENCE STANDARDS**

A. Abbreviations of standards organizations referenced in this and other sections are as follows:
   1. ANSI American National Standards Institute
   2. ASTM American Society for Testing and Materials

3. EPA Environmental Protection Agency
4. ETL Electrical Testing Laboratories, Inc.
5. IEEE Institute of Electrical and Electronics Engineers
6. IES Illuminating Engineering Society
7. ISA Instrument Society of America
8. NBS National Bureau of Standards
9. NEC National Electric Code
10. NEMA National Electrical Manufacturers Association
11. NESC National Electrical Safety Code
12. NFPA National Fire Protection Association
13. UL Underwriters Laboratories Inc.

1.06 **QUALITY ASSURANCE**

A. Substitution of Materials: Refer to Division 0 and 1 for equals and substitutions.
   1. Where the following conflicts with Division 0 and 1, the requirements of Division 0 and 1 shall govern.
   2. If the Contractor wishes to submit an alternate to the named manufacturers for any equipment, he may submit a voluntary alternative minimum 7 days prior to bid, stating the manufacturer's name, model number, written, detailed product data.
   3. Where materials or equipment are specified by name the proposed material or equipment must be identical to the specified material or equipment in all characteristics of quality, function and serviceability, regardless of application in the Project and, in addition, when the Architect deems that aesthetic significance is important, the equal material or equipment must be identical in all characteristics of visual appearance, design, color and texture. Any proposed equal shall be submitted to Architect/Engineer for prior approval, which Architect/Engineer may approve or disapprove in its sole discretion. Work performed or constructed with unapproved equals is at Contractor's risk and any required correction of work incorporating unapproved equals shall be at Contractor's sole cost and expense.
   4. In all instances, Contractor shall assume full responsibility for proof of equality of the statute to the equipment hereinafter specified. All data and information necessary for proof of equality, function and space requirements shall be prepared and accompany the submittal of the substitution to the Architect/Engineer. Approval by the Architect/Engineer of equipment other than the specified does NOT relieve Contractor of this responsibility.

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, including, but not limited to, coordination with other trades and any required changes by other trades and for obtaining the intended performance from the system into which these items are placed.

D. All materials, except medium voltage equipment and components, shall be listed by and shall bear the label of an approved electrical testing laboratory. If none of the approved electrical testing laboratories has published standards for a particular item, then other national independent testing standards, if available, applicable, and approved by A/E, shall apply and such items shall bear those labels. Where one of the approved electrical testing laboratories has an applicable system listing and label, the entire system, except for medium voltage equipment and components, shall be so labeled.

1.07 **GUARANTEE**

A. Refer to Division 0 and 1 for Guarantees and Warranties. In addition to the requirements in Division 0 and 1, this Contractor shall meet the following requirements.

B. In entering into a contract covering this work, the contractor accepts the specifications and guarantees that the work will be carried out in accordance with the requirements of this specification or such modifications as may be made under the contract documents.

C. Contractor further guarantees that the workmanship and material will be of the best procurable and that none but experienced workmen familiar with each particular class of work will be employed.

D. Contractor further guarantees to replace and make good at his own expense, including travel time, all defects, which may develop within 1 year after final payment and acceptance by the Architect/Engineer, due to faulty workmanship or material, upon, receipt of written notification from the Owner.

1.08 **WORK BY OWNER**

A. PCB equipment (other than light fixture ballasts) removal and disposal, if required, will be by the Owner under separate contract.
B. Electrical testing not described in these contract documents will be by the Owner under separate contract.

1.09 **EQUIPMENT FURNISHED BY OTHERS**

A. Computer room cooling units will be provided by the Owner, wired by the electrical contractor.

1.10 **OPERATION AND MAINTENANCE INSTRUCTIONS**

A. Refer to Division 0 and 1 for all operations and maintenance instructions.
B. In addition to the general content specified under Division 0 and 1 supply the following additional documentation:
   1. Manufacturer's wiring diagrams for electrically powered equipment.
   2. Copies of all approved submittals along with approval letters.

1.11 **RECORD DOCUMENTS**

A. Refer to Division 0 and 1 for record documents.
B. In addition to the general content specified under Division 0 and 1, follow the following procedures.
   1. During the progress of the work, Contractor shall maintain a current (daily) record set of the drawings and specifications, indicating thereon all work installed at variance with such Contract Documents including, without limitation, work covered by Addenda, Field Work Orders, Change Orders and Engineers additional instructions, interpretations and clarification. All changes or deviations from the original layout of the work and all critical dimensions of buried or concealed work shall be recorded. It shall be Contractor's responsibility to assure that said record sets are complete, accurate and up-to-date, Engineer shall have the right to inspect and review such record sets.
   2. At the completion of the work, Contractor shall indicated on record sets all record changes and such additional details necessary or appropriate to provide a complete reference document for use by Engineer. If variations and details cannot be shown clearly thereon, the Contractor shall prepare supplemental drawings adequate to impart the information. The foregoing drawings collectively shall constitute the "Record" drawings for the work.
   3. All indication on "Record" drawings shall be executed in a legible manner at Contractor's cost, using methods and legend presentations compatible with the overall scheme of the record drawings with respect to scale, drawing sheet sizes and sequential indexing. All changes shall be marked clearly in red and clouded.
   4. Engineer may review Contractor's "Record" drawings and notify Contractor of observed discrepancies or deviations. Contractor shall promptly correct discrepancies, deviations or illegible markups at Contractor's expense and resubmit revised drawings for Engineer review.
   5. Contractor shall provide final electronic record drawings to the Owner through the Engineer.
   6. Engineer will provide final electronic record drawings to the Owner based on Contractor's markups.

1.12 **CONTINUITY OF EXISTING SERVICES**

A. Do not interrupt or change existing services without prior written approval from the Owner's Project Representative. When interruption is required, coordinate scheduling of down-time with the Owner to minimize disruption to his activities. Unless specifically stated, all work involved in interrupting or changing existing services is to be done during normal working hours.

B. Each Contractor shall thoroughly familiarize himself with existing systems which will affect and be affected by relocation of existing equipment and installation of new lines and equipment. They shall plan installation of their work so that interruptions of services to any building or portion thereof will be a minimum and such interruptions shall occur only when system is not required, if possible. If not possible, each Contractor shall insure the operation of services by whatever means possible, such as, installing bypasses, capping of services or providing temporary service. Each interruption shall be for as short a duration as possible.
C. No extra costs will be paid to the Contractor for such outages which must occur outside of regular weekly working hours.
D. This Contractor shall restore any circuit interruption as a result of this work to proper operation as soon as possible. Note that institutional operations are on a seven day week schedule.

1.13 **PROTECTION OF FINISHED SURFACES**

A. Refer to Division 0 and 1 for protection of finished services.
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" per Division 0 and 1.

1.14 **SEALING AND FIRESTOPPING**

A. Sealing and firestopping of sleeves/openings between conduits, cable trays, wireways, troughs, cablebus, busduct, etc. and the structural or partition opening shall be the responsibility of the contractor whose work penetrates the opening. The contractor responsible shall hire individuals skilled in such work to do the sealing and firestopping. These individuals hired shall normally and routinely be employed in the sealing and fireproofing occupation.
B. Contractor shall request current life safety drawings from the Architect/Owner.

1.15 **OFFSITE STORAGE**

A. If payment will be requested for approved offsite stored material, then the Contractor shall complete an "Off-site Storage Agreement" which is available from the Owner. Prior approval by Owner's personnel for offsite storage will be needed. No material will be accepted for offsite storage unless submittals for the material have been approved.

1.16 **REGULATORY REQUIREMENTS**

A. All work and materials are to conform in every detail to applicable rules and requirements of the Wisconsin State Electrical Code Volumes 1 and 2, the National Electrical Code (ANSI/NFPA 70), other applicable National Fire Protection Association codes, the National Electrical Safety Code, present manufacturing standards (including NEMA) and the Authority Having Jurisdiction (AHJ).
B. All Division 26 work shall be done under the direction of a currently certified State of Wisconsin Certified Master Electrician.

1.17 **CERTIFICATES AND INSPECTIONS**

A. Refer to Division 0 and 1 for permits, regulations, utilities and taxes.
B. Obtain and pay for all required State or local installation inspections except those provided by the Architect/Engineer in accordance with State Code. Deliver originals of these certificates to the Owner. Include copies of the certificates in the Operating and Maintenance Instructions.
C. Coordinate and provide inspections as required by the Authority Having Jurisdiction over the site.
D. This contractor is responsible for coordination of Owner's electrical inspection. Inspection requirements will be issued at a pre-installation meeting, arranged by this contractor and the Owner's Electrical Inspector (See Article 15 of the General Conditions).

1.18 **COORDINATION**

A. Refer to Division 0 and 1 for coordination. In addition to the requirements specified under Division 0 and 1, the following requirements apply.

B. It shall be the responsibility of each Contractor to coordinate and consult with each other to determine space requirements and to determine that adequate space for servicing is provided for all equipment whether furnished by the Contractor or others. The General Contractor shall have final decision on all space priority conflicts among Contractors. All space priority conflicts shall be brought to the attention of the Architect/Engineer and Owner's Representative.

C. Each Contractor shall thoroughly familiarize himself with existing systems which will affect and be affected by relocation of existing equipment and installation of new lines and equipment. They shall plan installation of their work so that interruptions of services to any building or portion thereof will be a minimum, and such interruptions shall occur only when system is not required, if possible. If not possible, each Contractor shall insure the operation of services by whatever means possible, such as, installing bypasses, or providing temporary service or circuits. Each interruption shall be for as short a duration as possible.

D. Cooperation among all Contractors shall be required. Any Work that is installed without cooperating or coordinating with other Contractors and is in conflict shall be removed and reinstalled at that particular Contractor's cost. No cost additions to the Project will be considered due to a Contractor's lack of participation in the cooperation and coordination process. The following list of items of Work shall be the priority of order for all Contractors:
   1. Structure
   2. Recessed light fixtures
   3. Gravity-flow systems for sanitary, storm, steam and steam condensate piping
   4. Ductwork and appurtenances
   5. Electrical primary and secondary feeder conduits and low voltage cable tray
   6. Plumbing vent piping
   7. Fire protection (sprinkler system)
   8. HVAC piping
   9. Gas piping, process piping and domestic water
   10. Electrical branch circuit conduit and low voltage conduit
   11. Control air lines or conduit

E. The above list, in descending order, is the precedence assigned the Work items for space priority. Gravity-flow systems have first priority.

F. Exception: Plumbing lines below or behind plumbing fixtures shall have precedence over all other work. Electrical conduit above or below switchgear, panelboards and control panels shall have precedence over all other work. Do not install any fluid conveying piping over electrical or elevator equipment.

G. In the case of interconnection of the work of two or more contractors, verify at the site or on shop drawings all dimensions relating to such work. All errors due to the failure to so verify any such dimensions shall be promptly rectified.

H. Any installed work that is not coordinated and interferes with another contractor’s work shall be removed or relocated at the installing contractor’s expense.

I. Prior to start of Construction, the General Contractor shall schedule a meeting with all of the Contractors responsible for the work items listed above. The purpose of the meeting is to introduce the coordination program and to determine its implementation in relation to the progress schedule.

J. At the initial Coordination Meeting, the Mechanical Contractor / Ventilating Contractor shall provide to the General Contractor outline drawings at 1/4" scale indicating column centerlines, interior partition locations, and ceiling heights. The General Contractor shall verify all information shown on these drawings and relay any changes in the information to the Ventilation Contractor to be reflected on the Drawings. The Ventilating Contractor, with reference and consideration to the Structural, Heating, Electrical, Fire Protection, and Plumbing Drawings, shall draw to scale his proposed installation showing duct sizes, equipment layouts, and dimensions from column lines and from finished floors to bottom of ducts. Ductwork shall be maintained as tightly as possible to the underside of floor slabs and/or beams. For congested areas the Ventilating Contractor shall, in addition, prepare Drawings in section view. During this phase of the program, it shall be the Electrical Contractor's responsibility to furnish the Ventilating Contractor with recessed lighting installation and clearance requirements. This information shall be outlined on the Drawings by the Ventilating Contractor.

K. The ductwork layouts shall be produced in sequence as mandated by the Project Schedule. The earliest area indicated in the Schedule shall receive the first effort, etc.

L. When the Ductwork Drawings for the earliest scheduled area have been completed (time limitation as determined at the initial coordination meeting), the Ventilating Contractor shall provide the General Contractor with one set of drawings for each participant in the effort. The General Contractor will distribute the drawings to the participating Contractors for their use in drawing thereon the major components of their proposed installation using the general scheme shown on the Contract Drawings as a guide.

M. The major components to be indicated include (but are not limited to) the following:
   1. Structure
   2. Roof drain leaders
   3. Above 3" waste piping
   4. Sprinkler mains
   5. Heating hot water mains
   6. Chilled water mains
   7. Significant primary and secondary feeder conduit runs
   8. Cable trays
   9. Contract ceiling heights
   10. Soffits
   11. Access points
   12. Fire wall penetrations
   13. Steam and condensate mains
   14. Gas, water, and process piping

N. Information delineated shall be distance from column centerlines, pipe/equipment size, and distance from finished floor to bottom of pipe/equipment and hangers. Included on the Drawings shall be piping layout with hanger locations and hanger point loads. This information shall be developed satisfactorily enough to allow the Structural Engineer to verify the adequacy of the structural system for the projected loads. The hanger locations may have to be moved depending on the structural system review. No hanger shall be fabricated and/or installed until the hanger locations are reviewed and accepted by the Architect/Engineer.

O. Within a period not to exceed two weeks after distribution of the drawings, the General Contractor will schedule a meeting with the Architect/Engineer and participating Contractors at which time areas of conflict shall be resolved. The drawings shall be overlaid to identify areas of conflict. All parties shall then cooperate in resolving the conflicts. Records of the agreements shall be entered on the Ventilating Contractor's drawings, acknowledged by all participants by signature in space provided for this purpose, and two copies distributed to all involved parties. All coordination drawing preparation and reproduction costs shall be borne by the Ventilating Contractor. The above drawings, review, and coordination process shall be repeated until all areas on the Project have been coordinated.

P. In the event a Contractor fails to cooperate in the Coordination Program, they shall be held responsible for all costs incurred for adjustments to the work of others made necessary to accommodate the uncooperative Contractor's installations.

