RFB NO. 319037

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. 319037
BUILDING AUTOMATION CONTROLS
CITY COUNTY BUILDING
210 MARTIN LUTHER KING JR BLVD
MADISON, WISCONSIN

Due Date / Time: **TUESDAY, December 3, 2019 / 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:

Todd Draper, PROJECT MANAGER
TELEPHONE NO.: 608/267-0119
FAX NO.: 608/267-1533
E-MAIL: draper@COUNTYOFDANE.COM

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LEGAL NOTICE

INVITATION TO BID

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

2:00 P.M., TUESDAY, DECEMBER 3, 2019

RFB NO. 319037

BUILDING AUTOMATION CONTROLS

CITY COUNTY BUILDING

210 MARTIN LUTHER KING JR BLVD, MADISON, WI

Dane County is inviting Bids for construction services to remove and replace application specific controllers and associated components for HVAC equipment. Replication of existing sequence of operation and user interface along with network controller replacement is included in the scope of work. Three network controllers to be replaced to allow for N4 compatability. Only firms with capabilities, experience & expertise with similar projects should obtain this Request for Bids document & submit Bids.

Request for Bids document may be obtained after **2:00 p.m. on October 22, 2019** by downloading it from bids-pwht.countyofdane.com. Please call Todd Draper, Project Mgr, at 608/267-0119, or our office at 608/266-4018, for any questions or additional information.

All Bidders must be pre-qualified as a Best Value Contractor before award of Contract. Complete Pre-qualification Application for Contractors at countyofdane.com/pwht/BVC_Application.aspx or obtain one by calling 608/267-0119.

A pre-bid site tour will be held November 5, 2019 at 10 a.m. at City County Building, starting in Room B-8. Bidders are strongly encouraged to attend this tour.

PUBLISH: OCTOBER 22 & OCTOBER 29, 2019 - WISCONSIN STATE JOURNAL

OCTOBER 22 & OCTOBER 29, 2019 - THE DAILY REPORTER

Department of Public Works, Highway & Transportation
Public Works Engineering Division
608/266-4018

Gerald J. Mandli, P.E.
Commissioner / Director

Joseph T. Parisi
County Executive

Deputy Director
Todd Draper

1919 Alliant Energy Center Way
Madison, Wisconsin 53713
Fax: 608/267-1533
www.countyofdane.com/pwht/public_works.aspx

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 pre-certified 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?	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: ☐
18	Contractor has been in business less than one year?	Yes: ☐ No: ☐
19	Is your firm a first time Contractor requesting a one time exemption, but, intend to comply on all future contracts and are taking steps typical of a “good faith” effort?	Yes: ☐ No: ☐
20	Not applicable. My firm does not intend to work on Best Value Contracts. Note: Best Value Contracting is required to bid on most Public Works Contracts (if unclear, please call Todd Draper 608-267-0119).	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: _____

(Application is invalid without signature)

Print Name: _____ Date: _____

Title: _____

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

REMEMBER!

RETURN ALL TO FORMS AND ATTACHMENTS, OR QUESTIONS TO:

TODD DRAPER
EMAIL: DRAPER@COUNTYOFDANE.COM
OFFICE: (608)267-0119, 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 November 5, 2019 at 10 a.m., at City County Building, 210 Martin Luther King Jr Blvd, in Room B-8. Attendance by all bidders is optional, however bidders and subcontractors are strongly 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.

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 Architect / Engineer's attention at least ten (10) calendar 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 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.

B. County's Public Works Project Engineer 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 Engineer or designee all such information and data for this purpose as County's Public Works Project Engineer 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) business 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) business 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) calendar 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 ten (10) business days of 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 ten (10) business days 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 may solicit bids from this ESB listing: pdf.countyofdane.com/commissions/2013-2015_Targeted_Business_Directory.pdf.

G. **ESB Certification.** All contractors, subcontractors and suppliers seeking ESB certification must complete and submit Emerging Small Business Report 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) business 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. Wisconsin Statute 77.54 (9m) allows building materials that become part of local unit government facilities to be exempt from sales & use tax. Vendors & materials suppliers may not charge Bidders sales & use tax on these purchases. This does not include highways, streets or roads. Any other Sales, Consumer, Use & other similar taxes or fees required by law shall be included in Bid.

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 or emailed 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. Bidder shall carefully read requests for Alternate Bids, and thoroughly examine Drawings and Specifications to determine extent various changes and conditions will affect Bid.

B. Space is provided in Bid Form for requested Alternate Bids. Failure to submit bid for any requested Alternate Bids may result in rejection of entire Bid.

C. Bidder shall state amount to be added / subtracted to Base Bid for providing alternates, including all incidentals, omissions, additions, and adjustments as may be necessary or required by such changes. If there is no difference in price, Bidder shall state, "No Change".

D. Descriptions of requested Alternate Bids are as set forth in Construction Documents.

A. .

16. 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, titled "Time for Completion".

17. WORK BY OWNER

A. Not Applicable.

18. SPECIAL HAZARDS COVERAGE

A. Not Applicable.

FORM A

DANE COUNTY
EMERGING SMALL BUSINESS REPORT - CERTIFICATION

In accordance with General Conditions of Contract, submit this Emerging Small Business Report within ten (10) days after Bid Due Date.

PROJECT NAME: _____

_____

BID NO.: _____ BID DUE DATE: _____

BIDDER INFORMATION

COMPANY NAME: _____

ADDRESS: _____

_____

TELEPHONE NO.: _____

CONTACT PERSON: _____

EMAIL ADDRESS: _____

FORM B

DANE COUNTY
(Copy this Form as necessary to provide complete information)
EMERGING SMALL BUSINESS REPORT - INVOLVEMENT

COMPANY NAME: _____

PROJECT NAME: _____

BID NO.: _____ BID DUE DATE: _____

ESB NAME: _____

CONTACT PERSON: _____

ADDRESS: _____

_____

PHONE NO & EMAIL.: _____

_____

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

ESB NAME: _____

CONTACT PERSON: _____

ADDRESS: _____

_____

PHONE NO & EMAIL.: _____

_____

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

FORM C

DANE COUNTY
(Copy this Form as necessary to provide complete information)
EMERGING SMALL BUSINESS REPORT - CONTACTS

COMPANY NAME: _____

PROJECT NAME: _____

BID NO.: _____ BID DUE DATE: _____

	ESB FIRM NAME CONTACTED	DATE	PERSON CONTACTED	DID ESB BID?	ACC-EPT BID?	REASON FOR REJECTION
1)						
2)						
3)						
4)						
5)						
6)						
7)						
8)						

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. 319037
PROJECT: BUILDING AUTOMATION CONTROLS
CITY COUNTY BUILDING

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

NOTE: WISCONSIN STATUTE 77.54 (9M) ALLOWS FOR NO SALES & USE TAX ON THE PURCHASE OF MATERIALS FOR COUNTY PUBLIC WORKS PROJECTS.

BASE BID - LUMP SUM:
Remove and replace application specific controllers and associated components for HVAC equipment. Replication of existing sequence of operation and user interface included in the scope of work. Three network controllers to be replaced to allow for N4 compatibility. Seven AHU controllers, three steam to water converter controllers, ten reheat coil controls and valves, sixty six VAV controllers included in this SOW. 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

Numeric Price

The undersigned agrees to add the alternate(s) portion of the Work as described, for the following addition(s) to or subtraction(s) from the Base Bid, as stipulated below.

ALTERNATE BID 1 - LUMP SUM:
Add price for providing new network controller and associated VAV/ exhaust fan control for Central Police district offices. Install JACE in ENC 5 rm GR24 and provide new controllers for thirty six VAV boxes and control of four exhaust fans located in parking garage.

_____ and __ /100 Dollars
Written Price

$_____
Numeric Price (circle: Add or Deduct)

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 agrees to be qualified as a Best Value Contractor or will have proven their exemption before the award of this contract.

The undersigned further agrees to honor the Base Bid and the Alternate Bid(s) for sixty (60) calendar 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
]

DANE COUNTY BEST VALUE CONTRACTING PRE-QUALIFICATION

General Contractors & all Subcontractors must be pre-qualified as a Best Value Contractor with the Dane County Public Works Engineering Division before the award of contract. Qualification & listing is not permanent & must be renewed every 24 months. Obtain a *Best Value Contracting Application* by calling 608/266-4018 or complete one online at:

countyofdane.com/pwht/BVC_Application.aspx

DANE COUNTY VENDOR REGISTRATION PROGRAM

All bidders are strongly encouraged to be a registered vendor with Dane County. Registering allows vendors an opportunity to receive notifications for RFBs & RFPs issued by the County and provides the County with up-to-date company contact information. Complete a new form or renewal online at:

danepurchasing.com/Account/Login?

COUNTY OF DANE

PUBLIC WORKS CONSTRUCTION CONTRACT

Contract No. _____ Bid No. 319037

Authority: 2018 RES -_____

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 Deputy Public Works Director, 1919 Alliant Energy Center Way, Madison, WI 53713, desires to have CONTRACTOR provide Building Automation Controls at the City County Building

WHEREAS, CONTRACTOR, whose address is _____ _____ is able and willing to construct the Project, in accordance with the Scope of Work documents and site meeting..

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 Dane County Public Works Deputy Director , and as enumerated in the Project Manual Table of Contents, 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, Conditions of Contract], and to make payments on account thereof as provided in Article entitled, "Payments to Contractor" of the [General Conditions of Contract, 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,

Draft

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) business 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 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.

7. 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.

8. 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.

9. 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) business 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.

* * * * * * *

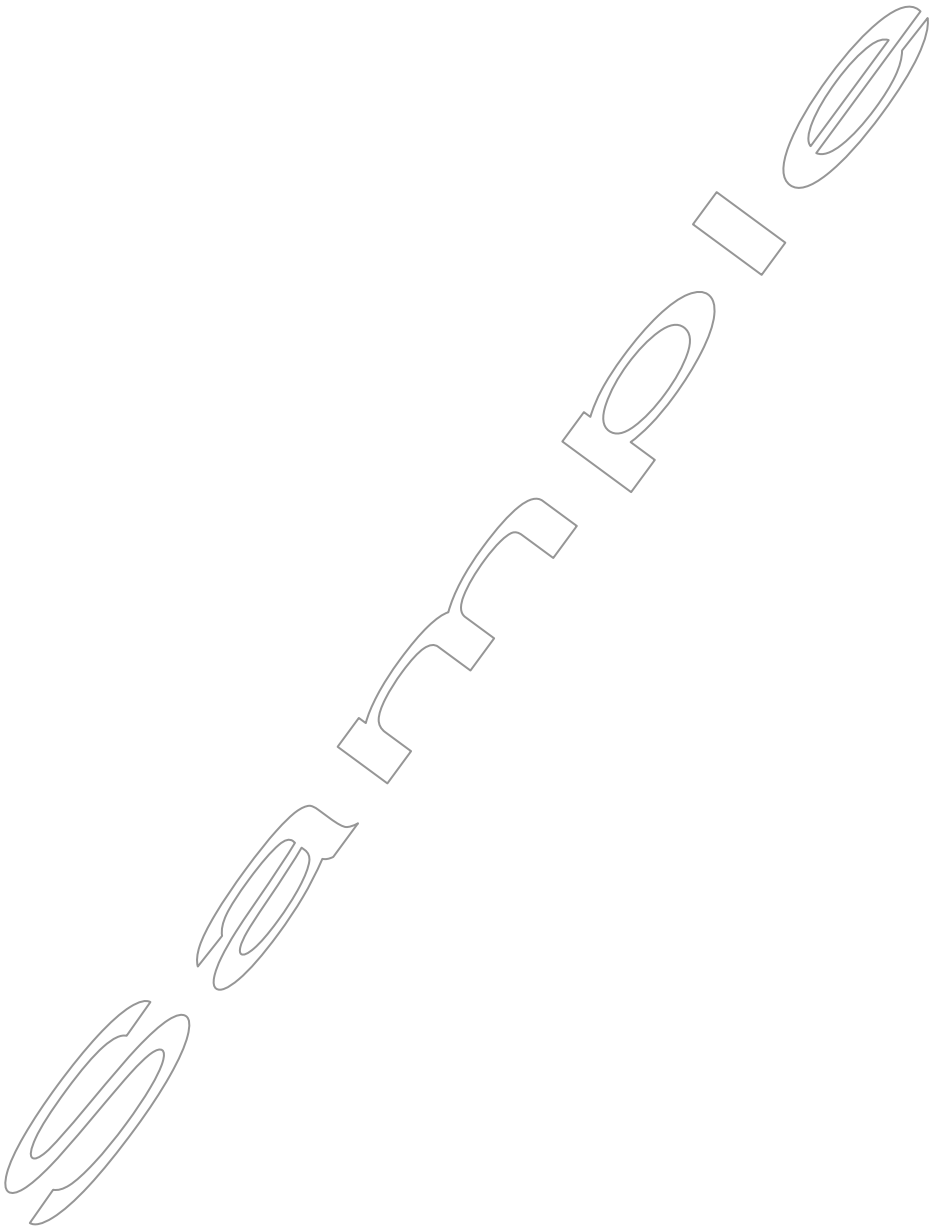
This Contract is not valid or effectual for any purpose until approved by the appropriate authority designated below, and no work is authorized until the CONTRACTOR has been given notice to proceed by COUNTY'S Assistant Public Works Director.

FOR COUNTY:

Joseph T. Parisi, County Executive Date

Scott McDonell, County Clerk Date

Sample



AIA® Document A310™ – 2010

Bid Bond

CONTRACTOR:
(Name, legal status and address)

SURETY:
(Name, legal status and principal place of business)

OWNER:
(Name, legal status and address)

BOND AMOUNT:

PROJECT:
(Name, location or address, and Project number, if any)

This document has important legal consequences. Consultation with an attorney is encouraged with respect to its completion or modification.

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

The Contractor and Surety are bound to the Owner in the amount set forth above, for the payment of which the Contractor and Surety bind themselves, their heirs, executors, administrators, successors and assigns, jointly and severally, as provided herein. The conditions of this Bond are such that if the Owner accepts the bid of the Contractor within the time specified in the bid documents, or within such time period as may be agreed to by the Owner and Contractor, and the Contractor either (1) enters into a contract with the Owner in accordance with the terms of such bid, and gives such bond or bonds as may be specified in the bidding or Contract Documents, with a surety admitted in the jurisdiction of the Project and otherwise acceptable to the Owner, for the faithful performance of such Contract and for the prompt payment of labor and material furnished in the prosecution thereof; or (2) pays to the Owner the difference, not to exceed the amount of this Bond, between the amount specified in said bid and such larger amount for which the Owner 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. The Surety hereby waives any notice of an agreement between the Owner and Contractor to extend the time in which the Owner may accept the bid. Waiver of notice by the Surety shall not apply to any extension exceeding sixty (60) days in the aggregate beyond the time for acceptance of bids specified in the bid documents, and the Owner and Contractor shall obtain the Surety's consent for an extension beyond sixty (60) days.

If this Bond is issued in connection with a subcontractor's bid to a Contractor, the term Contractor in this Bond shall be deemed to be Subcontractor and the term Owner shall be deemed to be Contractor.

When this Bond has been furnished to comply with a statutory or other legal requirement in the location of the Project, 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. When so furnished, the intent is that this Bond shall be construed as a statutory bond and not as a common law bond.

Signed and sealed this day of

(Witness)	*(Contractor as Principal)* *(Seal)*
	(Title)
(Witness)	*(Surety)* *(Seal)*
	(Title)

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.

Init.
/

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ACD43070810

AIA® Document A312™ – 2010

Performance Bond

CONTRACTOR:
(Name, legal status and address)

SURETY:
(Name, legal status and principal place of business)

OWNER:
(Name, legal status and address)

This document has important legal consequences. Consultation with an attorney is encouraged with respect to its completion or modification.

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

AIA Document A312–2010 combines two separate bonds, a Performance Bond and a Payment Bond, into one form. This is not a single combined Performance and Payment Bond.

CONSTRUCTION CONTRACT
Date:

Amount:

Description:
(Name and location)

BOND
Date:
(Not earlier than Construction Contract Date)

Amount:

Modifications to this Bond: ☐ None ☐ See Section 16

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

(Any additional signatures appear on the last page of this Performance Bond.)

(FOR INFORMATION ONLY — Name, address and telephone)

AGENT or **BROKER:**

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

Sample

§ 1 The Contractor and 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 when applicable to participate in a conference as provided in Section 3.

§ 3 If there is no Owner Default under the Construction Contract, the Surety's obligation under this Bond shall arise after

.1 the Owner first provides notice to the Contractor and the Surety that the Owner is considering declaring a Contractor Default. Such notice shall indicate whether the Owner is requesting a conference among the Owner, Contractor and Surety to discuss the Contractor's performance. If the Owner does not request a conference, the Surety may, within five (5) business days after receipt of the Owner's notice, request such a conference. If the Surety timely requests a conference, the Owner shall attend. Unless the Owner agrees otherwise, any conference requested under this Section 3.1 shall be held within ten (10) business days of the Surety's receipt of the Owner's notice. 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;

.2 the Owner declares a Contractor Default, terminates the Construction Contract and notifies the Surety; and

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

§ 4 Failure on the part of the Owner to comply with the notice requirement in Section 3.1 shall not constitute a failure to comply with a condition precedent to the Surety's obligations, or release the Surety from its obligations, except to the extent the Surety demonstrates actual prejudice.

§ 5 When the Owner has satisfied the conditions of Section 3, the Surety shall promptly and at the Surety's expense take one of the following actions:

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

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

§ 5.3 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 a 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 Section 7 in excess of the Balance of the Contract Price incurred by the Owner as a result of the Contractor Default; or

§ 5.4 Waive its right 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, make payment to the Owner; or

.2 Deny liability in whole or in part and notify the Owner, citing the reasons for denial.

§ 6 If the Surety does not proceed as provided in Section 5 with reasonable promptness, the Surety shall be deemed to be in default on this Bond seven 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 Section 5.4, and the Owner refuses the payment 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.

§ 7 If the Surety elects to act under Section 5.1, 5.2 or 5.3, 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. Subject to the commitment by the Owner to pay the Balance of the Contract Price, the Surety is obligated, without duplication, for

.1 the responsibilities of the Contractor for correction of defective work and completion of the Construction Contract;

.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 Section 5; and

.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.

§ 8 If the Surety elects to act under Section 5.1, 5.3 or 5.4, the Surety's liability is limited to the amount of this Bond.

§ 9 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, successors and assigns.

§ 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 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 a declaration of 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.

§ 12 Notice to the Surety, the Owner or the Contractor shall be mailed or delivered to the address shown on the page on which their signature appears.

§ 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. When so furnished, the intent is that this Bond shall be construed as a statutory bond and not as a common law bond.

§ 14 Definitions

§ 14.1 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.

§ 14.2 Construction Contract. The agreement between the Owner and Contractor identified on the cover page, including all Contract Documents and changes made to the agreement and the Contract Documents.

§ 14.3 Contractor Default. Failure of the Contractor, which has not been remedied or waived, to perform or otherwise to comply with a material term of the Construction Contract.

§ 14.4 Owner Default. Failure of the Owner, which has not been remedied or waived, to pay the Contractor as required under the Construction Contract or to perform and complete or comply with the other material terms of the Construction Contract.

§ 14.5 Contract Documents. All the documents that comprise the agreement between the Owner and Contractor.

§ 15 If this Bond is issued for an agreement between a Contractor and subcontractor, the term Contractor in this Bond shall be deemed to be Subcontractor and the term Owner shall be deemed to be Contractor.

§ 16 Modifications to this bond are as follows:

Sample

(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	

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 A312™ – 2010

Payment Bond

CONTRACTOR:
(Name, legal status and address)

SURETY:
(Name, legal status and principal place of business)

OWNER:
(Name, legal status 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 Section 18

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

(Any additional signatures appear on the last page of this Payment Bond.)

(FOR INFORMATION ONLY — Name, address and telephone)
AGENT or **BROKER:**

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

This document has important legal consequences. Consultation with an attorney is encouraged with respect to its completion or modification.

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

AIA Document A312–2010 combines two separate bonds, a Performance Bond and a Payment Bond, into one form. This is not a single combined Performance and Payment Bond.

Sample

§ 1 The Contractor and 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, subject to the following terms.

§ 2 If the Contractor promptly makes payment of all sums due to Claimants, and defends, indemnifies and holds harmless the Owner from claims, demands, liens or suits by any person or entity seeking payment for labor, materials or equipment furnished for use in the performance of the Construction Contract, then the Surety and the Contractor shall have no obligation under this Bond.

§ 3 If there is no Owner Default under the Construction Contract, the Surety's obligation to the Owner under this Bond shall arise after the Owner has promptly notified the Contractor and the Surety (at the address described in Section 13) of claims, demands, liens or suits against the Owner or the Owner's property by any person or entity seeking payment for labor, materials or equipment furnished for use in the performance of the Construction Contract and tendered defense of such claims, demands, liens or suits to the Contractor and the Surety.

§ 4 When the Owner has satisfied the conditions in Section 3, the Surety shall promptly and at the Surety's expense defend, indemnify and hold harmless the Owner against a duly tendered claim, demand, lien or suit.

§ 5 The Surety's obligations to a Claimant under this Bond shall arise after the following:

§ 5.1 Claimants, who do not have a direct contract with the Contractor,

.1 have furnished a written notice of non-payment to the Contractor, stating with substantial accuracy the amount claimed and the name of the party to whom the materials were, or equipment was, furnished or supplied or for whom the labor was done or performed, within ninety (90) days after having last performed labor or last furnished materials or equipment included in the Claim; and

.2 have sent a Claim to the Surety (at the address described in Section 13).

§ 5.2 Claimants, who are employed by or have a direct contract with the Contractor, have sent a Claim to the Surety (at the address described in Section 13).

§ 6 If a notice of non-payment required by Section 5.1.1 is given by the Owner to the Contractor, that is sufficient to satisfy a Claimant's obligation to furnish a written notice of non-payment under Section 5.1.1.

§ 7 When a Claimant has satisfied the conditions of Sections 5.1 or 5.2, whichever is applicable, the Surety shall promptly and at the Surety's expense take the following actions:

§ 7.1 Send an answer to the Claimant, with a copy to the Owner, within sixty (60) days after receipt of the Claim, stating the amounts that are undisputed and the basis for challenging any amounts that are disputed; and

§ 7.2 Pay or arrange for payment of any undisputed amounts.

§ 7.3 The Surety's failure to discharge its obligations under Section 7.1 or Section 7.2 shall not be deemed to constitute a waiver of defenses the Surety or Contractor may have or acquire as to a Claim, except as to undisputed amounts for which the Surety and Claimant have reached agreement. If, however, the Surety fails to discharge its obligations under Section 7.1 or Section 7.2, the Surety shall indemnify the Claimant for the reasonable attorney's fees the Claimant incurs thereafter to recover any sums found to be due and owing to the Claimant.

§ 8 The Surety's total obligation shall not exceed the amount of this Bond, plus the amount of reasonable attorney's fees provided under Section 7.3, and the amount of this Bond shall be credited for any payments made in good faith by the Surety.

§ 9 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 Surety under this Bond, subject to the Owner's priority to use the funds for the completion of the work.

§ 10 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 the payment of any costs or expenses of any Claimant under this Bond, and shall have under this Bond no obligation to make payments to, or give notice on behalf of, Claimants or otherwise have any obligations to Claimants under this Bond.

§ 11 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.

§ 12 No suit or action shall be commenced by a Claimant under this Bond other than in a court of competent jurisdiction in the state in which the project that is the subject of the Construction Contract is located or after the expiration of one year from the date (1) on which the Claimant sent a Claim to the Surety pursuant to Section 5.1.2 or 5.2, 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.

§ 13 Notice and Claims to the Surety, the Owner or the Contractor shall be mailed or delivered to the address shown on the page on which their signature appears. Actual receipt of notice or Claims, however accomplished, shall be sufficient compliance as of the date received.

§ 14 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. When so furnished, the intent is that this Bond shall be construed as a statutory bond and not as a common law bond.

§ 15 Upon request by any person or entity appearing to be a potential beneficiary of this Bond, the Contractor and Owner shall promptly furnish a copy of this Bond or shall permit a copy to be made.

§ 16 Definitions

§ 16.1 Claim. A written statement by the Claimant including at a minimum:

- **.1** the name of the Claimant;
- **.2** the name of the person for whom the labor was done, or materials or equipment furnished;
- **.3** a copy of the agreement or purchase order pursuant to which labor, materials or equipment was furnished for use in the performance of the Construction Contract;
- **.4** a brief description of the labor, materials or equipment furnished;
- **.5** the date on which the Claimant last performed labor or last furnished materials or equipment for use in the performance of the Construction Contract;
- **.6** the total amount earned by the Claimant for labor, materials or equipment furnished as of the date of the Claim;
- **.7** the total amount of previous payments received by the Claimant; and
- **.8** the total amount due and unpaid to the Claimant for labor, materials or equipment furnished as of the date of the Claim.

§ 16.2 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 Construction Contract. The term Claimant also includes any individual or entity that has rightfully asserted a claim under an applicable mechanic's lien or similar statute against the real property upon which the Project is located. 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.

§ 16.3 Construction Contract. The agreement between the Owner and Contractor identified on the cover page, including all Contract Documents and all changes made to the agreement and the Contract Documents.

§ 16.4 Owner Default. Failure of the Owner, which has not been remedied or waived, to pay the Contractor as required under the Construction Contract or to perform and complete or comply with the other material terms of the Construction Contract.

§ 16.5 Contract Documents. All the documents that comprise the agreement between the Owner and Contractor.

§ 17 If this Bond is issued for an agreement between a Contractor and subcontractor, the term Contractor in this Bond shall be deemed to be Subcontractor and the term Owner shall be deemed to be Contractor.

§ 18 Modifications to this bond are as follows:

Sample

(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	

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.

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 times 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 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 does not need to pay State and local sales & use taxes. See Wisconsin Statute 77.54 (9m).

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 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) business 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) business 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) business 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) business 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.

B. 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.

C. 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.

D. Contractor shall submit for approval 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.

E. 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) business days from receipt of payment.

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

G. 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.

H. 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.

I. County will make final payment within sixty (60) calendar 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.

J. 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.

K. 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.

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}) business 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) business 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.

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) business 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) business 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. Not Used.

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.

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 50.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 50.A.2 & 50.A.3. 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) business days written notice has been received by Risk Manager."

B. Builder's Risk:
   1. County shall provide Builder's Risk insurance coverage for its insurable interests in construction or renovation projects with completed value of $1,000,000 or less. Therefore, if project completed value is more than $1,000,000, Contractor shall obtain and maintain in force, at its own expense, Builder's Risk Insurance on all risks for amount equal to full completed value of covered structure or replacement value of alterations or additions. Any deductible shall not exceed $25,000 for each loss. Policy shall include occupancy clause and list Dane County as loss payee.

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.

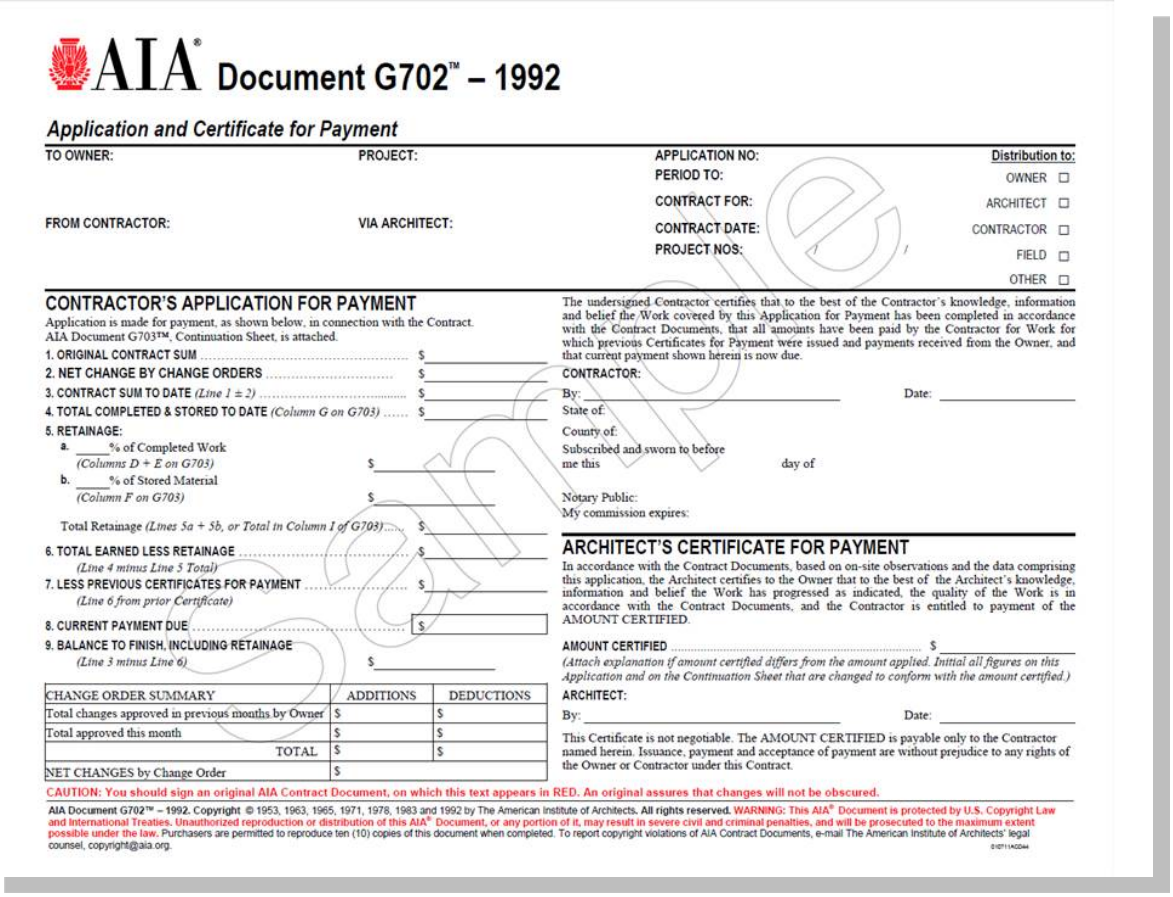
51. WISCONSIN LAW CONTROLLING

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 [project Architect / Engineer, 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.
AIA Document G703™, Continuation Sheet, 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 *(Columns 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 minus 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 minus Line 6)* $

CHANGE ORDER SUMMARY	ADDITIONS	DEDUCTIONS
Total changes approved in previous months by Owner	$	$
Total approved this month	$	$
TOTAL	$	$
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.

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.

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Sample

AIA® Document G703™ – 1992

Continuation Sheet

AIA Document G702™–1992, Application and Certificate for Payment, or G732™–2009, Application and Certificate for Payment, Construction Manager as Adviser Edition, containing Contractor's signed certification is attached.
In tabulations below, amounts are in US dollars.
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)
	GRAND TOTAL								

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.

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Sample

2

SOURCE OF BAGS / PLASTIC WRAP:

COMPANY NAME: _____

MAILING: _____
(STREET ADDRESS, CITY, STATE, ZIP)

PHONE NO.: _____

SPECIFY THICKNESS: _____ MILS

I AGREE TO ADHERE TO ALL TERMS AND CONDITIONS OF THIS PERMISSION. IF I AM SIGNING IN A REPRESENTATIVE CAPACITY, I ASSERT THAT I AM AUTHORIZED TO BIND MY PRINCIPAL IN ALL RESPECTS.

SIGNATURE: _____

PRINTED NAME: _____

DATED THIS _____ DAY OF _____, 20___

SAMPLE ONLY - NOT FOR SUBMITTAL

3. TO BE FILLED OUT BY WASTE HAULER:

HAULING COMPANY NAME: _____

CONTACT NAME: _____ WORK PHONE: _____

DRIVER'S NAME: _____ DATE: _____

DRIVER'S SIGNATURE: _____
(upon delivery)

4. TO BE FILLED OUT BY LANDFILL SUPERVISOR / ATTENDANT:

DATE OF DISPOSAL: _____ TRANSACTION NO.: _____

WEIGHT: _____ COPY GIVEN TO TRANSPORTER? Y _____ N _____

DISCREPANCIES: _____

_____

SIGNATURE: _____

PRINTED NAME: _____

DISPOSAL COODINATES: _____E to _____E, _____N to _____N

ELEVATION Base: _____ Top: _____

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 bid, application or proposal for a contract or agreement 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 25.09 is as follows:

(1) 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 Controller 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.

Include this completed Certification with your bid, application or proposal.