1.19 DEMOLITION AND EXISTING REQUIREMENTS

A. Existing active services: water, gas, medical gas, steam, ventilation, compressed or control air, sanitary waste, sanitary vent, storm electric, and any other building systems when encountered shall be protected against damage. Where existing services are to be abandoned, the services shall be removed back to the point of origin and removed from the site unless otherwise directed by the Owner's Representative.

B. Submit a "Sequence of Work Schedule" in respect to all temporary and permanent utility and service cutovers after final determination. This schedule shall be submitted for approval to the Owner and Architect/Engineer. The submittal shall designate priority order, service or utility affected, date of cutover, and time of day to start and finish.

C. Bidders should inspect the site to become familiar with conditions of the site which will affect the Work. Bidders should verify points of connection with utilities, routing of outside piping to include required clearances from any existing structures, or other obstacles.

D. Extra payment will not be allowed for changes in the Work required because of the successful bidder's failure to make this inspection.

1.20 **REQUEST AND CERTIFICATION FOR PAYMENT**

A. Within 10 days after Notice to Proceed, the successful bidder will submit to the Owner's Project representative in a form prescribed by Division 0 and 1, a cost breakdown of the proposed values for work performed which, if approved by the Owner's project representative, will become the basis for construction progress and monthly payments. The cost breakdown items shall reflect actual work progress stages as closely as feasible.

B. In addition, if payment will be requested for approved off-site stored material, then that material shall be listed as a line item in the request and certification for payment cost breakdown.

1.21 **TEMPORARY ELECTRICAL WORK**

A. Provide temporary electrical connections to temporary cooling units as described on the drawings. Remove temporary wiring upon removal of temporary cooling units.

1.22 **APPROVED ELECTRICAL 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.

1.23 **SLEEVES AND OPENINGS**

A. Openings required in new or existing construction that may be necessary for the installation of new work shall be provided by the respective contractor and all patching and repairing shall be done by workmen competent in the trade required, at the expense of the respective contractor. The respective contractor shall be responsible for arranging the work so that minimum cutting will be required. All rubbish and excess materials involved in such cutting shall be promptly removed from the site and disposed of by the contractor. Cutting through the floor or roof systems or load bearing walls shall be done only with the prior written approval of the Architect/Engineer so as to avoid damaging the structural system.

1.24 **OMISSIONS**

A. No later than ten (10) days before bid opening, the Contractor shall call the attention of the A/E to any materials or apparatus the Contractor believes to be inadequate and to any necessary items of work omitted.

1.25 **DEFINITIONS**

A. Wherever the words "the Contractor", "this Contractor" or "Electrical Contractor", appear in this section, they refer to the Contractor for Electrical Work.

B. The term "provide" includes such labor, methods, materials, equipment and transportation or other facilities required to complete the Contract and the performance of all duties thereby upon the Contractor.

1.26 **PROJECT/SITE CONDITIONS**

A. Install Work in locations shown on Drawings, unless prevented by Project conditions.

B. Prepare drawings showing proposed rearrangement of Work to meet Project conditions, including changes to Work specified in other Sections. Obtain permission of A/E before proceeding.

C. Tools, materials and equipment shall be confined to areas designated by the Owner's project representative.

1.27 **WORK SEQUENCE AND SCHEDULING**

A. Install work in phases to accommodate Owner's occupancy requirements. During the construction period coordinate schedule and operations with Owner's Construction Representatives.

1.28 **WORK BY OTHER TRADES**

A. Every attempt has been made to indicate in this trade's specifications and drawings all work required of this Contractor. However, there may be additional specific paragraphs in other trade specifications and addenda, and additional notes on drawings for other trades which pertain to this Trade's work, and thus those additional requirements are hereby made a part of these specifications and drawings.

B. Electrical details on drawings for equipment to be provided by others are based on preliminary design data only. This Contractor shall lay out the electrical work and shall be responsible for its correctness to match equipment actually provided by others.

1.29 **SALVAGE MATERIALS**

A. No materials removed from this project shall be reused (except as specifically noted below). All materials removed shall become the property of and shall be disposed of by the Contractor.

PART 2 - **PRODUCTS**

2.01 **ACCESS PANELS AND DOORS**

A. Lay-in Ceilings:
   1. Removable lay-in ceiling tiles in 2 x 2 foot or 2 x 4 foot configuration provided under Division 9 are sufficient; no additional access provisions are required unless specifically indicated.

B. Concealed Spline Ceilings:
   1. Removable sections of ceiling tile held in position with metal slats or tabs compatible with the ceiling system used will be provided under Division 9.

C. Metal Pan Ceilings:
   1. Removable sections of ceiling tile held in position by pressure fit will be provided under Division 9.

D. Plaster Walls and Ceilings:
   1. 16 gauge frame with not less than a 20 gauge hinged door panel, prime coated steel for general applications, stainless steel for use in toilets, showers and similar wet areas, concealed hinges, screwdriver operated cam latch for general application, key lock for use in public areas, UL listed for use in fire rated partitions if required by the application. Use the largest size access opening possible, consistent with the space and the equipment needing service; minimum size is 12" by 12".

2.02 **IDENTIFICATION**

A. Refer to Electrical Section 26 05 53 – Identification for Electrical Systems.

2.03 **SLEEVES AND OPENINGS**

A. General:
   1. Pipe sleeves shall be constructed of standard weight ASTM A53 or ASME B36.10 steel with an anchor plate constructed of A36/A36M steel welded to the pipe. The sleeve shall be sized a minimum of 1” larger than piping insulation diameter. The entire assembly shall be hot-dip galvanized after fabrication.
   2. Duct sleeves and piping sleeves passing through interior walls shall be constructed of 24 gauge galvanized steel minimum thickness.

B. Sleeves Through Below Grade Walls:
   1. Provide steel pipe sleeve, ASTM A53, pressure sealing with membrane clamp ring, gasket, water stop ring, external rings, and nitrile rubber link seals. The assembly shall be hot-dip galvanized after fabrication.
      a. Seals: Modular mechanical type seals, consisting of interlocking nitrile rubber links shaped to continuously fill the annular space between the pipe and the sleeve and electrically isolate the carrier pipe from the steel sleeve.
      b. Sealing Element: Polychloroprene rubber material compounded to resist aging, ozone, sunlight, hydrocarbon gases, water, and chemical action.

c. Hardware: Type 300 series stainless steel fasteners. Threads rolled to produce smooth uniform threads and unbroken flow lines.
d. Compression Plates: Fiberglass-reinforced polyester plastic, injection molded for high physical properties, dielectric strength and non-cold flow creep characteristics, having high resistance to acidic and alkaline soils.

2. For sleeves located 15 feet or more below grade provide cast iron sleeve ASTM A74 with compression seals.

2.04 **SEALING AND FIRESTOPPING**

A. Fire And/Or Smoke Rated Penetrations:
1. Manufacturers:
a. 3M, STI/SpecSeal, Tremco, Hilti
b. All firestopping systems shall be by the same manufacturer.
2. Submittals:
a. 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 judgment can be based upon.
3. Product:
a. Firestop systems shall be UL listed or tested by an independent testing laboratory approved by the Owner and the Authority Having Jurisdiction (AHJ).
b. Use a product that has a rating not less than the rating of the wall or floor being penetrated. Reference architectural drawings for identification of fire and/or smoke rated walls and floors.
c. Contractor shall use firestop putty, caulk sealant, intumescent wrapstrips, intumescent firestop collars, 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.

B. Non-Rated Penetrations:
1. Conduit Penetrations Through Below Grade Walls:
a. 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:
a. 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.

PART 3 **– EXECUTION**

3.01 **DEMOLITION**

A. Perform all demolition as indicated on the drawings to accomplish new work. Where demolition work is to be performed adjacent to existing work that remains in an occupied area, construct temporary dust partition to minimize the amount of contamination of the occupied space. Where pipe is removed and not reconnected with new work, cap ends of existing services as if they were new work. Coordinate work with the Owner to minimize disruption to the existing building occupants.

B. All devices, fixtures, equipment, wiring and associated conduit, insulation and similar items demolished, abandoned, or deactivated are to be removed from the site by the Contractor except as specifically noted otherwise. All designated equipment is to be turned over to the owner for their use at a place and time so designated. Maintain the condition of material and/or equipment that is indicated to be reused equal to that existing before work began.

C. All contractors requiring the personnel/ material hoist and or temporary construction elevator (i.e. new elevators, temporarily protected) at times other than outlined in the temporary facilities specifications will make arrangements directly with the general contractor. The general contractor is responsible for all coordination and scheduling of the use of any hoisting equipment so the flow of the project is smoothly maintained and all workers have access to the work areas to perform their work and deliver material to the areas needed according to the project schedule.

D. If any contractor's work requires the removal and replacement of any finished materials including but not limited to such materials as ceiling tiles, wall finishes, cabinets, doors, flooring, windows, etc. after those items are installed, each contractor will be responsible, at no additional cost to the owner, to replace any damaged, soiled or lost materials with new materials to match the existing materials and those materials damaged.

3.02 **CUTTING AND PATCHING**

A. Refer to Division 0 and 1 for cutting and patching. In addition to the requirements in Division 0 and 1:

B. Each Contractor shall coordinate the placing of openings in the new structure as required for the installation of each Contractor's work.

C. Each Contractor shall furnish to the General Contractor the accurate locations and sizes for required openings in the new work, but this shall not relieve each Contractor of the responsibility of checking to assure that properly sized openings are provided. When additional patching is required due to the Contractor's failure to inspect this work, then the Contractor shall make arrangements for the patching required to properly close the openings to include patch painting, and the Contractor shall pay any additional cost incurred in this respect.

D. If cutting and patching of the new structure is made necessary due to the Contractor's failure to install piping, ducts, sleeves, or equipment on schedule, or due to the Contractor's failure to furnish on schedule the information required for the leaving of openings, then it shall be the Contractor's responsibility to make arrangements and obtain approval from the General Contractor and Architect/Engineer for this cutting and patching, and the Contractor shall pay any additional cost incurred in this respect. The Contractor shall also reimburse the Owner for any additional costs incurred to the Architect/Engineer for additional services caused by the Contractor in this respect.

E. The Contractor shall provide cutting and patching and patch painting in the existing structure as required for the installation of his Work and shall furnish lintels and supports as required for openings. Cutting of structural support members will not be permitted without prior approval of the Architect/Engineer. Extent of cutting shall be minimized; use core drills, power saws, or other machines which will provide neat, minimum openings. Patching shall match adjacent materials and surfaces and shall be performed by craftsmen skilled in the respective craft required.

3.03 **BUILDING ACCESS**

A. 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.

3.04 **EQUIPMENT ACCESS**

A. 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 General Contractor, making sure that access is available for all equipment and specialties. Where access is required in plaster or drywall walls or ceilings, furnish the access doors to the General Contractor and reimburse the General Contractor for installation of those access doors.

B. The approximate location of all equipment and devices is shown on the drawings. The Architect/Engineer reserves the right to change the location of all equipment or devices 6 feet in any direction at no additional cost provided such changes are requested before final installation.

C. Install all equipment with ample space allowed for removal and repair. Provide ready accessibility to removable parts of equipment and to all wiring without moving equipment which is installed or which is already in place.

D. In mechanical and electrical equipment spaces, expose ceiling outlets and conduit with due consideration to ventilating ducts and mechanical piping. Where numerous ducts occur, install conduits and outlets after the ventilating ducts. Puncturing of ductwork or hanging equipment such as light fixtures, ceiling hangers and conduits from ductwork is prohibited unless specifically noted otherwise.
E. Electrical equipment shall be installed to maintain minimum clearances per Article 110 of NEC and ANSI C2 (National Electrical Safety Code).
F. No piping carrying fluids shall be installed directly over electrical equipment.
G. Equipment shall be installed in accordance with manufacturer's recommendation. Where conflicts occur between Contract Document and these recommendations, a ruling shall be requested of the Architect for decision before proceeding with such work.

3.05 **COORDINATION**

A. The Contractor shall cooperate with other trades in locating work in a proper manner. Should it be necessary to raise or lower or move longitudinally any part of the electrical work to better fit the general installation, such work shall be done at no extra cost to the Owner, provided such decision is reached prior to actual installation. The Contractor shall check location of electrical outlets with respect to other installations before installing.
B. The Contractor shall verify that all devices are compatible for the surfaces on which they will be used. This includes, but is not limited to light fixtures, panelboards, devices, etc. and recessed or semi-recessed heating units installed in/on architectural surfaces. Coordinate installation of required supporting devices and set sleeves in cast-in-place concrete, masonry walls and other structural components as they are constructed.
C. Coordinate all work with other contractors prior to installation. Any installed work that is not coordinated and that interferes with other contractor's work shall be removed or relocated at the installing contractor's expense.
D. Coordinate arrangements, mounting and support of electrical equipment:
    1. To allow maximum possible headroom unless specific mounting heights that reduce headroom are indicated.
    2. To provide for ease of disconnecting the equipment with minimum interference to other installations.
    3. To allow right of way for piping and conduit installed at required slope.
    4. So connecting raceways, cables, wireways, cable trays and busways will be clear of obstructions and of the working and access space of other equipment.
E. Coordinate with Division 27 and 28 contractors and equipment vendors for proper location, quantity and capacity of all required conduits, back boxes, device rings and power supplies required to support systems specified.
F. Cooperate with the testing consultant in ensuring Section 26 05 04 compliance. Verify system completion to the testing consultant. Demonstrate the starting, interlocking and control features of each system so the testing contractor can perform its work.

3.06 **SLEEVES AND OPENINGS**

A. General:
    1. Sleeves are not required for piping and ducts passing through interior non-rated drywall, plaster, or wood partitions and interior poured concrete walls that have been saw cut or core drilled.
    2. Pack annular space between sleeves and pipe or ducts with fiberglass insulation and seal.
    3. Piping sleeves that pass through fire rated floors, walls, or ceilings shall be provided with a UL listed fire stop material meeting UL 1479 to seal the opening between the pipe and the pipe sleeve to maintain the fire rating.
    4. Provide escutcheon plates on piping to cover sleeve and insulation in finished areas.
    5. Refer to Division 0 and 1, General Requirements for additional information on sleeves and openings.
B. Sleeves Through Floors/Ceilings:
    1. Sleeves shall be installed to extend 1 inch above finished floor with a watertight sealant between floor and sleeve in all mechanical rooms and wet rooms listed below.