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. Change Procedures
6. Alternates
7. Coordination
8. Progress Meetings
9. Submittal Procedures
10. Proposed Products List
11. Product Data
12. Manufacturers' Instructions
13. Manufacturers' Certificates
14. Quality Assurance / Quality Control of Installation
15. References
16. Interior Enclosures
17. Protection of Installed Work
18. Parking
19. Staging Areas
20. Occupancy During Construction and Conduct of Work
21. Products
22. Transportation, Handling, Storage and Protection
23. Product Options
24. Substitutions
25. Starting Systems
26. Demonstration and Instructions
27. Contract Closeout Procedures
28. Final Cleaning
29. Adjusting
30. Operation and Maintenance Data
31. Spare Parts and Maintenance Materials
32. 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 fully functional controls system replicating original. Use of existing relays, actuators, transducers, current relays, sensors and all other control devices permitted if compatible with

Distech/Niagara system specified. Contractor shall be responsible for supplying sensors and all control devices to replicate existing control sequence. Provide, install and program controllers for the following equipment:

Three network controllers (NC-2, NC-3, NC-4)

Seven Air Handling Units

Controls for three steam to water heat exchanger systems.

66 VAV controllers and associated thermostats

Control of ten reheat coils, thermostats and install 10 new control valves..

B. 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 Contractors or Subcontractors and access by Owner.

B. Coordinate utility outages and shutdowns with Owner.

1.4 APPLICATIONS FOR PAYMENT

A. Submit one (1) original copies with “wet” signatures 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

D. Submit Applications for Payment to Public Works Project Manager for approval & processing for payment.

1.5 CHANGE PROCEDURES

A. Contractor's costs for Products, delivery, installation, labor, insurance, payroll, taxes, bonding, equipment rental, overhead and profit will be included in Change Orders authorizing expenditure of funds from contingency allowance.

1.6 ALTERNATES

A. Alternates quoted on Bid Form shall be reviewed and accepted or rejected at Owner's option.

B. Coordinate related work and modify surrounding work as required.

.

C. Schedule of Alternates:
   a. Alternate Bid 1 Central District VAV controls.
   b. Provide new network controller. Install in ENC-5 in Rm GR-24 next to JACE 3 and JACE 8.
   c. Provide, install and program 36 VAV controllers in Ground floor Central Police District headquarters.
   d. Provide, install and program a controller with four DO to control garage level exhaust fans.

1.7 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.

D. Refer to Drawings for recommended work sequence and duration.

E. Contractor shall provide Public Works Project Engineer with work plan that ensures the Work will be completed within required time of completion.

F. Construct work in stages to accommodate Dane County operations. All activities shall be coordinated , one (1) week, (minimum) in advance with Public Works Project Manager unless noted otherwise in these specifications.

G. .

1.8 PROGRESS MEETINGS

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

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

C. Attendance at progress meetings by General Contractor, subcontractors, or their authorized representative, is mandatory.

D. Contractors shall give verbal reports of progress on the Work, discuss schedule for upcoming period and present all conflicts, discrepancies or other difficulties for resolution.

E. Day & time of progress meetings to be determined at pre-construction meeting.

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) business 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 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.

1.12 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.

1.13 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.

1.14 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.

1.15 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.

1.16 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.

1.17 PROTECTION OF INSTALLED WORK

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

1.18 PARKING

A. Arrange for temporary parking areas to accommodate construction personnel. Parking shall not be available at the Work site.

B. All contractors and their employees shall cooperate with General Contractor and others in parking of vehicles to avoid interference with normal operations and construction activities.

1.19 STAGING AREAS

A. Coordinate staging areas with Public Works Project Manager 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 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.

1.20 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. Work performed on Saturday shall be by permission of Owner. 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.

G. Contractor is not responsible for providing & maintaining temporary toilet facilities.

1.21 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.

1.22 TRANSPORTATION, HANDLING, STORAGE AND PROTECTION

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

1.23 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 for approval at least seven (7) business 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. .

1.24 SUBSTITUTIONS

A. Public Works Project Manager shall consider requests for Substitutions only within fifteen (15) calendar days after date of Public Works Construction Contract.

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.

1.25 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.

1.26 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. .

1.27 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.

1.28 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.

1.29 ADJUSTING

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

1.30 OPERATION AND MAINTENANCE MANUAL

A. Provide two (2) bound, hard-copy operation and maintenance manuals that include all systems, materials, products, equipment, mechanical and electrical equipment and systems supplied and installed in the Work. Provide electronic version of operation and maintenance manual also.

1.31 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.

1.32 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 Public Works Project Manager with original marked up redlines of Construction Documents' drawings and specifications that shall include all Addendums, Change Orders, Construction Bulletins, on-site changes, field corrections, etc. These are project As-Built Drawings & Specifications. Record Drawings & Specifications shall be created from these As-Builts by Public Works.

PART 2 PRODUCTS

Not Used.

PART 3 EXECUTION

Not Used.

END OF SECTION

SECTION 01 74 19

CONSTRUCTION WASTE MANAGEMENT, DISPOSAL & RECYCLING

PART 1 GENERAL

1.1 SUMMARY

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

B. Related Sections:
1. Section 01 00 00 - Basic Requirements

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 Dane County Green Building Policy, Resolution 299, 1999-2000.

1.3 CONSTRUCTION AND / OR DEMOLITION WASTE MANAGEMENT

A. All construction and demolition waste suitable for recycling must go to Dane County Construction & Demolition Recycling Facility located at 7102 US Hwy 12, Madison, located across from Yahara Hills Golf Course. This facility can receive mixed loads of construction and demolition waste. For complete list of acceptable materials see www.countyofdane.com/pwht/recycle/CD_Recycle.aspx.

B. Dane County Landfill, also at 7102 US Hwy 12, Madison, must receive all other waste from this project. www.countyofdane.com/pwht/recycle/landfill.aspx.

1.4 WASTE MANAGEMENT PLAN

A. Contractor shall develop Waste Management Plan (WMP) for this project. Dane County's Special Projects & Materials Manager may be contacted with questions. 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.

B. Contractor shall complete WMP and include cost of recycling / reuse in Bid. WMP will be submitted to Public Works Project Manager within fifteen (15) business days of Bid Due 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.

1.5 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.

1.6 RECYCLING

A. These materials [may, must] be recycled at Dane County Construction & Demolition Recycling Facility:
   1. Wood.
   2. Wood Pallets.
   3. PVC Plastic (pipe, siding, etc.).
   4. Asphalt & Concrete.
   5. Bricks & Masonry.
   6. Vinyl Siding.
   7. Cardboard.
   8. Metal.
   9. Unpainted Gypsum Drywall.
   10. Shingles.

B. These materials can be recycled elsewhere in Dane County area:
   1. Fluorescent Lamps.
   2. Foam Insulation & Packaging (extruded and expanded).
   3. Carpet Padding.
   4. Barrels & Drums.

C. All materials must be recycled at WDNR permitted waste processing facilities that adhere to all State Statutes.

1.7 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.

C. Mixed loads of recycled materials are allowed only per instructions at www.countyofdane.com/pwht/recycle/CD_Recycle.aspx.

1.8 LISTS OF RECYCLING FACILITIES PROCESSORS AND HAULERS

A. Refer to www.countyofdane.com/pwht/recycle/CD_Recycle.aspx for information on Dane County Construction & Demolition Recycling Facility.

B. Web site www.countyofdane.com/pwht/recycle/categories.aspx lists current information for Dane County Recycling Markets. Contractors can also contact Allison Rathsack 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 https://www.uwgb.edu/shwec/.

PART 2 PRODUCTS

Not Used.

PART 3 EXECUTION

Not Used.

END OF SECTION

WASTE MANAGEMENT PLAN FORM

Contractor 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:_____
Asphalt & Concrete	_____ cu. ft. _____ lbs.	_____ Recycled _____ Reused _____ Landfilled _____ Other	Name:_____
Bricks & Masonry	_____ cu. ft. _____ lbs.	_____ Recycled _____ Reused _____ Landfilled _____ Other	Name:_____
Vinyl Siding	_____ cu. ft. _____ lbs.	_____ Recycled _____ Reused _____ Landfilled _____ Other	Name:_____
Cardboard	_____ cu. ft. _____ lbs.	_____ Recycled _____ Reused _____ Landfilled _____ Other	Name:_____
Metals	_____ cu. yds. _____ tons	_____ Recycled _____ Reused _____ Landfilled _____ Other	Name:_____
Unpainted Gypsum / Drywall	_____ cu. yds. _____ tons	_____ Recycled _____ Reused _____ Landfilled _____ Other	Name:_____
Shingles	_____ cu. yds. _____ tons	_____ Recycled _____ Reused _____ Landfilled _____ Other	Name:_____
Fluorescent Lamps	_____ cu. ft. _____ lbs.	_____ Recycled _____ Reused _____ Landfilled _____ Other	Name:_____
Foam Insulation	_____ cu. ft. _____ lbs.	_____ Recycled _____ Reused _____ Landfilled _____ Other	Name:_____
Carpet Padding	_____ cu. ft. _____ lbs.	_____ Recycled _____ Reused _____ Landfilled _____ Other	Name:_____
Barrels & Drums	_____ units	_____ Recycled _____ Reused _____ Landfilled _____ Other	Name:_____

WASTE MANAGEMENT PLAN FORM

Glass	_____ cu. yds. _____ tons	_____ Recycled _____ Reused _____ Landfilled _____ Other	Name:_____
Other	_____	_____ Recycled _____ Reused _____ Landfilled _____ Other	Name:_____
Other	_____	_____ Recycled _____ Reused _____ Landfilled _____ Other	Name:_____
Other	_____	_____ Recycled _____ Reused _____ Landfilled _____ Other	Name:_____
Other	_____	_____ Recycled _____ Reused _____ Landfilled _____ Other	Name:_____
Other	_____	_____ Recycled _____ Reused _____ Landfilled _____ Other	Name:_____

SECTION 23 05 93

TESTING, ADJUSTING, AND BALANCING FOR HVAC

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
1. Testing adjusting, and balancing of air systems.
2. Measurement of final operating condition of HVAC systems.

1.2 REFERENCES

A. Associated Air Balance Council:
1. AABC MN-1 - National Standards for Testing and Balancing Heating, Ventilating, and Air Conditioning Systems.

B. American Society of Heating, Refrigerating and Air-Conditioning Engineers:
1. ASHRAE 111 - Practices for Measurement, Testing, Adjusting and Balancing of Building Heating, Ventilation, Air-Conditioning and Refrigeration Systems.

C. Natural Environmental Balancing Bureau:
1. NEBB - Procedural Standards for Testing, Adjusting, and Balancing of Environmental Systems.

D.

1.3 CLOSEOUT SUBMITTALS

A. Section 01 70 00 - Execution and Closeout Requirements : Closeout procedures.

B. Project Record Documents: Record actual locations of balancing dampers and rough setting.

C. Operation and Maintenance Data: Furnish final copy of testing, adjusting, and balancing report inclusion in operating and maintenance manuals.

1.4 QUALITY ASSURANCE

A. Perform Work in accordance with State of Wisconsin and Public Work's standard.]

B. Perform Work in accordance with NEBB Procedural Standards for Testing, Balancing and Adjusting of Environmental Systems.

1.5 QUALIFICATIONS

A. Agency: Company specializing in testing, adjusting, and balancing of systems specified in this section with minimum three years documented experience Certified by NEBB.
1.

B. Perform Work under supervision of NEBB Certified Testing, Balancing and Adjusting Supervisor in State of Wisconsin_____.

1.6 PRE-INSTALLATION MEETINGS

A. Section 01 30 00 - Administrative Requirements : Pre-installation meeting.

B. Convene minimum one week prior to commencing work of this section.

PART 2 EXECUTION

2.1 EXAMINATION

A. Section 01 30 00 - Administrative Requirements Coordination and project conditions.

B. Verify systems are complete and operable before commencing work. Verify the following:
1. Systems are started and operating in safe and normal condition.
2. Temperature control systems are installed complete and operable.
3. Final filters are clean and in place. If required, install temporary media in addition to final filters.
4. Fire and volume dampers are in place and open.
5. Air coil fins are cleaned and combed.
6. Access doors are closed and duct end caps are in place.
7. Air outlets are installed and connected.
8. Duct system leakage is minimized.

2.2 PREPARATION

A. Furnish instruments required for testing, adjusting, and balancing operations.

B. Make instruments available to Architect/Engineer to facilitate spot checks during testing.

2.3 INSTALLATION TOLERANCES

A. Air Outlets and Inlets: Adjust total to within plus 10 percent and minus 5 percent of design to space. Adjust outlets and inlets in space to within plus or minus 10 percent of design.

2.4 ADJUSTING

A. Section 01 70 00 - Execution and Closeout Requirements : Testing, adjusting, and balancing.

B. Verify recorded data represents actual measured or observed conditions.

C. Permanently mark settings of valves, dampers, and other adjustment devices allowing settings to be restored. Set and lock memory stops.

D. After adjustment, take measurements to verify balance has not been disrupted. If disrupted, verify correcting adjustments have been made.

E. Report defects and deficiencies noted during performance of services, preventing system balance.

F. Leave systems in proper working order, replacing belt guards, closing access doors, closing doors to electrical switch boxes, and restoring thermostats to specified settings.

2.5 AIR SYSTEM PROCEDURE

A. Adjust distribution system to obtain uniform space temperatures free from objectionable drafts.

B. Use volume control devices to regulate air quantities only to extent adjustments do not create objectionable air motion or sound levels. Effect volume control by using volume dampers located in ducts.

C. Provide system schematic with required and actual air quantities recorded at each outlet or inlet.

D. At modulating damper locations, take measurements and balance at extreme conditions. Balance variable volume systems at maximum airflow rate, full cooling, and at minimum airflow rate, full heating.

E. For variable air volume system powered units set volume controller to airflow setting indicated. Confirm connections properly made and confirm proper operation for automatic variable-air-volume temperature control.

2.6 SCHEDULES

A. Equipment Requiring Testing, Adjusting, and Balancing:
   1. Air Terminal Units.
   2. Air Inlets and Outlets.
   3. .

B. Report Forms
   1. Title Page:
      a. Name of Testing, Adjusting, and Balancing Agency
      b. Address of Testing, Adjusting, and Balancing Agency
      c. Telephone and facsimile numbers of Testing, Adjusting, and Balancing Agency
      d. Project name
      e. Project location
      f. Report date
   2. Summary Comments:
      a. Design versus final performance
      b. Notable characteristics of system
      c. Nomenclature used throughout report
      d. Test conditions
   3. Instrument List:
      a. Instrument
      b. Manufacturer
      c. Model number
      d. Serial number
      e. Range
      f. Calibration date
   4. Terminal Unit Data:
      a. Manufacturer
      b. Type, constant, variable, single, dual duct
      c. Identification/number
      d. Location
      e. Model number
      f. Size
      g. Minimum static pressure
      h. Minimum design air flow
      i. Maximum design air flow
      j. Maximum actual air flow
      k. Inlet static pressure
   5. Air Distribution Test Sheet:
      a. Air terminal number
      b. Room number/location
      c. Terminal type
      d. Terminal size
      e. Area factor
      f. Design air flow
      g. Test (final) air flow
      h. Percent of design air flow

END OF SECTION

SECTION 23 09 14
PNEUMATIC AND ELECTRIC INSTRUMENTATION AND CONTROL DEVICES FOR HVAC
BASED ON DFD MASTER SPECIFICATION DATED 6/20/2018

P A R T 1 - G E N E R A L

SCOPE
This section includes control system specifications for all HVAC work as well as related control for systems found in other specification sections. Included are the following topics:

POINT LIST (Section 23 09 15)

RELATED WORK
Section 23 09 24 - Direct Digital Control System for HVAC **REFERENCE**
Applicable provisions of Division 1 govern work under this section.

WORK NOT INCLUDED
Direct digital controls and energy management interface, as specified in Section 23 09 24.

QUALITY ASSURANCE
Installing contractor must be a manufacturer's branch office or an authorized representative of a Direct Digital Control (DDC) equipment manufacturer that provides engineering and commissioning of the DDC equipment. Submit written confirmation of such authorization from the manufacturer. Indicate in letter of authorization that installing contractor has successfully completed all necessary training required for engineering, installation, and commissioning of equipment and systems and that such authorization has been in effect for a period of not less than three years. DDC equipment may or may not be required to be installed by this contractor as part of the project, but the intent of this quality assurance specification is to ensure that the installing contractor has the capabilities to engineer, install, and commission the field devices supplied under this section for temperature control.

SYSTEM DESCRIPTION

System is to be electric/electronic.

System is to use direct digital control logic with pneumatic actuation.

System is to use direct digital control with electric actuation for air handling units; direct digital control with electric actuation for room temperature, room humidity, and terminal airflow control; and electric control for other terminal units.

System is to use direct digital control with pneumatic actuation for air handling units; direct digital control with electric actuation for room temperature, room humidity, and terminal airflow control; and electric or pneumatic control for other terminal units.

All pneumatic tubing and electrical wiring are to be permanently tagged or labeled (within one inch of terminal strip) with a numbering system to correspond with the "Record Drawings". Tags or labels shall be printed not hand written.

SUBMITTALS
Include the following information:

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.

Schematic flow diagrams of systems showing fans, pumps, coils, dampers, valves, and other control devices. Each control device provided under this Section shall be uniquely labeled. Duplicate labeling may be used within similar mechanical systems. 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.

Details of construction, layout, and location of each temperature control panel within the building, including instruments location in panel and labeling. Also include on drawings location of mechanical equipment controlled (room number), horsepower and flow of motorized equipment (when this data is available on plans), locations of all remote sensors and control devices (either by room number or column lines).

Schedule of control dampers indicating size, leakage rating, arrangement, pressure drop at design airflow, and number and size of operators required.

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.

Direct digital controlled equipment control sequences will be provided by the DDC control contractor.

Calculations completed to determine size of control air compressor(s) and dryer (s).

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.

Provide a complete set of Submittal Drawings to the 23 09 24 DDC Contractor to enable them to coordinate the interfacing of the 23 09 14 controls with the 23 09 24 supplied controls. The 23 09 24 contractor is also required to provide any information regarding their supplied control equipment to the 23 09 14 contractor so that the 23 09 14 contractor can complete his engineered Submittal Drawings.

Provide a complete set of control Record Drawings to the 23 09 24 DDC Contractor to enable them to provide a complete composite set of drawings incorporating DDC and electric/pneumatic controls as specified. Where communication and/or power wiring is specified to be provided under this Section, ppoint to point routing of communication trunks and power wiring between DDC controllers, DDC communication devices, control panels, and Ethernet switches shall be documented in the control Record Drawings.

All submittals are to comply with submission and content requirements specified in specification Section 01 91 01 or 01 91 02.

DEMOLITION

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.

DESIGN CRITERIA

Size all control apparatus to properly supply and/or operate and control the apparatus served.

Provide control devices subject to corrosive environments with corrosion protection or construct them so they are suitable for use in such an environment.

Provide devices exposed to outside ambient conditions with weather protection or construct them so they are suitable for outdoor installation.

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.

OPERATION AND MAINTENANCE DATA

All operations and maintenance data shall comply with the submission and content requirements specified under section GENERAL REQUIREMENTS.

MATERIAL DELIVERY AND STORAGE

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.

P A R T 2 - P R O D U C T S

AIR PIPING

ASTM B75 seamless, hard drawn or annealed copper tubing with ANSI B16.22 wrought copper fittings, except final connections to apparatus may be made with brass compression-type fittings. Use ANSI/ASTM B32, 95/5 tin antimony solder.

Virgin polyethylene plastic tubing classified as flame retardant under UL 94 and conforming to ASTM D1693 stress-crack test.

CONTROL AIR SUPPLY

Extend existing air supply for new work.

Provide a refrigerated air dryer with pressure regulator, filter, moisture separator, bypass valve, automatic drain, and pressure relief valve. Minimum capacity shall be equal to the calculated air quantity with a safety margin of 50%. Compressor shall be internally isolated from air dryer frame to prevent vibration transmission.

Instrumentation to include power on light, failure light, refrigerant suction pressure gauge, and air outlet pressure gauge.

For applications requiring airflow at or above 25 SCFM, equip dryer with hot gas bypass to maintain continuous operation and stable dew point of +13°F at 20 psig main pressure.

Equip with a coalescing filter with a replaceable element with an efficiency rating of 99.999+% for particles .025 microns or larger and a charcoal filter with an efficiency rating of 100% for particles .025 microns and larger.

CONTROL VALVES

Provide and install all control valves as shown on the plans/details and as required to perform functions specified. Belimo 0-10 VDC motorized ball valve.

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. For pneumatic actuated systems, use rolling diaphragm, spring loaded, and piston type operators. For electric modulating actuation, use fully proportional actuators with 0-10VDC inputs and zero and span adjustments unless specified otherwise in the chart below. If TriState with feedback is specified, valve position shall be fed back to the controller and controller shall position valve based on this feedback. For two-position electric actuation use 24 VAC for DDC controlled actuators, 120 VAC actuators may be used for hardwire interlocking. 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.

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.

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. For high pressure (> 20 PSI) full proportioning pneumatic actuators, provide with zero bleed pilot positioners that are integral with the actuator. For high pressure two-positioning actuators, provide with electro-pneumatic solenoid air valve and adjustable bleed orifice integral with the actuator.

Provide end switches integral to the valve actuator to prove the valve open, closed, or both to meet the application where specified in the plans or specifications. End switch contact ratings shall be suitable for application.

Two-position shut-off valves used for isolation of mechanical devices shall be sized for a maximum pressure drop of 2 PSI at design flow and shall be a minimum of line size.

Provide operators with linkages and brackets for mounting on device served.

All valves unless specifically noted on the plans or indicated below shall be globe style valves.

Reheat Coil	Globe or Ball	0-10VDC or TriState w/Feedback	No	Last Position
Radiation w/Reheat	Globe or Ball	0-10VDC or TriState	No	Last Position
Standalone Radiation	Globe	Pneumatic or TriState	Yes	Open or Last Position
CUH and UH	Globe	Pneu or 2-Pos Elect	Yes	Open
Steam Terminal Units	Globe	Pneumatic	Yes	Open
Fan Coil Heating	Globe	Pneumatic	Yes	Open
Fan Coil Cooling	Globe	Pneumatic	Yes	Closed
AHU Heating Coil	Globe	Pneumatic	Yes	Open
AHU Cooling Coil	Globe or BF[1]	Pneumatic	Yes	Closed
Humidifier	Globe	Pneumatic	Yes	Closed
Humidifier Shutoff	Globe	Pneumatic	Yes	Closed
HW Heat Exchanger	Globe	Pneumatic	Yes	Open
Process CHW HX	Globe	Pneumatic	Yes	Open
Process CHW Isolation	BF	Hi Pressure Pneumatic	Yes	See Flow Diagram

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.

VALVE SERVING	**TYPE** Globe Butterfly (BF) Ball Press Independent Ball (PI Ball)	**SIGNAL** 0-10 VDC TriState (24VAC) 2-Position Elect Pneumatic (Pneu)	**SPRING RETURN** REQUIRED Yes No	**FAIL POSITION** Open (thru Coil) Closed (bypass Coil) Last Position
Reheat Coil	Globe or Ball	0-10 VDC or TriState w/feedback	No	Last Position
Radiation w/Reheat	Globe or Ball	0-10 VDC or TriState	No	Last Position
Standalone Radiation	Globe or Ball	0-10 VDC	No	Last Position
CUH and UH	Globe or Ball	TriState or 2-Pos Elect	Yes	Open
Steam Terminal Units	Globe	0-10 VDC	No	Last Position
Fan Coil Heating	Globe or Ball	0-10 VDC	No	Last Position
Fan Coil Cooling	Globe or Ball	0-10 VDC	No	Last Position
AHU Heating Coil	Globe	0-10 VDC	Yes	Open
AHU Cooling Coil	Globe or BF[1]	0-10 VDC	Yes	Closed
Humidifier	Globe	0-10 VDC	Yes	Closed
Humidifier Shutoff	Globe	2-Pos Elect	Yes	Closed
HW Heat Exchanger	Globe	0-10 VDC	Yes	Open
Process CHW HX	Globe	0-10 VDC	Yes	Open
Process CHW Isolation	Butterfly	2-Pos Elect	Yes	See Flow Diagram

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.

WATER SYSTEMS:
Use equal percentage valves for two-way control valves; size for a pressure drop not less than 4 psi or more than 6 psi. Consult with AE for acceptable pressure drop if available valve selections do not fall within the desired pressure range. Note: For low flows, the required minimum Cv size will result in lower pressure drop than 4 psi.

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.

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%). For globe valves that are specified to fail in place, valves shall be open when the stem is up. Only the following globe valve body styles will be acceptable for terminal unit control: Siemens Powermite 599 VF Series (599 VE Series Zone Valves are not

Characterized Ball Valves: The following manufacturers are acceptable:, Belimo, . For use on terminal units only where specified above. Forged brass or bronze body, stainless steel shaft and ball, 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 0.4 Cv.

Pressure Independent Characterized Ball Valves: The following manufacturers and models are acceptable: Belimo model PICCV and Griswold Controls PIC-V. For use on terminal units only where specified above. Forged brass or bronze body, 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. Flow shall be varied by actuator position and at any given position, flow through the valve shall not vary more than +/- 5% due to system pressure fluctuations across the valve in the selected operating range. Valves shall be pressure independent between a system differential pressure of 8 and 50 PSID. Minimum size for ball valves shall be 0.4 Cv.

CONTROL SYSTEM INSTRUMENTATION
Manufacturers: Averaging Type - Johnson Controls, or equal; Bulb Type - Johnson Controls, Ashcroft, Marshall

DUCT THERMOMETERS:
3 inch or larger dial type with swivel mount. Maximum scale graduations of 2°F. Thermometers in ducts above 6 square feet to have averaging type, liquid or gas filled capillary sensing elements a minimum of 6 feet and supported across the width of the duct. Thermometer temperature range shall not be more than twice the expected temperature range at installed location.

PIPE THERMOMETERS:
9 inch stem type with an adjustable swivel mount. Scale graduations of 2°F and mid-range accuracy of ±1°F. Install thermometers in separable brass wells filled with conductive fluid. Thermometer temperature range shall not be more than twice the expected temperature range at installed location.

REMOTE BULB THERMOMETERS:
3 inch or larger dial type with recalibration screw on face. Accuracy within 1% of scale range. Thermometers with sensing elements in air ducts with an area of above 6 square feet to have averaging liquid or gas filled capillary sensing elements. Provide separable wells for all pipeline applications. Thermometer temperature range shall not be more than twice the expected temperature range at installed location.

ELECTRIC/ELECTRONIC THERMOSTATS
ELECTRIC THERMOSTATS:
For single setpoint applications, provide line or low voltage electric type suitable for heating or heating and cooling as required. Provide the required number of heating and/or cooling stages required for the application. For line voltage ventilation applications utilizing fans and where specified in the sequence of operations, provide an integral manual On/Off/Auto selector switch. Minimum contact rating shall be equal or greater to electrical load of device being controlled. For all thermostats not located in mechanical rooms, provide concealed adjustment. For thermostats located in mechanical rooms, provide exposed adjustment.

TEMPERATURE CONTROL PANELS
Constructed of steel or extruded aluminum, with hinged door, keyed lock, and baked enamel finish. Install controls, relays, transducers and automatic switches inside panels. Label devices with permanent printed labels and provide asbuilt wiring/piping diagram within enclosure. Provide raceways for wiring and poly within panel for neat appearance. Provide termination blocks for all wiring terminations. Label outside of panel with panel number corresponding to plan tags and asbuilt control drawings as well as building system(s) served. Panels may me left in place and retrofit with new prewired inserts if remounting a new panel is cost or space prohibitive.

Control panels that have devices or terminations that are fed or switch 50V or higher shall enclose the devices, terminations, and wiring so that Personal Protective Equipment (PPE) is not required to service the under 50V devices and terminations within the control panel. As an alternative, a separate panel for only the 50V and higher devices may be provided and mounted adjacent to the under 50V control panel.

For panels that have 120VAC power feeds provide a resettable circuit breaker. Provide label within the panel indicating circuit number of 120VAC serving panel

TEMPERATURE SENSORS

Thermistor temperature sensor manufacturers: PreCon, BAPI, or approved equal.

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.
RTD's shall be of nickel or platinum construction and have a base resistance of 1000Ω at 70°F and 32°F respectively. 100Ω platinum RTD's are acceptable if used with temperature transmitters.

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

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.

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.

Terminal unit space sensors specified with overrides or adjustments shall be furnished under Section 23 09 24. Terminal unit space sensors specified to be provided without overrides or adjustments shall be provided under this Section. Terminal unit discharge temperature sensors shall be provided under this Section.

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.

In piping systems use temperature sensors with separable wells designed to be used with temperature element.

PRESSURE TRANSDUCERS (AIR)

Provide pressure transducers specified below for the following applications:

- Duct static pressure applications where setpoints are specified to control at greater than 0.1" w.c.
- Pitot type fan inlet air flow stations.
- Air filtration in fan powered equipment.

Manufacturers: Mamac Systems, Setra, and Veris Industries.

Provide a transmitter that operates on the capacitance principle and is capable of sensing low positive, negative or differential pressures. Transmitter shall have a minimum of three pressure ranges adjustable by an onboard switch or jumper. Size the transmitter where the middle or high range is suitable for the application. Use a bi-directional transmitter for applications that may have both positive and negative pressure excursions. Transmitter shall be provided with an integral four-digit display of the pressure sensed.

Accuracy (including non-linearity and hysteresis)	± 1% FS
Compensated Temperature Range	32°-140° F
Temperature Effect	0-1"wc Range .09% FS/°F; >1"wc Range .02% FS/°F
Output	4-20 MA
Load Impedance (smallest maximum acceptable)	800 Ω max.
Operating Temperature	32°-140° F

For air filtration monitoring, size differential pressure transducers to provide for the following ranges:

Filter Type	Scale Range (inch W.G.)
Panel filters	0.0 to 0.5
MERV 7	0.0 to 1.0
MERV 11	0.0 to 2.0
MERV 14	0.0 to 2.0
HEPA filters	0.0 to 4.0
Roll filters	0.0 to 1.0
Activated carbon filters	0.0 to 2.0

Provide pressure transducers specified below for the following applications:

- Duct static pressure applications where setpoints are specified to control at 0.1" w.c. or lower.
- All duct mounted pitot type air flow stations.
- Space/building static control or monitoring.

Manufacturers: Paragon Controls MicroTrans, Air Monitor Veltron DPT2500 Plus, or approved equal.
The airflow transducer shall provide noise filtration and automatic auto-zeroing. The automatic zeroing circuit shall be capable of maintaining the transducer output to within ±0.25% of operating span. The transducer output shall be locked and maintained at the last given output value during the automatic zeroing period so as not to interrupt the automatic control process. Use a bi-directional transmitter for applications that may have both positive and negative pressure excursions. Transmitter shall be provided with an integral four-digit display of the pressure sensed.

Transducer Span: <2 times the design velocity pressure at maximum flow, single range
Accuracy: ±0.25% of full scale, including non-linearity, hysteresis, deadband, and non-repeatability
Temperature Effect: ±0.15% of full scale/°F
Response: 0.5 sec. for 98% of full span change
Overpressure: 5 PSIG Proof
Power: 24VAC/VDC
Analog Output: 0-5VDC, 0-10VDC, or 4-20mA field adjustable
Auto Zero Frequency: every 1 to 24 hours on 1 hour intervals

For space or building static pressure monitoring, use Vaisala model SPH10 Static Pressure Head, or approved equal for outside air reference and Mamac A-523 or equal for space reference. For fan housing or duct static or differential pressure sensing, use gasketed metal static pressure sensors. Mamac A-520 or equal. Mount in location shown on plans or approved by AE.

DIFFERENTIAL PRESSURE SWITCHES
Differential pressure switches shall sense both inlet and outlet of fans and pumps. Device shall be rated for 150% of maximum system pressures that may be encountered. Provide with pressure differential that will be required to meet specified operation and/or to prevent nuisance "toggling" of the device in the system served. For static pressure sensing, use gasketed metal static pressure sensors for insertion into fan housing and ductwork. Mamac A-520 or equal.

AIR PRESSURE SAFETY SWITCHES
Air pressure safety switches shall be a differential pressure switch that will sense differential, negative, or positive pressure as required by the sequence of operation specification. Device shall be rated for a minimum of 150% of maximum system pressures that may be encountered. Provide with pressure range that will be required to meet specified operation in the system served. Provide with a normally closed contact that will open above setpoint and will not close until the manual reset button is depressed. Setpoint shall be manually adjustable. For static pressure sensing, use gasketed metal static pressure sensors for insertion into fan housing and ductwork. Mamac A-520 or equal.

CURRENT STATUS SWITCHES
Provide a current sensor with adjustable threshold and digital output with LED display, equal to a Veris model H-708/H-904. Threshold adjustment must be by a multi-turn potentiometer or set by multiprocessor that will automatically compensate for frequency and amperage changes associated with variable frequency drives. When used on variable speed motor applications, use a current sensor that will not change state due to varying speeds. Current switches with integral relays shall not be used for start/stop and status motor applications.

ELECTRIC TO PNEUMATIC TRANSDUCERS
Electric to pressure transducers shall have internal pressure feedback to compare actual commanded pressure value and will compensate for leakage or drift. Provide with manual override. Output of transducer shall bleed to zero PSI on power fail.