2. If a sleeve is not provided, provide 1-1/2 inch angle ring with urethane caulk between the angle and the floor and seal at the corners to form a watertight seal.
3. Wet Locations:
    a. Mechanical Rooms
    b. Parking Ramps
    c. Sanitary pumping stations
    d. Swimming pool equipment rooms
    e. Chemical storage and hazardous waste storage rooms
    f. Food service/kitchen areas (behind/under equipment, cabinets, tables, etc.)

3.07 **SEALING AND FIRESTOPPING**

A. The Contractor shall refer to building life safety drawings for all smoke and fire rates in addition to the mechanical drawings. Any discrepancies shall be brought to the attention of the Architect/Engineer before final addendum.

B. Fire and/or Smoke Penetrations:
1. Install approved product in accordance with the manufacturer's instructions where a pipe (i.e. cable tray, bus, cable bus, conduit, wireway, trough, etc.) penetrates a fire rated surface.
2. Where firestop mortar is used to infill large fire-rated floor openings that could be required to support weight, provide permanent structural forming. Firestop mortar alone is not adequate to support any substantial weight.
3. When the opening is through a non-fire rated wall, floor, ceiling or roof the opening must be sealed using an approved type of material.
4. Install escutcheons or floor/ceiling plates where conduit, penetrates non-fire rated surfaces in occupied spaces. Occupied spaces for this paragraph include only those rooms with finished ceilings and the penetration occurs below the ceiling.
5. In exterior wall openings below grade, assemble rubber links of mechanical seal to the proper size for the conduit and tighten in place, in accordance with the manufacturer's instructions. Install so that the bolts used to tighten the seal are accessible from the interior of the building or vault.
6. At interior partitions, conduit penetrations are required to be sealed for all clean rooms, laboratories, and most hospital spaces, computer rooms, dormitory rooms, tele/data/com rooms and similar spaces where the room pressure or odor transmission must be controlled. Apply sealant to both sides of the penetration in such a manner that the annular space between the conduit sleeve and the conduit is completely filled.

3.08 **HOUSEKEEPING AND CLEAN UP**

A. The Contractor shall clean up and remove from the premises, on a daily basis, all debris and rubbish resulting from its work 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.

END OF SECTION

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SECTION 26 05 02
ELECTRICAL DEMOLITION FOR REMODELING

PART 1 – GENERAL

1.01 SCOPE OF WORK
A. Base Bid: The work under this section includes selective demolition associated with the removal of the existing computer room cooling units.

1.02 SECTION INCLUDES
A. Materials and Equipment

1.03 RELATED WORK
A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 0 and 1 Specification Sections, apply to this Section.

PART 2 - PRODUCTS

2.01 MATERIALS AND EQUIPMENT
A. Materials and equipment for patching and extending work as specified in the individual Sections.

PART 3 - EXECUTION

3.01 EXAMINATION
A. Verify field measurements and circuiting arrangements as shown on Drawings.
B. Verify that abandoned wiring and equipment serve only abandoned facilities.
C. Verify whether or not PCB ballasts exist in light fixtures which will be disposed of.
D. Demolition Drawings are based on casual field observation and/or existing record documents. Report discrepancies to the Owner, Architect/Engineer and Owner's Field Representative before disturbing existing installation.
E. Beginning of demolition means installer accepts existing conditions.

3.02 PREPARATION
A. Existing Electrical Service: Maintain existing system in service Obtain permission from the Owner and Owner's Field Representative at least 48 hours before partially or completely disabling system. Minimize outage duration. If required, make temporary connections to maintain service in areas adjacent to work area.
B. Existing Fire Alarm System: Maintain existing system in service Obtain permission from the Owner, Owner's Field Representative and local Authority Having Jurisdiction at least 48 hours before partially or completely disabling system. Minimize outage duration. If required, make temporary connections to maintain service in areas adjacent to work area.
C. Existing Communication/Data System: Maintain existing system.

3.03 DEMOLITION AND EXTENSION OF EXISTING ELECTRICAL WORK
A. Demolish and extend existing electrical work to meet all requirements of these specifications.
B. If certain raceways and boxes are abandoned but not scheduled for removal, those items must be shown on the "As Built Drawings".
C. Remove, relocate, and extend existing installations to accommodate new construction.
D. Remove abandoned wiring to source of supply.
E. Remove exposed abandoned conduit, including abandoned conduit above accessible ceiling finishes. Cut conduit flush with walls and floors, and patch surfaces.

F. Disconnect abandoned outlets and remove devices. Remove abandoned outlets if conduit servicing them is abandoned and removed. Provide blank cover for abandoned outlets which are not removed.
G. Disconnect and remove electrical devices and equipment serving utilization equipment that has been removed.
H. Repair adjacent existing construction and finishes damaged during demolition and extension work to match adjacent existing surfaces.
I. Maintain access to existing electrical installations which remain active. Modify installation or provide access panel as appropriate.
J. Extend existing installations using materials and methods compatible with existing electrical installations, or as specified. This includes the extension of the circuit from the last active device to the next device in the system to be activated.

3.04 CLEANING AND REPAIR

A. Clean and repair existing materials and equipment which remain or are to be reused.
B. Panelboards: Clean exposed surfaces and check tightness of electrical connections. Replace damaged circuit breakers and provide closure plates for vacant positions. Provide typed circuit directory showing revised circuiting arrangement.
C. Luminaires: Remove existing luminaires for cleaning. Use mild detergent to clean all exterior and interior surfaces; rinse with clean water and wipe dry. Replace lamps, ballasts (if required) and broken electrical parts.

3.05 INSTALLATION

A. Install relocated materials and equipment under the provisions of other sections.

END OF SECTION

SECTION 26 05 04
CLEANING, INSPECTION, AND TESTING OF ELECTRICAL EQUIPMENT

PART 1 – GENERAL

1.01 SCOPE OF WORK

A. Base Bid: The work under this section includes the required cleaning, repair, adjustment, calibration, maintenance and testing of electrical equipment, as specified herein. This applies only to new electrical and existing electrical equipment being furnished, modified, worked on or serviced by this contractor for this project.

1.02 SECTION INCLUDES

A. General Inspection and Cleaning of All Electrical Equipment
B. Grounding System
C. Panelboards

1.03 RELATED WORK

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 0 and 1 Specification Sections, apply to this Section.

PART 2 – PRODUCTS

2.01 NOT USED.

PART 3 – EXECUTION

3.01 GENERAL INSPECTION AND CLEANING OF ALL ELECTRICAL EQUIPMENT

A. Inspect for physical damage and abnormal mechanical and electrical conditions.
B. Any item found to be out of tolerance, or in any other way defective as a result of the required testing, shall be reported to the A/E. Procedure for repair and/or replacement will be outlined. After appropriate corrective action is completed the item shall be re-tested.
C. Compare equipment nameplate information with the latest single line diagram and report any discrepancies.
D. Verify proper auxiliary device operation and indicators.
E. Check tightness of accessible bolted electrical joints. Use torque wrench method.
F. Make a close examination of equipment and remove any shipping brackets, insulation, packing, etc. that may not have been removed during original installation.
G. Make a close examination of equipment and remove any dirt or other forms of debris that may have collected in existing equipment or in new equipment during installation.
H. Clean All Equipment:
    1. Vacuum inside of panelboards, fire alarm panels, comm/data, security panel, etc.
    2. Loosen attached particles and vacuum them away.
    3. Wipe all insulators with a clean, dry, lint free rag.
    4. Clean insulator grooves.
    5. Re-vacuum inside surfaces as directed by the Owner’s Construction Representative or Inspector
I. Inspect equipment anchorage.
J. Inspect equipment and bus alignment.
K. Check all overload elements for operation and control.
L. Lubricate nonelectrical equipment per manufacturer's recommendations.

3.02 GROUNDING SYSTEMS

A. Inspect the ground system for adequate termination at all devices.

3.03 PANELBOARDS

A. Torque all the connections per the manufacturers spec. Verify phase wires, color coding, separate neutral and mechanical bonding. Verify circuit breaker operation. Verify the directory.

END OF SECTION

SECTION 26 05 19
LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLE

PART 1 **– GENERAL**

1.01 **SCOPE OF WORK**

A. Base Bid: The work under this section includes furnishing and installing required wiring and cabling systems including pulling, terminating and splicing.

1.02 **SECTION INCLUDES**

A. General
B. Manufacturers
C. Building Wire
D. Wiring Connectors

1.03 **RELATED WORK**

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 0 and 1 Specification Sections, apply to this Section.
B. Section 26 05 00 – Common Work Results for Electrical
C. Section 26 05 26 – Grounding and Bonding for Electrical Systems
D. Section 26 05 33 – Raceway and Boxes for Electrical Systems.
E. Section 26 05 53 – Identification for Electrical Systems.

1.04 **SUBMITTALS**

A. Submit product data: Provide for each cable assembly type.
B. Submit factory test reports: Indicate procedures and values obtained.
C. Submit shop drawings for modular wiring system including layout of distribution devices, branch circuit conduit and cables, circuiting arrangement, and outlet devices.
D. Submit manufacturer's installation instructions. Indicate application conditions and limitations of use stipulated by product testing agency specified under Regulatory Requirements.

1.05 **REFERENCE STANDARDS**

A. NFPA 70 - National Electrical Code
B. IPCEA S-61-402/NEMA WC-5 Thermoplastic Insulated Wire and Cable
C. IPCEA S-66-524/NEMA WC-7 Cross-linked Thermosetting Polyethylene-Insulated Wire and Cable
D. UL 83
E. ASTM

1.06 **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.

PART 2 **– PRODUCTS**

2.01 **GENERAL**

A. All wire shall be new, delivered to the site in unbroken cartons and shall be less than one year old out of manufacturer's stock.
B. All conductors shall be copper.

C. All cable and wire shall have 600 volts insulation, have a conductivity of 98 percent, and shall be annealed coated copper per ASTM B33 or B189.
D. Wire sizes No. 12 AWG and smaller shall be solid wire, and wire No. 10 AWG and larger shall be stranded, Class B, ASTM B8.
E. Stranded conductors may only be terminated with UL OR ETL Listed type terminations or methods: e.g. stranded conductors may not be wrapped around a terminal screw but must be terminated with a crimp type device or must be terminated in an approved back wired method.
F. Minimum wire sizes shall be as follows:
   1. Power wiring- #12 AWG
   2. Control Wiring- #18 AWG
G. All conductors shall be continuous without splices except at locations approved for the purpose.

2.02 **MANUFACTURERS**

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the work include, but are not limited to, the following:
   1. Alcan Products Corporation; Alcan Cable Division
   2. American Insulated Wire Corp.; a Leviton Company
   3. General Cable Corporation
   4. Senator Wire & Cable Company
   5. Southwire Company
   6. Houston Wire & Cable
   7. AFC Cable Systems, Inc.
   8. Hubbell Power Systems, Inc.
   9. O-Z/Gedney; EGS Electrical Group, LLC
   10. 3M; Electrical Products Division
   11. Tyco Electronics Corp.
   12. Insert Manufacturer's Name

2.03 **BUILDING WIRE**

A. Description: Single conductor insulated wire.
B. Insulation: Type THHN/THWN, XHHW-2 insulation for feeders and branch circuits.

2.04 **VARIABLE FREQUENCY DRIVE(VFD) WIRE**

A. All power wiring from the VFD output to the motor shall be type XHHW-2 insulation, single conductor wire.

2.05 **FIRE RATED CABLE**

A. Fire rated cables shall be UL Listed, Type RHH/RHW-2, 600 volt, rated 75 degree C wet.
B. Cables shall be classified two hour fire rating per UL 2196 – "Standard For Tests For Fire Resistive Cables".
C. Cables shall be classified electrical circuit protective system (FHIT) No 25 of the UL Fire Resistive Directory.
D. Cable shall be low smoke halogen free (LSHF) and rated for wet and dry locations.
E. Cables shall meet the fire rating requirements of National Electrical Code Articles 695 & 700. Conduit installation shall comply with manufacturers' instructions and supporting requirements.

2.06 **WIRING CONNECTORS**

A. Split Bolt Connectors: Not acceptable.
B. Solderless Pressure Connectors: High copper alloy terminal. May be used only for cable termination to equipment pads or terminals. Not approved for splicing.
C. Spring Wire Connectors: Solderless spring type pressure connector with insulating covers for copper wire splices and taps. Use for conductor sizes 10 AWG and smaller.
D. 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.

E. Mechanical Connectors: Bolted type tin-plated; high conductivity copper alloy; spacer between conductors; beveled cable entrances.
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.

PART 3 – EXECUTION

3.01 GENERAL WIRING METHODS

A. All wire and cable shall be installed in conduit.
B. Do not use wire smaller than 12 AWG for power and lighting circuits.
C. 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).
D. Make conductor lengths for parallel conductors equal.
E. Splice only in junction or outlet boxes.
F. No conductor less than 10 AWG shall be installed in exterior underground conduit.
G. Identify ALL low voltage, 600v and lower, wire per section 26 05 53.
H. Neatly train and lace wiring inside boxes, equipment, and panelboards.

3.02 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.

3.03 FIRE RATED CABLE INSTALLATION

A. Conduit installation for fire rated cable shall comply with manufacturers' instructions.
B. Supporting requirements for conduit shall comply with manufacturers' instructions.
C. Conduit shall be supported every 5 feet on center in lieu of the code standard of 10 feet unless a different spacing has been verified by manufacturer testing.
D. Conduit system shall be code compliant with all steel components or components that have been fire rated and approved. No aluminum die cast (zinc) plastic acceptable.

3.04 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. All splices shall be so made that they have an electrical resistance not in excess of two feet (600 mm) of the conductor.
D. Use solderless spring type pressure connectors with insulating covers for wire splices and taps, 10 AWG and smaller.
E. 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.
F. Thoroughly clean wires before installing lugs and connectors.
G. At all splices and terminations, leave tails long enough to cut splice out and completely re-splice.