High air capacity	500 SCIM at 20 psig
Low air consumption	15 SCIM at 20 psig
Input	4-20 MA / 0-10VDC
Output	0-20 psig
Linearity	1% of span
Hysteresis	1% of span

This contractor shall be responsible for verifying that the input of electric to pneumatic transducers is compatible with the output of the DDC controller provided under 23 09 24 or 23 09 23.

POWER SUPPLIES

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

INSTALLATION

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.

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 shown in existing control drawings.

All cables to the electronic input/output devices, sensors, relays and interlocking wiring (all of which shall be supplied and installed under this section of specification) interfaced with the Direct Digital Control System shall be extended into the 23 09 24 DDC panel with a minimum of 5 ft. of cable to allow for termination by the 23 09 24 DDC Contractor. This contractor shall provide a technician to inspect and validate all tubing, wiring, and field devices associated with the DDC interface in coordination with and under direction of the 23 09 24 DDC Contractor.

Label all control devices with the exception of terminal unit devices with permanent printed labels that correspond to control drawings. Labeling for each device shall be unique within each mechanical system. Temperature control junction and pull boxes shall be identified utilizing spray painted green covers.

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.

Mounting of electrical or electronic devices shall be protected from weather if the building is not completely enclosed. This Contractor shall be solely responsible for replacing any equipment that is damaged by water that infiltrates the building if equipment is installed prior to the building being enclosed.

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 except above accessible ceilings as noted below. See Wire and Air Piping Conduit Installation Schedule below for specific conduit or tubing to be used. All raceways, enclosures, fittings and associated supports shall be provided and installed according to the requirements set forth in Division 26, NFPA 90 (NEC) and Chapter SPS 316 of the Wisconsin Administrative Code. All conduits shall be routed parallel and/or perpendicular to walls and adjacent piping. Raceways shall be located to maintain headroom and working clearance around equipment and devices that require inspection and service.

In general, support all raceways from the building structure. No component of a raceway system shall be secured to corrugated metal roof deck. Do not impose on the installations of other trades. Securing conduit, rods, straps, hangers, etc. to suspended ceiling components, electrical raceways, plumbing piping, fire protection sprinkler piping, HVAC piping or ductwork, or their associated support systems, will not be accepted.

Conduit shall be a minimum of 1/2 " for low voltage control provided the pipe fill does not exceed 40%.

Minimum low voltage wiring gauge to be 18 AWG for outputs and 20 AWG for inputs. All low voltage wiring to be stranded.

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 shall be installed in conduit. Wire for wall sensors shall be installed in conduit concealed in the wall. Wiring for radiation valves shall be installed in conduit concealed in the wall. For retrofit installations,

all wiring for sensors and valves shall be installed in conduit concealed in new walls. Sensor wiring for existing walls shall be installed without conduit and concealed in the wall (fished) where possible. If running wire concealed in the existing wall is not possible, install in surface raceway as specified or if not specified, consult with the AE for raceway type and color to be provided.

Where low voltage wiring is installed free-air, installation shall comply with the following:

- Wiring shall utilize the cable tray wherever possible.
- Wiring shall run at right angles and be kept clear of other trades work.
- 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.
- At HVAC terminal units only, where the wiring serves a specific device; e.g. controller, actuator, transmitter, etc. associated with the unit, the j-hooks or Bridal rings required to support the wiring, may be secured to the rods or straps that support the ductwork or piping that serves the unit. Wall penetrations shall be sleeved.
- 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.
- Wall penetrations shall be sleeved and fire stopped as specified.
- Wiring shall not be supported from existing cabling, existing tubing, plumbing or steam piping, ductwork, any component of a suspended ceiling, or electrical or communications conduit.

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. Power shown for temperature control panels on plans may be utilized by the 23 09 24 and 23 09 14 contractors.

Provide communication trunk wiring to integrated devices (i.e. VFD's, Flow Meters, Chillers, Lighting Panels, Electrical Meters, etc.) and terminal unit controllers that are specified to be connected to the building automation system. Communication trunk wiring shall be as required by the equipment specified under the 23 09 23, 23 09 24, or 23 09 25 Sections and shall be routed to the DDC panel designated for that equipment as shown on the plans or the closest DDC panel if not designated. If communication trunks require daisy chained style wiring, provide two communication cables to the DDC panel so that the communication trunk is not dead ended.

Install all communicating thermostats and terminal unit DDC controls and associated sensors furnished under Section 23 09 14, 23 09 23, 23 09 24, or 23 09 25 that are field mounted at the terminals units (not terminal unit controls that are mounted in centralized temperature control panels). For terminal units, i.e. fin tube radiation, convectors, cabinet unit heaters, fan coils, where the DDC controller is to be installed in the terminal unit enclosure, the DDC controller shall be installed in a location within the terminal unit enclosure designed to house controls. In no cases shall DDC controllers be installed in the convective or forced air flow stream of the terminal unit.

Above accessible lay-in tile ceilings where VAV box DDC controllers are designed to be directly mounted on air terminals, the DDC controller shall be installed without an enclosure. Above accessible lay-in tile ceilings where additional controllers are required, they shall not be mounted directly to the ductwork but be mounted on din rail or back panel in an accessible location as close as possible to the terminal unit(s) being controlled. In exposed ceilings or in mechanical rooms, provide an equipment enclosure that completely encloses the DDC controller and allows for conduit terminations.

Any devices other than DDC controllers, i.e. relays, pressure switches or sensors, etc. shall be installed in an enclosure furnished under this Section.

This contractor shall provide all 24VAC power transformers and wiring for DDC terminal unit controls. This contractor shall provide all communication wiring to the DDC supervisory controller provided under 23 09 23, 23 09 24, or 23 09 25. Provide all power and communication wiring type and installation as required by

the DDC controller manufacturer. Tag all terminal units with printed labels to match the terminal unit room schedules. This contractor shall terminate wiring for all terminal unit controllers and perform end to end point checkout of all inputs and outputs to the terminal unit controllers. This contractor shall verify the communication trunk and controller addressing.

If terminal unit controllers are furnished under Section 23 09 24, the 23 09 24 contractor shall provide a laptop or other tools and training to the 23 09 14 contractor on how to perform the communication trunk testing and end to end point checkout as described above. Terminal unit room schedules are to be provided under this Section and supplied to the 23 09 24 contractor. The 23 09 24 contractor shall provide engineered control drawings for installation of the terminal unit controllers and deliver these to the 23 09 14 contractor in time to meet the project schedule for the installation of these terminals.

Install "hand/off/auto" selector switches on systems where automatic interlock controls are specified and "hand/off/auto" selector switches are not supplied with the equipment controlled. Control panel power will not be required for “hand” switch to operate. When switch is in "hand" position, allow manual operation of the selected device without operating the interlocked motors but allowing all unit safety devices to stay in the circuit.

Install all shutdown switches furnished under this Section where specified or shown on the plans. Boiler kill switches shall be wired to each boiler safety circuit and an auxiliary contact shall be wired to a DDC binary input. Emergency HVAC shutdown switches shall be wired to DDC binary inputs for shutdown of all HVAC equipment serving the building.

All wiring in control panels shall be terminated on a terminal strip. Wire nuts are not acceptable. A maximum of two wires shall be terminated under any one terminal.

All pneumatic tubing, cabling and electrical wiring terminated at controllers, devices and terminal strips are to be permanently tagged or labeled with permanent adhesive labels within one inch of terminal strip with a numbering system to correspond exactly with the "Record Drawings". Jumpers where the both ends of the wire are visible and terminations are within 6” of each other do not need to be labeled. Spare wires are to be labeled as “Spare” with unique number designations.

After completion of installation, test and adjust control equipment. Submit data showing set points and final adjustments of controls.

AIR PIPING

Conceal piping whenever possible. Exposed piping may be run only in mechanical rooms, storage rooms, or other areas where mechanical systems piping is exposed.

Mechanically attach tubing to supporting surfaces. Sleeve through concrete surfaces in minimum one-inch sleeves, extended 6 inches above floors and one inch below bottom surface of slabs. Fire stop any open space in the sleeve after the air piping is installed if the sleeve is in a fire rated surface.

Isolate air supply from compressor assembly with wire braid reinforced rubber hose or polyethylene tubing.

Take-offs shall enter top of main air piping wherever possible. Install a shut-off valve at each PRV connection to high-pressure air main.

Purge tubing with dry, oil free compressed air before connecting control instruments.

Install all polyethylene tubing in conduit as scheduled below unless specified otherwise hereafter. Exposed polyethylene tubing not exceeding 18 inches may be used for connection to an instrument or operator without being installed in conduit. All Conduit to be independently supported, all boxes must be supported, all conduit ends to have bushings for protection of tubing.

Conduit shall be a minimum of 1/2 " for poly tubing provided the pipe fill does not exceed 40%.

Minimum poly tubing size allowed is ¼” OD. If an instrument has a barbed fitting that will only accept 5/32” tubing, connection to the device can be made with 5/32” tubing that is as short as is practical. Couplings are acceptable in this instance.

Install all exposed piping and conduit parallel to or at right angles to the building structure and support adequately at uniform intervals. Use only tool made bends in copper air pipe.

Tubing must be installed and supported in a manner as specified for exposed locations and acceptable to DFD.

Where polyethylene tubing is installed free-air, installation shall consider the following:

- Tubing shall run at right angles and be kept clear of other trades work.
- Tubing shall be supported utilizing "J-" or "Bridal-type" mounting rings anchored to ceiling concrete, piping supports or structural steel beams. Rings shall be designed to maintain tubing bend to larger than the minimum bend radius (typically 4 x tubing diameter).
- Supports shall be spaced at a maximum 4-foot interval unless limited by building construction. If tubing "sag" at mid-span exceeds 6-inches, another support shall be used.
- Tubing shall never be laid directly on the ceiling grid or attached in any manner to the ceiling grid wires.
- Air piping may be routed with Class 2 control wiring in J-hooks.

Tubing shall not be attached to existing cabling, existing tubing, plumbing or steam piping, ductwork, ceiling supports or electrical or communications conduit.

Tubing connected to air terminal unit devices shall be attached to the terminal unit device to prevent tubing from becoming kinked or becoming disconnected. Tubing serving air terminals may be routed on top of ductwork serving that terminal unit for a maximum distance of eight feet.

Tubing directly connected to steam valve actuators shall be copper tubing for a minimum of six inches.

Where tubing is connected to ductwork at an exterior location for sensing purposes, the tubing shall be sloped to a heated interior location without sags or traps in the tubing to prevent condensation to be trapped in the tubing and prevent accurate sensing. Install drip leg at low point at interior location and note location on control record drawings.

Number code all polyethylene tubing and install neatly with no concealed splices.

Test entire piping system by pressurizing it to 20 psig for 24 hours. Pressure drop during this period shall not exceed 3 pounds.

Low-pressure air mains shall be designed so that the pressure at any point in the main shall not vary by more than 1 PSI from the pressure at the air pressure regulator.

Piping material used shall be as follows:

Use hard copper tubing for all main air lines, above 30 psi.

All exposed copper to be hard drawn.

Use only polyethylene tubing inside panels.

In concealed locations (other than noted below) hard copper, soft copper, or polyethylene tubing in conduit shall be used.

Polyethylene tubing in block, stud. or concrete walls must be in conduit and associated boxes to be of steel.

Where air piping is within concrete slab or under grade use only polyethylene tubing in conduit

For exposed outdoor locations, use hard copper or polyethylene tubing in conduit. Provide shielding for polyethylene tubing that is used for final device connection that will be exposed to direct sunlight.

For static sensing lines connected to ductwork located in exposed outdoor locations, slope piping from connection into building to a location that will be above freezing so any condensation will run into the building and not freeze in piping. Piping tap shall not be on the bottom of the ductwork. Provide a drip leg of 3/8” tubing a minimum of one foot in length in an accessible location inside the building that will collect condensation from the sensing line.

Polyethylene tubing may be used in exposed areas if run in a fully enclosed rigid metal raceway or metal conduit and ambient temperature is less than 150°F.

Use copper tubing, where subject to temperatures in excess of 150°F or where adjacent to heating pipes passing through a common sleeve.

When polyethylene tubing is used above accessible lay-in acoustical panel ceilings it must be fire resistance "FR" rated pass the UL 94 vertical flame test with a rating of V2, be rated as self-extinguishing under ASTM D 635, and may be run without conduit.

High pressure rated polyethylene tubing in conduit may be used for branch lines to high-pressure actuators. Compression fittings must be used for high-pressure (above 30 PSI) applications.

For pneumatic actuated dampers that are involved in a smoke control system, all air piping shall be hard copper, except within control panels and shall be isolated from the non-smoke control system controls by automatic isolation valves in the event of a smoke control event. Installation shall conform to applicable International Building Code Section 909 requirements.

WIRE AND AIR PIPING CONDUIT AND TUBING INSTALLATION SCHEDULE

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 Section 26 05 33 and as defined below.

Air piping shall be run in independent conduit without wiring. In no cases shall wiring and air piping share a conduit, raceway or cable tray.

Where air piping and wiring share a trough or wire management system above a control panel, code required separation shall be provided.

Conduit other than that specified below for specific applications shall not be used.

Underground Installations within Five Feet (1.5 m) of Foundation Wall: Rigid steel conduit.

Underground Installations More than Five Feet (1.5 m) From Foundation Wall: Rigid steel conduit. Plastic-coated rigid steel conduit. Schedule 40 PVC conduit.

Under Slab on Grade Installations: Schedule 40 PVC conduit.

Exposed Outdoor Locations: Rigid steel conduit.

Concealed in Concrete and Block Walls: Rigid steel conduit. Schedule 40 PVC conduit. Electrical Nonmetallic Tubing (ENT).

Within Concrete Slab: Rigid steel conduit. Schedule 40 PVC conduit. Electrical Nonmetallic Tubing (ENT).

Wet Interior Locations: Rigid steel conduit. Schedule 40 PVC conduit.

Concealed Dry Interior Locations: Rigid steel conduit. Intermediate metal conduit. Electrical Metallic Tubing (EMT).

Exposed Dry Interior Locations: Rigid steel conduit. Intermediate metal conduit. Electrical metallic tubing.

Exposed Dry Interior Locations for Control Devices with Conduit Connections: EMT or Flexible Metal Conduit (FMC). Minimum length shall be one foot (300 mm); maximum length shall be three feet (900 mm). Minimum size FMC of 3/8".

Exposed Dry Interior Locations for Control Devices without Conduit Connections: Where HVAC equipment control panels or devices do not provide for the direct connection of conduits, exposed wiring may be extended to complete the final connections in dry locations, providing it does not exceed 18 inches in length.

CONTROL SYSTEM INSTRUMENTATION

For pneumatically actuated systems install pressure gauges as follows: for indication of supply air pressure in each temperature control panel; at the output of pneumatic/electric transducers; the output of each pneumatic controller; the output of each solenoid air valve; the input of each PE switch; at each modulated damper and valve except terminal devices; other points where the visible indication of air pressure is required for operating and maintenance purposes. On dampers and valves with pilot positioners, locate gauge in the output of positioner to controlled device. Mount gauges so they are visible when looking at the monitored device. At each receiver controller input port, install a 1-1/2" diameter dial indicator with scale to match input range (in degrees F., % R.H., in. w.c., etc.). Equip control air output line with a 1-1/2" diameter air pressure gauge.

Install thermometers at each point of temperature transmission (sensors) and control, except reheat coils, unless the drawings indicate a thermometer is to be installed by the piping or sheetmetal installer. Install thermometers to permit easy reading from the floor or operating platform. Provide remote mounting or swiveled mounting as required for easy reading. Flush mounting where not easily read is not acceptable.

ROOM THERMOSTATS AND TEMPERATURE SENSORS

Check and verify location of thermostats, humidistats, and other exposed control sensors with plans and room details before installation. Locate room thermostats and sensors [____] inches above floor. 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.

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.

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.

Provide guards on thermostats and sensors in entrance hallways, other public areas, or in locations where thermostat is subject to physical damage.

PRESSURE TRANSDUCERS AND HIGH LIMIT PRESSURE SWITCHES

Install capped tees in air piping at air pressure transducers for connection of calibration equipment. Capped tee shall consist of two inch poly tubing capped with a brass plug. Rubber caps are not acceptable. Install Petes Plugs fittings at each take-off from main piping for liquid pressure transducers for connection of calibration equipment. Install differential pressure transducers for filter monitoring at the filter section of the air handling unless otherwise specified.. All other differential or static pressure transducers and differential or static pressure high limit switches for air applications should be mounted in the temperature control panel serving the equipment being controlled or monitored. All devices mounted on equipment shall be mounted in a location that is at a maximum of five feet above the floor. For all air static and differential pressure applications, use metal static pressure tips for insertion into the fan housing or ductwork. For steam and liquid applications, provide shutoff valves at piping takeoff points.

TEMPERATURE CONTROL PANELS

Mount control panels adjacent to associated equipment on vibration-free walls or freestanding angle iron supports. All control panel openings shall be plugged. Conduits and other penetrations on the top of the cabinets shall be sealed on the exterior of the cabinet with silicone caulk to resist water penetration. One cabinet may accommodate more than one system in same equipment room. Provide permanent printed labeling for instruments and controls inside cabinet and engraved plastic nameplates on cabinet face.

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.

DIFFERENTIAL PRESSURE SWITCHES

Provide for each fan or pump specified, or shown on point list. Provide shutoff valves at piping takeoff points. Readjust pressure and/or differential setpoints for proper operation after final balancing is completed.

CURRENT STATUS SWITCHES

Provide for each fan or pump specified, or shown on point list. Set threshold adjustment to indicate belt or coupling loss. Readjust threshold for proper operation after final balancing is completed. Use the variable frequency drive (VFD) integrated relay output for motor status, if provided on the VFD, in lieu of a discrete current switch. A separate current switch provided under this Section shall be wired in parallel with the VFD motor status relay when a bypass starter is provided on the VFD to prove motor status in the bypass mode.

CONSTRUCTION VERIFICATION

Contractor is responsible for utilizing the construction verification checklists supplied under specification Section 23 08 00 in accordance with the procedures defined for construction verification in Section 01 91 01 or 01 91 02.

AGENCY TRAINING

All training provided for agency shall comply with the format, general content requirements and submission guidelines specified under Section 01 91 01 or 01 91 02.

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 8 hours.

END OF SECTION

SECTION 23 09 24
DIRECT DIGITAL CONTROL SYSTEM FOR HVAC

P A R T 1 - G E N E R A L

SCOPE

Work in this section includes Direct Digital Control (DDC) panels, main communication trunk, software programming, and other equipment and accessories necessary to constitute a completely coordinated extension of the existing campus or building Direct Digital Control (DDC) system. This system interfaced with pneumatic/electric controls (Section 23 09 14) utilizing Direct Digital Control signals to operate actuated control devices will meet, in every respect, all operational and quality standards specified herein, a fully coordinated modification and extension via DDC of the existing Central Campus Automation System.

RELATED WORK

Section 23 09 14 - Pneumatic and Electric Instrumentation and Control Devices for HVAC
Division 23 - HVAC - Equipment provided to be controlled or monitored

REFERENCE

Applicable provisions of Division 1 govern work under this section.

REFERENCE STANDARDS

FCC Part 15, Subpart J, Class A - Digital Electronic Equipment to Radio Communication Interference

WORK NOT INCLUDED

Section 23 09 14 work includes 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.

Motorized control dampers and actuators, thermowells (temperature sensing wells), automatic control valves and their actuators are also covered in Section 23 09 14.

QUALITY ASSURANCE

MANUFACTURERS: ***Distech***

INSTALLER:
CBRE-ESI, 3410 Gateway Rd, Brookfield WE, 53045-5115; Mechanical Technologies INC, 701 Morley Rd, Green Bay WI 54303.. All engineering and commissioning work shall be done by qualified personnel in the direct employ of this manufacturer, or of an Authorized Representative of that manufacturer that provides engineering and commissioning of the manufacturers control equipment. Where installing contractor is an authorized representative of the control equipment manufacturer, submit written confirmation of such authorization. Indicate in letter of authorization that the installing contractor has successfully completed all necessary training required for the engineering, installation, and commissioning of equipment and systems to be provided for the project, and that such authorization has been in effect for a period of not less than three years. The letter of authorization should also indicate that the installing contractor is authorized to install the manufacturer's DDC equipment at the project location at the time the project is bid. Installation of the equipment shall be done by qualified mechanics and/or electricians in the direct employ or be directly subcontracted and under the supervision of the manufacturer or Authorized Representative.

RESPONSE TIME:
During warrantee period, four (4) hours or less, 24-hours/day, 7 days/week.

ELECTRICAL STANDARDS:
Provide electrical products, which have been tested, listed and labeled by Underwriters' Laboratories (UL) and comply with NEMA standards.

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).

SUBMITTALS
Include the following information:

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.

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.

MAINTENANCE DATA:
Submit maintenance data and spare parts lists for each control device. Include this data in maintenance manual.

RECORD DRAWINGS:
Prior to request for final payment provide complete composite record drawings to incorporate the DDC and Pneumatic/Electric fieldwork. Accurate Section 23 09 14 record drawings to be supplied by the Section 23 09 14 contractor with the accuracy of these drawings being the responsibility of the 23 09 14 contractor. In the event that changes are required to the 23 09 14 supplied record drawings after they have been compiled by the 23 09 24 contractor, it shall be the 23 09 14 contractor's responsibility to provide updated composite record drawings incorporating the 23 09 24 record drawings. 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. Point to point routing of communication trunks and power wiring between DDC controllers, DDC communication devices, control panels, and Ethernet switches shall be documented. For systems that have additions to existing communication networks, provide complete DDC network diagrams for the entire building with new work clearly delineated. 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.

OPERATION AND MAINTENANCE DATA

All operations and maintenance data shall comply with the submission and content requirements specified under section GENERAL REQUIREMENTS.

MATERIAL DELIVERY AND STORAGE

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.

P A R T 2 - P R O D U C T S

GENERAL

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 indicate.

System shall be capable of operating with 120 VAC power supply, fully protected with a shutdown-restart circuit, and associated hardware and software.

All DDC controllers shall use screw terminals for termination of individual wires. Spade lugs are not acceptable.

LOCAL CONTROL PANELS

Use control panels with suitable mounting brackets for each supply fan system. Locate panel adjacent to system served. Existing panels may be reused if space is limited or compatable pre wired insert can be installed.

Fabricate panels of 14 gauge furniture grade steel or 6063-T5 extruded aluminum alloy, totally enclosed on six sides, hinged door and keyed lock, with manufacturer's standard shop painted finish and color.

Provide UL listed cabinets for use with line voltage devices.

Control panels that have devices or terminations that are fed or switch 50V or higher shall enclose the devices, terminations, and wiring so that Personal Protective Equipment (PPE) is not required to service the under 50V devices and terminations within the control panel. As an alternative, a separate panel for only the 50V and higher devices may be provided and mounted adjacent to the under 50V control panel. For DDC controllers that are directly fed by 120VAC, provide an externally mounted 120VAC, 5A fast blow fuse to feed these controllers.

Plastic control enclosures will be approved provided all conduits are bonded and grounded.

Provide control panels for all DDC Controllers, ASC's and associated function modules. All controls to be in control panels provided under this Section except for the following:

- Terminal unit controllers mounted within the terminal unit equipment enclosure as specified under Section 23 09 14.
- Above accessible lay-in tile ceilings where VAV box controllers designed to be directly mounted on air terminals.
- Above accessible lay-in tile ceilings where additional controllers are required for air terminal unit control. Where additional controllers are required, they shall not be mounted directly to the ductwork but be mounted on din rail or back panel in an accessible location as close as possible to the terminal unit(s) being controlled.
- Any devices other than DDC controllers, i.e. relays, pressure switches, etc. shall be installed in an enclosure.

All wiring for controllers shall be managed in a neat and workmanlike manner.

All cabling and electrical wiring terminated at controllers, devices and terminal strips are to be permanently tagged or labeled with permanent adhesive labels within one inch of terminal strip with a numbering system to correspond exactly with the "Record Drawings". Jumpers where the both ends of the wire are visible and terminations are within 6” of each other do not need to be labeled. Spare wires are to be labeled as “Spare” with unique number designations.

DIRECT DIGITAL CONTROLS

System to be capable of integrating multiple building functions, including equipment supervision and control, alarm management, energy management, and trend data collection.

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.

The vendor of the system provided under this Section shall provide all software and communication interface hardware necessary to program and upload/download programmable and application specific controllers from a laptop computer and make additional copies and future software revisions available for sale directly to the user Agency.

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.

The failure of any single component or network connection shall not interrupt the execution of control strategies at other operational devices.

NETWORKING/COMMUNICATIONS

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.

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.

The supervisory controller shall directly oversee a local network such that communications may be executed directly to and between programmable controllers and ASC's. All operator devices, either network resident or connected via dial-up modems, shall have the ability to access all points and application reports on the network.

Provide serial communication ports on all ASC's for operator's terminal communications with the DDC Controller.

Access to system data shall not be restricted by the hardware configuration of the DDC system.

Global data sharing or global point broadcasting shall allow point data to be shared between programmable controllers and ASC's when it would be impractical to locate multiple sensors.

Network design shall include the following provisions:

- 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.

- Support of any combination of programmable controllers and ASC's. A minimum of 32 programmable controllers and ASC's shall be supported on a single local network. The buss shall be addressable for up to 32 ASC's.

- Detection of single or multiple failures of programmable controllers and ASC's or the network media.

- Error detection, correction, and re-transmission to guarantee data integrity.

- Use commonly available, multiple-sourced, networking components.

- Use of an industry standard communication transport, such as ARCNET, Ethernet, and IEEE RS-485 communications interface.

Provide a temporary Ethernet network for communications between supervisory controllers and operator workstation until the building IT network is available for use by the DDC system. The temporary Ethernet network and all other communications required for the DDC system shall be installed as required for specified operation of mechanical equipment so check out and commissioning of the equipment can occur in a timely manner.

BACNET REQUIREMENTS

BACnet of highest level network communications shall be capable of BACnet/IP over Ethernet and field level communications shall utilize BACnet MSTP

Supervisory controllers shall provide a Protocol Implementation Conformance Statement (PICS) and BACnet Interoperability Building Blocks (BIBB"S) as required by the American National Standards Institute/American Society of Heating, Refrigerating, and Air-Conditioning Engineers (ANSI/ASHRAE) Standard 135-2001, BACnet protocol.

In general, all highest level networked supervisory devices shall support the following

Segmentation Capability
Segmentation requests supported
Segmentation responses supported

Standard Object Types Supported

- Analog input
- Analog output
- Analog value
- Binary input
- Binary output
- Binary value
- Calendar
- Device
- Event enrollment
- Group
- Multistate input
- Multistate output
- Multistate value
- Notification class
- Schedule

Data Link Layer Option

- BACnet Internet Protocol (IP) (Annex J)

Networking Options

BACnet/IP Broadcast Management Device (BBDM)

Character Sets supported

- ANSI X3.4
- ISO 10646 Universal Character Set-2

BACnet object name and description shall match the existing naming conventions used by the state Agency for their existing Building Automation System. Coordinate with Agency control personnel to establish the naming conventions prior to programming of any controllers provided under this specification section. All controllers shall have object names, descriptions, and engineering units that are writable at the controller level and shall be programmed so that the object names, descriptions, and engineering units match the desired naming standards as specified above. Ensure that the BACnet object attributes for object name, object

description, engineering units and other required attributes will be transferred through to the Supervisory Controller when the auto-discovery function is executed.

Coordinate BACnet device instance numbering with the agency facility personnel for controllers provided under this Section that are being connected to an existing building automation system. This contractor shall be responsible for correcting any conflicts with existing devices that may occur or changing the device instance numbers to comply to follow the agency BACnet device instance numbering scheme.

The following table indicates the minimum VAV terminal unit objects, the associated naming, and the object values that are required to be writable that shall be provided for all VAV terminals. If the agency does not have a convention for VAV terminal object names and descriptions that it prefers, use the naming standards as listed below. Provide similar naming and descriptions that are approved by the agency for other types of terminal units and mechanical systems.

Object Type	Object Name	Object	
Description	Units	Writeable	
BV	DEVICE-S	DEVICE STATUS - SERVED BY	
AHU#	ONLINE/OFFLINE		
MV	OCC-MODE	OCCUPIED	
MODE	OCC/UNOCC/STNDBY		
BV	OCC-SCHED	OCCUPIED SCHEDULE Xam-	
Xpm	OCC/UNOCC	Yes	
DI	OCC-S	OCCUPANCY SENSOR	
STATUS	OCC/UNOCC		
AV	ZN-SP	ZONE TEMPERATURE SETPOINT	DEG
F	Yes		
AI	RM#-T	ROOM #### TEMPERATURE	DEG
F			
AI	DA-T	DISCHARGE AIR TEMPERATURE	DEG
F			
AO	HTG-VLV	HEATING VALVE	%
OPEN	Yes		
AO	RAD-VLV	RADIATION VALVE	%
OPEN	Yes		
AO	SA-DPR	SUPPLY AIR DAMPER	%
OPEN	Yes		
AV	CFM-SP	ACTUAL FLOW	
SETPOINT	CFM		
AI	CFM-FLOW	SUPPLY AIR	
FLOW	CFM		
AV	HTG-SP	HEATING TEMPERATURE SETPOINT	DEG
F	Yes		
AV	CLG-SP	COOLING TEMPERATURE SETPOINT	DEG
F	Yes		
AV	OCC-C-CFM-MIN	OCCUPIED CLG CFM MIN	
SETPOINT	CFM	Yes	
AV	OCC-C-CFM-MAX	OCCUPIED CLG CFM MAX	
SETPOINT	CFM	Yes	

SUPERVISORY CONTROLLERS

Supervisory controllers shall be microprocessor-based, N4 compatable, multi-tasking, multi-user and digital control processors.

Each supervisory controller shall have sufficient memory to support its own operating system and databases including:

- Control processes
- Energy management application
- Alarm management
- Trend data
- Maintenance support applications
- Operator I/O
- Dial-up communications

- Manual override monitoring

The system shall be modular in nature, and shall permit easy expansion through the addition of field controllers, sensors, and actuators.

Supervisory controllers shall provide at least two RS-232C, USB serial communication ports, or Ethernet ports for simultaneous operation of multiple operator I/O devices, such as laptop computers, personal computers, and video display terminals.

Supervisory controllers shall monitor the status of all overrides and include this information in the logs and summaries to inform the operator that automatic control has been inhibited.

Each supervisory controller shall continuously perform self-diagnostics, communications diagnostics, and diagnostics of all subsidiary equipment. Supervisory controllers shall provide both local and remote annunciation of any detected component failures, or repeated failure to establish communication. Indication of the diagnostic results shall be provided at each supervisory controller.

Isolation shall be provided at all network terminations, as well as all field point terminations, to suppress induced voltage transients consistent with IEEE Standard 587-1980. Isolation levels shall be sufficiently high to allow all signal wiring to be run in the same conduit as high voltage wiring acceptable by electrical code.

In the event of the loss of normal power, there shall be an orderly shutdown of the supervisory controller to prevent the loss of data base or operating system software. Non-volatile memory shall be incorporated for all critical controller configuration data, and battery backup shall be provided to support the real-time clock and all volatile memory for a minimum of 72 hours.

Upon restoration of normal power, the supervisory controller shall automatically resume full operation without manual intervention.

Should supervisory controller memory be lost for any reason, the supervisory controller shall have the capability of reloading the it's programming via high speed local area network from the control system archive workstation or server, the local RS-232C port, or telephone line dial-in.

SOFTWARE LICENSE AGREEMENT

For Niagara based systems, it is the express goal of this specification to implement an open system that will allow products from various suppliers to be integrated into a unified system in order to provide flexibility for expansion, maintenance, and service of the system. The user Agency shall be the named license holder of all software associated with any and all incremental work on the project(s). All Niagara software licenses shall have the "accept.station.in=*"; "accept.station.out=*" and "accept.wb.in=*" and "accept.wb.out=*" section of the software licenses. The intent is to insure that the installed Niagara products may be completely open for integrations. The user Agency shall be free to direct the modification of the any software license, regardless of supplier. In addition, the user Agency shall receive ownership of all job specific software configuration documentation, data files, and application-level software developed for the project. This shall include all custom, job specific software code and documentation for all configuration and programming that is generated for a given project and /or configured for use within Niagara Framework (Niagara) based controllers and/or servers and any related LAN / WAN / Intranet and Internet connected routers and devices. Any and all required Ids and passwords for access to any component or software program shall be provided to the user Agency. Provide all software necessary for developing software algorithms in all supervisory, programmable, and application specific direct digital controllers which is licensed to the owner

Programming tools for programmable and application specific controllers that utilize the Niagara Framework shall not be restricted to any specific brand of Jace. Tools and controllers shall be able to connect to any brand of Jace that are provided under this specification Section.

SYSTEM SOFTWARE FEATURES

All necessary software to form a complete operating system, as described in this specification, shall be provided as an integral part of the supervisory controller, and shall not be dependent upon higher level computer for execution.

Programming tools for programmable and application specific controllers that utilize the Niagara Framework shall not be restricted to any specific brand of Jace. Tools and controllers shall be able to connect to any brand of Jace that are provided under this specification Section. Vendor of the system provided under this

Section shall provide all software and hardware necessary to program programmable and application specific controllers and make additional copies and future software revisions available for sale directly to the user Agency.

Control software shall include a provision for limiting the number of times that each piece of equipment may be cycled within any one-hour period.

The system shall provide protection against excessive demand situations during start-up periods by automatically introducing time delays between successive start commands to heavy electrical loads.

Supervisory controllers shall have the ability to perform any or all of the following energy management routines:

- Time of day scheduling
- Calendar based scheduling
- Holiday scheduling
- Optimal start
- Optimal stop
- Demand limiting
- Load rolling
- Heating/cooling interlock

All programs to be executed automatically without the need for operator intervention, and be flexible enough to allow user customization. Programs shall be applied to building equipment described in Section 23 09 93 of this specification.

Supervisory controllers shall be able to execute configured processes defined by the user to automatically perform calculations and control routines.

It shall be possible to use any of the following in a configured process:

- Any system-measured point data or status
- Any calculated data
- Any results from other processes
- Boolean logic operators (and, or)

Configured processes may be triggered based on any combination of the following:

- Time of day
- Calendar date
- Other processes
- Events (e.g., point alarms)

A single process shall be able to incorporate measured or calculated data from any and all other ASC's.

A single process shall be able to issue commands to points in any and all other programmable controllers and ASC's on the local network.

Alarm management shall be provided to monitor, buffer, and direct alarm reports to operator devices and memory files. Each supervisory controller shall perform distributed; independent alarm analysis and filtering to minimize network traffic and prevent alarms from being lost. At no time shall the ability of supervisory controllers to report alarms be affected by either operator activity at the local I/O device or communications with other ASC's on the network.

All alarm or point change reports shall include the English language description of each point and the time and date of the occurrence.

The user shall be able to define the specific system reaction for each point. Alarms shall be prioritized to minimize nuisance reporting and to speed operator response to critical alarms. A minimum of three priority levels shall be provided. Users shall have the ability to manually inhibit alarm reporting for each point.

The user shall also be able to define conditions under which point changes need to be acknowledged by an operator and/or logged for analysis at a later date.

Alarms reports and messages shall be directed to an operator device.

In addition to the point's descriptor and the time and date, the user shall be able to print, display or store a 60-character alarm message to more fully describe the alarm condition or direct operator response.

Each supervisory controller shall be capable of storing a library of at least 100 messages. Each message may be assignable to any number of points in the panel.

A data collection utility shall be provided to automatically sample, store, and display system data.

Measured and calculated analog and binary data shall be assignable to user definable trends for the purpose of collecting operator specified performance data over extended periods of time. Sample intervals of 1 minute to 24 hours, in one minute or one hour intervals, shall be provided. Each supervisory controller shall have a dedicated buffer for trend data and shall be capable of storing 16 trend logs. Each trend log shall have up to four points trended at 48 data samples each. Data shall be stored at the supervisory controller and up-loaded to the DDC system server when archiving is desired.

Supervisory controllers shall automatically accumulate and store runtime hours for binary input and output points specified in Section 23 09 14 of this specification.

Supervisory controllers shall automatically sample, calculate and store consumption totals on a daily, weekly, or monthly basis, user defined, for user-selected analog and binary pulse input type points.

Totalization shall provide calculation and storage accumulations of up to 9,999,999 units (e.g., KWH, gallons KBTU, tons, etc.).

The totalization routine shall have a sampling resolution of one minute.

The user shall have the ability to define a warning limit. Unique, user specified messages shall be generated when the limit is reached.

The information available from pulse totalization shall include, but not be limited to, the following:

- Peak demand, with date and time stamp
- 24-hour demand log
- Accumulated KWH for day
- Sunday through Saturday KWH usage
- Demand KW annual history for past 12 periods
- KWH annual history for past periods

Supervisory controllers shall have the ability to count events, such as the number of times a pump or fan system is cycled on and off.

The event totalization feature shall be able to store the records associated with a minimum of 9,999,999 events before reset.

PROGRAMMABLE CONTROLLERS

Programmable controllers shall be provided with a software program that shall allow the user to design flexible software algorithms for the control sequences as described in Sections 23 09 14 and 23 09 93 portions of this specification.

Programmable controllers shall support all necessary point inputs and outputs to perform the specified control sequence in a totally stand-alone fashion.

Each programmable controller shall perform its own limit and status monitoring and analysis to maximize network performance by reducing unnecessary communications.

Each programmable controller shall support the use of a locally mounted status and adjust panel interface to allow for the local adjustment of all setpoints, temporary override of any input or output points and status of all points directly at the controller. The capabilities of the locally mounted status and adjust panel shall include, but not be limited to, the following information for the programmable controllers to which:

- Display temperatures
- Display status

- Display setpoints
- Display control parameters
- Override binary output control
- Override analog output control
- Override analog setpoints
- Modification of gain and offset constants

All system setpoints, proportional bands, control algorithms, and any other programmable parameters shall be stored such that a power failure of any duration does not necessitate reprogramming the programmable controller.

Programmable controllers shall support, but not be limited to, the following configurations of systems to address current requirements as described in Sections 23 09 14 and 23 09 93 portions of this specification, and for future expansion of air handling units:

- Mixed air handling units
- 100 percent outside air handling units
- Boiler or chiller plants with pump logic
- Hot water heat exchangers
- Cooling towers
- Zone pressurization of labs
- Smoke control systems
- Generic system interlocking through hardware

APPLICATION SPECIFIC CONTROLLERS - HVAC APPLICATIONS

Each supervisory controller shall be able to extend its monitoring and control through the use of stand-alone application specific controllers (ASC's).

Each ASC shall operate as a stand-alone controller capable of performing its specified control responsibilities independently of other controllers in the network. Each ASC shall be a microprocessor based, multi-tasking, real-time digital control processor.

Each ASC shall have sufficient memory to support its own operating system and databases including:

- Control Processes
- Energy Management Applications
- Operator I/O (Portable Service Terminal)

The operator interface to any ASC point or program shall be through the supervisory controller connection to any ASC on the network.

ASC's shall directly support the temporary use of a portable service terminal that can be connected to the ASC via zone temperature or directly at the controller. The capabilities of the portable service terminal shall include, but not be limited to, the following information for the ASC:

- Display temperatures
- Display status
- Display setpoints
- Display control parameters
- Override binary output control
- Override analog output control
- Override analog setpoints
- Modification of gain and offset constants

All system setpoints, proportional bands, control algorithms, and any other programmable parameters shall be stored such that a power failure of any duration does not necessitate reprogramming the ASC.

ASC’s shall support, but not be limited to, the following configurations of systems to address current requirements as described in Sections 23 09 14 and 23 09 93 portions of this specification, and for future expansion of air handling units:

- Variable Air Volume Terminals
- Reheat Terminals
- Fan Coils

- Unit Ventilators
- Packaged Air Handling Units

For butterfly type Variable Air Volume (VAV) Terminals, provide differential pressure transducers and damper actuators for flow measurement and actuation of the VAV terminal damper. Pressure transducers for VAV box flow applications do not need to have adjustable pressure ranges or integral display. Provide filter on high side of flow pickups if flow measurement device requires airflow through the device.

Terminal unit space temperature sensors shall be furnished under this Section if they are specified to be provided with digital displays with setpoint adjustments and/or manual occupancy override and indication of occupancy status. Provide information to the AE on sensor colors offered by the manufacturer and obtain approval on what color should be provided on the project. Provide setpoint adjustment as specified in the DDC Input/Output Summary Table and sequence of operation.

Provide a method to view and print a summary of current K-factors for flow correction for each VAV terminal through the DDC system. The summary shall have a minimum of 50 K-factors per group of VAV terminals.

OPERATOR INTERFACE REQUIREMENTS

COMMAND ENTRY/MENU SELECTION PROCESS:
Operator interface software shall minimize operator training through the use of English language prompting and English language point identification.

TEXT-BASED DISPLAYS:
The operator interface shall provide consistent text-based displays of all system point and application data described in this specification. Point identification, engineering units, status indication, and application-naming conventions shall be the same at all operator devices.

GRAPHIC-BASED DISPLAYS:
The operator interface shall include graphic based displays of each system on DDC systems that currently employ graphic based displays. The point data associated with each system shall dynamically update at a minimum of every 30 seconds. Graphic displays shall have the ability to be linked to each other to provide a “drill down” capability from main graphic displays to more specific system based displays. Provide a building level graphic display that links to system graphics. For systems that have ASC controlled terminal unit controls, provide a building floor plan with dynamic temperatures shown on the graphic that can be drilled into for more specific terminal information. Points provided in the graphic shall have the override and adjust capability specified under operator commands.

PASSWORD PROTECTION:
Multiple-level password access protection shall be provided to allow the user/manager to limit control, display, and data base manipulation capabilities as he deems appropriate for each user, based upon an assigned password.

Passwords shall be exactly the same for all operator devices.

A minimum of three levels of access shall be supported:

- Level 1: Data access and display
- Level 2 = Level 1 + operator overrides and commands
- Level 3 = Level 2 + database generation and modification

A minimum of 4 passwords shall be supported at each supervisory controller.

Operators will be able to perform only those commands available for their respective passwords. Menu selections displayed at any operator device shall be limited to only those items defined for the access level of the password used to log-on.

Provide user definable, automatic log-off timers of from 1 to 60 minutes to prevent operators from inadvertently leaving devices on-line.

OPERATOR COMMANDS:
The operator interface shall allow the operator to perform commands including, but not limited to, the following:

- Start-up or shutdown selected equipment
- Adjust setpoints
- Override analog and binary outputs
- Add/modify/delete time programming
- Enable/disable process execution
- Lock/unlock alarm reporting for each point
- Enable/disable totalization for each point
- Enable/disable trending
- Enter temporary override schedules
- Define holiday schedules
- Change time/date
- Enter/modify analog alarm limits
- Enable/disable analog alarm limits
- Enable/disable demand limiting
- Enable/disable duty cycle

LOGS AND SUMMMARIES:
Reports shall be generated manually, and directed to the displays. As a minimum, the system shall allow the user to easily obtain the following general listing of all points in the system, which shall include, but not be limited to:

- Points currently in alarm
- Off-line points
- Points currently in override status
- Points in weekly schedules
- Holiday programming

Summaries shall be provided for specific points, for a logical point group, for a user-selected group of groups, or for the entire facility without restriction due to the hardware configuration on the facility management system. Under no conditions shall the operator need to specify the address of hardware controller to obtain system information.

SYSTEM CONFIGURATION AND DEFINITION:
All temperature and equipment control strategies and energy management routines shall be definable by the operator. System definition and modification procedures shall not interfere with normal system operation and control.

The system shall be provided complete with all equipment, software, and documentation necessary to allow an operator to independently perform the following functions:

- Add/delete/modify application specific controllers
- Add/delete/modify points of any type, and all associated point parameters, and tuning constants
- Add/delete/modify alarm reporting definition for each point
- Add/delete/modify energy management applications
- Add/delete/modify time and calendar-based programming
- Add/delete/modify totalization for every point
- Add/delete/modify historical data trending for every point
- Add/delete/modify configured control processes
- Add/delete/modify dial-up telecommunication definition
- Add/delete/modify all operator passwords
- Add/delete/modify alarm messages

NETWORK WIDE STRATEGY DEVELOPMENT:
Inputs and outputs for any process shall not be restricted to a single programmable controller or ASC, but shall be able to include data from any and all other programmable controller or ASC's to allow the development of network-wide control strategies.

SYSTEM DEFINITION/CONTROL SEQUENCE:
All portions of system definition shall be self-documenting and capable of providing hardcopy printouts of all configuration and application data.

DATA BASE SAVE/RESTORE/BACK-UP:

Backup copies of all programmable controller, ASC and supervisory controller databases shall be stored in at least one personal computer or laptop. Users shall also have the ability to manually execute downloading of a programmable controller, ASC or supervisory controller database.

OPERATOR WORK STATION & DDC SYSTEM SERVER

A Personal Computer (PC) Operator Workstation and DDC System Server software shall be provided for command entry, information management, network alarm management, and database management and archiving functions. The functions of the operator workstation and DDC system server may reside on a single personal computer. Provide a separate DDC System Server PC if required to perform the specified requirements. All functions specified under the Operator Interface section of this specification must be met.

All real-time control functions shall be resident in the stand-alone supervisory controllers to facilitate greater fault tolerance and reliability.

Workstation shall be general purpose, commercially available, personal computers with a dual core processor with a minimum speed of 2.5 GHz, a minimum of 4GB of RAM, a minimum hard drive size of 1TB, and a DVDRW/CDRW drive. Provide more memory and/or a faster processor if necessary to perform all the functions described in this specification.

Sufficient storage shall be provided to accommodate all fully configured point databases all application databases, all graphics databases, all user-defined reports, and all historical data archived as described in this specification.

The flat panel display provided for system operation shall have a diagonal screen measurement of no less than 20" and have a minimum display resolution of no less than 1280 x 1024 pixels. Separate controls shall be provided for color, contrast, and brightness.

Printer shall be a current production model.

Provide software, including but not limited to functions such as:

- Grouping point data by systems or types
- Displaying trends in textual and graphical format
- Application software for programming all DDC controllers specified herein
- Graphics definition and development
- Managing archive data and programs

This contractor shall provide all labor and software upgrades required so that the manufacturer’s current software revision is provided at substantial completion. If the manufacturer will be upgrading within three months after substantial completion, the contractor must notify the agency that this will occur before substantial completion and provide a quote for upgrading to the current revision.

Prior to installation of any Operator Workstation or DDC System server, the contractor shall work with the owner to ensure that proper virus protection software and security measures are in place before the system is put online.

WEB BASED HTML BROWSER INTERFACE

Provide a HTML based browser interface (Web Server) for accessing the DDC system. This shall include all hardware and software to provide an Ethernet twisted pair connection to the owners local or wide area network (LAN or WAN) that can be used to access the DDC system through a standard internet browser.

All information shall be provided to the owners IT staff to facilitate connection through the owners LAN/WAN.

At a minimum, this interface shall be capable of all functions described under the Operator Interface section, Password Protection, Operator Commands, and Logs and Summary subsections of this specification.

P A R T 3 - E X E C U T I O N

GENERAL

All electronic work required as an integral part of the central campus automation system work is the responsibility of this section unless specifically indicated otherwise in this section, Section 23 09 14..

This contractor shall provide all labor, materials, engineering, software permits, tools, check-out and certificates required to install a complete DDC upgrade to the existing central campus automation system as herein specified. This system upgrade shall be compatible with and interfaced to the existing computer driven automation center on campus, and shall operate through all the existing I/O devices, central processing unit (CPU), and digital communication trunks. This connection to the digital communications trunk shall be true bi-directional analog and digital communications with the existing central campus automation system.

Any and all points added with this project shall be properly interfaced into the existing central campus automation system format and grouped for display purposes into the system such that all points associated with a new or existing DDC system can appear together on the CRT display or printed log. Assignment of points to a group shall not be restricted by hardware configuration of the points of direct digital control. It shall be possible to assign a point to appear in more than one system. An English descriptor and an alpha/numeric identifier shall identify each system.

This central campus automation system expansion as herein specified shall be fully integrated and completely installed by this section. It shall include all required computer CPU software and hardware. Include the engineering, installation, supervision, calibration, software programming, and checkout necessary for a fully operational system.

INSTALLATION

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. All material shall be UL approved.

The addition of this specified system expansion shall in no way impair the future capabilities of any existing functions of the computer driven central campus automation system. A system expansion with lessor capabilities will not be accepted. Further, this contractor will not put in jeopardy the normal, uninterruptable operation of the entire campus automation system the time it is interfaced through the completion of this project.

Install system and materials in accordance with manufacturer's instructions, rough-in drawings and details on drawings.

Line voltage wiring to power the DDC Controllers, to be by this contractor.

Control panels serving equipment fed by emergency power shall also be served by emergency power.

Provide uninterruptable power supplies where necessary to provide proper startup of equipment or to accomplish power restart control sequences specified.

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.

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.

Cable tray routing of the communication trunks is acceptable.

Provide all necessary routers and or repeaters to accomplish connection to the LAN via the panel-mounted port provided.

Provide two data jacks in control panels housing supervisory controllers and allocate 6”x6” for each data jack in the panel. The first jack will be used for connecting the supervisory controller to the Building Automation Network (BAN). The second jack will be used as a spare for connecting to the BAN by service personnel.

END OF SECTION

SECTION 23 09 25
DIRECT DIGITAL CONTROL SYSTEM FOR HVAC
INTEGRATED TERMINAL UNITS

PART 1 - GENERAL

SCOPE

Work in this section includes Direct Digital Control (DDC) terminal unit application specific controllers (ASC's), field level communication trunk, software programming, and other equipment and accessories necessary to integrate ASC's into a supervisory controller provided under Section 23 09 24. This system interfaced with electric controls (Section 23 09 14) utilizing Direct Digital Control signals to operate actuated control devices will meet, in every respect, all operational and quality standards specified herein. Provide TAB services on all terminal units installed per section 23 05 93.

RELATED WORK

Applicable provisions of Division 1 govern work under this section.

Section 23 05 93 - Testing, Adjusting, and Balancing for HVAC – Coordination
Section 23 09 14 - Pneumatic and Electric Instrumentation and Control Devices for HVAC

Division 23 - HVAC - Equipment provided to be controlled or monitored

REFERENCE

Applicable provisions of Division 1 govern work under this section.

REFERENCE STANDARDS

FCC Part 15, Subpart J, Class A - Digital Electronic Equipment to Radio Communication Interference
ANSI/ASHRAE Standard 135-2001 BACnet - A Data Communication Protocol for Building Automation and Control Networks

WORK NOT INCLUDED

Section 23 09 14 and 23 09 24 work includes 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.

Motorized control dampers and actuators, temperature sensors, automatic control valves and their actuators

are also covered in Section 23 09 14.

QUALITY ASSURANCE

MANUFACTURER:: Distech

INSTALLER:

A firm specializing and experienced in DDC control system installation for no less than 3 years. All engineering and commissioning work shall be done by qualified employees of this manufacturer, or qualified employees of an Authorized Representative of that manufacturer that provides engineering and commissioning of the manufacturer's control equipment. Where installing contractor is an authorized representative of the control equipment manufacturer, submit written confirmation of such authorization. Indicate in letter of authorization that the installing contractor has successfully completed all necessary training required for the engineering, installation, and commissioning of equipment and systems to be provided for the project and that such authorization has been in effect for a period of not less than three years. The letter of authorization should also indicate that the installing contractor is authorized to install the manufacturer's DDC equipment at the project location at the time the project is bid. Installation of the equipment shall be done by qualified mechanics and/or electricians in the direct employ or be directly subcontracted and under the supervision of the manufacturer or Authorized Representative. The contractor providing and installing the equipment under this specification section shall be the same contractor providing and installing equipment under the 23 09 14 specification section.

RESPONSE TIME:

During warranty period, four (4) hours or less, 24-hours/day, 7 days/week.

ELECTRICAL STANDARDS:

Provide electrical products, which have been tested, listed and labeled by Underwriters' Laboratories (UL) and comply with NEMA standards.

DDC STANDARDS: DDC manufacturer shall provide written proof with shop drawings that the equipment being provided is in compliance with F.C.C. rules governing the control of interference caused by Digital Electronic Equipment to Radio Communications (1979 Amendment to Part 15, Subpart J).

SUBMITTALS

Include the following information:

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 would list mechanical equipment tag, room number of space served, address of DDC controller, and any other pertinent information required for service.

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.

MAINTENANCE DATA

Submit maintenance data and spare parts lists for each control device. Include this data in maintenance manual.

RECORD DRAWINGS

Prior to request for final payment provide complete composite record drawings to incorporate the DDC and Pneumatic/Electric field work. Schedules and other interface information specified below for integration of the equipment specified in this section to the ELDM shall be updated and included in the record drawings provided under this specification section. 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. Point to point routing of communication trunks and power wiring between DDC controllers, DDC communication devices, control panels, and Ethernet switches shall be documented. 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.

OPERATION AND MAINTENANCE DATA
All operations and maintenance data shall comply with the submission and content requirements specified under section GENERAL REQUIREMENTS.

MATERIAL DELIVERY AND STORAGE
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.

P A R T 2 - P R O D U C T S

GENERAL
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 indicate.

The system components shall be capable of operating with 120 VAC and/or 24VAC/DC power supply and shall be fully overcurrent protected with resettable shutdown-restart circuitry. These circuits shall be implemented with the proper hardware and associated software functions. When the devices or components require 24VAC/DC, the controls contractor shall provide the proper power supplies and/or transformers. All transformers shall have resettable overload protection.

All DDC controllers shall use screw terminals for termination of individual wires. Spade lugs are not acceptable.

CONTROL PANELS
Fabricate panels of 14 gauge furniture grade steel or 6063-T5 extruded aluminum alloy, totally enclosed on six sides, hinged door and keyed lock, with manufacturer's standard shop painted finish and color.

Provide UL listed cabinets for use with line voltage devices.

Control panels that have devices or terminations that are fed or switch 50V or higher shall enclose the devices, terminations, and wiring so that Personal Protective Equipment (PPE) is not required to service the under 50V devices and terminations within the control panel. As an alternative, a separate panel for only the 50V and higher devices may be provided and mounted adjacent to the under 50V control panel. For DDC controllers that are directly fed by 120VAC, provide an externally mounted 120VAC, 5A fast blow fuse to feed these controllers.

Plastic control enclosures will be approved provided all conduits are bonded and grounded.

Provide control panels for all DDC Controllers, ASC's and associated function modules. All controls to be in control panels provided under this Section except for the following:

- Terminal unit controllers mounted within the terminal unit equipment enclosure as specified under Section 23 09 14.
- or Above accessible lay-in tile ceilings where VAV box controllers designed to be directly mounted on air terminals.
- Above accessible lay-in tile ceilings where additional controllers are required for air terminal unit control. Where additional controllers are required, they shall not be mounted directly to the ductwork but be mounted on din rail or back panel in an accessible location as close as possible to the terminal unit(s) being controlled.
- Any devices other than DDC controllers, i.e. relays, pressure switches, etc. shall be installed in an enclosure.

All wiring for controllers shall be managed in a neat and workmanlike manner.

Permanently label all controls; tag all control wiring, and document both on control drawings.

DIRECT DIGITAL CONTROLS
DDC system to consist of a supervisory controller provided under 23 09 24, stand-alone terminal unit DDC Application Specific Controllers (ASC's).

The vendor of the system provided under this Section shall provide all software and communication

interface hardware necessary to program and upload/download programmable and application specific controllers from a laptop computer and make additional copies and future software revisions available for sale directly to the user Agency.

The integration of the DDC terminal controllers provided in this section and the supervisory controller provided under Section 23 09 24 shall be capable of terminal unit equipment supervision and control, time scheduling, alarm management, energy management functions, trend data collection and reporting, and controller integrity monitoring.

Control logic necessary for DDC terminal unit control as specified in Section 23 09 15 point charts and Section 23 09 93 control sequences shall reside within the DDC terminal unit controller or the Section 23 09 24 supervisory controller.

Time schedules for occupancy and other functions specified in Section 23 09 93 shall be programmed in the 23 09 24 supervisory controller. Time schedules shall be programmed so that all terminal units served by a given AHU shall be indexed by the same schedule unless otherwise directed in the 23 09 93 sequence of operation. When specified, grouping of terminals shall be provided under this section so a single data point provided under this section associated with the grouped terminals can be scheduled in the supervisory controller.

When specified, flow totalization for AHU outside air ventilation reset shall be provided by the Section 23 09 24 supervisory controller.

When specified, static pressure reset strategies that poll the terminal units shall be provided by the Section 23 09 24 supervisory controller.

Trend data shall be collected by the 23 09 24 supervisory controller by polling the appropriate controllers provided in this section.

Alarms will be monitored by the 23 09 24 supervisory controller by polling the appropriate controllers provided in this section. Special programming shall not be required by this contractor for alarm monitoring.

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.

The failure of any single component or network connection shall not interrupt the execution of control strategies at other operational devices.

NETWORKING/COMMUNICATIONS

The intent of this specification is to provide a networked, stand-alone, distributed control system with the capability to integrate the ANSI/ASHRAE Standard 135-2001 BACnet communication protocols, in one open, interoperable system.

The supplied computer software shall employ object-oriented technology (OOT) for representation of all data and control devices within the system. In addition, adherence to industry standards including ANSI/ASHRAE Standard 135-2001, BACnet to assure interoperability between all system components is required. For each BACnet device, the device supplier must provide a Protocol Implementation Conformance Statement (PICS) document showing the installed device’s compliance level. Minimum compliance is Level 3; with the ability to support data read and write functionality.

The DDC terminal unit communications network shall be capable of direct connection to and communication with the supervisory controller furnished in Section 23 09 24.

Provide communication ports on all terminal unit ASC's for operator's terminal interface.

Access to system data shall not be restricted by the hardware configuration of the DDC system.

Global data sharing as facilitated through a 23 09 24 supervisory controller or through peer to peer communication of the ASC’s shall allow point data to be shared between ASC's when it would be impractical to locate multiple sensors.

Network design shall include the following provisions:

- Data transfer rates for alarm reporting and quick point status from multiple BACnet devices. The minimum baud rate shall be 9600 baud.

- Support of any combination of BACnet devices. A maximum of 32 BACnet devices shall be supported on a single BACnet MSTP segment. Up to 64 BACnet devices can be connected to a single BACnet MSTP trunk.

- Detection of single or multiple failures of ASC's or the network media.

- Error detection, correction, and re-transmission to guarantee data integrity.

- Use BACnet MSTP protocol that utilizes IEEE RS-485 communications interface.

- The ASC device and software object count limits shall be coordinated with the Section 23 09 24 contractor so that the required number of communication trunks are routed to the Section 23 09 24 supervisory controllers.

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BACNET REQUIREMENTS

Integration to the supervisory controller provided under Section 23 09 24 shall be via BACnet MSTP. Field level communications for ASC's shall utilize BACnet MSTP - no other protocol is acceptable. All controllers to be integrated shall provide a Protocol Implementation Conformance Statement (PICS) and BACnet Interoperability Building Blocks (BIBB"S) as required by the American National Standards Institute/American Society of Heating, Refrigerating, and Air-Conditioning Engineers (ANSI/ASHRAE) Standard 135-2001, BACnet protocol.

In general all devices shall support the following:

Segmentation Capability
Segmentation requests supported
Segmentation responses supported

Standard Object Types Supported

- Analog input
- Analog output
- Analog value
- Binary input
- Binary output
- Binary value
- Calendar
- Device
- Event enrollment
- Group
- Multistate input
- Multistate output
- Multistate value
- Notification class
- Schedule

Character Sets supported

- ANSI X3.4
- ISO 10646 Universal Character Set-2

For all controllers other than Communicating Thermostats that are not programmable, BACnet object name and description shall match the existing naming conventions used by the state agency for their existing Building Automation System. Coordinate with the agency and the 23 09 24 contractor to establish the naming conventions prior to programming of any controllers provided under this specification section. If the agency does not have a naming standard for a point type, the BACnet object name shall match the point description as listed in the DDC Input / Output Summary Table as listed in 23 09 15 unless the agency preference is different. All controllers, with the exception of non-programmable Communicating Thermostats, shall have object names, descriptions, and engineering units that are writable at the controller level and shall be programmed so that the object names, descriptions, and engineering units match the desired naming standards as specified above. Ensure that these point names will be transferred through to the 23 09 24 supervisory when the auto-discovery function is executed.

A test integration of a single terminal unit controller provided under this Section shall be performed with the Section 23 09 24 contractor to ensure that the BACnet object attributes in the terminal unit controllers are correctly edited to provide the naming this is noted above will be transferred to the 23 09 24 supervisory controller during auto-discovery and will be properly presented on the Section 23 09 24 building automation system. This test integration shall be performed before this contractor programs the remaining terminal unit controllers or this contractor shall reprogram the controllers to comply with the above specification.

Coordinate BACnet device instance numbering with the agency facility personnel for controllers provided under this Section that are being connected to an existing building automation system. This contractor shall be responsible for correcting any conflicts with existing devices that may occur or changing the device instance numbers to comply to follow the agency BACnet device instance numbering scheme.

The following table indicates the minimum VAV terminal unit objects, the associated naming, and the object values that are required to be writable that shall be provided for all VAV terminals. If the agency does not have a convention for VAV terminal object names and descriptions that it prefers, use the naming standards as listed below. Provide similar naming and descriptions that are approved by the agency for other types of terminal units.

Object Type	Object Name	Object Description	Units	Writeable
BV	DEVICE-S	DEVICE STATUS - SERVED BY AHU#	ONLINE/OFFLINE	
MV	OCC-MODE	OCCUPIED MODE	OCC/UNOCC/STNDBY	
BV	OCC-SCHED	OCCUPIED SCHEDULE Xam-Xpm	OCC/UNOCC	Yes
DI	OCC-S	OCCUPANCY SENSOR STATUS	OCC/UNOCC	
AV	ZN-SP	ZONE TEMPERATURE SETPOINT	DEG F	Yes
AI	RM#-T	ROOM #### TEMPERATURE	DEG F	
AI	DA-T	DISCHARGE AIR TEMPERATURE	DEG F	
AO	HTG-VLV	HEATING VALVE	% OPEN	Yes
AO	RAD-VLV	RADIATION VALVE	% OPEN	Yes
AO	SA-DPR	SUPPLY AIR DAMPER	% OPEN	Yes
AV	CFM-SP	ACTUAL FLOW SETPOINT	CFM	
AI	CFM-FLOW	SUPPLY AIR FLOW	CFM	
AV	HTG-SP	HEATING TEMPERATURE SETPOINT	DEG F	Yes
AV	CLG-SP	COOLING TEMPERATURE SETPOINT	DEG F	Yes
AV	OCC-C-CFM-MIN	OCCUPIED CLG CFM MIN SETPOINT	CFM	Yes
AV	OCC-C-CFM-MAX	OCCUPIED CLG CFM MAX SETPOINT	CFM	Yes

APPLICATION SPECIFIC CONTROLLERS - TERMINAL UNIT CONTROL

Each terminal unit ASC shall operate as a stand-alone controller capable of performing its specified control responsibilities independently of other controllers in the network. Each ASC shall be a microprocessor based, multi-tasking, real-time digital control processor.

Each ASC shall have sufficient memory to support its own operating system and databases including:

- Control Processes
- Energy Management Applications
- Operator I/O (Portable Service Terminal)

Provide a portable service terminal or laptop with the necessary software that can be connected to the ASC via zone temperature sensor or directly at the controller. The capabilities of the portable service terminal shall include, but not be limited to, the following information for the ASC to which connected but also any other ASC, or digital panel on the network:

- Display temperatures
- Display status
- Display setpoints
- Display control parameters
- Override binary output control
- Override analog output control
- Override and adjust analog setpoints
- Modification of tuning and offset calibration constants

All temperature inputs shall have calibration offsets that can be adjusted from the portable service terminal.

For butterfly type Variable Air Volume (VAV) Terminals, provide differential pressure transducers and damper actuators for flow measurement and actuation of the VAV terminal damper. Pressure transducers for VAV box flow applications do not need to have adjustable pressure ranges or integral display. Provide filter on high side of flow pickups if flow measurement device requires airflow through the device.
All differential pressure transducer inputs for airflow measurement shall have a method to compensate for sensor drift to calibrate the zero point of the input. The differential pressure transducers and damper actuators can be integrated into the terminal unit controller or be discrete devices.

Terminal unit space sensors shall be provided with digital displays with setpoint adjustments and manual occupancy override and indication of occupancy status. Provide information to the AE on sensor colors offered by the manufacturer and obtain approval on what color should be provided on the project. Provide setpoint adjustment as specified in the DDC Input/Output Summary Table and sequence of operation.

Provide a method to view and print a summary of current K-factors for flow correction for each VAV terminal through the DDC system. The summary shall have a minimum of 50 K-factors per group of VAV terminals.

All system setpoints, proportional bands, control algorithms, calibration constants, and any other programmable parameters shall be stored such that a power failure of any duration does not necessitate reprogramming the ASC.

All application specific controllers shall be fully programmable. Question and answer or template programming is not acceptable. Control sequences for terminal unit control that utilize devices wired directly to the terminal unit application controller shall be programmed in the application specific controller and shall be stand-alone in function, i.e. occupancy sensing, temperature setpoint setback, etc. Supervisory controllers shall not be involved in the control sequence logic unless it involves sharing data between or from individual terminal unit controllers to be utilized in a global sequence, i.e. trim and respond strategies, terminal unit grouping, etc.