3.05 FIELD QUALITY CONTROL

A. Field inspection and testing will be performed under provisions of Section 26 05 04.

B. Additional testing as follows shall be performed if aluminum conductors are used:
C. Equipment terminated with aluminum conductors shall be tested with a thermal imager and recorded.
D. Conductors shall be closely checked for loose or poor connections, and for signs of overheating or corrosion.
E. Test procedures shall meet NETA guidelines.
F. Test results and report shall be provided to the engineer.
G. Contractor shall correct all deficiencies reported in the test report.

3.06 **WIRE COLOR**

A. General:
   1. For wire sizes 10 AWG and smaller - Wire shall be colored as indicated below.
   2. For wire sizes 8 AWG and larger – Use colored wire, or identify wire with colored tape at all terminals, splices and boxes. Colors to be as indicated below.
   3. In existing facilities, use existing color scheme.
B. Neutral Conductors: White for 120/208V and 120/240V systems, Gray for 277/480V systems. Where there are two or more neutrals in one conduit, each shall be individually identified with a different stripe.
C. Branch Circuit Conductors: Three or four wire home runs shall have each phase uniquely color coded.
D. Ground Conductors: Green for 6 AWG and smaller. For 4 AWG and larger, identify with green colored wire, or with green tape at both ends and at all access points, such as panelboards, motor starters, disconnects and junction boxes. When isolated grounds are required, contractor shall provide green with yellow tracer.

3.07 **BRANCH CIRCUITS**

A. The use of single-phase, multi-wire branch circuits with a common neutral are not permitted. All branch circuits shall be furnished and installed with an individual accompanying neutral, sized the same as the phase conductors.

3.08 **EMERGENCY CIRCUITS**

A. All emergency system wiring (level 1 and level 2) shall be installed in separate raceways after their associated transfer switches. The wiring shall be separate from each other and from all normal system wiring.

END OF SECTION

SECTION 26 05 26
GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS

PART 1 **– GENERAL**

1.01 **SCOPE OF WORK**
- A. Base Bid: The work under this section includes equipment grounding conductors.

1.02 **SECTION INCLUDES**
- A. Manufacturers
- B. Wire

1.03 **RELATED WORK**
- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 0 and 1 Specification Sections, apply to this Section.
- B. Section 26 05 00 – Common Work Results for Electrical

1.04 **SUBMITTALS**
- A. Product Data: Provide data for grounding electrodes and connections.
- B. Test Reports: Indicate overall resistance to ground [and resistance of each electrode].
- C. Manufacturer's Instructions: Include instructions for preparation, installation and examination of exothermic connectors.

1.05 **REFERENCE STANDARDS**
- A. NFPA 70 - National Electrical Code.
- B. ANSI/IEEE 142 (Latest edition) - Recommended Practice for Grounding of Industrial and Commercial Power Systems.

1.06 **PROJECT RECORD DOCUMENTS**
- A. Accurately record actual locations of grounding electrodes.

1.07 **REGULATORY REQUIREMENTS**
- A. Conform to requirements of NFPA 70.
- B. Furnish products listed and classified by Underwriters Laboratories, Inc. or testing firm acceptable to authority having jurisdiction as suitable for purpose specified and shown.
- C. Comply with UL 467 for grounding and bonding materials and equipment.

PART 2 **- PRODUCTS**

2.01 **WIRE**
- A. Material: Stranded copper (aluminum not permitted).
- B. Grounding Electrode Conductor: Size as shown on drawings, specifications or as required by NFPA 70, whichever is larger.
- C. 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**

3.01 **EXAMINATION**
- A. Verify that final backfill and compaction has been completed before driving rod electrodes.

3.02 **GENERAL**

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

3.03 **LESS THAN 600 VOLT SYSTEM GROUNDING**

A. 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.

3.04 **FIELD QUALITY CONTROL**

A. Inspect grounding and bonding system conductors and connections for tightness and proper installation.

END OF SECTION

SECTION 26 05 29
HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS

PART 1 **- GENERAL**

1.01 **SCOPE OF WORK**

A. Base Bid: The work under this section includes conduit and equipment supports, straps, clamps, steel channel, etc., and all required fastening hardware for supporting electrical work.

1.02 **SECTION INCLUDES**

A. Support, Anchorage And Attachment Components
B. Manufacturers

1.03 **RELATED WORK**

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 0 and 1 Specification Sections, apply to this Section.
B. Section 26 05 00 – Common Work Results for Electrical
C. Section 26 05 19 – Low-Voltage Electrical Power Conductors and Cables
D. Section 26 05 26 – Grounding and Bonding for Electrical Systems
E. Section 26 05 33 – Raceway and Boxes for Electrical Systems
F. Section 26 24 16 – Panelboards

1.04 **SUBMITTALS**

A. Product Data: Provide data for support channel and equipment supports.

1.05 **QUALITY ASSURANCE**

A. Support systems shall be adequate for weight of equipment and conduit, including wiring, which they carry.
B. Welding: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code – Steel".

1.06 **PERFORMANCE REQUIREMENTS**

A. Delegated Design: Design supports for multiple raceways, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.
B. Design supports for multiple raceways capable of supporting combined weight of supported systems and its contents.
C. Design equipment supports capable of supporting combined operating weight of supported equipment and connected systems and components.

1.07 **COORDINATION**

A. Coordinate size and location of concrete bases. Cast anchor-bolt inserts into bases. Concrete, reinforcement and formwork requirements are specified in Division 03.
B. Coordinate installation of roof curbs, equipment supports and roof penetrations as specified in Division 07 Section "Roof Accessories".

PART 2 **- PRODUCTS**

2.01 **SUPPORT, ANCHORAGE AND ATTACHMENT COMPONENTS**

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.
E. Support for Conductors in Vertical Conduit: Factory-fabricated assembly consisting of threaded body and insulating wedging plug or plugs for non-armored electrical conductors or cables in riser conduits. Plugs shall have number, size and shape of conductor gripping pieces as required to suit individual conductors or cables supported. Body shall be malleable iron.
F. Mechanical-Expansion Anchors: Insert-wedge-type, (zinc-coated) (stainless) steel, for use in hardened Portland cement concrete with tension, shear and pullout capacities appropriate for supported loads and building materials in which used.

2.02 **MANUFACTURERS**

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the work include, but are not limited to, the following:
   1. Allied Tube & Conduit
   2. Cooper B-Line, Inc.; a Division of Cooper Industries
   3. ERICO International Corporation
   4. GS Metals Corp.
   5. Thomas & Betts Corporation
   6. Unistrut; Tyco International, Ltd.
   7. Wesanco, Inc.
   8. Fabco Plastics Wholesale Limited
   9. Seasafe, Inc.
   10. Empire Tool & Manufacturing Co.
   11. Hilti, Inc.
   12. ITW Ramset/Red Head; a Division of Illinois Tool Works, Inc.
   13. MKT Fastening, LLC
   14. Simpson Strong-Tie Co., Inc.; Masterset Fastening Systems Unit
   15. Insert Manufacturer's Name

PART 3 **- EXECUTION**

3.01 **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).
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. Powder-actuated fasteners and plastic wall anchors are not permitted.
D. File and de-bur cut ends of support channel and spray paint with cold galvanized paint to prevent rusting.
E. Do not fasten supports to piping, ductwork, mechanical equipment, cable tray or conduit. Do not fasten to suspended ceiling grid system.
F. Do not drill structural steel members unless approved by Engineer.
G. 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.
H. In wet locations, mechanical rooms and electrical rooms install free-standing electrical equipment on 3.5 inch (89 mm) concrete pads.
I. 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).

J. Bridge studs top and bottom with channels to support flush-mounted cabinets and panelboards in stud walls.
K. 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.

3.02 **INSTALLATION OF FABRICATED METAL SUPPORTS**

A. Comply with installation requirements in Division 05 Section "Metal Fabrications" for site-fabricated metal supports.
B. Cut, fit and place miscellaneous metal supports accurately in location, alignment and elevation to support and anchor electrical materials and equipment.
C. Field Welding: Comply with AWS D1.1/D1.1M.

3.03 **PAINTING**

A. Touchup: Clean field welds and abraded areas of shop paint. Paint exposed areas immediately after erecting hangers and supports. Use same materials as used for shop painting. Comply with SSPC-PA 1 requirements for touching up field painted surfaces.
   1. Apply paint by brush or spray to provide minimum dry film thickness of 2.0 mils (0.05 mm).
B. Touchup: Comply with requirements in Division 09 (painting sections) (Section "High Performance Coating") for cleaning and touchup painting of field welds, bolted connections and abraded areas of shop paint on miscellaneous metal.
C. Galvanized Surfaces: Clean welds, bolted connections and abraded areas and apply galvanizing repair paint to comply with ASTM A 780.

END OF SECTION

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SECTION 26 05 33
RACEWAY AND BOXES FOR ELECTRICAL SYSTEMS

PART 1 **– GENERAL**

1.01 **SCOPE OF WORK**

A. Base Bid:
   1. The work under this section includes conduits, fittings, boxes, surface raceways, multi-outlet assemblies, auxiliary gutters, and wall duct for electrical systems including wall and ceiling outlet boxes, floor boxes, and junction boxes.

1.02 **SECTION INCLUDES**

A. General
B. Manufacturers
C. Electrical Metallic Tubing (EMT) and Fittings
D. Liquidtight Flexible Metal Conduit and Fittings
E. Conduit Supports
F. Auxiliary Gutters (Wireways)
G. Pull and Junction Boxes

1.03 **RELATED WORK**

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 0 and 1 Specification Sections, apply to this Section.
B. Section 26 05 00 – Common Work Results for Electrical
C. Section 26 05 26 – Grounding and Bonding for Electrical Systems
D. Section 26 05 29 – Hangers and Supports for Electrical Systems
E. Section 26 27 02 – Equipment Wiring Systems
F. Section 28 31 00 – Fire Detection and Alarm

1.04 **SUBMITTALS**

A. Surface Raceway System - submit product data and catalog sheets for all components.
B. Boxes - provide product data showing configurations, finishes, dimensions, and manufacturer's instructions.
C. Product data for conduit, wireways, fittings, floor boxes, hinged-cover enclosures or cabinets.

1.05 **QUALITY ASSURANCE**

A. Electrical Components, Devices and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction and marked for intended use.

PART 2 **– PRODUCTS**

2.01 **GENERAL**

A. All steel fittings and conduit bodies shall be galvanized.
B. No cast metal, or split-gland type fittings permitted.
C. Mogul-type condulets larger than 2 inch (50 mm) not permitted except as approved or detailed.
D. All condulet covers must be fastened to the condulet body with screws and be of the same manufacture.
E. Wireways, gutters and c-condulets shall not be used in lieu of pull boxes and condulets.
F. All boxes shall be of sufficient size to provide free space for all conductors enclosed in the box and shall comply with NEC requirements.

2.02 **MANUFACTURERS**

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the work include, but are not limited to, the following:

B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. AFC Cable Systems, Inc.
2. Alflex Inc.
3. Allied Tube & Conduit; a Tyco International Ltd. Co
4. Anamet Electrical, Inc.; Anaconda Metal Hose
5. Armorcast Products Company
6. Arnco Corporation
7. CANTEX inc
8. Carson Industries LLC
9. CDR Systems Corporation
10. CertainTeed Corp.; Pipe & Plastics Group
11. Christy Concrete Products
12. Condux International, Inc
13. Cooper Crouse-Hinds; Div. of Cooper Industries, Inc.
14. EGS/Appleton Electric
15. ElecSYS, Inc
16. Electri-Flex Co.
17. Erickson Electrical Equipment Company
18. Hoffman
19. Hubbell Incorporated; Killark Electric Manufacturing Co. Division
20. Hubbell Incorporated; Quazite
21. Lamson & Sessions: Carlon Electrical Products
22. Manhattan/CDT/Cole-Flex
23. Maverick Tube Corporation
24. NewBasis
25. Nordic Fiberglass, Inc.
26. O-Z Gedney; a unit of General Signal
27. RACO; a Hubbell Company
28. Robroy Industries, Inc.; Enclosure Division
29. Scott Fetzer Co.; Adalet Division
30. Spring City Electrical Manufacturing Company
31. Synertech Moulded Products, Inc.; a division of Oldcastle Precast
32. Thomas & Betts Corporation
33. Walker Systems, Inc.; Wiremold Company (The)
34. Wheatland Tube Company
35. Woodhead, Daniel Company; Woodhead Industries, Inc. Subsidiary

2.03 **ELECTRICAL METALLIC TUBING (EMT) AND FITTINGS**

A. Conduit: Steel, galvanized tubing. ANSI C80.3

B. Fittings: All steel, set screw, concrete tight. No push-on or indenter types permitted.

C. Conduit Bodies: All steel threaded conduit bodies.

2.04 **LIQUIDTIGHT FLEXIBLE METAL CONDUIT AND FITTINGS**

A. Conduit: flexible, steel, galvanized, spiral strip with an outer Liquidtight, nonmetallic, sunlight-resistant jacket.

B. 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.

2.05 **CONDUIT SUPPORTS**

A. See section 26 05 29.

2.06 **AUXILIARY GUTTERS (WIREWAYS)**

A. Description: [General purpose] [Oil-tight and dust- tight] [Rain-tight] type wireway without knockouts.
B. Size: [4 x 4] [6 x 6] [8 x 8] [12 x 12] inch ([100 x 100] [150 x 150] [200 x 200] [300 x 300] mm) [As indicated on Drawings]; length as indicated on Drawings.
C. Cover: [Hinged] [Screw applied] cover [with full gasketing.]
D. Connector: [Slip-in construction;] [Flanged;] [hinged cover.] [screw applied cover.]
E. Fittings: Lay-in type with [removable top, bottom, and side; captive screws.] [drip shield.]
F. Finish: Rust inhibiting primer coat with gray enamel finish.