All application software loaded in the controllers shall be provided to the agency along with all hardware (cabling, convertors, etc.) and software required to modify and download the ASC application software. If this software requires a PC to download the controllers, this contractor shall include labor to install this on an agency provided PC. Training specified under this Section shall include how to accomplish this function.

P A R T 3 - E X E C U T I O N

GENERAL

All electronic work required as part of the Direct Digital Control system work for DDC terminal unit control is the responsibility of this section unless specifically indicated otherwise in this section, Section 23 09 24, Section 23 09 14, 23 09 15, or in Division 26.

This contractor shall provide all labor, materials, engineering, software, permits, tools, checkout and certificates required to install a complete Direct Digital Control terminal unit system as herein specified.

This Direct Digital Control system as herein specified shall be fully integrated with the 23 09 24 supervisory controller and completely installed by this section. Include the engineering, installation, supervision, calibration, software programming, and checkout necessary for a fully operational system.

INSTALLATION

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 material shall be UL approved.

Install system and materials in accordance with manufacturer's instructions, rough-in drawings and details on drawings.

Line voltage wiring to power the DDC Controllers, not provided by the Division 26 contractor, to be by this contractor.

Mount control panels adjacent to associated equipment on vibration-free walls or freestanding angle iron supports. One cabinet may accommodate power for multiple terminal unit controllers. Provide engraved plastic nameplates for instruments and controls inside cabinet and on cabinet face.

All cable and individual wiring is to be permanently tagged, with numbers corresponding with "Record Drawings", spares are to be labelled as "Spare".

The portable service terminal shall be utilised by the balancing contractor to set all the necessary parameters necessary for accurate airflow control of the DDC terminal unit. Provide necessary training to the balancing contractor so he can perform this function without assistance.

Provide all BACnet MSTP communication wiring to the supervisory controllers provided under Section 23 09 24 in the locations shown on the plans. Coordinate with the 23 09 24 for determining device limits and trunk routing to supervisory controllers.

Provide technician to work with 23 09 24 contractor to coordinate connection of terminal unit DDC system to the supervisory controller furnished by the 23 09 24 contractor.

This contractor shall be responsible for coordination with the mechanical contractor and providing for all valves that are controlled by the terminal unit controllers provided under this section to be overridden open for system cleaning of water piping.

Provide documentation to demonstrate that all points, input and output, have been checked out and verified operational, note any points not operating properly with notation of reason.

CONSTRUCTION VERIFICATION

Contractor is responsible for utilizing the construction verification checklists supplied under specification Section 23 08 00 in accordance with the procedures defined for construction verification in Section 01 91 01 or 01 91 02.

FUNCTIONAL PERFORMANCE TESTING

Contractor is responsible for utilizing the functional performance test forms supplied under specification Section 23 08 00 in accordance with the procedures defined for functional performance testing in Section 01 91 01 or 01 91 02.

AGENCY TRAINING

All training provided for agency shall comply with the format, general content requirements and submission guidelines specified under Section 01 91 01 or 01 91 02.

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 2 hours.

Provide two follow-up visits for troubleshooting and instruction, one six months after substantial completion and the other at the end of the warranty period. Length of each visit to be not less than [XX] 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/Agency and provide an inspection report to the owner of any deficiencies found.

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JACE 2 Scope of Work

Control Drawings

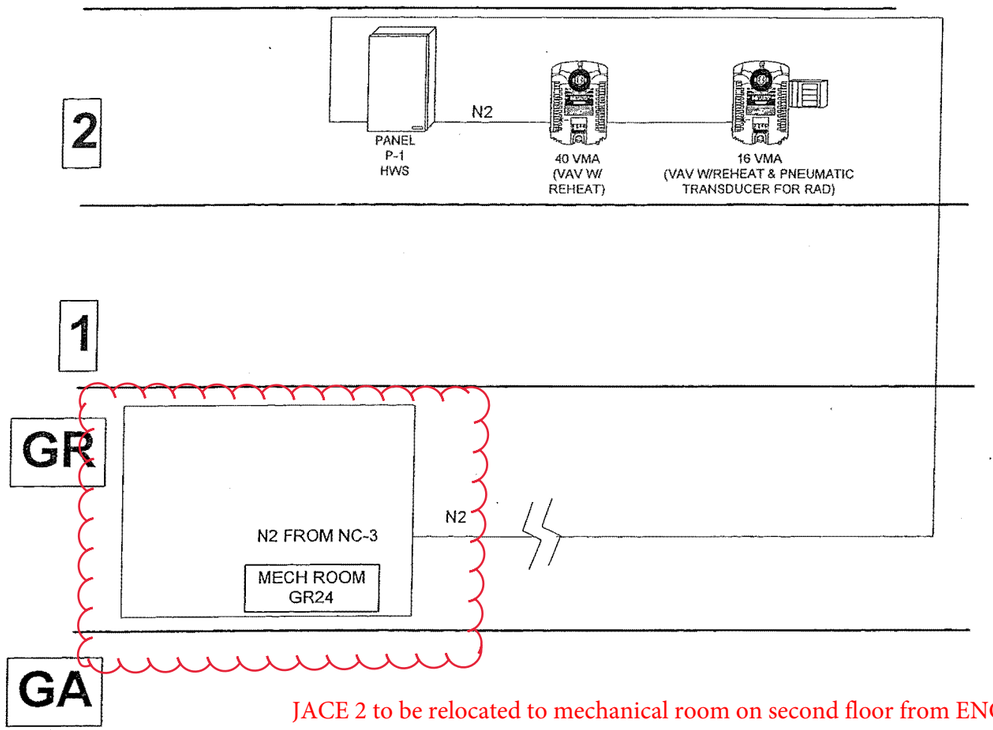
Page 1: Current communication trunk diagram.

Pages 2 : Heat exchanger for juvenile detention.

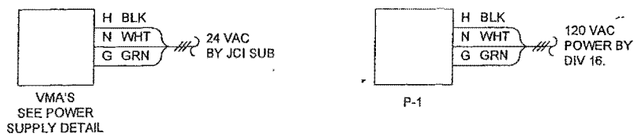
Page 3: Power roof ventilators for juvenile detention.

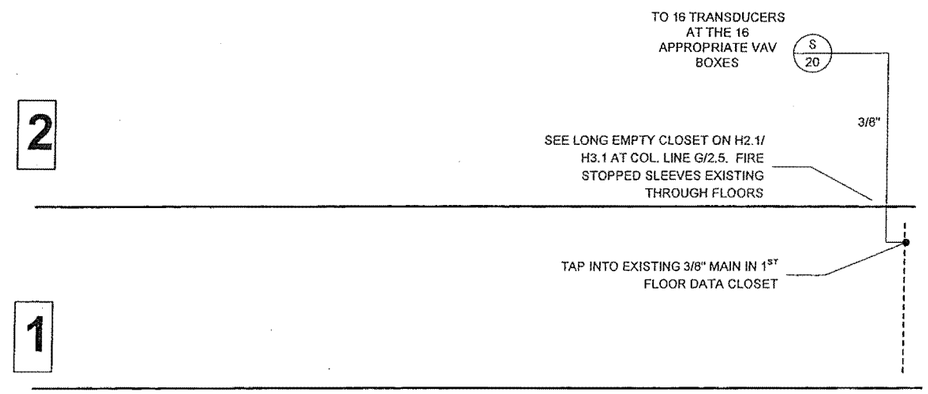
Pages 4-7: Juvenile detention VAV sequences.

Pages 8-9: Floorplans for VAV and mechanical room layout.



JACE 2 to be relocated to mechanical room on second floor from ENC 5 in GR24.





REVISION INFORMATION	
NUMBER	
DATE	03/12/07
TIME	02:01 PM
FILE NAME	COMM BUS.vsd

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Drawing Title: COMM BUS.vsd

REFERENCE DRAWING	NO.	REVISION-LOCATION	ECN	DATE	BY

Sales Engineer	Project Manager	Application Engineer	DRAWN BY	DRAWN DATE	APPROVED BY	APPROVED DATE

Project Title: JUVENILE DET. & COURT OFC.
JUVENILE DETENTION &
COURT OFFICES, DANE CO.
210 MLK JR BLVD, MADISON WI

JOHNSON CONTROLS
Systems & Services Division

Branch Information
Madison Branch
2400 Kilgust Rd.
Madison
WI 53713
Phone: (608) 226-5100
Fax: (608) 222-9490

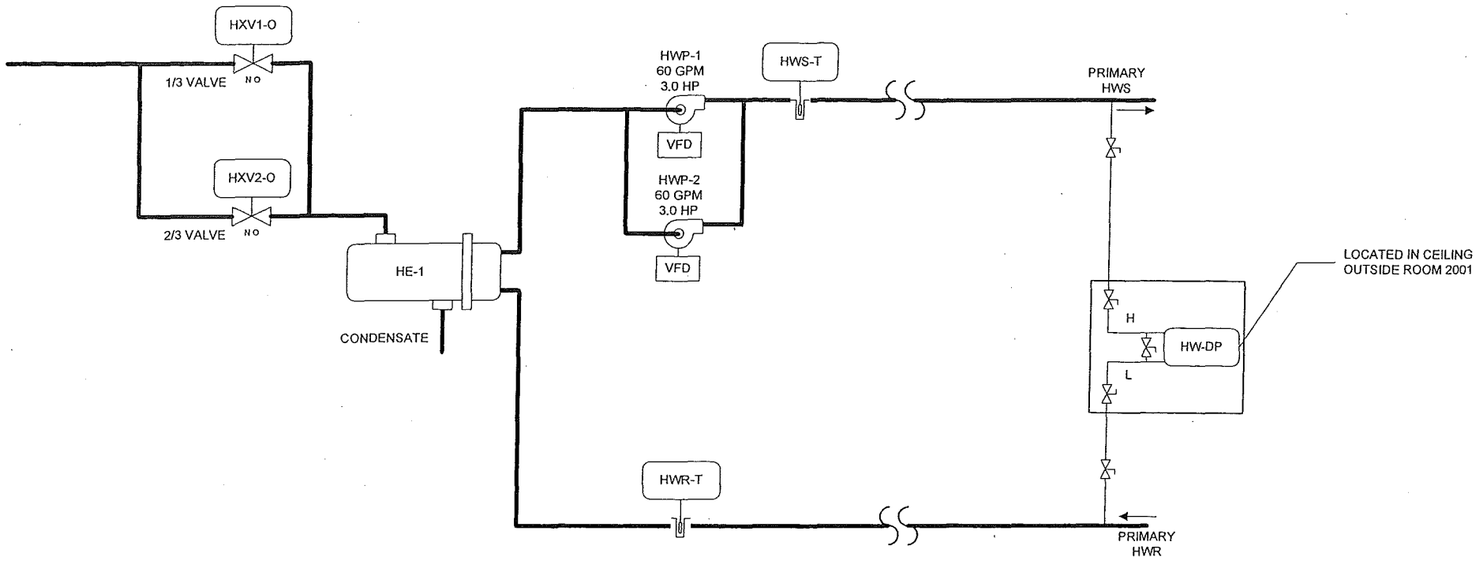
CONTRACT NUMBER: 0 7109 0007

DRAWING NUMBER: 2.1

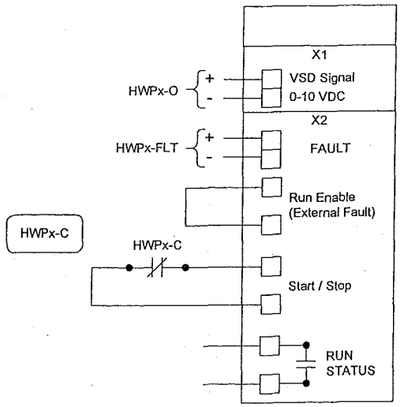
9001

BILL OF MATERIALS

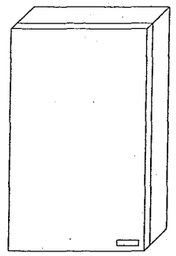
Designation	Qty	Part Number	Description
Field Devices:			
HW-DP	1	DPT2301-025D-V	PRESS SENS,DP,0-25 PSI,MA,0.25%,3-VLV
HWPx-C	2	RIBU1C	SPDT,10A,HC=10-30 VAC/DC,W/LED
HWS-T,HWR-T	2	TE-631AP-1	SENSOR,T-NI,0.1%,F/WZ1000-5 WELL
	2	WZ-1000-5	WELL,BRASS,2-3/8IN,1/2IN NPT+COMPOUND
HXVx-O	1	VALVE	SEE VALVE SCHEDULE
P-1	1	PAUE00001FH0	PANEL UNT1144 16X20
R-x	2	RR3B-ULAC24V	3PDT 24VAC 10A W/LED PLUG
	2	SR3B-05	11 PIN BLADE RELAY BASE



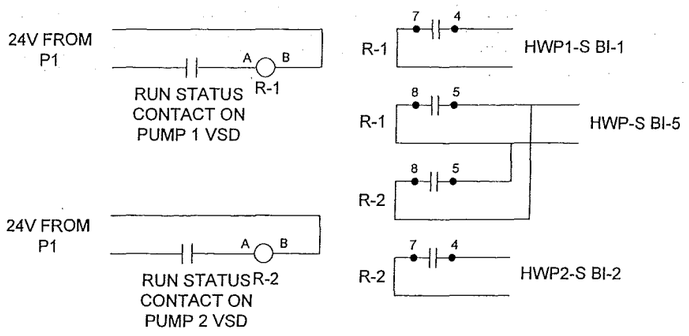
PUMP VSD WIRING
TYPICAL OF 2
HWP-1, HWP-2



HWS PANEL
P1



UNT CONTROLLER
NC-3 N2 ADDR = 30



HEAT EXCHANGER VALVE CONTROL: WHENEVER PUMP (HWP-x) IS RUNNING, AS DETERMINED BY THE DDC SYSTEM, THE TEMPERATURE OF THE HEATING WATER SUPPLY SHALL BE CONTROLLED TO MAINTAIN A SETPOINT. THE SETPOINT SHALL BE 180 DEG F (ADJ.) AT AN OUTSIDE AIR DRY BULB REFERENCE TEMPERATURE OF 0 DEG F (ADJ) AND SHALL BE RESET TO 140 DEG F (ADJ) AT AN OUTSIDE AIR DRY BULB REFERENCE TEMPERATURE OF 60 DEG F (ADJ).

THE 1/3 AND 2/3 CAPACITY STEAM CONTROL VALVES SHALL BE MODULATED IN SEQUENCE TO MAINTAIN THE HEATING WATER SUPPLY TEMPERATURE. WHEN THE HOT WATER SUPPLY TEMPERATURE IS BELOW SETPOINT, THE 1/3 CONTROL VALVE SHALL MODULATE OPEN FIRST FOLLOWED BY THE 2/3 VALVE. THE REVERSE SHALL OCCUR WHEN THE HOT WATER SUPPLY TEMPERATURE IS ABOVE THE SETPOINT

WHENEVER PUMP (HWP-x) IS NOT RUNNING , THE STEAM CONTROL VALVE SHALL BE FULLY CLOSED.

WHENEVER TEMPERATURE AT HWS-T RISES ABOVE 205 DEG F ,STEAM VALVES WILL BE COMMANDED CLOSED AND AN ALARM SHALL BE SENT THROUGH THE DDC SYSTEM

HOT WATER PUMP CONTROL: THE DDC SYSTEM SHALL START THE LEAD PUMP WHENEVER THE OUTSIDE AIR TEMPERATURE IS BELOW 70 DEG F AND THE STEAM IS AVAILABLE. THE LAG PUMP NORMALLY REMAIN OFF. THE HOT WATER PUMP START/STOP RELAYS SHALL UTILIZE NORMALLY CLOSED CONTACTS SO UPON FAILURE OF THE RELAY OR DDC CONTROLLER THE PUMP WILL FAIL ON CURRENT STATUS SWITCHES, EITHER INTEGRAL TO THE VFD OR DISCRETE DEVICES, SHALL PROVE LEAD AND LAG PUMP OPERATION. IF THE LEAD PUMP IS CALLED TO RUN AND CURRENT STATUS SWITCH INDICATES THAT THE LEAD PUMP IS NOT OPERATING FOR 30 SECONDS (ADJ), AN ALARM SHALL BE SENT TO THE OPERATOR INTERFACE AND THE DDC SYSTEM SHALL START THE LAG PUMP. UPON SENSING THE LEAD PUMP IS OPERATING THE LAG PUMP SHALL BE STOPPED. THE DDC SYSTEM SHALL INDEX THE LAG PUMP TO BECOME THE LEAD PUMP THROUGH WEEKLY SCHEDULING FEATURE OF THE BAS.

A DIFFERENTIAL PRESSURE SENSOR ACROSS THE SUPPLY AND RETURN PIPING AT THE POINT IN THE SYSTEM WITH THE HIGHEST PRESSURE DROP WILL CONTROL THE OPERATING PUMP VFD TO MAINTAIN AN INITIAL SETPOINT OF 10 PSIF (ADJ.) AT THE DIFFERENTIAL SENSOR .FINAL SETPOINT SHALL BE OPTIMIZED BY THE BALANCING CONTRACTOR.

REVISION INFORMATION	Drawing Title						
NUMBER	HWS.vsd						
			1	AS BUILTS		1/21/2008	KDK
DATE 01/21/08	REFERENCE DRAWING: Sales Engineer / Project Manager / Application Engineer	NO.	REVISION-LOCATION	ECN	DATE	BY	
TIME 01:38 PM	Project Title	DRAWN BY / DATE	APPROVED BY / DATE	Branch Information	CONTRACT NUMBER		
	JUVENILE DET. & COURT OFC. JUVENILE DETENTION & COURT OFFICES, DANE CO. 210 MLK JR BLVD, MADISON WI			Madison Branch 2400 Kilgust Rd. Madison WI 53713 Phone: (608) 226-5100 Fax: (608) 222-9490	71090007		
FILE NAME HWS.vsd	JOHNSON CONTROLS Systems & Services Division				DRAWING NUMBER 3.1		

REV	FAN	FAN LOCATION	REF DRWG.	STARTER LOCATION/TYPE	SERVING	HP	CFM	POINT(S) TERMINATION	DETAIL	INTERLOCK WITH
	PRV-1	North Quadrant Roof	H2.0		North Quadrant General Exhaust	1/2	1810	VAV - 10	A	AHU 7
	PRV-2	Northwest Quadrant Roof	H2.1		West Quadrant General Exhaust	3/4	3150/1585	VAV - 33	A	AHU 7
	PRV-3	South Quadrant Roof	H2.1		South Quadrant General Exhaust	1/2	1585	VAV - 4	A	AHU 7
	PRV-4	Southwest Quadrant Roof	H2.0		East Quadrant Hood Exhaust	3/4	2820	VAV - 32	A	AHU 7
	PRV-5	Southwest Quadrant Roof	H2.0		Kitchen Dishwashing Exhaust	1/2	1500	VAV - 2	C	Manual Switch by E.C.
	PRV-6	Southwest Quadrant Roof	H2.0		Kitchen Grease Hood Exhaust	1/4	900	VAV - 1	D	Manual Switch by E.C.
	PRV-7	South Quadrant Roof	H2.1		Court Offices Exhaust	1/4	850	VAV - 31	B	D-1 And D-2 VAV Boxes
	EF-1	Basement Generator Room	H4.1		Generators	7.5	16600		E	Space Thermostat

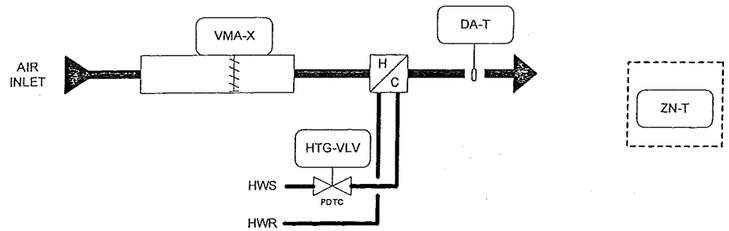
REVISION INFORMATION	Drawing Title										
NUMBER	FAN SCH.vsd										
DATE 03/12/07		REFERENCE DRAWING		NO.	REVISION-LOCATION		ECN	DATE	BY		
TIME 02:34 PM		Sales Engineer	Project Manager	Application Engineer	DRAWN BY	DATE	APPROVED BY	DATE			
FILE NAME FAN SCH.vsd	Project Title: JUVENILE DET. & COURT OFC. JUVENILE DETENTION & COURT OFFICES, DANE CO. 210 MLK JR BLVD, MADISON WI	JOHNSON CONTROLS Systems & Services Division			Branch Information: Madison Branch 2400 Kilgust Rd. Madison WI 53713 Phone: (608) 226-5100 Fax: (608) 222-9490		CONTRACT NUMBER 71090007				
							DRAWING NUMBER 4.1				

BILL OF MATERIALS

Designation	Qty	Part Number	Description
Field Devices:			
DA-T	1	TE-6311M-1	8" 1000 OHM NI DUCT TEMP
HTG-VLV	1	VALVE	SEE VALVE SCHEDULE
SECURITY STAT COVER	1	TGV-16	T-STAT SECURITY COVER, SHAW-PERKINS
VMA-x	1	AP-VMA1420-0	VAV MODULAR ASSY - CLG W/ REHEAT
ZN-T	1	TE-67NP-2B00	SENSOR,RM,1K NI,PHONE JACK,SET-PT,THERM

DETAIL A

TYPICAL OF 22
VMA WITH REHEAT



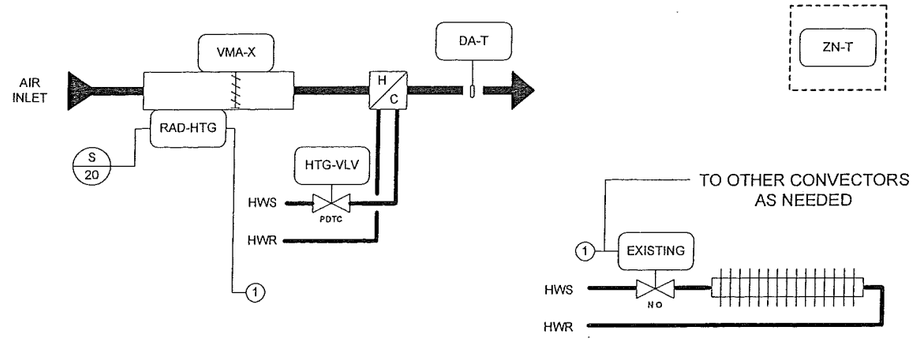
SEQUENCE OF OPERATION :
PROVIDE A DDC CONTROLLER WITH SPACE OR DUCT TEMPERATURE SENSOR TO CONTROL, IN SEQUENCE ,A MODULATING ELECTRONIC CONTROL VALVE FOR THE REHEAT COILAND ACTUATOR FOR TERMINAL AIR FLOW.
WHEN SPACE TEMPERATURE IS BELOW SETPOINT, THE AIR TERMINAL DAMPER SHALL MODULATE TOWARDS THE COOLING MINIMUM FLOW POSITION. AFTER THE AIR TERMINAL DAMPER IS AT MINIMUM FLOW, THE HOT WATER VALVE SHALL MODULATE OPEN TO MAINTAIN SPACE TEMPERATURE. THE REVERSE SHALL OCCUR WHEN SPACE TEMPERATURE IS ABOVE THE SETPOINT
FLOW SETPOINTS SHALL BE SET AS SCHEDULED ON THE PLANS AND SPECIFICATIONS.
VAV BOX SMOKE CONTROL: ON DETECTION OF SMOKE IN A ZONE THE DAMPER OF VAV BOX SERVING THAT ZONE SHALL CLOSE TO SUPPLY AIR FLOW.

BILL OF MATERIALS

Designation	Qty	Part Number	Description
Field Devices:			
DA-T	1	TE-6311M-1	8" 1000 OHM NI DUCT TEMP
HTG VLV,	1	VALVE	SEE VALVE SCHEDULE
RAD-HTG	1	UCP-522-43	0-20# OUT X-DUCER W/GAGE, KELE
SECURITY STAT COVER	1	TGV-16	T-STAT SECURITY COVER, SHAW-PERKINS
VMA-x	1	AP-VMA1420-0	VAV MODULAR ASSY - CLG W/ REHEAT
ZN-T	1	TE-67NP-2B00	SENSOR,RM,1K NI,PHONE JACK,SET-PT,THERM

DETAIL B

TYPICAL OF 3
VMA WITH REHEAT & RADIATION
VAV-20, 23 & 26

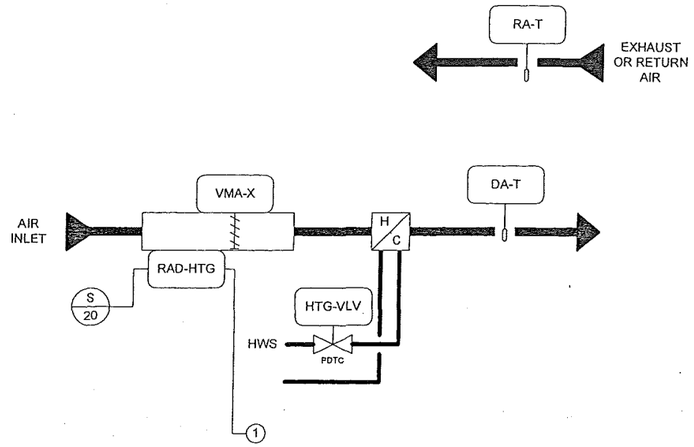


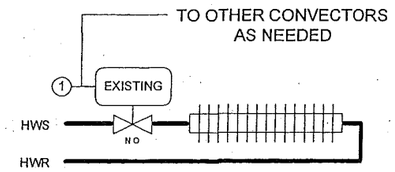
SEQUENCE OF OPERATION :
PROVIDE A DDC CONTROLLER WITH SPACE OR DUCT TEMPERATURE SENSOR TO CONTROL, IN SEQUENCE ,A MODULATING ELECTRONIC CONTROL VALVE FOR THE REHEAT COIL AND ACTUATOR FOR TERMINAL AIR FLOW.
WHEN SPACE TEMPERATURE IS BELOW SETPOINT, THE AIR TERMINAL DAMPER SHALL MODULATE TOWARDS THE COOLING MINIMUM FLOW POSITION. AFTER THE AIR TERMINAL DAMPER IS AT MINIMUM FLOW, THE HOT WATER VALVE SHALL MODULATE OPEN TO MAINTAIN SPACE TEMPERATURE. THE REVERSE SHALL OCCUR WHEN SPACE TEMPERATURE IS ABOVE THE SETPOINT. WHEN VAV BOX IS ALSO CONTROLS STEAM RADIATION, PROVIDE A TRANSDUCER TO PROVIDE PNEUMATIC CONTROL VALVE, IN SEQUENCE WITH WITH THE VAV REHEAT CONTROL. FIRST STAGE OF HEATING SHALL BE THE VAV BOX HEATING COIL. ON THE FURTHER DROP IN TEMPERATURE THE PERIMETER RADIATION SHALL BE ACTIVATED. ON THE RISE IN TEMPERATURE THE SEQUENCE SHALL REVERSE.
LOCK STEAM VALVE CLOSED WHENEVER OUTSIDE AIR IS ABOVE 50 DEG F (ADJ).
FLOW SETPOINTS SHALL BE SET AS SCHEDULED ON THE PLANS AND SPECIFICATIONS.
VAV BOX SMOKE CONTROL: ON DETECTION OF SMOKE IN A ZONE THE DAMPER OF VAV BOX SERVING THAT ZONE SHALL CLOSE TO SUPPLY AIR FLOW.

REVISION INFORMATION	Drawing Title							
NUMBER	RS-A-B.vsd							
DATE		REFERENCE DRAWING		NO.	REVISION-LOCATION	ECN	DATE	BY
03/12/07		Sales Engineer	Project Manager	Application Engineer	DRAWN BY / DATE	APPROVED BY / DATE		
TIME 02:08 PM	Project Title: JUVENILE DET. & COURT OFC. JUVENILE DETENTION & COURT OFFICES, DANE CO. 210 MLK JR BLVD, MADISON WI	JOHNSON CONTROLS Systems & Services Division	Branch Information: Madison Branch 2400 Kilgust Rd. Madison WI 53713 Phone: (608) 226-5100 Fax: (608) 222-9490	CONTRACT NUMBER 71090007				
FILE NAME RS-A-B.vsd				DRAWING NUMBER 5.1				

DETAIL C

TYPICAL OF 4
VMA WITH EA-T , REHEAT & RADIATION
VAV-1, 21, 27 & 63





BILL OF MATERIALS

Designation	Qty	Part Number	Description
Field Devices:			
RA-T, DA-T	1	TE-6311M-1	8" 1000 OHM NI DUCT TEMP
HTG-VLV	1	VALVE	SEE VALVE SCHEDULE
VMA-x	1	AP-VMA1420-0	VAV MODULAR ASSY - CLG W/ REHEAT
RAD-HTG	1	UCP-522-43	0-20# OUT X-DUCER W/GAGE, KELE

SEQUENCE OF OPERATION :
PROVIDE A DDC CONTROLLER WITH SPACE OR DUCT TEMPERATURE SENSOR TO CONTROL, IN SEQUENCE ,A MODULATING ELECTRONIC CONTROL VALVE FOR THE REHEAT COIL AND ACTUATOR FOR TERMINAL AIR FLOW.
WHEN SPACE TEMPERATURE IS BELOW SETPOINT, THE AIR TERMINAL DAMPER SHALL MODULATE TOWARDS THE COOLING MINIMUM FLOW POSITION. AFTER THE AIR TERMINAL DAMPER IS AT MINIMUM FLOW, THE HOT WATER VALVE SHALL MODULATE OPEN TO MAINTAIN SPACE TEMPERATURE. THE REVERSE SHALL OCCUR WHEN SPACE TEMPERATURE IS ABOVE THE SETPOINT. WHEN VAV BOX IS ALSO CONTROLS STEAM RADIATION, PROVIDE A TRANSDUCER TO PROVIDE PNEUMATIC CONTROL VALVE, IN SEQUENCE WITH WITH THE VAV REHEAT CONTROL. FIRST STAGE OF HEATING SHALL BE THE VAV BOX HEATING COIL. ON THE FURTHER DROP IN TEMPERATURE THE PERIMETER RADIATION SHALL BE ACTIVATED. ON THE RISE IN TEMPERATURE THE SEQUENCE SHALL REVERSE.
LOCK STEAM VALVE CLOSED WHENEVER OUTSIDE AIR IS ABOVE 50 DEG F (ADJ).
FLOW SETPOINTS SHALL BE SET AS SCHEDULED ON THE PLANS AND SPECIFICATIONS.
VAV BOX SMOKE CONTROL: ON DETECTION OF SMOKE IN A ZONE THE DAMPER OF VAV BOX SERVING THAT ZONE SHALL CLOSE TO SUPPLY AIR FLOW.

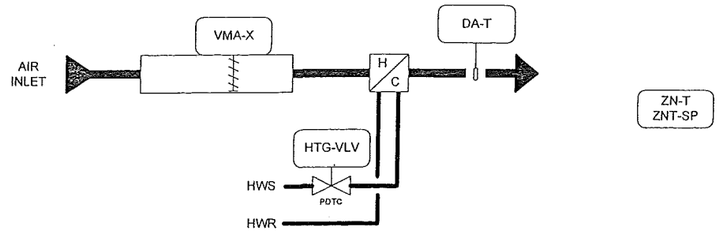
REVISION INFORMATION	Drawing Title								
NUMBER	RS-C.vsd								
DATE 03/12/07		REFERENCE DRAWING		NO.	REVISION-LOCATION		ECN	DATE	BY
TIME 02:08 PM		Sales Engineer / Project Manager / Application Engineer		DRAWN BY / DATE	APPROVED BY / DATE				
FILE NAME RS-C.vsd	Project Title: JUVENILE DET. & COURT OFC. JUVENILE DETENTION & COURT OFFICES, DANE CO. 210 MLK JR BLVD, MADISON WI	JOHNSON CONTROLS Systems & Services Division	Branch Information: Madison Branch 2400 Kilgust Rd. Madison WI 53713 Phone: (608) 226-5100 Fax: (608) 222-9490	CONTRACT NUMBER 71090007	DRAWING NUMBER 5.2				

BILL OF MATERIALS

Designation	Qty	Part Number	Description
Field Devices:			
DA-T	1	TE-6311M-1	8" 1000 OHM NI DUCT TEMP
HTG-VLV	1	VALVE	SEE VALVE SCHEDULE
VMA-x	1	AP-VMA1420-0	VAV MODULAR ASSY - CLG W/ REHEAT
ZN-T,ZNT-SP	1	TE-67NP-2B00	SENSOR,RM,1K NI,PHONE JACK,SET-PT,THERM

DETAIL D

TYPICAL OF 4
VMA WITH SETPOINT & REHEAT
VAV-7, -8, -9 & -13



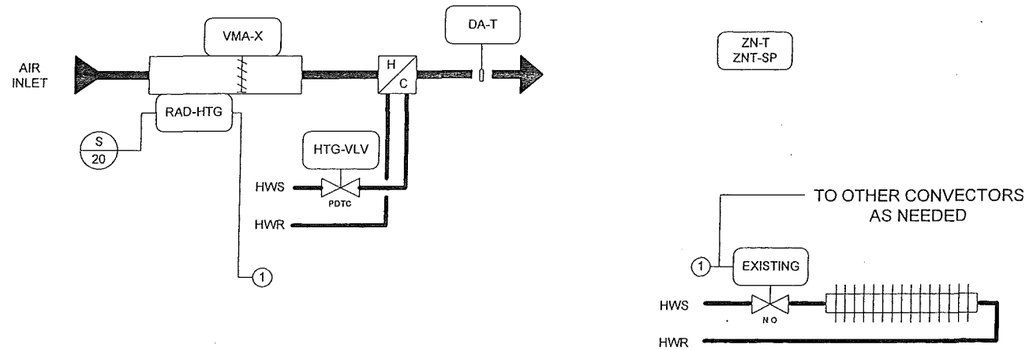
SEQUENCE OF OPERATION :
PROVIDE A DDC CONTROLLER WITH SPACE OR DUCT TEMPERATURE SENSOR TO CONTROL, IN SEQUENCE ,A MODULATING ELECTRONIC CONTROL VALVE FOR THE REHEAT COILAND ACTUATOR FOR TERMINAL AIR FLOW.
WHEN SPACE TEMPERATURE IS BELOW SETPOINT, THE AIR TERMINAL DAMPER SHALL MODULATE TOWARDS THE COOLING MINIMUM FLOW POSITION. AFTER THE AIR TERMINAL DAMPER IS AT MINIMUM FLOW, THE HOT WATER VALVE SHALL MODULATE OPEN TO MAINTAIN SPACE TEMPERATURE. THE REVERSE SHALL OCCUR WHEN SPACE TEMPERATURE IS ABOVE THE SETPOINT
FLOW SETPOINTS SHALL BE SET AS SCHEDULED ON THE PLANS AND SPECIFICATIONS.
VAV BOX SMOKE CONTROL: ON DETECTION OF SMOKE IN A ZONE THE DAMPER OF VAV BOX SERVING THAT ZONE SHALL CLOSE TO SUPPLY AIR FLOW.

BILL OF MATERIALS

Designation	Qty	Part Number	Description
Field Devices:			
DA-T	1	TE-6311M-1	8" 1000 OHM NI DUCT TEMP
HTG-VLV	1	VALVE	SEE VALVE SCHEDULE
VMA-x	1	AP-VMA1420-0	VAV MODULAR ASSY - CLG W/ REHEAT
ZN-T,ZNT-SP	1	TE-67NP-2B00	SENSOR,RM,1K NI,PHONE JACK,SET-PT,THERM
RAD-HTG	1	UCP-522-43	0-20# OUT X-DUCER W/GAGE, KELE

DETAIL E

TYPICAL OF 3
VMA WITH SETPOINT , REHEAT & RADIATION
VAV-14, 15 & 17



SEQUENCE OF OPERATION :
PROVIDE A DDC CONTROLLER WITH SPACE OR DUCT TEMPERATURE SENSOR TO CONTROL, IN SEQUENCE ,A MODULATING ELECTRONIC CONTROL VALVE FOR THE REHEAT COIL AND ACTUATOR FOR TERMINAL AIR FLOW.
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LOCK STEAM VALVE CLOSED WHENEVER OUTSIDE AIR IS ABOVE 50 DEG F (ADJ).
FLOW SETPOINTS SHALL BE SET AS SCHEDULED ON THE PLANS AND SPECIFICATIONS.
VAV BOX SMOKE CONTROL: ON DETECTION OF SMOKE IN A ZONE THE DAMPER OF VAV BOX SERVING THAT ZONE SHALL CLOSE TO SUPPLY AIR FLOW.

REVISION INFORMATION	Drawing Title									
NUMBER	RS-D-E.vsd									
DATE 03/12/07		REFERENCE DRAWING		NO.	REVISION-LOCATION		ECN	DATE	BY	
		Sales Engineer	Project Manager	Application Engineer	DRAWN BY	DRAWN DATE	APPROVED BY	APPROVED DATE		
TIME 02:09 PM	Project Title	JOHNSON CONTROLS			Branch Information		CONTRACT NUMBER			
	JUVENILE DET. & COURT OFC. JUVENILE DETENTION & COURT OFFICES, DANE CO. 210 MLK JR BLVD, MADISON WI	Systems & Services Division			Madison Branch 2400 Kilgust Rd. Madison WI 53713 Phone: (608) 226-5100 Fax: (608) 222-9490		71090007			
FILE NAME RS-D-E.vsd							DRAWING NUMBER 5.3			

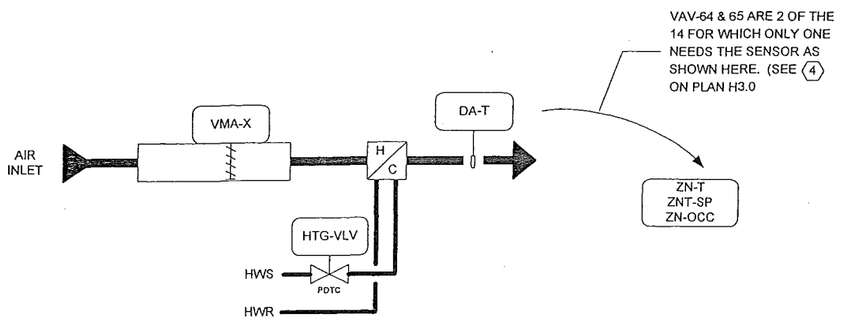
BILL OF MATERIALS

Designation	Qty	Part Number	Description
Field Devices:			
DA-T	1	TE-6311M-1	8" 1000 OHM NI DUCT TEMP
HTG-VLV	1	VALVE	SEE VALVE SCHEDULE
VMA-x	1	AP-VMA1420-0	VAV MODULAR ASSY - CLG W/ REHEAT
ZN-T,ZNT-SP	1	TE-67NP-2B00	SENSOR,RM,1K NI,PHONE JACK,SET-PT,THERM

DETAIL F

TYPICAL OF 14

VMA WITH SETPOINT-OCC OVERRIDE & REHEAT



SEQUENCE OF OPERATION :
VAV WITH HOT WATER REHEAT, SPACE SENSOR WITH SPACE CONTROLLED SET PONT, OCCUPIED / UNOCCUPIED OPERATION WITH SENSOR LOCATED UNOCCUPIED OVERRIDE SWITCH TO PLACE VAV BOX IN OCCUPIED CONTROL FOR 3 HOURS. IN THE UNOCCUPIED MODE THE VAV BOX DAMPERS SHALL BE CLOSED. IF UNOCCUPIED SET UP COOLING IS REQUIRE THE VAV BOX DAMPER SHALL BE CONTROLLED TO MAINTAIN THE SPACE TEMPERATURE.

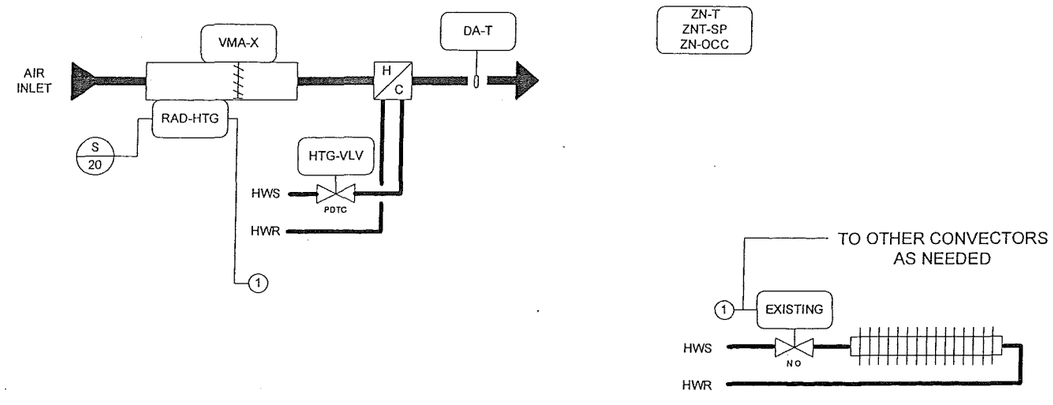
BILL OF MATERIALS

Designation	Qty	Part Number	Description
Field Devices:			
DA-T	1	TE-6311M-1	8" 1000 OHM NI DUCT TEMP
SEE VALVE SCHEDULE	1	VALVE	SEE VALVE SCHEDULE
VMA-x	1	AP-VMA1420-0	VAV MODULAR ASSY - CLG W/ REHEAT
ZN-T,ZNT-SP	1	TE-67NP-2B00	SENSOR,RM,1K NI,PHONE JACK,SET-PT,THERM
RAD-HTG	1	UCP-522-43	0-20# OUT X-DUCER W/GAGE, KELE

DETAIL G

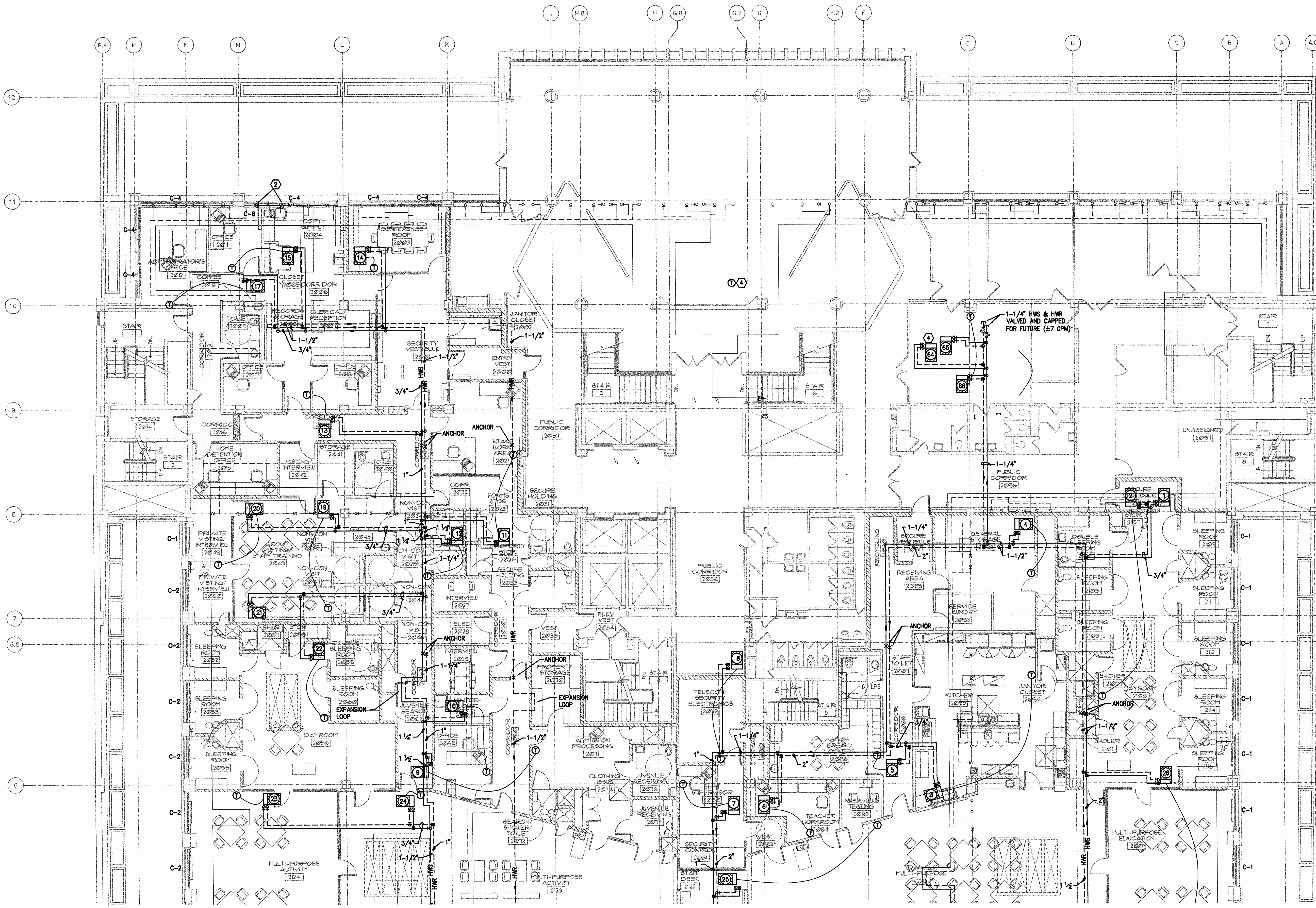
TYPICAL OF 6

VMA WITH SETPOINT-OCC OVERRIDE, REHEAT & RADIATION
VAV-37, 43, 44, 51, 56 & 57



SEQUENCE OF OPERATION :
VAV BOX HOT WATER REHEAT, SPACE SENSOR WITH SPACE CONTROLLED SETPOINT, STEAM CONVECTOR PERIMETER RADIATION, OCCUPIED/UNOCCUPIED OPERATION WITH SENSOR LOCATED UNOCCUPIED OVERRIDE SWITCH TO PLACE VAV BOX IN OCCUPIED CONTROL FOR 2 HOURS . IN THE UNOCCUPIED MODE THE VAV BOX DAMPERS SHALL BE CLOSED. IF HEATING IS REQUIRED THE RADIATION SHALL BE CONTROLLED TO PROVIDE SET BACK HEATING. IF UNOCCUPIED SET UP COOLING IS REQUIRE THE VAV BOX DAMPER SHALL BE CONTROLLED TO MAINTAIN THE SPACE TEMPERATURE.

REVISION INFORMATION	Drawing Title								
NUMBER	RS-F-G.vsd								
DATE 03/12/07		REFERENCE DRAWING		NO.	REVISION-LOCATION		ECN	DATE	BY
TIME 02:09 PM		Sales Engineer	Project Manager	Application Engineer	DRAWN BY	DATE	APPROVED BY	DATE	
FILE NAME RS-F-G.vsd	Project Title: JUVENILE DET. & COURT OFC. JUVENILE DETENTION & COURT OFFICES, DANE CO. 210 MLK JR BLVD, MADISON WI	JOHNSON CONTROLS Systems & Services Division	Branch Information: Madison Branch 2400 Kilgust Rd. Madison WI 53713 Phone: (608) 226-5100 Fax: (608) 222-9490	CONTRACT NUMBER 71090007	DRAWING NUMBER 5.4				



HVAC SECOND FLOOR PIPING NOTES

1. REPLACE STEAM TRAPS ON ALL C-1, C-2, C-3, C-4 & C-5 CONVECTORS.
2. CONNECT TO 3/4" STEAM SUPPLY AND 3/4" RETURN AT REMOVED, RECESSED CONVECTOR. LEFT END OF CONVECTOR TO BE TIGHT TO WALL.
3. CLEAN FIN TUBE ELEMENTS AT ALL C-1, C-2, C-3, C-4 & C-5 CONVECTORS.
4. VVB 64 & 65 ARE CONTROLLED BY ONE THERMOSTAT, LOCATED IN BOARD ROOM. LOCATION SHALL BE FIELD VERIFIED.
5. UNDER BASE BID PROVIDE TEMPORARY SPACE THERMOSTAT FOR VVB 62 & 63 AND CONVECTORS.

A / H2.0 SECOND FLOOR PLAN EAST – PIPING

SCALE: 1/8" = 1'-0"

NOTE: ALL HWS & HWR PIPING RUN OUTS TO VAV BOXES ARE 3/4" UNLESS OTHERWISE NOTED.

Date of Issue 6/16/06

No. Description Date

Reference Diagram

Reference Plan

DANE COUNTY JUVENILE DETENTION / COURT OFFICE

2nd Floor,
City / County Building
210 Martin Luther King Jr. Blvd.
Madison, Wisconsin

PHASE 2 - CONSTRUCTION

Henneman Engineering Inc.
Madison:
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Madison, Wisconsin 53717-1960 F 608.833.6996
Email: info@henneman.com
Website: http://www.henneman.com
© 2005 Henneman Engineering Inc. / IL reg. #184-000245 (001-013372) (062-036272)
JOB NO. 04-3416B

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Venture Architects
205 W. Highland
Milwaukee, WI 53203
Telephone 414-271-3359
Fax 414-271-0939

COUNTY BID # 106085

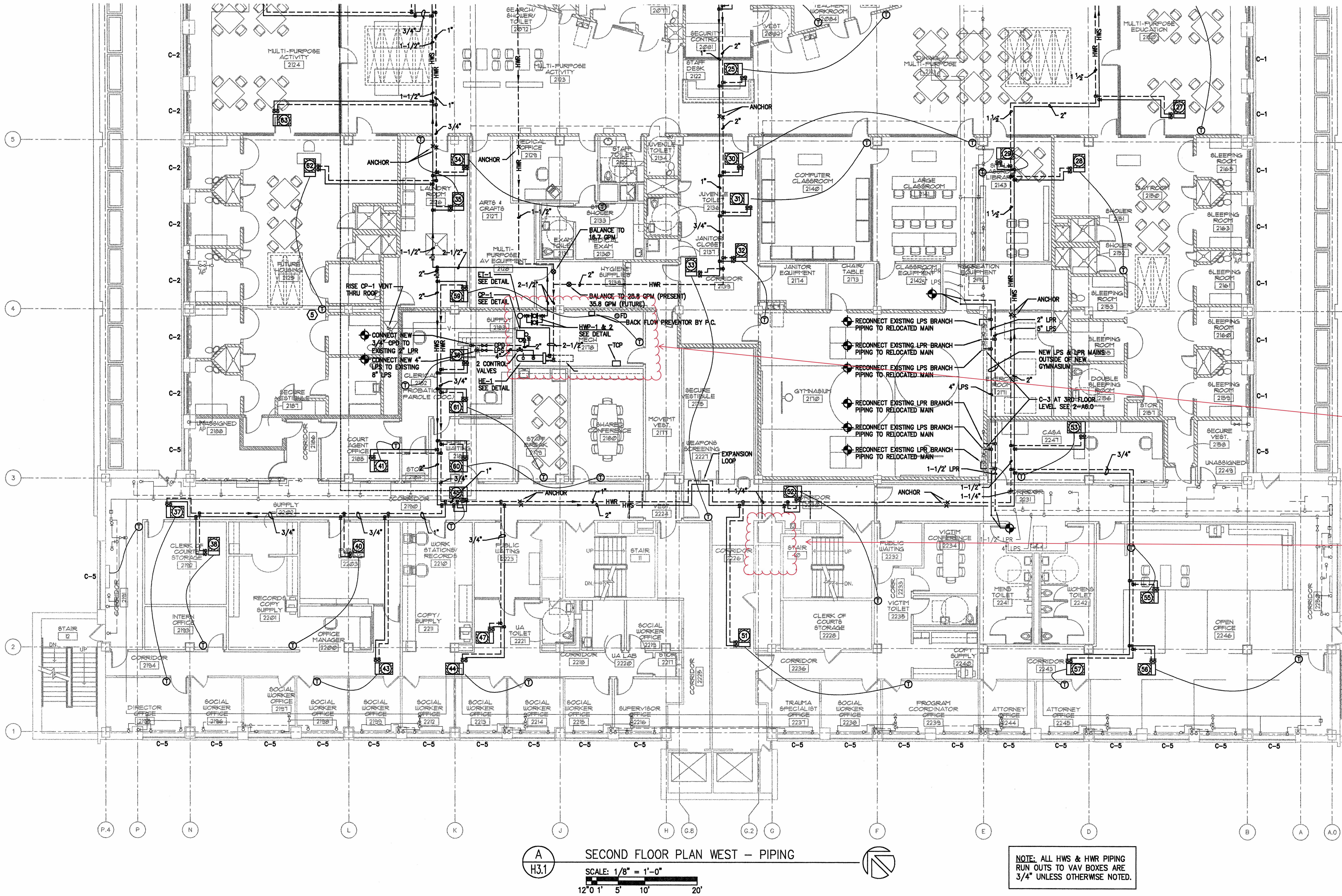
VA PROJECT # 204001

Sheet Name
SECOND FLOOR - EAST HVAC PIPING

Sheet No.
H3.0

Page 9

Note:
Ceiling tiles in detention areas screwed down. In common areas and office space accessibility is through lay in tile.



JACE 2 panel to be relocated to this mechanical room.
Heat exchanger located in this room

Network connection on third floor in stacked data rooms.

HVAC SECOND FLOOR PIPING NOTES

1. REPLACE STEAM TRAPS ON ALL C-1, C-2, C-3, C-4 & C-5 CONVECTORS.
2. CONNECT TO 3/4" STEAM SUPPLY AND 3/4" RETURN AT REMOVED, RECESSED CONVECTOR. LEFT END OF CONVECTOR TO BE TIGHT TO WALL.
3. CLEAN FIN TUBE ELEMENTS AT ALL C-1, C-2, C-3, C-4 & C-5 CONVECTORS.
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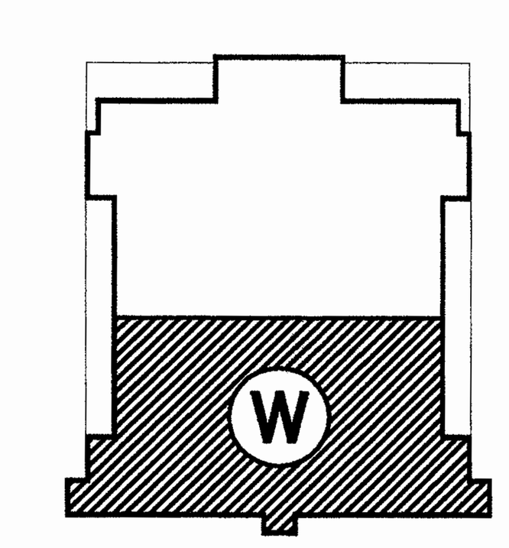
Date of Issue 6/16/06

No. Description Date

Reference Diagram

Reference Plan



DANE COUNTY JUVENILE DETENTION / COURT OFFICE

2nd Floor,
City / County Building
210 Martin Luther
King Jr. Blvd.
Madison, Wisconsin

PHASE 2 - CONSTRUCTION

Henneman Engineering Inc.
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1232 Fourier Drive, Suite 101 T 608.833.7000
Madison, Wisconsin 53717-1960 F 608.833.6996
Email: info@henneman.com
Website: http://www.henneman.com

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JOB NO. 04-3416B

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205 W. Highland
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COUNTY BID # 106085

VA PROJECT # 204001

Sheet Name
SECOND FLOOR - WEST
HVAC PIPING

Sheet No.
H3.1

Jace 3 Scope of Work

Control drawings

Pages 1-4 : AHU 7 located on Basement floor serving second floor.

Pages 5-7 : AHU 12 located on ground floor serving ground and first floors.

Pages 8-9 : AHU 1 located on ground floor serving ground floor Madison Police.

Page 10 : Reheat coil control for fifth floor lab space.

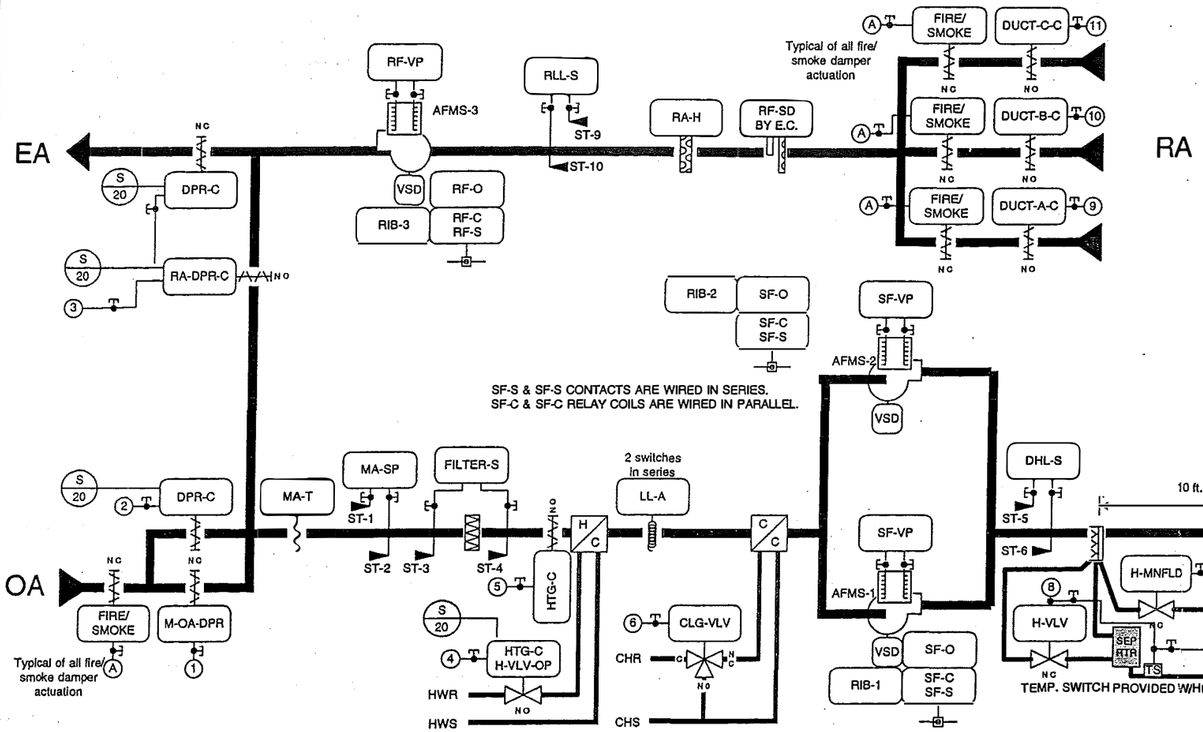
Page 11 : AHU1 located on fifth floor serving lab space. Heat exchanger points included.

Page 12-13 : AHU 1 located on seventh floor serving jail segregation pod.

Page 14-15 : AHU S-27 located in east penthouse serving 6th and 7th floor jail (East).

Note: Panel on Basement level. JACE 3 control panel ENC 5 one floor directly above.

AHU-7
GARAGE, GROUND FLOOR



OUTSIDE AIR SENSOR
LOCATE IN OUTSIDE AIR PLENUM

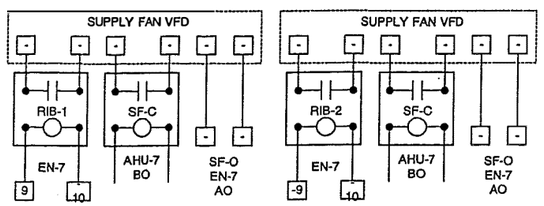
OA-T

SPACE TEMPERATURE SENSORS
LOCATE ON SECOND FLOOR PER OWNERS INSTRUCTIONS

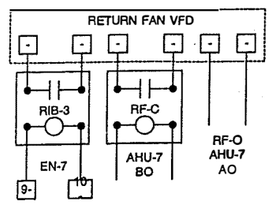
ZN1-T ZN2-T ZN3-T ZN4-T

These sensors no longer exist so do not include in bid.

SUPPLY FANS VFD WIRING REQUIREMENTS



RETURN FAN VFD WIRING REQUIREMENTS

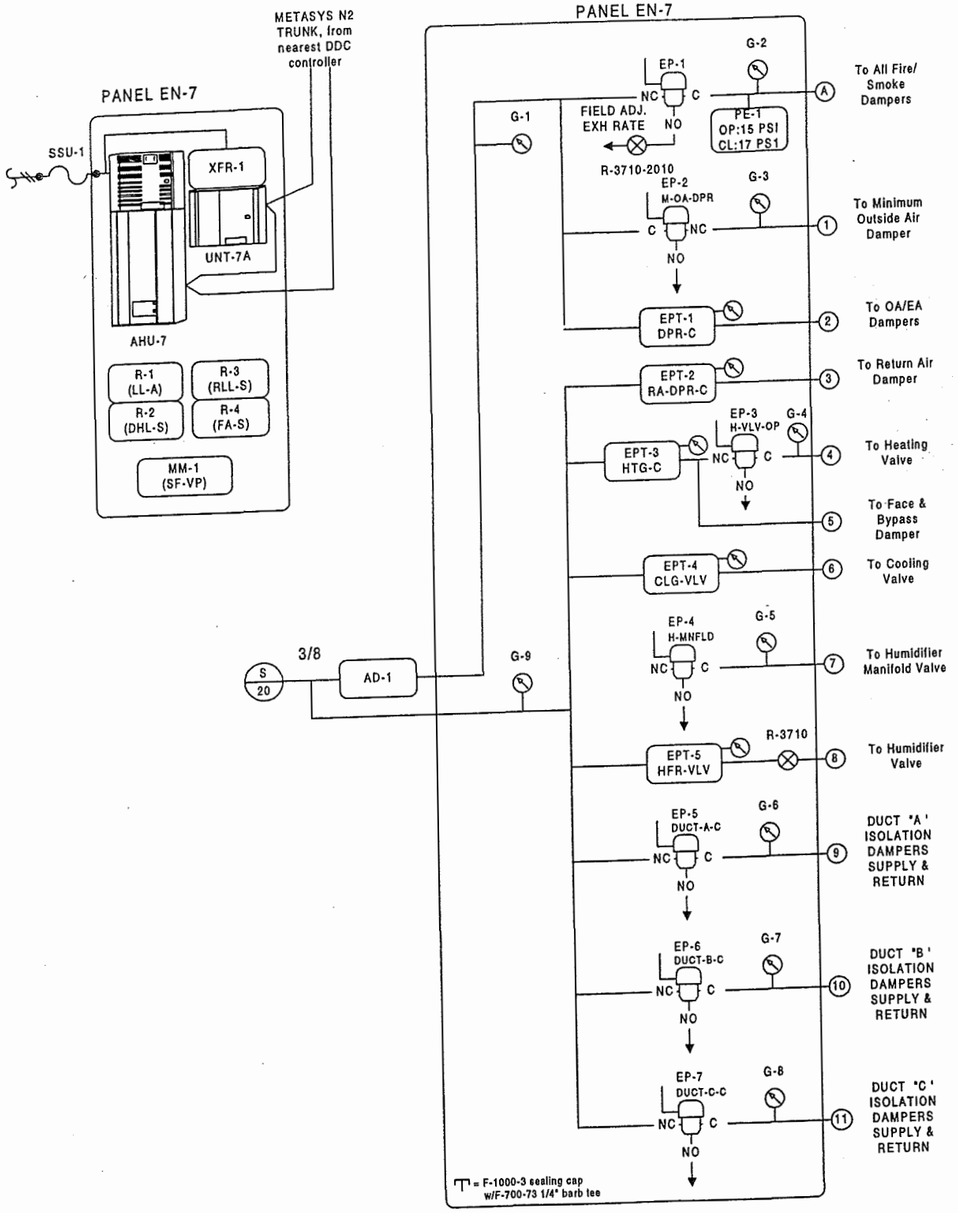


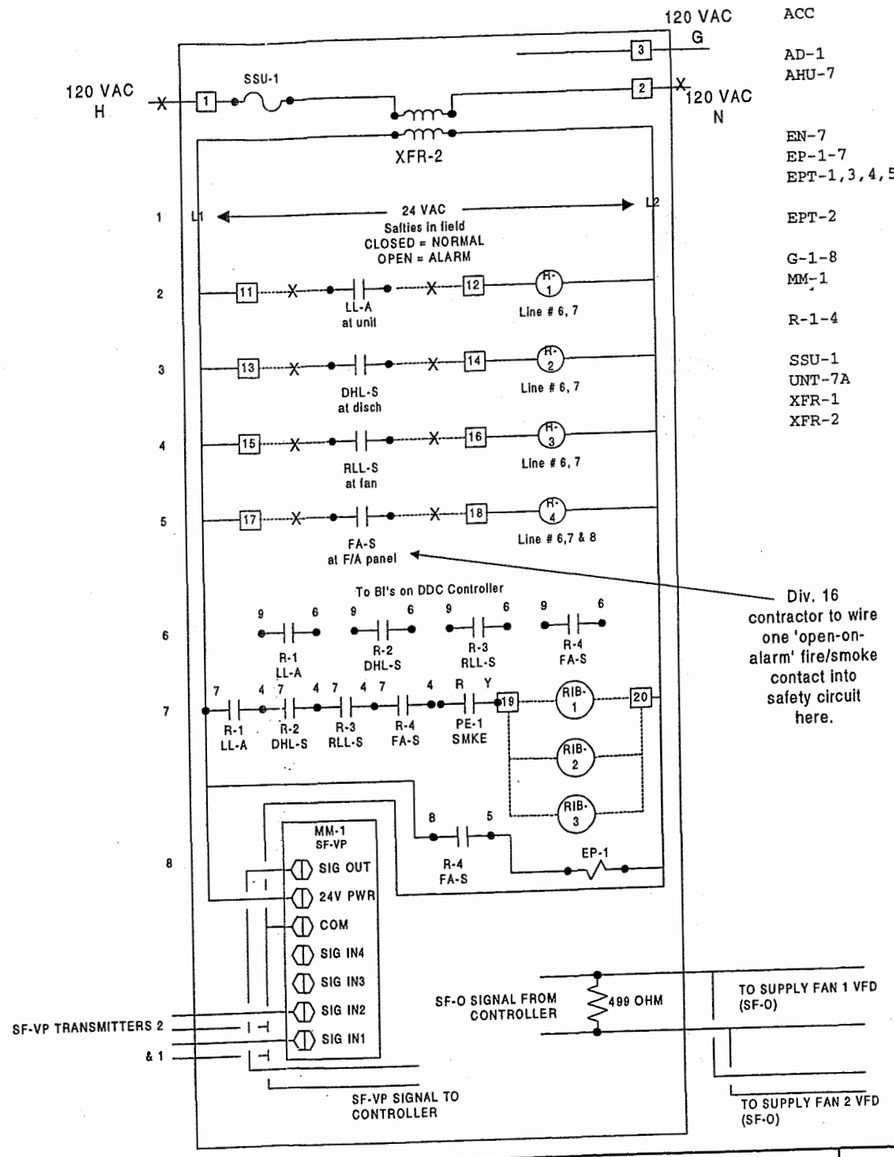
BILL OF MATERIALS

Estimate: AHU-7 FIELD ahu-7.pre

Desig.	Qty	Part #	Description
Field Devices:			
AFMS-1,2,3	3	VOLUPROBES	AIR FLOW VOLUPROBES
DA-T	1	TE-6315P-1	SENS,T-Ni,0.1%,8' AVG
DHL-S,RLL-S	2	AFS-460	CLEVLAND SW MANUAL RESET
DPR-C	1	DPR-C	SEE DPR SCHEDULE
DUCT-A,B,C-C	1	DUCT-A,B,C-C	SEE DPR SCHEDULE
FILTER-S	1	P32AC-2C	SW,DP,SPDT,5",U-BRKT
FIRE/SMOKE	9	FIRE/SMOKE	FIRE/SMOKE DPR-SEE DPR SCHEDULE
HC-1	1	H-3610-1001	H'STAT,DUCT,H-LIM,85%,REV
LL-A	2	A11A-1C	STAT,LL,SPST,MAN,35/45F
M-OA-DPR	1	M-OA-DPR	MIN OSA DPR- SEE DPR SCHEDULE
MA-SP,DA-SP, SF-VP,RF-VP	5	PR274-R3-VDC	XDUCER, LOW P-E IN=R3 OUT=VDC NEMA 4
MA-T	2	TE-6316P-1	SENS,T-Ni,0.1%,17' AVG
OA-T	1	TE-6313P-1	SENS,T-Ni,0.1%,3" OAT
RA-DPR-C	1	RA-DPR-C	SEE DPR SCHEDULE
RA-H, RA-T	1	HE-6310-2	XMTR,RH/T-Ni,DUCT,AC/DC
RF-C, RF-S, SF-C, SF-S	3	H-735	CSW ADJ. W/ COM. RELAY
RIB-1,2,3	3	RIBTU1C	SPDT, 10/24/30/120V COIL, 1/3 HP, 10A
ST-1-5	6	BPS-2100	A-302 DWYER STATIC PRESSURE TIP
	6	BPS-2105	MTG. PLATE FOR A-302
ZN-T	4	TE-6314P-1	SENS,T-Ni,0.1%,RM