2.07 **PULL AND JUNCTION BOXES**

A. Pull boxes and junction boxes shall be minimum 4 inch square (100 mm) by 2 1/8th inches (54 mm) deep for use with 1 inch (25 mm) conduit and smaller. On conduit systems using 1 1/4 inch (31.75 mm) conduit or larger, pull and junction boxes shall be sized per NEC but not less than 4 11/16 inch square (117 mm).
B. For telecommunication, fiber optic, security, and other low voltage cable installations the NEC box size requirements shall apply. All boxes, used on telecommunication, security, other low voltage and fiber optic systems with conduits of 1 1/4" and larger, shall be sized per the NEC conduit requirements. For determining box size, the conduit is the determining factor not the wire size.
C. Sheet Metal Boxes: code gauge galvanized steel, screw covers, flanged and spot welded joints and corners.
D. 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.
E. Cast Metal Boxes for Outdoor and Wet Location Installations: Type 4 and Type 6, flat-flanged, surface-mounted junction box, UL listed as rain tight. Galvanized cast iron or aluminum box and cover with ground flange, neoprene gasket, and stainless steel cover screws.
F. Fiberglass or Concrete Handholes with weatherproof cover of non-skid finish shall be used for underground installations. Provide traffic rate covers.
G. Box extensions and adjacent boxes within 48" of each other are not allowed for the purpose of creating more wire capacity.
H. Junction boxes 6" x 6" or larger size shall be without stamped knock-outs.
I. Wireways shall not be used in lieu of junction boxes.

PART 3 **– EXECUTION**

3.01 **CONDUIT SIZING, ARRANGEMENT AND SUPPORT**

A. EMT is permitted to be used in sizes 4" (50 mm) and smaller for power and telecommunication systems. See CONDUIT INSTALLATION SCHEDULE below for other limitations for EMT and other types of conduit.
B. Size power conductor raceways for conductor type installed. Conduit size shall be 1/2 inch (13 mm) minimum except all homerun conduits shall be ¾", or as specified elsewhere. Caution: Per the NEC, the allowable conductor ampacity is reduced when more than three current-carrying conductors are installed in a raceway. Contractor must take the NEC ampacity adjustment factors into account when sizing the raceway and wiring system.
C. Size conduit for all other wiring, including but not limited to data, control, security, fire alarm, telecommunications, signal, video, etc. shall be sized per number of conductors pulled and their cross-section. 40% fill shall be maximum for all new conduit fills.
D. Arrange conduit to maintain headroom and present a neat appearance.
E. Route exposed conduit and conduit above accessible ceilings parallel and perpendicular to walls and adjacent piping.
F. Maintain minimum 6 inch (150 mm) clearance between conduit and piping. Maintain 12 inch (300 mm) clearance between conduit and heat sources such as flues, steam pipes, and heating appliances.
G. Arrange conduit supports to prevent distortion of alignment by wire pulling operations. Fasten conduit using galvanized pipe straps, conduit racks (lay-in adjustable hangers), clevis hangers, or bolted split stamped galvanized hangers.

H. Group conduit in parallel runs where practical and use conduit rack (lay-in adjustable hangers) constructed of steel channel with conduit straps or clamps. Provide space for 25 percent additional conduit.
I. Do not fasten conduit with wire or perforated pipe straps. Before conductors are pulled, remove all wire used for temporary conduit support during construction.
J. Support and fasten metal conduit at a maximum of 8 feet (2.4 m) on center.
K. Supports shall be independent of the installations of other trades, e.g. ceiling support wires, HVAC pipes, other conduits, etc., unless so approved or detailed.
L. In general, all conduit shall be concealed except where noted on the drawings or approved by the Architect/Engineer. Contractor shall verify with Architect/Engineer all surface conduit installations except in mechanical rooms.
M. Changes in direction shall be made with symmetrical bends, cast steel boxes, stamped metal boxes or cast steel conduit bodies.
N. For indoor conduits, no continuous conduit run shall exceed 100 feet (30 meters) without a junction box.
O. All conduits installed in exposed areas shall be installed with a box offset before entering box.

3.02 **CONDUIT INSTALLATION**

A. Cut conduit square; de-burr cut ends.
B. Conduit shall not be fastened to the corrugated metal roof deck.
C. Bring conduit to the shoulder of fittings and couplings and fasten securely.
D. Use conduit hubs for fastening conduit to cast boxes. Use sealing locknuts or conduit hubs for fastening conduit to sheet metal boxes in damp or wet locations.
E. All conduit terminations (except for terminations into conduit bodies) shall use conduit hubs, or connectors with one locknut, or shall use double locknuts (one each side of box wall) and insulated bushing. Provide bushings for the ends of all conduit not terminated in box walls. Refer to Section 26 05 26 – Grounding and Bonding for Electrical Systems for grounding bushing requirements.
F. Install no more than the equivalent of three 90 degree bends between boxes.
G. Use hydraulic one-shot conduit bender or factory elbows for bends in conduit larger than 2 inch (50 mm) size unless sweep elbows are required.
H. Conduit shall be bent according to manufacturer's recommendations.
I. Use suitable conduit caps or other approved seals to protect installed conduit against entrance of dirt and moisture.
J. Provide 1/8 inch (3 mm) nylon pull string in empty conduit, except sleeves and nipples.
K. Install expansion-deflection joints where conduit crosses building expansion joints. Note: expansion-deflection joints are not required where conduit crosses building control joints if the control joint does not act as an expansion joint. Install expansion fitting in PVC conduit runs as recommended by the manufacturer.
L. Avoid moisture traps where possible. Where moisture traps are unavoidable, provide junction boxes with drain fittings at conduit low points.
M. Where conduit passes between areas of differing temperatures such as into or out of cool rooms, freezers, unheated and heated spaces, buildings, etc., provide Listed conduit seals to prevent the passage of moisture and water vapor through the conduit.
N. Ground and bond conduit under provisions of Section 26 05 26.
O. Maximum Size Conduit in Slabs Above Grade: 3/4 inch (19 mm). Do not route conduits to cross each other in slabs above grade.
P. Identify conduit under provisions of Section 26 05 53.

3.03 **CONDUIT INSTALLATION SCHEDULE**

A. Conduit other than that specified below for specific applications shall not be used.
B. Concealed Dry Interior Locations: Electrical metallic tubing.
C. Exposed Dry Interior Locations: Electrical metallic tubing.
D. 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.

3.04 **AUXILIARY GUTTERS (WIREWAYS) INSTALLATION**

A. Bolt auxiliary gutter to wall using two-piece hangers or steel channels fastened to the wall or in self-supporting structure.
B. Gasket each joint in oil-tight gutter.
C. Mount rain-tight gutter in horizontal position only.
D. Maintain grounding continuity between raceway components to provide a continuous grounding path under provisions of Section 26 05 26.

3.05 **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.
B. 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.
C. No outlet, junction, or pull boxes shall be located where it will be obstructed by other equipment, piping, lockers, benches, counters, etc.
D. Boxes shall not be fastened to the metal roof deck.
E. It shall be the Contractor's responsibility to study drawings pertaining to other trades, to discuss location of outlets with workmen installing other piping and equipment and to fit all electrical outlets to job conditions.
F. In case of any question or argument over the location of an outlet, the Contractor shall refer the matter to the Architect/Engineer and install outlet as instructed by the Architect/Engineer.
G. 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.
H. Locate and install boxes to allow access to them. Where installation is inaccessible, coordinate locations and provide 18 inch (450 mm) by 24 inch (600 mm) access doors.
I. Locate and install to maintain headroom and to present a neat appearance.
J. Install boxes to preserve fire resistance rating of partitions and other elements, using approved materials and methods.

3.06 **PULL AND JUNCTION BOX INSTALLATION**

A. Locate pull boxes and junction boxes above accessible ceilings, in unfinished areas or furnish and install Owner 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 24 16
PANELBOARDS

PART 1 – GENERAL

1.01 SCOPE OF WORK
A. Base Bid: The work under this section includes main, distribution and branch circuit panelboards.

1.02 SECTION INCLUDES
A. Distribution Panelboards

1.03 RELATED WORK
A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 0 and 1 Specifications Sections, apply to this section.

1.04 SUBMITTALS
A. Include outline and support point dimensions, voltage, main bus ampacity, integrated short circuit ampere rating, and circuit breaker arrangement and sizes.

1.05 OPERATION AND MAINTENANCE DATA
A. All operations and maintenance data shall comply with the submission and content requirements specified under section GENERAL REQUIREMENTS.

1.06 COORDINATION
A. Coordinate new circuit breakers in existing panelboards with manufacturer.

PART 2 – PRODUCTS

2.01 DISTRIBUTION PANELBOARDS
A. Branch Circuit Panelboards: Existing is Circuit breaker type.
B. Molded Case Circuit Breakers:
   1. Provide circuit breakers UL listed as Type HACR for air conditioning equipment branch circuits.
   2. Thermal-Magnetic Circuit Breakers: Inverse time-current element for low-level overloads and instantaneous magnetic trip element for short circuits. Adjustable magnetic trip setting for circuit-
C. Do not use tandem circuit breakers.
D. Circuit breakers shall be bolt-on type with common trip handle for all poles. No handle ties of any sort will be permitted.

PART 3 – EXECUTION

3.01 INSTALLATION
A. Install new circuit breakers in existing panelboards as required by manufacturer.

END OF SECTION

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SECTION 26 27 02
EQUIPMENT WIRING SYSTEMS

PART 1 – GENERAL

1.01 SCOPE OF WORK
A. Base Bid: The work under this section includes electrical connections to equipment specified under other Divisions and/or Sections, or furnished by Owner, including, but not limited to:
   1. HVAC motors

1.02 RELATED WORK
A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 0 and 1 Specification Sections, apply to this section.
B. Section 26 05 19 – Low-Voltage Electrical Power Conductors and Cables.
C. Section 26 05 33 – Raceway and Boxes for Electrical Systems.

1.03 SUBMITTALS
A. Product Data: Provide data for cord and wiring devices.

1.04 COORDINATION
A. 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.

PART 2 – PRODUCTS

PART 3 – EXECUTION

3.01 INSPECTION
A. Verify that equipment is ready for electrical connection, wiring, and energization.

3.02 PREPARATION
A. Review equipment submittals prior to installation and electrical rough-in. Verify location, size, and type of connections. Coordinate details of equipment connections with supplier and installer.

3.03 INSTALLATION
A. Use wire and cable with insulation suitable for temperatures encountered in heat-producing equipment.
B. Make conduit connections to equipment using flexible PVC-coated metal conduit.
C. Install pre-finished cord set where connection with attachment plug is indicated or specified, or use attachment plug with suitable strain-relief clamps.
D. Provide suitable strain-relief clamps for cord connections to outlet boxes and equipment connection boxes.
E. Make wiring connections in control panel or in wiring compartment of pre-wired equipment in accordance with manufacturer's instructions. Provide interconnecting wiring where indicated.
F. Install disconnect switches, controllers, control stations, and control devices such as limit switches and temperature switches as indicated. Connect with conduit and wiring as indicated.
G. Coolers and Freezers: Cut and seal conduit openings in freezer and cooler walls, floor, and ceilings.

3.04 HVAC AND PLUMBING CONNECTIONS
A. Provide all power wiring including all circuitry carrying electrical energy from panelboard or other source through starters, variable frequency drives (VFDs), and disconnects to motors or to packaged control panels. Packaged control panels may include disconnects and starters and overcurrent protection. Provide all wiring between packaged control panels and motors.

B. VFD Installations: Install VFD input wiring and output wiring in separate conduit systems. Do not mix VFD input power and output power, or control wiring in a common raceway.
C. Unless otherwise specified, all electrical motors and control devices such as aquastats, float and pressure switches, fan powered VAV boxes, switches, electro-pneumatic switches, solenoid valves and damper motors requiring mechanical connections shall be furnished and installed and wired by the Contractor supplying the devices.
D. Each motor terminal box shall be connected with a minimum 12", maximum 36" piece of flexible PVC-coated metal conduit to a fixed junction box. Conduit must be installed perpendicular to direction of equipment vibration to allow conduit to freely flex.
E. Check for proper rotation of each motor.

END OF SECTION

SECTION 28 31 00
FIRE DETECTION AND ALARM

PART 1 – GENERAL

1.01 SCOPE OF WORK

A. The Dane County City-County Building has an existing fire alarm system. This project will add interface with a new fire protection double interlock pre-action system in the east penthouse and system connections to new duct smoke detectors associated with the computer room cooling units installed within the 1st floor space. The existing fire alarm system shall be extended to the new devices as required.
B. Existing fire alarm system is Simplex 4100U series and only devices compatible and approved for use with the system by Simplex shall be permitted.
C. All fire alarm system cabling shall be routed in EMT raceway.