REVISION INFORMATION	Drawing Title									
NUMBER 1	AHU-7 AIR FLOW SERVES 2ND FLOOR LOCATED IN GARAGE MECH. ROOM, GROUND FLOOR									
DATE 08/18/98		REFERENCE DRAWING	NO.	REVISION-LOCATION			ECN	DATE	BY	
TIME 02:59 PM	Project Title	Sales Engineer EWC	Project Manager TLS	Application Engineer AJS	DRAWN BY AJS	DATE 12/23/97	APPROVED BY	DATE		
extra	CITY/COUNTY BUILDING 2ND FLR HVAC MODIFICATION 210 M L KING JR BLVD MADISON, WI 53703	JOHNSON CONTROLS Systems & Services Division	Branch Information JOHNSON CONTROLS, INC 2400 KILGUST ROAD MADISON, WI 53713 608-222-9100 FAX 608-222-9490				CONTRACT NUMBER 8109-5012			
FILE NAME AHU-7.VSD							DRAWING NUMBER 1			





BILL OF MATERIALS

ahu-7.pre

Estimate: AHU-7 PANEL

Desig.	Qty	Part #	Description
Panel Devices:			
ACC	16	PD-113-3	TERM BLK,MED,300V
	6	PD-113-4	TERM BLK,MED,300V,END SEC
AD-1	1	X04-02-000	WILKERSON DESSICANT AIR DRYER
AHU-7	1	AS-AHU100-0	AHU TERM BD W/O ENCLOSURE
	1	AS-AHU102-0	AHU LOGIC BD,CONTROLLER
	1	AS-XFR100-1	XFMR KIT,100VA,F/METASYS
EN-7	1	M-8100-3042	PANEL,STANDARD,22 UNITS
EP-1-7	7	V11HGA-100	3-W SOLENOID,W/OV,24 VAC
EPT-1,3,4,5	4	UCP-422-43	KELE E-P XDUCER I TO 3-15PSI W/GAUGE
EPT-2	1	UCP-422-V-43	KELE E-P XDUCER V TO 3-15PSI W/GAUGE
G-1-8	9	G-2010-5	GAGE,1.5",0-30 PSIG,STEM
MM-1	1	UMM-1	UNIVERSAL MATH MODULE-KELE & ASSOC
R-1-4	4	PD-101-35	RLY BASE,3PDT,11PIN,10A
	4	PD-109-51	RELAY PLUG-IN 3PDT 24VAC
SSU-1	1	PD-112-22	FUSE HLDR/CVR,T-TYP,W/SW
UNT-7A	1	AS-UNT141-1	UNT111-1 W/SCREW TERM
XFR-1	1	Y65AS-1C	XFMR,120/24,40VA,FT,LEAD
XFR-2	1	PD-114-2	XFMR 120/24V 100VA

TAG SCHEDULE

T-1 EN-7 AHU-7

REVISION INFORMATION	Drawing Title
NUMBER 1	EN-7 PANEL FOR AHU-7 LOCATED IN GARAGE MECH ROOM, GROUND FLOOR
DATE 06/29/98	
TIME 02:37 PM	Project Title
extra	CITY/COUNTY BUILDING 2ND FLR HVAC MODIFICATION 210 M L KING JR BLVD MADISON, WI 53703
FILE NAME AHU-7-P.VSD	

REFERENCE DRAWING	NO.	REVISION-LOCATION	ECN	DATE	BY

Sales Engineer	Project Manager	Application Engineer	DRAWN	APPROVED
EWC	TLS	AJS	BY AJS DATE 12/23/97	BY DATE

JOHNSON CONTROLS
Systems & Services Division

Branch Information
JOHNSON CONTROLS, INC
2400 KILGUST ROAD
MADISON, WI 53713
608-222-8100
FAX 608-222-9490

CONTRACT NUMBER 8109-5012

DRAWING NUMBER 2

OCCUPIED MODE:

Supply Fan: When indexed to the occupied mode, the supply fans will run continuously.

Return Fan: When indexed to the occupied mode, the return fan will run continuously. The return fan will start first.

Control Strategy: A discharge air sensor, DA-T, will control the dampers and the heating and cooling devices in sequence to maintain the desired set point. The set point will be reset from the four (4) space sensors located on the second floor. The space temperature sensors will be averaged and the average space temperature will reset the discharge air setpoint. The initial space setpoint is 72F.

Supply Fan Capacity Control: A static pressure sensor, located in the supply ductwork, will control the capacity of the supply fans, through its associated VFD, to maintain the desired set point. The static pressure sensor will be located in the main supply duct as indicated on the mechanical drawings. Air flow sensors, located on the supply fan inlets, will measure the supply air volume of each supply air fan. This CFM measurement will be used to control the return fan VFD.

Return Fan Capacity Control: An air flow sensor, located in the inlet of the return fan, will sense the return fan CFM. The AHU controller, AHU-7 will control the capacity of the return fan to maintain a fixed CFM differential between the supply and return fans. The fixed CFM differential will be initial set for 80%. The supply fans speed and the return fan speed will be controlled through its associated VFD. If the EF/RF-7 air volume drops below 65%, of the supply fan average volume, for more than (1) one minute, all fans will stop and an alarm will be annunicated through the BAS system.

Return Air Damper Control: The return air damper and exhaust air damper will be controlled to maintain a static pressure setpoint of -0.2 in. Wg in the mixed air plenum. This pressure will be sensed by a pressure sensor located in the mixed air plenum. The mechanical room will be used as a reference point.

Economizer: Whenever the outdoor air temperature is above the economizer set point of 65F, the maximun outdoor air damper will be modulated to its closed position. The minimum outside air damper will be 100% open when the outside air is below 65F. The outside air damper will modulate to maintain 55F upstream of the preheat coil.

Preheat Coil Control: On a call for heating, the outdoor air damper will be modulated to its closed position. When the mixed air temperature is above 52F setpoint , the face damper will be fully open with the heating valve closed. When the mixed air temperature is below 45F set point, the heating coil valve will be fully open with the face and bypass dampers under control to maintain discharge air setpoint. When the outside air temperature is below 35F, the discharge air temperature will be reset from 55F to 65F to maintain the average space temperature setpoint of 72F.

Cooling: On a call for cooling, the outdoor air damper exhaust air damper will be modulated open with the return damper closed subject to the economizer controller set point. On a further call for cooling, the cooling coil valve will be modulated open to maintain the desired set point. When the outside air temperature is above the economizer setpoint, the outside air damper and the exhaust air damper will modulate to the closed position. The minimum outside air damper will be open 100%.

Humidification Control: A return air humidity sensor will control the humidifier to maintain return air humidity setpoint. On a call for humidity, the 2-position humidifier manifold valve will open through EP-4. The humidifier valve will be controlled by EPT-5 to maintain return air humidity setpoint. During the un-occupied cycle, the humidifier will not be allowed to operate. The humidifier will not operate when AHU-7 is off.

Second Floor Ventilation Control: Three (3) supply air dampers and return air dampers will control the air flow on the second floor. This air flow control will be manually controlled through EP-5,6,7. The associated supply air and return air isolation damper will be controlled. Only one set of isolation damper will be allowed to be closed.

Smoke Control: Smoke detectors in the supply air and the return air will sense if smoke is in the air stream. If smoke is detected, the smoke detectors will alarm the Fire Alarm Control Panel. The Fire Alarm Control Panel will send a signal closing the smoke dampers associated with AHU-7. The smoke dampers are located in the outside air duct, discharge air duct, return air duct, and in the main supply air riser and return air riser. The smoke dampers are on the ducts serving the space area. (Total of 6 smoke dampers serving the floors)

UN-OCCUPIED MODE:

Supply Fan: When indexed to the un-occupied mode, the supply fan will be on. The supply fans will maintain the un-occupied space setpoint with the minimum outside air damper open.

Return Fan: When indexed to the un-occupied mode, the return fan will be on. The return fan will operate with the supply fan to maintain the un-occupied space setpoint.

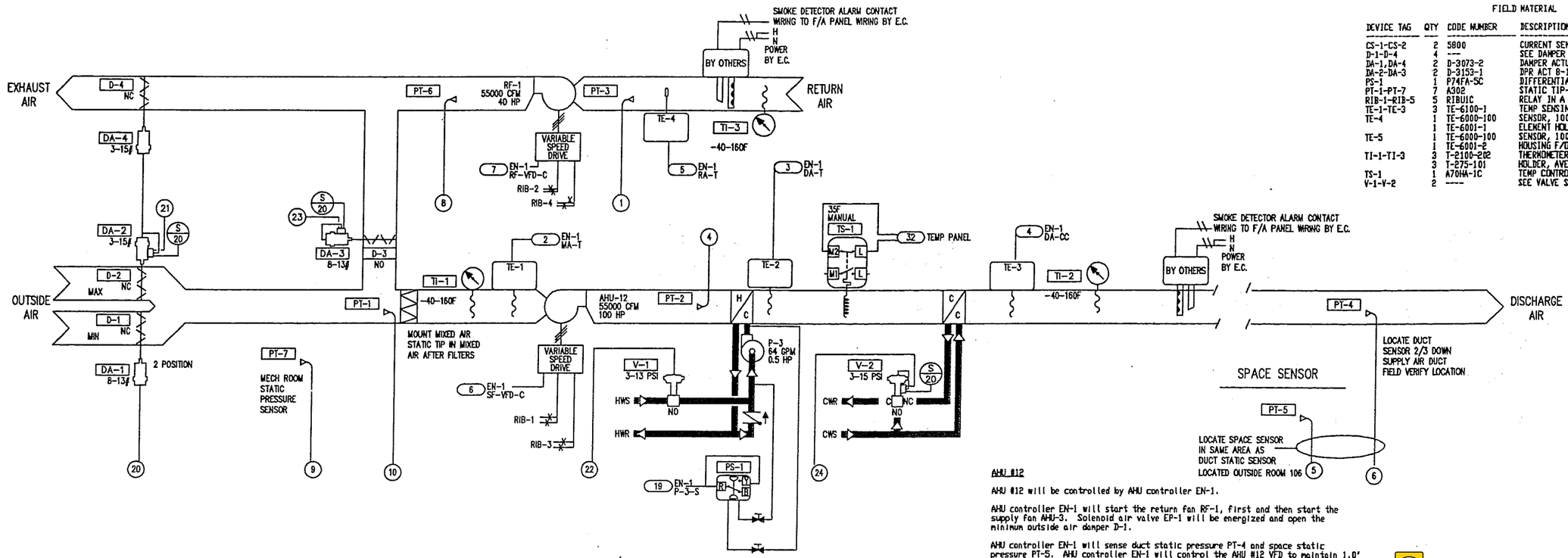
SAFETY CIRCUITS:

Whenever a manual reset safety device exceeds its limit, the unit will be shut down. Safety device by type: low limit thermostat, smoke detector, static cutout.

REVISION INFORMATION	Drawing Title							
NUMBER number	AHU-7 SEQUENCE OF OPERATION							
DATE 06/29/98		REFERENCE DRAWING		NO.	REVISION-LOCATION	ECN	DATE	BY
TIME 02:53 PM	Project Title	Sales Engineer EWC	Project Manager TLS	Application Engineer KJKTLS	DRAWN BY TLS DATE 2-25-98	APPROVED BY TLS DATE 2-25-98		
extra	CITY/COUNTY BUILDING 2ND FLR HVAC MODIFICATION 210 M L KING BLVD MADISON, WI. 53703	JOHNSON CONTROLS Systems & Services Division	Branch Information JOHNSON CONTROLS INC 2400 KILGUST ROAD MADISON, WI. PHONE:608-222-9100 FAX:608-222-9490		CONTRACT NUMBER 8109-5012			
FILE NAME SEQ63.VSD					DRAWING NUMBER 3			

ull Spreadsheet		Software					Digital Controller Information						Panel Information					Intermedic	Field Device					
Tag	Point Type	System Name	Object Name	Expanded ID	Display Units		DC Type	N2 Trunk	N2 Addr	Cable Destination Bay/Terminal	Module Type	Termination	Panel	Panel Location	Slot Number	Reference Drawing	Cable Number	Wiring/Tubing	Terminations	Device	Location	Ref Detail	Comment
		AHU-7					AHU						EN-7	Mech Room GA-17									Power to Controller
		AHU-7	*				AHU	1	10				EN-7	Mech Room GA-17	0								N2 Trunk
	BO-1	AHU-7	SF-C	Supply Fan Control	Off	On	AHU	1	10	BO-1		BO#,24V	EN-7	Mech Room GA-17	0		7-10-BO-1	2/18	24VAC OUT	H-735,SF-C	STARTER	A50	
	BO-2	AHU-7	RF-C	Return Fan Control	Off	On	AHU	1	10	BO-2		BO#,24V	EN-7	Mech Room GA-17	0		7-10-BO-2	2/18	24VAC OUT	H-735,RF-C	STARTER	A50	
	BO-3	AHU-7	M-DPR-EN	Min OSA Damper Cmd	Close	Open	AHU	1	10	BO-3		BO#,24V	EN-7	Mech Room GA-17	0		7-10-BO-3	2/18	24VAC OUT	V11,EP-2	PANEL	A50	
	BO-4	AHU-7	H-VLV-OP	Htg Valve Open	Open	Auto	AHU	1	10	BO-4		BO#,24V	EN-7	Mech Room GA-17	0		7-10-BO-4	2/18	24VAC OUT	V11,EP-3	PANEL	A50	
	BO-5	AHU-7	H-MNFLD	Humidifier Manifold Valve	Close	Open	AHU	1	10	BO-5		BO#,24V	EN-7	Mech Room GA-17	0		7-10-BO-5	2/18	24VAC OUT	V11,EP-4	PANEL	A50	
	BO-6	AHU-7	DUCT-A-C	Sup Air Duct "A" Dpr Ctl	Open	Close	AHU	1	10	BO-6		BO#,24V	EN-7	Mech Room GA-17	0		7-10-BO-6	2/18	24VAC OUT	V11,EP-5	PANEL	A50	
	BO-7	AHU-7	DUCT-B-C	Sup Air Duct "B" Dpr Ctl	Open	Close	AHU	1	10	BO-7		BO#,24V	EN-7	Mech Room GA-17	0		7-10-BO-7	2/18	24VAC OUT	V11,EP-6	PANEL	A50	
	BO-8	AHU-7	DUCT-C-C	Sup Air Duct "C" Dpr Ctl	Open	Close	AHU	1	10	BO-8		BO#,24V	EN-7	Mech Room GA-17	0		7-10-BO-8	2/18	24VAC OUT	V11,EP-7	PANEL	A50	
	BO-9	AHU-7					AHU	1	10	BO-9			EN-7	Mech Room GA-17	0		7-10-BO-9	2/18					
	BO-10	AHU-7	FAN-STATUS	FAN STATUS	Off	On	AHU	1	10	BO-10		BO#,24V	EN-7	Mech Room GA-17	0		7-10-BO-10	2/18	24VAC OUT	RELAY		A50	
	AO-1	AHU-7	DPR-C	Damper Command	%		AHU	1	10	AO-1		AO#,AOCOM	EN-7	Mech Room GA-17	0		7-10-AO-1	2/18	0-20mA OUT	UCP-422,EPT-1	PANEL	A21	
	AO-2	AHU-7	HTG-C	Heating Coil Valve	%		AHU	1	10	AO-2		AO#,AOCOM	EN-7	Mech Room GA-17	0		7-10-AO-2	2/18	0-20mA OUT	UCP-422,EPT-3	PANEL	A21	
	AO-3	AHU-7	CLG-VLV	Clg Coil Valve	%		AHU	1	10	AO-3		AO#,AOCOM	EN-7	Mech Room GA-17	0		7-10-AO-3	2/18	0-20mA OUT	UCP-422,EPT-4	PANEL	A21	
	AO-4	AHU-7	HFR-VLV	Humidifier Valve	%		AHU	1	10	AO-4		AO#,AOCOM	EN-7	Mech Room GA-17	0		7-10-AO-4	2/18	0-20mA OUT	UCP-422,EPT-5	PANEL	A21	
	AO-5	AHU-7	SF-O	Supply Fan Output	%		AHU	1	10	AO-5		AO#,AOCOM	EN-7	Mech Room GA-17	0		7-10-AO-5	2/18	0-10/0-15V OUT	SUP AN VFD	UNIT	A22	
	AO-6	AHU-7	RF-O	Return Fan Control	%		AHU	1	10	AO-6		AO#,AOCOM	EN-7	Mech Room GA-17	0		7-10-AO-6	2/18	0-10/0-15V OUT	RET FAN VFD	UNIT	A22	
	BI-1	AHU-7	SF-S	Supply Fan Status	Off	On	AHU	1	10	BI-1		BI#,BICOM	EN-7	Mech Room GA-17	0		7-10-BI-1	2/18	Contact (NO)	H-735,SF-S	STATER	A40	
	BI-2	AHU-7	RF-S	Return Fan Status	Off	On	AHU	1	10	BI-2		BI#,BICOM	EN-7	Mech Room GA-17	0		7-10-BI-2	2/18	Contact (NO)	H-735,RF-S	STARTER	A40	
	BI-3	AHU-7	LL-ALM	Low Temperature Alarm	Normal	Alarm	AHU	1	10	BI-3		BI#,BICOM	EN-7	Mech Room GA-17	0		7-10-BI-3	2/18	Contact (NO)	R-1,9,6	PANEL	A40	
	BI-4	AHU-7	DSHL-S	Disch Static High Limit Status	Normal	Alarm	AHU	1	10	BI-4		BI#,BICOM	EN-7	Mech Room GA-17	0		7-10-BI-4	2/18	Contact (NO)	R-2,9,6	PANEL	A40	
	BI-5	AHU-7	FA-ALM	Fire Alarm Status	Normal	Alarm	AHU	1	10	BI-5		BI#,BICOM	EN-7	Mech Room GA-17	0		7-10-BI-5	2/18	Contact (NO)	R-3,9,6	PANEL	A40	
	BI-6	AHU-7	RSLL-S	Return Static Low Limit Status	Normal	Alarm	AHU	1	10	BI-6		BI#,BICOM	EN-7	Mech Room GA-17	0		7-10-BI-6	2/18	Contact (NO)	R-4,9,6	PANEL	A40	
	BI-7	AHU-7	FILTER-S	Filter Status	Normal	Dirty	AHU	1	10	BI-7		BI#,BICOM	EN-7	Mech Room GA-17	0		7-10-BI-7	2/18	Y,R	P32 (NO)	UNIT	A40	
	BI-8	AHU-7					AHU	1	10	BI-8			EN-7	Mech Room GA-17	0		7-10-BI-8						
	AI-1	AHU-7	SF-VP	Supply Fan Vel Pressure	In. Wg		AHU	1	10	AI-1		AI#,AICOM,+VD(	EN-7	Mech Room GA-17	0		7-10-AI-1	3/18	0-10V IN INT-PWR	PR-274,SF-SP	UNIT	A11	
	AI-2	AHU-7	MA-T	Mixed Air Temperature	Deg F		AHU	1	10	AI-2		AI#,AICM	EN-7	Mech Room GA-17	0		7-10-AI-2	2/18	2-Wire	TE	UNIT	A4	
	AI-3	AHU-7	DA-T	Discharge Air Temperatur	Deg F		AHU	1	10	AI-3		AI#,AICM	EN-7	Mech Room GA-17	0		7-10-AI-3	2/18	2-Wire	TE	UNIT	A4	
	AI-4	AHU-7	ZN-T	Zone Temperature	Deg F		AHU	1	10	AI-4			EN-7	Mech Room GA-17	0		7-10-AI-4			SOFTWARE			
	AI-5	AHU-7	RF-VP	Return Fan Vel Pressure	In. Wg		AHU	1	10	AI-5		AI#,AICOM,+VD(	EN-7	Mech Room GA-17	0		7-10-AI-5	3/18	0-10V IN INT-PWR	PR-274,RF-VP	UNIT	A11	
	AI-6	AHU-7	OA-T	Outdoor Air Temperature	Deg F		AHU	1	10	AI-6		AI#,AICM	EN-7	Mech Room GA-17	0		7-10-AI-6	2/18	2-Wire	TE	UNIT	A4	
	AI-7	AHU-7	DA-SP	Discharge Air Static Pressure	In. Wg		AHU	1	10	AI-7		AI#,AICOM,+VD(	EN-7	Mech Room GA-17	0		7-10-AI-7	3/18	0-10V IN INT-PWR	PR-274,DA-SP	UNIT	A11	
	AI-8	AHU-7	RA-H	Return Air Humidity	% RH		AHU	1	10	AI-8		AI#,AICOM,+VD(	EN-7	Mech Room GA-17	0		7-10-AI-8	3/18	OUT,COM,PWR	HE-63X0-HE	UNIT	A13	
		AHU-7					UNT						EN-7	Mech Room GA-17									Power to Controller
		AHU-7	*				UNT	1	11				EN-7	Mech Room GA-17	0								N2 Trunk
	AI-1	AHU-7	MA-SP	Mixed Air Static Pressu	In. Wg		UNT	1	11	AI-1		AI#,AICM,+15VD	EN-7	Mech Room GA-17	0		7-11-AI-1	3/18	0-10V IN INT-PWR	PR-274,MA-SP	UNIT	U5	
	AI-2	AHU-7	ZN1-T	Zone 1 Temperature	Deg F		UNT	1	11	AI-2		AI#,AICM	EN-7	Mech Room GA-17	0		7-11-AI-2	2/18	2-Wire	TE	SPACE	U1	
	AI-3	AHU-7	ZN2-T	Zone 2 Temperature	Deg F		UNT	1	11	AI-3		AI#,AICM	EN-7	Mech Room GA-17	0		7-11-AI-3	2/18	2-Wire	TE	SPACE	U1	
	AI-4	AHU-7	ZN3-T	Zone 3 Temperature	Deg F		UNT	1	11	AI-4		AI#,AICM	EN-7	Mech Room GA-17	0		7-11-AI-4	2/18	2-Wire	TE	SPACE	U1	
	AI-5	AHU-7	ZN4-T	Zone 4 Temperature	Deg F		UNT	1	11	AI-5		AI#,AICM	EN-7	Mech Room GA-17	0		7-11-AI-5	2/18	2-Wire	TE	SPACE	U1	
	AI-6	AHU-7					UNT	1	11	AI-6			EN-7	Mech Room GA-17	0		7-11-AI-6						
	BI-1	AHU-7	SF-S	Supply Fan Status	Off	On	UNT	1	11	BI-1			EN-7	Mech Room GA-17	0		7-11-BI-1			SOFTWARE			
	BI-2	AHU-7					UNT	1	11	BI-2			EN-7	Mech Room GA-17	0		7-11-BI-2						
	BI-3	AHU-7					UNT	1	11	BI-3			EN-7	Mech Room GA-17	0		7-11-BI-3						
	BI-4	AHU-7					UNT	1	11	BI-4			EN-7	Mech Room GA-17	0		7-11-BI-4						
	BO-1	AHU-7					UNT	1	11	BO-1			EN-7	Mech Room GA-17	0		7-11-BO-1						
	BO-2	AHU-7					UNT	1	11	BO-2			EN-7	Mech Room GA-17	0		7-11-BO-2						
	BO-3	AHU-7					UNT	1	11	BO-3			EN-7	Mech Room GA-17	0		7-11-BO-3						
	BO-4	AHU-7					UNT	1	11	BO-4			EN-7	Mech Room GA-17	0		7-11-BO-4						
	BO-5	AHU-7					UNT	1	11	BO-5			EN-7	Mech Room GA-17	0		7-11-BO-5						
	BO-6	AHU-7					UNT	1	11	BO-6			EN-7	Mech Room GA-17	0		7-11-BO-6						
	AO-1	AHU-7	RA-DPR	Return Air Damper Ctl	%		UNT	1	11	AO-1		AO#,AOCOM,24V	EN-7	Mech Room GA-17	0		7-11-AO-1	3/18	0-10V OUT	UCP-422-V,EPT-2	PANEL	U23	
	AO-2	AHU-7					UNT	1	11	AO-2			EN-7	Mech Room GA-17	0		7-11-AO-2						

Notes: This control panel is located next to panel 5 in GR-24 and will communicate with new JACE 3 controller. (N4 compatible)



FIELD MATERIAL

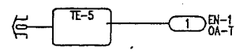
DEVICE TAG	QTY	CODE NUMBER	DESCRIPTION
CS-1-CS-2	2	5800	CURRENT SENSOR-VERIS
D-1-D-4	4	---	SEE DAMPER SCHEDULE
DA-1,DA-4	2	D-3073-2	DAMPER ACTUATOR; 8-13#
DA-2-DA-3	2	D-3153-1	DPR ACT 8-13# W/POS
PS-1	1	P74FA-5C	DIFFERENTIAL PRES CONTROL
PT-1-PT-7	7	A302	STATIC TIP-DWYER
RIB-1-RIB-5	5	RIBUIC	RELAY IN A BOX-PILOT DUTY-F.D. INC.
TE-1-TE-3	3	TE-6100-1	TEMP SENSING ELEMENT 17'
TE-4	1	TE-6000-100	SENSOR, 1000 OHM +/- .1%
	1	TE-6001-1	ELEMENT HOLDER
TE-5	1	TE-6000-100	SENSOR, 1000 OHM +/- .1%
	1	TE-6001-2	HOUSING F/O O.A.TEMP.
TI-1-TI-3	3	T-2100-202	THERMOMETER, -40/160F AVG
	3	T-275-101	HOLDER, AVERAGING ELEMENT
TS-1	1	A70HA-1C	TEMP CONTROL 4 WIRE, 2-C
V-1-V-2	2	----	SEE VALVE SCHEDULE

	DEVICE	BAY	TERM	XDUCER	SYSTEM	OBJECT	EXPANDED ID	REFERENCE DETAIL
** CONTROLLER: EN-1								
	RIB-1	BO	BO1	----	AHU-12	SF-C	SUPPLY FAN CONTROL	A-BOUT-24V-2WIRE
	RIB-2	BO	BO2	----	AHU-12	RF-C	RETURN FAN CONTROL	A-BOUT-24V-2WIRE
	RIB-5	BO	BO5	----	AHU-12	P-3-C	HW PUMP #3 ST/SP CONTROL	A-BOUT-24V-2WIRE

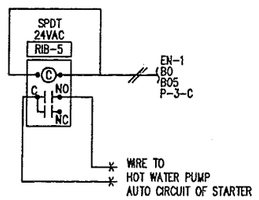
CABLE	DEVICE	BAY	TERM	XDUCER	SYSTEM	OBJECT	EXPANDED ID	REFERENCE DETAIL
** CONTROLLER: EN-1								
1	TE-5	AI	AI1	----	AHU-12	DA-T	OUTSIDE AIR TEMP	A-RTD-PHONE
2	TE-1	AI	AI2	----	AHU-12	MA-T	MIXED AIR TEMP	A-RTD-PHONE
3	TE-2	AI	AI3	----	AHU-12	DA-T	DISCHARGE AIR TEMP	A-RTD-PHONE
4	TE-3	AI	AI4	----	AHU-12	DA-CC	DISCH AIR COOLING COIL	A-RTD-PHONE
5	TE-4	AI	AI8	----	AHU-12	RA-T	RETURN AIR TEMP	A-RTD-PHONE
6	VFD	AO	AO3	----	AHU-12	SF-VFD-C	SUPPLY FAN VFD CONTROL	A-mA-OUTP-PHONE
7	VFD	AO	AO5	----	AHU-12	RF-VFD-C	RETURN FAN VFD CONTROL	A-mA-OUTP-PHONE
9	CS-2	BI	BI2	----	AHU-12	RF-S	RETURN FAN STATUS	A-BIN-PHONE-M
19	PS-1	BI	BI4	----	AHU-12	P-3-S	HW PUMP #3 STATUS	A-BIN-PHONE-M

OUTSIDE AIR TEMPERATURE SENSOR

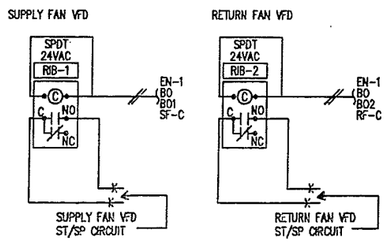
NORTH / NORTHWEST SIDE OF BUILDING



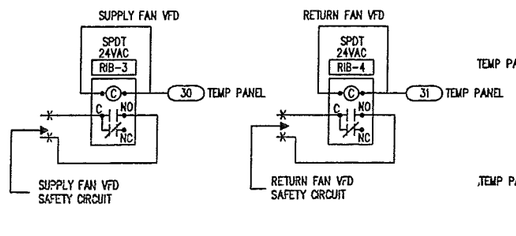
HOT WATER PUMP ST/SP CONTROL



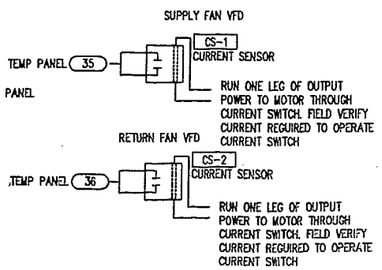
SUPPLY FAN & RETURN FAN ST/SP CONTROL



SUPPLY FAN & RETURN FAN VFD SAFETY CIRCUIT INTERLOCK



SUPPLY FAN & RETURN FAN VFD RUN INDICATION



AHU #12

AHU #12 will be controlled by AHU controller EN-1.

AHU controller EN-1 will start the return fan RF-1, first and then start the supply fan AHU-3. Solenoid air valve EP-1 will be energized and open the minimum outside air damper D-1.