1.02 SECTION INCLUDES

A. Operation: Multiplex/Intelligent Fire Alarm System
B. Multiplex/Intelligent Peripheral Devices

1.03 RELATED WORK

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 0 and 1 Specifications Sections, apply to this Section.
B. Section 26 05 00 – Common Work Results for Electrical
C. Section 26 05 29 – Hangers and Supports for Electrical Systems
D. Section 26 05 33 – Raceway and Boxes for Electrical Systems

1.04 SUBMITTALS

A. Under the provisions of Section 26 05 00 and Division 0 and 1, submit the following for approval prior to ordering any equipment in accordance with requirements of Division 0 and 1, General Conditions. Submit a total of ten (10) sets.
B. Copies of CAD Files (AutoCAD, latest version, or DXF Format) for the Fire Alarm floor plans will be made available to the successful bidder for preparation of the required shop drawings and as-builts.
C. REQUIRED SUBMITTAL MATERIALS:
    1. The following items, and any additional items required per Section 26 05 00, shall be included within the submittal package:
        a. Although they may be submitted under separate cover, Submittal Brochures/Booklets/Binders and Shop Drawings shall be submitted together, and shall be treated as a complete set.
    2. COVER SHEET:
        a. The submittals shall contain a cover sheet, which shall include the following information:
            1) Submittal Date
            2) Specification Section(s)
            3) Fire Alarm Contractor (Contact Name, name, address, and telephone number)
            4) Electrical Contractor (Contact Name, name, address, and telephone number)
            5) Project Name, Project City, Project State, and Project Address.
    3. TABS AND TABLE OF CONTENTS:
        a. The Table of Contents shall appear immediately behind the Cover Sheet, and shall contain a complete listing of all of the tabs contained within the binder/booklet.
            1) Tabbed index sheets shall be inserted into each of the binders, such that each binder is clearly sub-divided into sections. Tabbed sections shall be provided, at minimum, for the following:
            2) One section for each building – ALL submittal data, which applies to any particular building, shall be located within the tabbed section for the corresponding building. All submittal data within each "building" section shall appear in the same order.
            3) One section for manufacturer's data sheets – divided into sub-sections for the following:
                a) Panel Equipment (Panels, Panel Components/Modules, Printers, Annunciators, etc.)
                b) Addressable Field Devices (Initiating and Control/Monitoring/Isolation)

c) Non-Addressable Field Devices (Initiating Devices, relays, etc.)
d) Notification Appliances
e) Fire-Fighter Communications Equipment if applicable

4. EQUIPMENT LIST:
   a. A complete equipment list of all components, including the following: Quantity, Manufacturer, Part Number, and Description. If the supplier uses different part numbers from those of the actual manufacturer, the actual manufacturer and part numbers as they appear – marked on the shipping box/packages, shall also be identified on this list.
      1) Each Equipment List shall include a complete listing of the modules, components, and software included for each modular Fire Alarm Control Panel, Network Panel, Transponder, Outboard Gear Panel or Annunciator. Such items shall be listed in a manner that clearly indicates that such items are parts of/components of a larger unit. Simply stating a single part number and description for such panels shall be unacceptable.
      2) A separate list shall be included for each section, with items grouped by system.
      3) For projects involving multiple systems, separate equipment lists shall be provided - one for each system.
      4) Spare Parts shall also be listed separately, and shall be identified clearly as "Spare Equipment".
5. PRODUCT DATA:
   a. Manufacturer's product data sheets and equipment description of all system components. These data sheets shall be highlighted or suitably marked, so that included items and options are indicated. On data sheets that include multiple products, products that are not used shall be crossed out.
      1) Product Data Sheets shall be organized, in order, corresponding to the FIRST occurrence of the corresponding item on the equipment list
6. SEQUENCE OF OPERATION:
   a. Complete sequence of operations of all functions of the system. This sequence of operation shall be custom-created for this particular job.
      1) In order to satisfy this submittal requirement, it shall be acceptable to include copies of the "Operation" portions of the specifications, including any applicable schedules/other supplementary information. Copied specification pages shall be marked and highlighted, where the programmed operation will differ from the specified operation. Copied specification pages shall be marked "no changes", where no significant deviation will occur. Other acceptable alternatives shall include written narratives, organized in a logical manner, and Matrix Charts.
      2) Where Matrix Charts are provided, such charts shall be organized and labeled clearly, and shall incorporate suitable levels of detail (refer to NFPA-72 (1999) A-7-5-2.2(9) for an example of an acceptable matrix chart). The Leftmost column of the Matrix Chart shall include groupings of initiating devices and other function switches. The Topmost Row shall include groupings of notification appliances and output devices.
7. BATTERY CALCULATIONS:
   a. These calculations shall clearly illustrate both the Standby and Alarm loads, due to the various field devices and panel components/modules. It is generally recommended to submit such calculations in a "spreadsheet" format. These calculations shall include any reserve/additional capacity, as required elsewhere within these specifications. Final results shall indicate both the minimum battery capacity required and the capacity actually provided.
8. ADDRESSABLE DEVICE/DESCRIPTOR LIST:
   a. Prior to programming the system, submit a chart or printout, listing every system address provided for purposes of alarm initiation, status monitoring, supervised signaling, and auxiliary controls. This printout shall include the corresponding device type and field programmable "custom labels", as they will be displayed on the New System – at the FACP and Local Annunciator. The addresses listed within this document shall directly correspond to the addresses marked on the submitted floor plan drawings. This list will be modified as needed by the Owner and returned to the contractor for final programming in to the system.

9. NAC WIRE DROP CALCULATIONS:
    a. Calculations shall be provided for all Notification Appliance Circuits (NAC) in the building. It is recommended that this calculation should follow a "spreadsheet" format, and should clearly indicate the following:
        1) The name of the circuit
        2) Point of origin of the circuit
        3) Complete list of all devices served by the circuit, including location and type of each device
        4) Alarm Current Draw for each device, at the applied voltage
        5) Applied Voltage (Based on anticipated battery voltage after specified stand-by & alarm operation)
        6) Acceptable Operating Voltage for each type of device on circuit
        7) Calculated Voltage at each device on circuit
    b. These calculations should mathematically prove that all Notification Appliances on the circuit will receive acceptable power for proper operation, under "worst-case-scenario" conditions.
10. SHOP DRAWINGS:
    a. All submitted drawings shall be created using CAD, and shall be coordinated so that terminal numbering, circuit designation and equipment or device designations are the same on all drawings. All drawings must be submitted and approved by the engineer before ordering or fabrication starts, but such approval will not waive any specification requirements unless specifically stated. CAD formatted fire alarm drawings may be made available from the A/E at a cost of $100 per sheet requested.
    b. Each and every sheet of the Shop Drawings shall be clearly and prominently identified as "SHOP DRAWINGS – PREPARED BY: (insert name of contractor firm preparing the shop drawings)", and shall be clearly and visibly different from the Contract Documents/Bidding Drawings. As a minimum, the name and company logo for the Electrical Contractor and the Fire Alarm Equipment Vendor should be added to each sheet, and a revision date shall be inserted on each sheet.
    c. The submitted Shop Drawings shall include the following types of drawings:
        1) PROJECT-SPECIFIC DRAWINGS:
            a) Project-Specific Drawings. These drawings shall include the following:
            b) SYSTEM RISER DRAWING:
            c) A separate riser drawing shall be furnished for each system. Each System Riser shall illustrate all fire alarm circuits, which serve the facility, and shall incorporate the following information, in a clear, concise format:
                - Point of origin of each circuit (usually a Panel, or a Module within a panel)
                - Circuit type and labeling
                - Area served by each circuit
                - Wire/cable type and size
                - Locations of Panelboards where primary system power is obtained
                - The following information for each Field Device:
                    - Device Type
                    - Circuit(s) to which device is connected
                    - Locations of any End-Of-Line Resistor (EOLR)
                    - (and the circuit terminated by any such EOLR)
11. BLOCK DIAGRAMS:
    a. Showing layout and operation of the entire system.
    b. FLOOR PLANS:
        1) These drawings shall consist of edited versions of the Contract Documents, which shall include the following information:
            a) Fire Department Response Location(s)
            b) Annunciator Location(s)
            c) Panel Location(s)
            d) Device Addresses - The addresses shown on these drawings shall directly correspond to the chart or printout, as specified previously, which spells out specific information about each device, including the field programmable "custom label".

D. TYPICAL DEVICE/MODULE WIRING DETAILS:
   1. Component and module wiring diagrams – intended to illustrate terminations and wiring connections to each typical Field Device (Detectors, Notification Appliances, etc.), and each typical panel component/module utilized within the system. This set of drawings shall only include diagrams for modules and components, which are actually used in the provided system(s).
   2. These drawings shall incorporate clear labeling/nomenclature, which shall clearly indicate the corresponding field device or module, to which it corresponds.
   3. OMISSION OF ANY OF THE ABOVE MATERIALS FROM THE SUBMITTALS SHALL RESULT IN AN IMMEDIATE REJECTION OF THE SUBMITTALS FOR THIS PROJECT. If the EC/FAC has any questions concerning the preparation of these materials, please contact the Engineer.

1.05 QUALITY ASSURANCE

A. Unless specifically stated otherwise, each and all items of the fire alarm system shall be listed as a product of a SINGLE fire alarm system manufacturer under the appropriate category by Underwriters' Laboratories, Inc. (UL), and shall bear the UL label.
B. Notification Appliances may be products of a single, different manufacturer – provided that the Primary Equipment Provider or Manufacturer provides written documentation of compatibility, and agrees to assume any and all responsibility for compatibility with the Control Equipment.
C. In addition to previously listed UL standards, all control equipment shall be listed under the following UL Standards:
   1. UOJZ UL category UOJZ as a single control unit. Partial listing shall NOT be acceptable.
   2. UL 864 Transient protection
   3. UL 497B Isolated Loop Circuit Protectors. Where fire alarm circuits leave the building, additional transient protection must be provided for each circuit.
   4. UL 1481 Power Limited Applications.

1.06 OPERATION AND MAINTENANCE DATA

A. All operations and maintenance data shall comply with the submission and content requirements specified under section GENERAL REQUIREMENTS.
B. In addition to the general content specified under GENERAL REQUIREMENTS supply the following additional documentation:
   1. A material guide, which shall contain the replacement part numbers and description of all components used. If this information is included in an instruction section for any of the equipment, it will not be necessary to duplicate the list. In either case, the parts list shall be associated with its respective chassis, modules or kit wherein it is found. A total listing of parts without such grouping will not be acceptable.
   2. Catalog data or literature
   3. Manufacturer's operating instructions.
   4. Manufacturer's maintenance instructions
   5. Installation instructions
   6. Name, address and telephone number of source for parts (i.e. keys, guards, etc.) not supplied by the Fire Alarm Manufacturer
   7. Copies of all approved shop drawings
   8. An updated copy of the submitted sequence of operation, revised to reflect any implemented changes

1.07 DELIVERY, STORAGE AND HANDLING

A. Receive equipment at job site; verify applicable components and quantity delivered.
B. Handle equipment to prevent internal components' damage and breakage, as well as denting and scoring of enclosure finish.
C. Do not install damaged equipment.
D. Store equipment in a clean, dry space and protect from dirt, fumes, water, and construction debris and physical damage. Make arrangements with the Owner at the pre-construction meeting for storage of equipment on the premises.

1.08 REGULATORY REQUIREMENTS

A. The complete installation shall conform to the applicable sections of the latest edition of the following Codes and Standards:
   1. NATIONAL FIRE PROTECTION ASSOCIATION (NFPA):
      a. NFPA-70 National Electrical Code (NEC) Generally, and Article 760 in particular
      b. NFPA-72 National Fire Alarm Code
      c. NFPA 101 Life Safety Code
      d. IBC International Building Code
      e. IFC International Fire Code
      f. IMC International Mechanical Code
   2. NATIONAL ELECTRICAL MANUFACTURER'S ASSOCIATION (NEMA)
   3. UNDERWRITERS' LABORATORIES, INC. (UL)
      a. UL-864 Control Units for Fire Protective Signaling Systems
      b. UL-268 Smoke Detector for Fire Protective Signaling Systems
      c. UL-217 Smoke Detectors for Single and Multiple Station
      d. UL-521 Heat Detectors for Fire Protective Signaling Systems
      e. UL-464 Audible Signaling Appliances
      f. UL-1971 Visual Signaling Appliances
      g. UL-38 Manually Actuated Signaling Boxes
      h. UL-1481 Power Supplies for Fire Protective Signaling Systems

1.09 MANUFACTURER PROVIDED SERVICES

A. A manufacturer-trained service technician shall provide the following installation supervision. This Technician shall be certified by the equipment manufacturer, and shall have had a minimum of two (2) years of service experience in the fire alarm industry.

B. The technician's name shall appear on equipment submittals and a letter of certification from the fire alarm manufacturer shall be sent to the project engineer. The manufacturer's service technician shall be responsible for the following items:
   1. Pre-installation visit to the job site to review equipment submittals and verify method by which the system should be wired.
   2. Periodic job site visits to verify installation and wiring of system, and to perform any partial system programming – required to permit portions of the existing system to be removed.
   3. Upon completion of wiring, final connections shall be made under the supervision of this technician, and final checkout and certification of the system.
   4. At the time of final checkout, technician shall give operational instructions to the Owner and/or his representative on the system.
   5. All job site visits shall be dated and documented in writing and signed by the Electrical Contractor. Any discrepancy shall be noted on this document and a copy kept in the system job folder that shall be available to the Project Engineer any time during the project.

1.10 QUALIFICATIONS

A. All equipment shall be supplied by a firm, which specializes in fire alarm and smoke detection systems with a minimum of five (5) years-documented experience. The company shall be an authorized distributor of the proposed equipment

B. All work shall be performed by a licensed contractor, who is regularly engaged in the installation and servicing of fire alarm systems. Proof of five (5) years documented experience and of factory authorization to furnish and install the equipment proposed shall be furnished prior to contract award, if required by Division of State Facilities.

C. Contractor shall be located within three (3) hours of travel time or less from the site of this project.

1.11 DEPARTMENT OF SAFETY AND PROFESSIONAL SERVICES PLAN REVIEW

A. REQUIRED DOCUMENTS (per building)
   1. This project requires a submittal to the Department of Safety and Professional Services for review and approval. The following details the requirements of the contractor and the A/E with regard to the fire alarm Department of Safety and Professional Services submittal.

B. CONTRACTOR'S RESPONSIBILITY
   1. Department of Safety and Professional Services approval is required prior to the start of fire alarm system construction. The contractor shall prepare and submit the required documents in a timely fashion to meet this requirement. If the contractor starts fire alarm system construction before approval is given by the Department of Safety and Professional Services, the contractor is responsible for all additional fees required by the Department of Commerce.
   2. Initially, prepare one set of the Department of Safety and Professional Services fire alarm submittals and send it to the A/E for approval before proceeding with actual submittal to DSPS.
   3. Contractor shall follow Owner's CAD standards when preparing fire alarm shop drawings, using information consistent with the project's construction drawings.
   4. After obtaining A/E approval to proceed with the Department of Safety and Professional Services fire alarm submittal, prepare four (4) sets of the fire alarm shop drawings as approved by the A/E that will be sent to the Department of Safety and Professional Services by the contractor. These shop drawings shall be stamped, signed and dated by a Wisconsin registered architect, professional engineer or electrical designer taking responsibility for the shop drawings. Signing and sealing shall comply with SPS 361.31(1). Note that each shop drawing copy must be stamped, signed and dated unless there is a drawing index sheet, in which case only the four index sheets need to be stamped, signed and dated. Where the submitter is both the designer and installer of the fire alarm system, a signature only will suffice [ch. 443.14(6), Stats.]. It shall be an original signature and date.
   5. Prepare one bound booklet of the fire alarm system device cut sheets and all calculations (indicating device power calculations, voltage drop calculations and battery calculations). These booklets do not need to be stamped, signed or dated.
   6. Prepare a letter of transmittal listing all items being sent to the Department of Safety and Professional Services. Copy the A/E on the letter of transmittal only.
   7. Complete the Application for Review, Buildings, HVAC, Fire and Components – SBD-118 form.
   8. Calculate the SDB-118 submittal fee; write a check for the appropriate amount, payable to Safety and Professional Services.
   9. Request a review date with Department of Safety and Professional Services, Division of Safety and Buildings by emailing the completed first page of the review application, SBD-118, to planschedule@commerce.state.wi.us or, fax it to 877-840-9172.
   10. Assemble the submittal and send the documents described in items (d), (e), (f), (g) and (h) above to the Department of Safety and Professional Services at the appropriate address shown on at the bottom of DBS-118.
   11. If requested by [Owner] [user], A/E, Department of Safety and Professional Services or its authorized representative, additional data pertaining to the construction, materials and equipment shall be submitted to the A/E to substantiate conformance to DSPS 361 code.

1.12 PLAN REVIEW FEES

A. Fees shall be determined in accordance with Table 302.31-1 or Table 302.31-2 found in Chapter SPS 302 of the Wisconsin Administrative Code.
B. Reduced plan review fees (Table 302.31-2) may be utilized for projects in municipalities that perform inspections as an agent of the Division of Safety & Buildings.
C. A list of "Delegated Municipalities" that perform inspections can be found at:
D. http://dsps.wi.gov/sb/SB-CommBldgsDeleMunis.html
E. Reduced fees (Table 302.31-2) do not apply to State-owned buildings.
F. In addition to the plan review fee, a plan entry fee of $100 shall be included with each submittal.
G. Per SPS 302.10, plan review fees shall be doubled for projects where the installation, erection or construction was initiated without the required Departmental approval.

1.13 WHAT TO SUBMIT

A. Four (4) sets of properly signed/sealed fire alarm plans.
   1. In an effort to limit handling and mailing costs, the submitter may opt to submit one (1) complete set of plans and three (3) index sheets. The plan set will be retained. A copy of the approval letter will be attached to the index sheets and returned. It shall then be the responsibility of the submitter to properly attach the approval and index page to plans matching the copy on file with the Department.

2. A maximum of five (5) plan sets may be submitted. Additional plan sets (in excess of 5) will incur a $25/set fee.

B. One (1) set of battery calculations.
C. One (1) set of voltage-drop calculations for each notification circuit.
D. One (1) copy of applicable material data sheets.
E. A detailed, project-specific 'Sequence of Operation' which clearly identifies all functions of the fire alarm system, including the transmission of alarm, supervisory and trouble signals to an approved supervising station.
F. A completed SBD-118 application form.
   1. The application must identify the Transaction ID No. related to the parent building review approval. Fire alarm submittals for new construction, building additions or building alterations cannot be reviewed prior to building plan approval.
   2. The original supervising professional's signature for the building project is applicable to fire alarm submittals and a separate signature is not required. Standalone fire alarm system submittals do not require a supervising professional.
G. Plan review fee.

1.14 FORMS

A. SBD-118 (R11/11) can be downloaded from: http://dsps.wi.gov/sb/docs/sb-Form118App.pdf (PDF) or http://dsps.wi.gov/sb/docs/SB-Form118App.doc (Word)
B. Visit Department of Safety and Professional Services, Division of Safety and Buildings Commercial Buildings Plan Review info website for additional information: http://dsps.wi.gov/sb/SB-HomePage.html.
C. For scheduling of building, HVAC, and fire plans, use the electronic online request for commercial building plan appointments: http://dsps.wi.gov/sb/SB-DivPlanReview.html
D. Once approved, Safety and Buildings will retain one of the sets, and will return three sets, which shall be distributed as follows:
   1. (1) copy shall be retained by the fire alarm contractor on-site, and shall be used as a reference/made available to any Department of Safety and Professional Services inspectors, who may make periodic inspection visits to the site.
   2. (1) copy shall be forwarded to the Owner for their records.
   3. (1) copy shall be retained by the Division 26 electrical contractor, for their records. If the Division 26 electrical contractor and the fire alarm contractor are the same firm, this copy shall be kept on site, at or near to the Fire Alarm Control Panel.
E. CITY OF MADISON – FIRE DEPARTMENT INSPECTION/FIRE ALARM WORK PERMIT:
F. PER A LOCAL ORDINANCE (City of Madison General Ordinance 34 – Fire Prevention Code) EFFECTIVE AS OF JULY 2, 2002 - THE FIRE ALARM AND FIRE PROTECTION SYSTEMS, AS INSTALLED WITHIN THIS FACILITY ARE SUBJECT TO PERMIT REQUIREMENTS AND INSPECTIONS OF THE INSTALLATION BY THE CITY OF MADISON – FIRE DEPARTMENT/FIRE PREVENTION BUREAU:
G. THE FAC SHALL BE RESPONSIBLE FOR SCHEDULING, COORDINATING, AND ATTENDING THIS INSPECTION, AND FOR PAYMENT OF ALL ASSOCIATED INSPECTION/PERMIT FEES.
H. This process normally involves both a plan review and inspections; however, for State-Owned Buildings, the City of Madison only performs the inspections, with the Plan Review being performed by COMM/Safety & Buildings as specified previously under "Submittals".
I. Copies of the applicable Code can be obtained on-line, via the following link:
   1. http://www.madisonfire.org/prevention/pdf/mgo34.pdf
J. Because of this Permit/Inspection process, the following procedure shall be followed by the Division 26 Electrical Contractor, (and by their sub-contractors, where particular arrangements have been made between the EC and their sub-contractor(s)):
   1. First, the Electrical Contractor shall obtain State-Approval of the Installation Drawings, per the process previously described under "Submittals – Plan Review Process", as found within this specification.

2. Once the State-Approved Drawings are received by the contractor, and PRIOR TO STARTING ANY CONSTRUCTION, the Electrical Contractor shall completely fill-out submit the proper "City of Madison Fire Department – Fire Protection System Work Permit Application" form. If required, suitable fee payment shall accompany the form. Copies of this form may be obtained via the following link:
    a. http://www.madisonfire.org/prevention/fire_protection_engineering/pdf_files/master_plan_review_permit_application.pdf
3. Once the form has been received, processed, and accepted by the Madison Fire Department (MFD), MFD will issue the proper permit, and construction may begin.
4. The inspection program involves at least two inspections, as follows:
    a. A Rough-In Inspection shall be scheduled and performed, prior to installation of any new devices. In certain buildings (high-rises), multiple rough-in inspections may be required, as subsequent areas are completed. It is highly recommended that these inspections should be carefully scheduled and adhered to, since potentially costly mistakes can be prevented before the associated devices are completely installed.
    b. Final Inspection of the System – prior to this inspection, the Electrical Contractor shall have conducted all necessary pre-testing.
    c. Questions regarding this inspection program may be directed to:
    City of Madison – Fire Department – Fire Prevention Bureau
    325 West Johnson Street
    Madison, WI 53703
    Phone: (608) 266 – 4420 (Non-Emergency Number)

1.15 PROJECT RECORD DRAWINGS

A. Installing Electrical Contractor shall submit to the Owner the as-built drawings for the entire work done under this project prior to final payment.
B. These drawings shall show:
    1. Locations and addresses of Initiation Devices, Notification Appliances, isolation devices, status-monitoring devices, supervised signaling devices, and auxiliary control devices.
    2. Circuit and Address information for each field device listed above.
    3. Conduit layout and size
    4. Number/size/type of conductors in each conduit run
    5. Riser diagrams
    6. Location of end-of-line devices
C. Riser diagrams shall include locations (room or area number) of notification, initiating, end-of-line devices and addresses for all addressable field devices.
D. Also see requirements in Division 0 and 1, General Conditions.

PART 2 – PRODUCTS

2.01 ENCLOSURES

A. All panels and peripheral devices shall be the standard product of a single manufacturer and shall display the manufacturer's name on each component.
B. Cabinet shall be equipped with locks and transparent door panel providing tamper proof enclosure yet allowing full view of the various lights and controls as required above.

2.02 OPERATION: MULTIPLEX/INTELLIGENT FIRE ALARM SYSTEM

A. COMPUTER ROOM COOLING SYSTEM INTERFACE
    1. Duct Smoke Detectors and Addressable Control Modules, or Supervised Remote Relays shall be provided as required. Duct Smoke Detectors shall be installed in compliance with the manufacturer's recommendations. Each Addressable Control Module or Supervised Remote Relay for unit shutdown shall be installed within 3 feet of the computer room cooling unit to which it is connected. The Division 26 EC shall provide all wiring and terminations required for shutdown of the specified cooling equipment.

2. The Addressable Control Modules or Supervised Remote Relays provided for this purpose shall be provided with DPDT output contacts. One SPDT set of the DPDT contacts shall be utilized for the specified shutdown function. The second SPDT set of the DPDT contacts shall be available for connection to the temperature controls, to indicate that unit shutdown – due to Duct Smoke – has occurred.
3. The associated Fan shall be shut down only upon actuation of the Duct Smoke Detector associated with the particular unit.
4. All programming required at the fire alarm system head end shall be included within bid.

B. PRE-ACTION FIRE PROTECTION SYSTEM.
1. Addressable control, monitor modules and/or supervised relays shall be provided as required. All interface relays shall be installed in compliance with the manufacturer's recommendations. Furnish quantity of devices to separately transmit alarm, supervisory and trouble conditions from the pre-action system control panel. Install devices adjacent to the pre-action system control panel.
2. All programming required at the fire alarm system head end shall be included within bid.

2.03 MULTIPLEX/INTELLIGENT PERIPHERAL DEVICES

A. All devices shall be supervised for trouble conditions. The system control panel shall be capable of displaying the type of trouble condition (open, short, device missing/failed). Failure of a device shall not hinder the operation of other system devices.

B. DEVICE IDENTIFICATION
1. Each intelligent device must be uniquely identified by an address code entered on each device at time of installation. The use of jumpers to set address shall not be acceptable.
2. Device addressing schemes which use permanently-imbedded, electronically-identifiable "serial number" which is similar to the address imbedded within Personal Computer Network Interface Cards shall be acceptable.
3. Fire Alarm Systems utilizing hand-held or briefcase-style programming tools. Which are used to electronically assign addresses and/or programming parameters to devices shall be acceptable. However one such programmer tool shall be provided to the Owner at no additional cost.
4. The address along with the loop number and end-of-line device if present shall be indicated, and be visible from the ground, on the device in the field using machine generated marking. Contractor shall provide a sample of such labeling scheme before using it.
5. End-of Line devices shall also be identified by means of permanent, machine generated label, affixed to the device.
6. Device identification schemes that do not use uniquely set addresses but rely on electrical position along the communication channel are unacceptable. These systems cannot accommodate t tapping and the addition of an intelligent device between existing devices requires re-programming all existing devices beyond added device.
7. The system must verify that proper type device is in place and matches the desired software configuration.

C. INTELLIGENT DETECTORS - GENERAL
1. Smoke and heat detectors must be approved by the State Engineer prior to installation.
2. Each detector shall incorporate the following features:
   a. LED(s), which shall flash to indicate communication with the Fire Alarm System, and which also illuminate in a steady manner when the detector is in an alarm status
   b. A means to allow field function testing of the detector
   c. A low-profile design/shape
   d. An insect screen
   e. Voltage and RF transient suppression techniques, in order to minimize false alarms
   f. Smoke detectors shall communicate the actual smoke chamber values to the system control panel.
3. Smoke detectors shall be listed for sensitivity testing from the control panel. Sensitivity test results shall be logged and downloaded to a printer.
4. The detectors shall be plug-in units, which mount to a common base, and shall be UL 268 approved.

5. Each detector shall be compatible with the fire alarm panel and shall obtain its operating power from the SLC, to which it is connected. (Where relay or sounder-equipped bases are used, it shall be acceptable to require a separate 24 VDC or NAC connection.) Each detector shall be reset by actuating the control panel reset switch.
6. If field conditions so require the smoke detection devices shall not be installed until the construction is completed.

D. INTELLIGENT DETECTOR BASES
1. Bases shall be suitable for either smoke or heat detector mounting.
2. Either the base or the head shall contain electronic circuits that communicate the detector's status (normal, alarm, sensitivity status, trouble, etc.) to the control panel over two wires. The same two wires shall also provide power to the base and detector. Contacts between the base and head shall be of the bifurcated type using spring-type, self-wiping contacts.
3. The base shall be lockable. The locking feature must be field-removable when not required.
4. Upon removal of the detector's head, a trouble signal shall be transmitted to the control panel.
5. The detector base shall be sealed against rear airflow entry.
6. Each detector's base or head shall contain LED(s), which shall flash when the detector is being scanned by the control panel. The LED(s) shall turn on steady when the detector is in an alarm condition.

E. INTELLIGENT PHOTOELECTRIC SMOKE DETECTORS
1. The detectors shall contain no radioactive material.
2. Detectors shall be of the solid state photoelectric type and shall operate on the light scattering photodiode principle using a pulsed infrared LED light.

F. INTELLIGENT DUCT SMOKE DETECTORS
1. Duct detectors shall be of the photoelectric type specified above. It shall be possible to alarm the duct detector by using a remote or local test switch.
2. For maintenance purposes, it shall be possible to clean the duct housing sampling tubes by accessing them through the duct housings front cover.
3. Detector shall include remote keyed test switch and alarm LED indicator.
4. In mechanical rooms, alarm LED indicators for duct detectors shall be grouped on a stainless steel cover plate mounted adjacent to the main mechanical room door. Each LED shall be labeled with the detectors loop and address. A floor plan of the room showing the detectors and addresses shall be located adjacent to the cover plate. Provide Plexiglas cover over the plan.

G. INTERFACE MODULES - GENERAL
1. If external power to Addressable Interface Modules is required, such power shall be 24VDC, and shall be derived from a supervised fire alarm power supply.
2. Addressable Interface Modules may be provided in either a Class B or Class A supervision version.
3. In the Class B version the wiring shall be supervised by an end-of-line device.
4. In the Class A version the wiring shall be looped back and connected to the module to allow continual operation of the controlled devices even if the wiring sustains a single break.
5. The interface modules shall be supervised and uniquely identified by the control panel. Device identification shall be transmitted to the control panel for processing according to the program instructions.

H. INTERFACE MODULES - SUPERVISED CONTROL
1. Supervised Control Modules shall be utilized where needed, for control of Notification Appliances.
2. For Notification Appliances, speakers, and other device control with Class B or Class A wiring supervision, the interface module shall provide a double-pole/double-throw relay output, with supervision.
3. These interface modules shall communicate the supervised wiring status (normal, trouble) to the fire alarm control panel and shall receive from the fire alarm control panel a command to transfer the relay.

I. INTERFACE MODULES - SUPERVISED MONITORING
1. Addressable Monitor Modules shall be suited for monitoring of water-flow, valve tamper, Fire Suppression Control Panels, and other non-intelligent detectors and systems.
2. Addressable Monitor Modules shall be provided in any needed configuration, and may be used to interface any of the following initiation devices to a Signaling Line Circuit, as follows:
    a. Conventional 2-wire smoke detectors, including providing suitable power to the IDC.
    b. Normally Open, dry contact type devices - with class B or class A wiring supervision:

1) These interface modules shall communicate the Initiating Device Circuit status (normal, alarm, trouble) to the control panel.

J. INTERFACE MODULES - NON-SUPERVISED CONTROL
   1. This interface module shall provide double-pole/double-throw relay switching for loads up to 120VAC. It shall contain easily replaceable 2 amp fuses, one on each common leg of the relay.

PART 3 – EXECUTION

3.01 GENERAL

A. The complete installation shall be done in a neat, workmanlike manner in accordance with the applicable requirements of NFPA 70 - Article 760 and the manufacturer's recommendations.
B. Smoke detectors shall not be mounted until the construction is completed, unless they are covered with plastic bags or fitted covers immediately after installation to maintain cleanliness.

3.02 RACEWAYS

ALL FIRE ALARM SYSTEM WIRING SHALL BE INSTALLED WITHIN METALLIC CONDUIT UNLESS SPECIFIED.

A. All wiring shall be in a conduit system separate from other building wiring. See Section 26 05 33 – Raceway and Boxes for Electrical Systems for specifications.
B. All wiring shall be in minimum ½" steel raceway.
C. 40% fill factor shall be applied to all conduit sizes.
D. The contractor shall size conduit and boxes by circular mil size of each cable in each conduit or box. The circular mil sizing can be found on the manufacture's spec sheet, then use the NEC codebook to make calculation to follow NEC Chapter 9 Tables and Annex C for box and conduit fill.
E. There shall be no sharp edges with installed materials.
F. Use only identified conduit entries or request approval for other penetrations in cabinets; (certain areas require clear space for interior components/batteries). Cabinet shall be grounded to either a cold water pipe or grounding rod.
G. Existing conduit and surface metal raceway that is ½" in size or larger may be reused if found to have adequate space provided that it only serves the Fire Alarm system and doesn't contain any AC wiring. All existing conduit that is reused MUST be brought up to the current State of Wisconsin Electrical Code and Approved for usage by the Engineer prior to work being done.

3.03 CONDUCTORS

A. All wire and cable associated with this system shall be as required by the equipment manufacturer. The following information is intended for estimating purposes only. However, the minimum wire gauges and colors specified shall be strictly adhered to. All cable shall be installed as per NEC Article 760.
B. Type FPL wiring is required if the system is run in conduit or 'free-air.
C. All initiation and notification circuit cabling shall be listed Type FPL (300V) in accordance with NEC article 760."
D. All cables and wires #14 AWG and larger shall be stranded.
E. Fire alarm wiring shall be held in place at the device box, by means of a two-screw connector, (do not use squeeze or crimp type connectors).
F. All wiring shall be completely supervised. In the event of a primary power failure, disconnected standby battery, disarrangement of any components, any open circuits or grounds in the system, an audible and visual trouble signal shall be activated until the system is restored to normal.
G. All conductors shall be color-coded. Coding shall be consistent throughout the facility. Green wire shall be used only for equipment ground.
H. Fire alarm risers, notification appliance circuits and interconnections to remote panels (per NFPA 72) shall have a minimum 2Hr fire alarm rating. All notification appliance circuits shall be protected from the fire alarm panel of origination to the signaling zone they serve.
I. Where fire alarm circuits enter or leave a building, additional transient 75 to 90 volt gas tube protection shall be provided for each conductor.

J. Cable for Intelligent detector Loops shall be 18 to 12 AWG twisted pair with a shield jacket or per manufacturers recommendations installed in ½" conduit. Shield continuity must be maintained and connected to earth ground only at the control panel.
K. SLC wiring must not be in the same conduit with AC power wiring or other high current circuits. T-taps or branch circuit connections are allowed for all class B SLCs.
L. All splices or connections shall be made within approved junction boxes and with approved fittings. Boxes shall be red and labeled "FIRE ALARM SYSTEM" or "FA" by decal or other approved markings.
M. Tray cable is not acceptable for use as fire alarm system wiring installed in conduit.

3.04 DEVICE MOUNTING

A. Unless otherwise noted on the drawings, plans, specifications or by the Architect or Engineer; the recommended mounting heights, and requirements are as follows:
B. Heat and Smoke Detectors
   1. The location of detectors shown on the plans is schematic only. The detectors must be located according to code requirements.
   2. Surface mounted detectors shall be installed using back boxes equal to the base's size. Standard octagon and square boxes are not acceptable.
   3. Detectors should be located on the highest part of a smooth ceiling so that the edge of the detector is no closer than 4 inches from a sidewall. Ceilings with beams, joists or soffits that exceed 8 inches in depth require special planning and closer spacing.
   4. If it is necessary to mount a detector upon a sidewall, the top of the detector (the sensing chamber portion of the device) shall be located no closer than 4 inches from the ceiling and no further away than 12 inches.
   5. Smoke detectors should be installed to favor the air flow towards return openings and not located closer than 3 feet from air supply diffusers which could dilute smoke before it reaches the detector. No detectors shall be installed in direct airflow.
   6. Duct smoke detector installation to be by this contractor and should be installed in the locations shown on the mechanical and electrical plans. Ensure that the duct smoke detectors are in serviceable locations. Consult with the mechanical designer for alternate locations if these are shown in non-serviceable locations. When locations on mechanical plans are not available, install in locations called for that provide accessibility for service. Do not install within four feet of a fan discharge
   7. Heat and smoke detectors should be located near the center of the open area which they are protecting, thus providing coverage generally for 15-foot radius for heat and smoke detectors. Questionable locations shall be verified with Architect or Engineer before installation takes place.
   8. Heat and smoke detectors/Sensors – both Intelligent and non-addressable, shall be installed in accordance with their UL Listed Spacing. The quantity of Heat and smoke detectors/Sensors depicted on the drawings is based on the 900 square foot per detector rule. If detectors with significantly different spacing requirements are selected by the Fire Alarm equipment provider/EC, then additional detectors/sensors, if required, shall be provided at no additional cost to the project.
C. Duct Mounted Smoke Detectors
   1. Each duct smoke detector indicated on the contract documents shall be installed in cooperation with the Division 23 and Division 26 contractors. Duct detector locations shown are diagrammatic only and require pressure differential testing to insure proper smoke detector operation. Each duct detector housing and sampling tube kit installed shall be mounted and tested prior to the installation of the duct smoke detector. Air sampling tube installation shall be tested per the manufacturers written instructions.
   2. Division 26 contractor shall furnish the duct detector assembly and sampling tube kits sized for the installation locations indicated on the mechanical ductwork drawings. This contractor shall maintain possession of the duct detector smoke detection device.
   3. Division 26 contractor shall provide smoke detector installation, interconnecting cabling, and testing of the smoke detection system in accordance with specification section 16721.
   4. Division 23 contractor shall install detector housing and sampling tubes in accordance with the listing manufacturers' installation instructions, project documentation, and provide differential pressure testing and adjustments as described in Section 3 – Execution.
   5. Duct smoke detector assemblies shall be tested and installed in accordance with the following:

a. Post air system balancing – testing and adjusting for proper operation shall be done by the installing contractor with a pressure differential manometer.
b. The differential pressure readings taken across the duct detector housing inlet and return tube shall be between 0.06 minimum and 1.28 maximum inches of water. Provide adjustment to sampling tube as needed to accomplish required pressure differential.
c. Provide a written record of readings. Submit to the project engineer for review and acceptance prior to the final installation of the duct smoke detector.
d. Initial tests shall be conducted to qualify installation location suitability. If initial testing concludes appropriate pressure differential may be available, contractor shall install the duct detector assembly complete in accordance with the installation details.
e. If acceptable differential pressure readings are not obtained, the inlet sampling tube may be rotated until the proper differential pressure readings are obtained. If inlet sampling tube rotation does not yield the proper differential pressure reading, the duct detector assembly shall be relocated further downstream at no additional cost to the owner.

6. Final installation wiring of the duct smoke detector shall not be completed by the Division 26 contractor until after the proper differential pressure reading has been obtained, documented, and approved.
7. Installation Requirements: In addition to the manufactures instructions the following guidelines will be enforced:
   a. Duct detector may be installed in any wall of the duct unless otherwise restricted by the manufacturer's instructions.
   b. Cut inlet sampling tube length to suite dimension of duct. If duct is more than 18" wide drill an appropriate diameter hole directly opposite to support inlet sampling tube of lengths longer than 18". Sampling tube shall protrude no longer than 1" outside of duct wall.
   c. Contractor to note that air inlet sampling tubes are designed for differing duct widths employing air inlet holes in a quantity matching the duct width. Verify each inlet tube is appropriately sized for the duct width (typically 10 to 12 holes, each 0.193" diameter holes [#11 drill bit]).
   d. Angle cut return tube at a length as recommended by manufacturer if required. Support in accordance with manufacturers recommendations.
   e. Position inlet holes facing upstream of airflow. This initial installation position shall be used as the starting point for differential pressure testing. If required adjust as stated in the testing/adjusting procedure above. Angle cut of return tube shall be orientated downstream of airflow.
   f. Once acceptable differential pressure readings are obtained, tubes shall be locked in place in accordance with the manufacturer's installation instructions.
   g. Duct detector assembly and sampling tubes shall be mounted rigidly to prevent noise, chatter, and mechanical fatigue. Any installation found unacceptable will be corrected at the installing contractor's expense.
   h. Inlet tubes installed protruding through duct walls greater in width of 18" shall have the sampling tube end plugged with the manufacturer furnished air stopper.
   i. Air leaks are unacceptable, the installing contractor shall provide gaskets, or duct sealant around inlet and outlet air tubes. Sealing around detector housing perimeter is not acceptable. Seal all duct wall penetration to pressure class rating of duct assembly.
   j. Once the detector is installed, verify correct differential pressure readings across sampling tubes and record. Install manufacturer furnished sampling tube filters.
   k. If duct is insulated, provide detector housing standoffs, equivalent in depth of the duct wall insulation, to rigidly support detector assembly. Seal any sampling tube air holes that are not inside duct wall and duct sealant and tape.
   l. At each duct detector installation location provide a service opening. Include a minimum 12" x 12" access door as specified in division 15.
8. After assembly is installed and tested, coordinate with division 16 contractor for smoke detector installation.

3.05 IDENTIFICATION

A. Attach the label containing the address and SLC designation to:
   1. Each addressable detector. Label shall be visible and readable from the floor, 3/16" minimum character size (¼" is recommended).
   2. Each manual pull station. Label shall be placed on the top part
   3. Each Addressable Module. Label shall be attached to the faceplate
B. Label shall consist of black writing on white or clear background.
C. All junction boxes shall be painted red and labeled "Fire Alarm" or "FA".
D. All circuits must be labeled with the name of circuit and the area being served by the circuit.
E. Wire/cable splices in junction boxes shall be labeled indicating where the wire/cable is coming from and where it is going.
F. All conductors terminated in control panels, annunciator panels and extension panels shall be labeled.
G. All audio visual devices shall be labeled by each circuit and the order of the device on that circuit such as "Circuit No. 2, strobe No. 05 of 10".
H. All labels shall be permanent, and be machine generated. NO HANDWRITTEN OR NON-PERMANENT LABELS SHALL BE ALLOWED. Submit a sample for approval before using any labeling schemes.
I. Label size shall be appropriate for the conductor or cable size(s) and design. All labels to be used shall be self-laminating, white/transparent vinyl and be wrapped around the cable (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.
J. Adhesive type labels not permitted except for phase and wire identification.

3.06 TESTING

A. Before proceeding with any testing, all persons, facilities and building occupants whom receive alarms or trouble signals shall be notified by the contractor to prevent unnecessary response or building occupant distress. At the conclusion of testing, those previously notified shall be notified that testing has been concluded.
B. The manufacturer's authorized representative shall provide on-site supervision of installation of the complete fire alarm system installation, perform a complete functional test of the system, and submit a written report to the Contractor attesting to the proper operation of the completed system prior to final inspection.
C. Contractor shall pre-test each and every device in the system before the system is considered ready for final inspection.
D. The completed and pre-tested fire alarm system shall be fully tested in accordance with NFPA-72 by the Contractor in the presence of the Engineer, Owner's representative and the local Fire Marshal.
E. The Engineer or his authorized representative may suspend or discontinue the tests at any time performance is considered unsatisfactory. Resumption of testing will cover untested elements and any replaced elements. The contractor shall furnish all test personnel, test instruments and equipment of the accuracy necessary to perform the test. Arrangements for testing must be made with the Owner and the Engineer at least two weeks before the proposed testing date.
F. Upon the completion of a successful test, and prior to the final request for payment the Contractor shall:
   1. Certify the system to the Owner in writing
   2. Complete the NFPA 72 record of completion form
   3. Provide as builts and O&M manuals.
   4. Provide a signed statement that the Owner had received the specified system operation and maintenance training
G. The final payment will not be processed unless these documents are complete and are on hand.

3.07 SPECIAL CONSIDERATIONS

A. Contractor shall refer to Division 1, General Requirements, "SPECIAL SITE CONDITIONS".
B. The contractor must maintain the existing fire alarm system operational during the construction period. During periods of construction where dust or dirt may contaminate the existing detectors, the contractor shall cover the detectors to avoid nuisance alarms and trouble-calls.
C. Individual zones and/or devices of the existing fire alarm system can be bypassed by the contractor during construction under the following requirements:

1. The Superintendent of Buildings and Grounds is notified of which zones and/or devices are inoperative and for how long in writing, hand delivered.
2. The contractor covers all manual-pull stations that are not active and post temporary fire alarm notification procedures next to each inactive manual-pull station.
3. Ensure the fire alarm system is fully operational before leaving the job site.
4. Ancillary signals are acceptable during the construction period.

END OF SECTION

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