AHU controller EN-1 will sense duct static pressure PT-4 and space static pressure PT-5. AHU controller EN-1 will control the AHU #12 VFD to maintain 1.0' static pressure in the ductwork compared to space static pressure.

AHU controller EN-1 will sense return fan discharge static pressure PT-6. AHU controller EN-1 will control the return fan RF-1 VFD to maintain 0.2" discharge static pressure.

AHU controller EN-1 will sense discharge air temperature TE-3. AHU controller EN-1 will modulate the cooling coil valve V-2 through transducer TC-4 to maintain discharge air setpoint (55CF). Solenoid air valve EP-3 will not allow the cooling valve to op en below 50CF outside air.

AHU controller EN-1 will sense heating coil discharge air temperature TE-2. AHU controller EN-1 will modulate the heating coil valve V-1 through transducer TC-2 and maximum outside air damper D-2 through transducer TC-1 to maintain setpoint (52CF). If d ischarge air temperature should drop below 40CF, the heating coil valve V-2 will be full open, the maximum DSA damper D-2 will modulate close and the minimum DSA damper will close through solenoid at valve EP-2.

AHU controller EN-1 will sense mixed air static pressure PT-1. AHU controller EN-1 will modulate the return air damper, through transducer TC-3 to maintain static pressure setpoint (0.3").

AHU controller EN-1 will sense outside air temperature TE-5. AHU Controller EN-1 will use dry bulb economizer control and override the maximum DSA damper D-2, return air damper D-3 and exhaust air damper D-4 to their closed and open position whenever out side air temperature is above 70CF.

Heating coil low limit controller TS-1 will sense heating coil discharge air. If discharge air drops below setpoint (38CF), AHU #12 and RF-1 will stop. The minimum and maximum outside air dampers will close, the return air damper will open, the exhaust air damper will close, the heating coil valve will open and the cooling coil valve will close. Heating coil low limit controller TS-1 is manual reset.

Discharge static high limit controller PS-1 set for 7"wg will stop AHU #12 if discharge static exceeds its setpoint. Discharge static high limit PS-1 is manual reset.

Return air low static limit PS-2 will stop RF-1 if return fan static drops below 0.01"WG. Return air low static limit controller is an automatic reset controller.

The Fire Alarm System will control AHU #12 and RF-1 on smoke or fire alarm shutdown. The existing fire alarm panel will shutdown AHU #12 and RF-1 and close the smoke dampers on a signal from the fire alarm panel.

Refer to the METASYS schedules shown on each individual page for the METASYS automation points associated with the air handling unit system.

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DRAWING TITLE
AHU-12 FIELD
MECH ROOM GR-24
GROUND FLOOR

PROJECT
CITY COUNTY BUILDING
HVAC SYSTEM MODIFICATIONS
GROUND AND FIRST FLOOR
MADISON, WI.

REVISION DATE: 02/14/95 07:46

FILE: AHU-3F

REFERENCE DRAWING	NO.	REVISION-LOCATION	ECN	DATE	BY

SALES ENGR	PROJECT MGR	APPL. ENGR	DRAWN	APPROVED
JP	TLS	TLS	BY TLS DATE 01/12/95	BY DATE

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MADISON, WI 53713
608-222-9100
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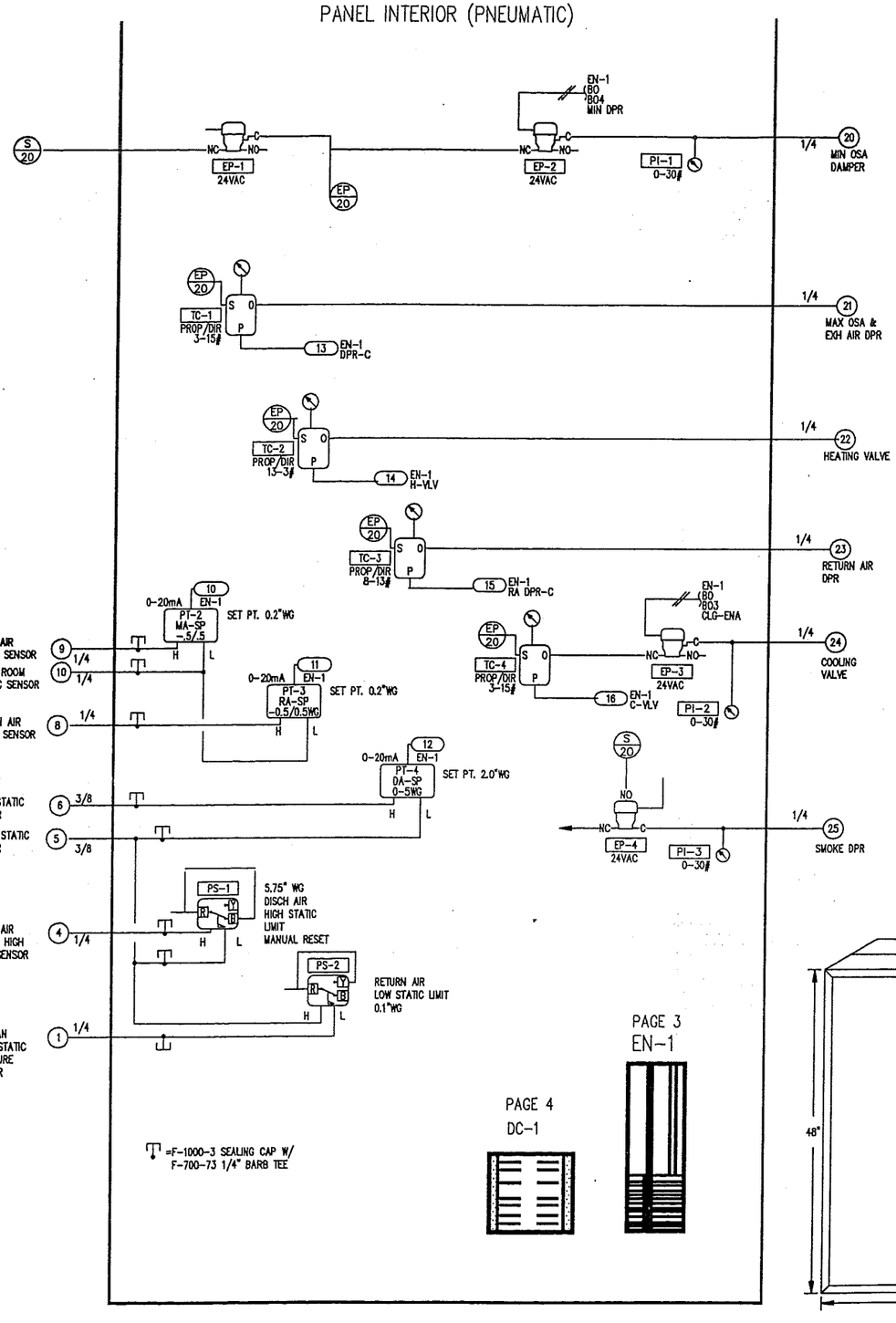
CONTRACT NUMBER 85109-5017

DRAWING NUMBER 1

PANEL INTERIOR (PNEUMATIC)



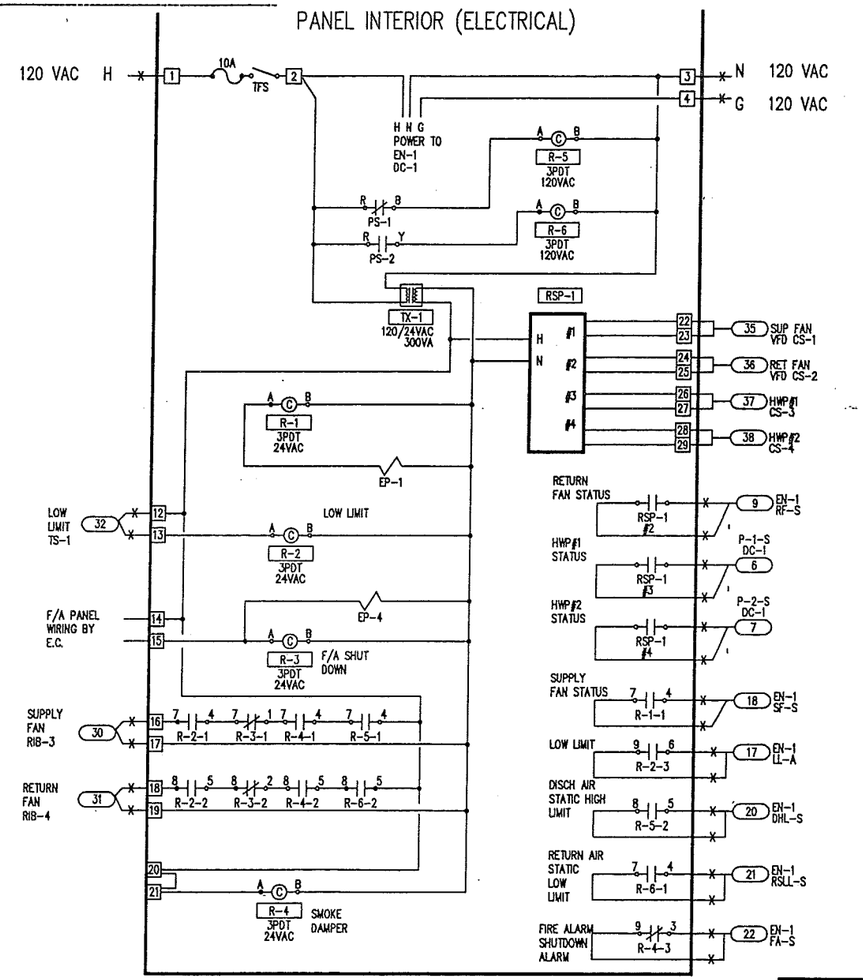
	DEVICE	BAY	TERM	XDUCER	SYSTEM	OBJECT	EXPANDED ID	REFERENCE DETAIL
CONTROLLER: EN-1								
	EP-2	BO	BO4	----	AHU-12	MIN DPR	MIN DPR LOW TEMP CLOSE	A-BOUT-24V-2WIRE
	EP-3	BO	BO3	----	AHU-12	CLG-ENA	COOLING COIL ENABLE	A-BOUT-24V-2WIRE

CABLE	DEVICE	BAY	TERM	XDUCER	SYSTEM	OBJECT	EXPANDED ID	REFERENCE DETAIL
CONTROLLER: DC-1								
6	R-1	BI	BI1		HV SYS	P-1-S	PUMP #1 STATUS	----
7	R-1	BI	BI2		HV SYS	P-2-S	PUMP #2 STATUS	----
CONTROLLER: EN-1								
9	CS-2	BI	BI2	----	AHU-12	RF-S	RETURN FAN STATUS	A-BIN-PHONE-M
10	PT-2	AI	AI5	----	AHU-12	MA-SP	MIXED AIR STATIC PRESS	A-mA-IN-P-PHONE
11	PT-3	AI	AI6	----	AHU-12	RA-SP	RET FAN DISCH STATIC PRS	A-mA-IN-P-PHONE
12	PT-4	AI	AI7	----	AHU-12	DA-SP	DISCH AIR STATIC PRESS	A-mA-IN-P-PHONE
13	TC-1	AO	AO1	----	AHU-12	DPR-C	DAMPER CONTROL	A-mA-OUTP-PHONE
14	TC-2	AO	AO2	----	AHU-12	H-VLV	HEATING VALVE CONTROL	A-mA-OUTP-PHONE
15	TC-3	AO	AO5	----	AHU-12	RA DPR-C	RETURN AIR DAMPER CONTRL	A-mA-OUTP-PHONE
16	TC-4	AO	AO4	----	AHU-12	C-VLV	COOLING COIL VALVE CTL	A-mA-OUTP-PHONE
17	R-3	BI	BI3	----	AHU-12	LL-A	LOW LIMIT ALARM	A-BIN-PHONE-N
18	R-1	BI	BI1	----	AHU-12	SF-S	SUPPLY FAN STATUS	A-BIN-PHONE-N
20	R-5	BI	BI5	----	AHU-12	DHL-S	DISCH STATIC HI LIM STAT	A-BIN-PHONE-M
21	R-6	BI	BI6	----	AHU-12	RSLL-S	RA STATIC LOW LIM STATUS	A-BIN-PHONE-M
22	R-4	BI	BI7	----	AHU-12	FA-S	FIRE ALARM STATUS	A-BIN-PHONE-M

PANEL MATERIAL

DEVICE TAG	QTY	CODE NUMBER	DESCRIPTION
EP-1-EP-3	3	V11HGA-100	3-WAY AIR VALVE;W/BARBED
EP-4	1	V-2410-1	VALVE, SOL. AIR, 3-WAY
P-1	1	M-8100-3648	CONTROL CABINET;STD, FACE
PI-1-PI-3	3	G-2010-5	AIR GAGE 1-1/2"
PS-1	1	1910-10	HIGH STATIC LIMIT-DWYER
PS-2	1	1910-00	LOW STATIC LIMIT-DWYER
PT-2-PT-3	2	DPT-2641-23	DIFF PRESS TRANS;-.5/.5
PT-4	1	DPT-2641-6	DIFF PRESS TRANS;0/5.0"VC
R-1-R-4	4	PD-109-21	RELAY; PLUG IN 3PDT
	4	PD-101-35	RELAY SOCKET; 11PIN BLADE
R-5-R-6	2	PD-109-20	RELAY; PLUG IN, 3PDT
	2	PD-101-35	RELAY SOCKET; 11PIN BLADE
RSP-1	1	5800-4	REMOTE SENSOR PANEL-VERIS
TC-1-TC-4	4	UCP-422M-43	TRANSDUCER-KELE
TFS	1	PD-112-18	FUSE; FAN 10AMP
	1	PD-112-11	FUSE TERMINAL BLOCK
TX-1	1	TZ-5000-11	TRANSFORMER; POWER,

PANEL INTERIOR (ELECTRICAL)



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DRAWING TITLE
AHU-12 PANEL
MECH ROOM GR-24
GROUND FLOOR

PROJECT
CITY COUNTY BUILDING
HVAC SYSTEM MODIFICATIONS
GROUND AND FIRST FLOOR
MADISON, WI.

REVISION DATE: 02/09/95 14:29 FILE: AHU-3P

REFERENCE DRAWING	NO.	REVISION-LOCATION	ECN	DATE	BY
SALES ENGR	PROJECT MGR	APPL. ENGR	DRAWN		APPROVED
JP	TLS	TLS	BY TLS DATE 01/25/95	BY	DATE

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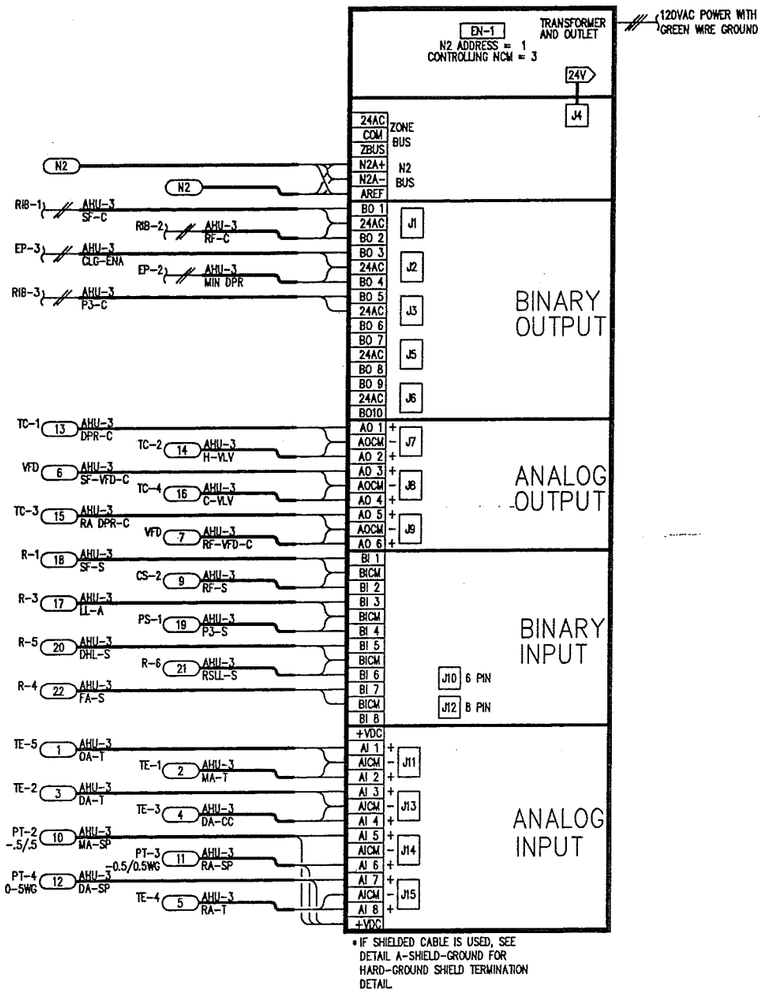
CONTRACT NUMBER 85109-5017

DRAWING NUMBER 2



*IF SHIELDED CABLE IS USED, SEE DETAIL A-SHIELD-GROUND FOR HARD-GROUND SHIELD TERMINATION DETAIL.

SIDE LOOPS
1. CLG VLV CTRL
2. MA-STATIC
3. RA-STATIC
4. CLG INTERLOCK
5. MIN O.A. LOCKOUT
6. HWP3-SST

PANEL MATERIAL

DEVICE TAG	QTY	CODE NUMBER	DESCRIPTION
EN-1	1	AS-AHU101-0	AIR HANDLING UNIT ENC/TER
	1	AS-AHU102-0	AIR HANDLING UNIT LOGIC B
	1	AS-XFR100-1	TRANSFORMER KIT;120/240

BAY	TERM	XDUCER	DEVICE	SYSTEM	OBJECT	EXPANDED ID	REFERENCE DETAIL
■■ CONTROLLER		EN-1					
AI	AI1	——	TE-5	AHU-12	DA-T	OUTSIDE AIR TEMP	A-RTD-PHONE
AI	AI2	——	TE-1	AHU-12	MA-T	MIXED AIR TEMP	A-RTD-PHONE
AI	AI3	——	TE-2	AHU-12	DA-T	DISCHARGE AIR TEMP	A-RTD-PHONE
AI	AI4	——	TE-3	AHU-12	DA-CC	DISCH AIR COOLING COIL	A-RTD-PHONE
AI	AI5	——	PT-2	AHU-12	MA-SP	MIXED AIR STATIC PRESS	A-mA-IN-P-PHONE
AI	AI6	——	PT-3	AHU-12	RA-SP	RET FAN DISCH STATIC PRS	A-mA-IN-P-PHONE
AI	AI7	——	PT-4	AHU-12	DA-SP	DISCH AIR STATIC PRESS	A-mA-IN-P-PHONE
AI	AI8	——	TE-4	AHU-12	RA-T	RETURN AIR TEMP	A-RTD-PHONE
AO	AO1	——	TC-1	AHU-12	DPR-C	DAMPER CONTROL	A-mA-OUTP-PHONE
AO	AO2	——	TC-2	AHU-12	H-VLV	HEATING VALVE CONTROL	A-mA-OUTP-PHONE
AO	AO3	——	VFD	AHU-12	SF-VFD-C	SUPPLY FAN VFD CONTROL	A-mA-OUTP-PHONE
AO	AO4	——	TC-4	AHU-12	C-VLV	COOLING COIL VALVE CTL	A-mA-OUTP-PHONE
AO	AO5	——	TC-3	AHU-12	RA DPR-C	RETURN AIR DAMPER CONTRL	A-mA-OUTP-PHONE
AO	AO6	——	VFD	AHU-12	RF-VFD-C	RETURN FAN VFD CONTROL	A-mA-OUTP-PHONE
BI	BI1	——	R-1	AHU-12	SF-S	SUPPLY FAN STATUS	A-BIN-PHONE-N
BI	BI2	——	CS-2	AHU-12	RF-S	RETURN FAN STATUS	A-BIN-PHONE-N
BI	BI3	——	R-3	AHU-12	LL-A	LOW LIMIT ALARM	A-BIN-PHONE-N
BI	BI4	——	PS-1	AHU-12	P-3-S	HV PUMP #3 STATUS	A-BIN-PHONE-N
BI	BI5	——	R-5	AHU-12	DHL-S	DISCH STATIC HI LIM STAT	A-BIN-PHONE-N
BI	BI6	——	R-6	AHU-12	RSLL-S	RA STATIC LOW LIM STATUS	A-BIN-PHONE-N
BI	BI7	——	R-4	AHU-12	FA-S	FIRE ALARM STATUS	A-BIN-PHONE-N
BO	BO1	——	RIB-1	AHU-12	SF-C	SUPPLY FAN CONTROL	A-BOUT-24V-2WIRE
BO	BO2	——	RIB-2	AHU-12	RF-C	RETURN FAN CONTROL	A-BOUT-24V-2WIRE
BO	BO3	——	EP-3	AHU-12	CLG-ENA	COOLING COIL ENABLE	A-BOUT-24V-2WIRE
BO	BO4	——	EP-2	AHU-12	MIN DPR	MIN DPR LOW TEMP CLOSE	A-BOUT-24V-2WIRE
BO	BO5	——	RIB-5	AHU-12	P-3-C	HV PUMP #3 ST/SP CONTROL	A-BOUT-24V-2WIRE
N2BUS	IN						A-N2-PHONE-PHONE
N2BUS	OUT						A-N2-PHONE-PHONE
X-FMR	120VA		120VAC				A-ENC-POWER

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DRAWING TITLE
ENCLOSURE EN-1
AHU

PROJECT
CITY COUNTY BUILDING
HVAC SYSTEM MODIFICATIONS
GROUND AND FIRST FLOOR
MADISON, WI.

REVISION DATE: 02/09/95 14:37

FILE: EN-1

REFERENCE DRAWING	NO.	REVISION-LOCATION	ECN	DATE	BY

SALES ENGR	PROJECT MGR	APPL. ENGR	DRAWN	APPROVED
JP	TLS	TLS	BY TLS DATE	BY DATE

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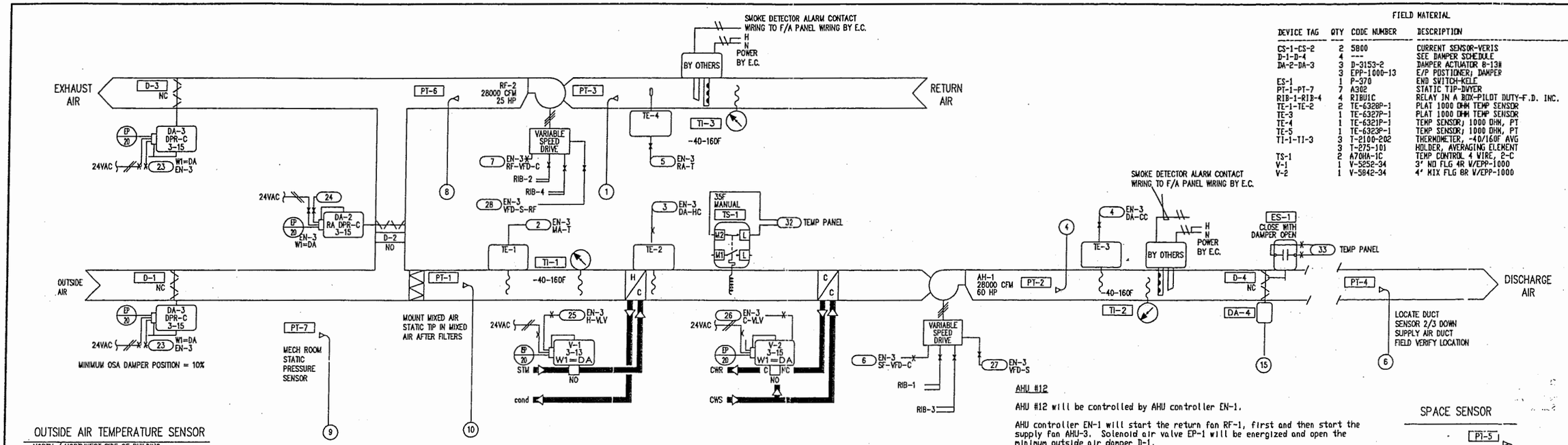
CONTRACT NUMBER
85109-5017

DRAWING NUMBER
3

Note: Controller located on Ground floor and communicates with JACE 3 in ENC5 located in room GR24. JACE 3 to be replaced with N4 compatible controller



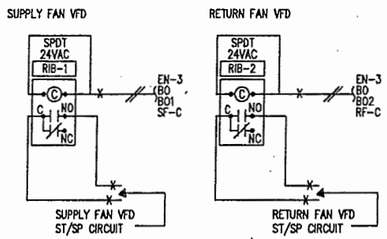
FIELD MATERIAL

DEVICE TAG	QTY	CODE NUMBER	DESCRIPTION
CS-1-CS-2	2	5800	CURRENT SENSOR-VERIS
D-1-D-4	4	---	SEE DAMPER SCHEDULE
DA-2-DA-3	3	D-3153-2	DAMPER ACTUATOR 8-13#
	3	EPP-1000-13	E/P POSTIONER; DAMPER
ES-1	1	P-370	END SWITCH-KELE
PT-1-PT-7	7	A302	STATIC TIP-DWYER
RIB-1-RIB-4	4	RIBUIC	RELAY IN A BOX-PILOT DUTY-F.D. INC.
TE-1-TE-2	2	TE-6328P-1	PLAT 1000 OHM TEMP SENSOR
TE-3	1	TE-6327P-1	PLAT 1000 OHM TEMP SENSOR
TE-4	1	TE-6321P-1	TEMP SENSOR; 1000 OHM, PT
TE-5	1	TE-6323P-1	TEMP SENSOR; 1000 OHM, PT
TI-1-TI-3	3	T-2100-202	THERMOMETER, -40/160F AVG
	3	T-275-101	HOLDER, AVERAGING ELEMENT
TS-1	2	A70HA-1C	TEMP CONTROL 4 WIRE, 2-C
V-1	1	V-5852-34	3" NO FLG 4R W/EPP-1000
V-2	1	V-5842-34	4" MIX FLG 8R W/EPP-1000

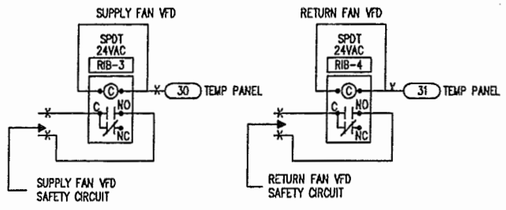
OUTSIDE AIR TEMPERATURE SENSOR

NORTH / NORTHWEST SIDE OF BUILDING

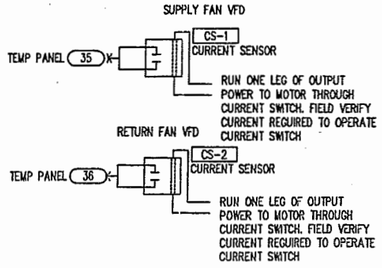
SUPPLY FAN & RETURN FAN ST/SP CONTROL



SUPPLY FAN & RETURN FAN VFD SAFETY CIRCUIT INTERLOCK



SUPPLY FAN & RETURN FAN VFD RUN INDICATION



	DEVICE	BAY	TERM	XDUCER	SYSTEM	OBJECT	EXPANDED ID	REFERENCE DETAIL
** CONTROLLER: EN-3								
	RIB-1	BO	BO1	——	AH-1	SF-C	SUPPLY FAN CONTROL	A-BOUT-24V-2WIRE
	RIB-2	BO	BO2	——	AH-1	RF-C	RETURN FAN CONTROL	A-BOUT-24V-2WIRE

CABLE	DEVICE	BAY	TERM	XDUCER	SYSTEM	OBJECT	EXPANDED ID	REFERENCE DETAIL
** CONTROLLER: EN-3								
1	TE-5	AI	AI1	——	AH-1	OA-T	OUTSIDE AIR TEMP	A-RTD-PHONE
2	TE-1	AI	AI2	——	AH-1	MA-T	MIXED AIR TEMP	A-RTD-PHONE
3	TE-2	AI	AI3	——	AH-1	DA-HC	DISCHARGE AIR HTG COIL	A-RTD-PHONE
4	TE-3	AI	AI4	——	AH-1	DA-CC	DISCH AIR COOLING COIL	A-RTD-PHONE
5	TE-4	AI	AI5	——	AH-1	RA-T	RETURN AIR TEMP	A-RTD-PHONE
6	VFD	AO	AO3	——	AH-1	SF-VFD-C	SUPPLY FAN VFD CONTROL	A-mA-OUTP-PHONE
7	VFD	AO	AO6	——	AH-1	RF-VFD-C	RETURN FAN VFD CONTROL	A-mA-OUTP-PHONE
23	DA-3 DA-3	AO	AO1	——	AH-1	DPR-C	AH-1 OSA/EA DPR CONTROL	A-EPP-mA-PHONE
24	DA-2	AO	AO5	——	AH-1	RA DPR-C	AH-1 RET AIR DPR CONTRL	A-EPP-mA-PHONE
25	V-1	AO	AO2	——	AH-1	H-VLV	AH-1 HTG VLV CONTROL	A-mA-OUTP-PHONE
26	V-2	AO	AO4	——	AH-1	C-VLV	AH-1 CLG VLV CONTROL	A-mA-OUTP-PHONE
27	VFD	BI	BI4	——	AH-1	VFD-S	AH-1 VFD STATUS	A-BIN-PHONE-N
28	VFD	BI	BI8	——	AH-1	VFD-S-RF	RETURN FAN VFD STATUS	A-BIN-PHONE-N

AHU #12

AHU #12 will be controlled by AHU controller EN-1.

AHU controller EN-1 will start the return fan RF-1, first and then start the supply fan AHU-3. Solenoid air valve EP-1 will be energized and open the minimum outside air damper D-1.

AHU controller EN-1 will sense duct static pressure PT-4 and space static pressure PT-5. AHU controller EN-1 will control the AHU #12 VFD to maintain 1.0" static pressure in the ductwork compared to space static pressure.

AHU controller EN-1 will sense return fan discharge static pressure PT-6. AHU controller EN-1 will control the return fan RF-1 VFD to maintain 0.2" discharge static pressure.

AHU controller EN-1 will sense discharge air temperature TE-3. AHU controller EN-1 will modulate the cooling coil valve V-2 through transducer TC-4 to maintain discharge air setpoint (55(F). Solenoid air valve EP-3 will not allow the cooling valve to op en below 50(F outside air.

AHU controller EN-1 will sense heating coil discharge air temperature TE-2. AHU controller EN-1 will modulate the heating coil valve V-1 through transducer TC-2 and maximum outside air damper D-2 through transducer TC-1 to maintain setpoint (52(F). If d ischarge air temperature should drop below 40(F, the heating coil valve V-2 will be full open, the maximum OSA damper D-2 will modulate close and the minimum OSA damper will close through solenoid at valve EP-2.

AHU controller EN-1 will sense mixed air static pressure PT-1. AHU controller EN-1 will modulate the return air damper, through transducer TC-3 to maintain static pressure setpoint (0.3").

AHU controller EN-1 will sense outside air temperature TE-5. AHU Controller EN-1 will use dry bulb economizer control and override the maximum OSA damper D-2, return air damper D-3 and exhaust air damper D-4 to their closed and open position whenever out side air temperature is above 70(F.

Heating coil low limit controller TS-1 will sense heating coil discharge air. If discharge air drops below setpoint (38(F), AHU #12 and RF-1 will stop. The minimum and maximum outside air dampers will close, the return air damper will open, the exhaust air damper will close, the heating coil valve will open and the cooling coil valve will close. Heating coil low limit controller TS-1 is manual reset.

Discharge static high limit controller PS-1 set for 7"wg will stop AHU #12 if discharge static exceeds its setpoint. Discharge static high limit PS-1 is manual reset.

Return air low static limit PS-2 will stop RF-1 if return fan static drops below 0.01"WG. Return air low static limit controller is an automatic reset controller.

The Fire Alarm System will control AHU #12 and RF-1 on smoke or fire alarm shutdown. The existing fire alarm panel will shutdown AHU #12 and RF-1 and close the smoke dampers on a signal from the fire alarm panel.

Refer to the METASYS schedules shown on each individual page for the METASYS automation points associated with the air handling unit system.

SPACE SENSOR

PT-5

LOCATE SPACE SENSOR IN SAME AREA AS DUCT STATIC SENSOR LOCATED OUTSIDE ROOM

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DRAWING TITLE
AH-1 FIELD

REVISION DATE: 10/24/95 09:23

FILE: AH-1-F

REFERENCE DRAWING	NO.	REVISION-LOCATION	ECN	DATE	BY

SALES ENGR	PROJECT MGR	APPL. ENGR	DRAWN	APPROVED
ART	TLS	TLS	BY TLS DATE 10/02/95	BY DATE

PROJECT
HVAC MODIFICATIONS TO AH-1 & AH-13, MECH ROOM GR-9
CITY-COUNTY BLDG
MADISON, WI.

JOHNSON CONTROLS
Systems & Services Division

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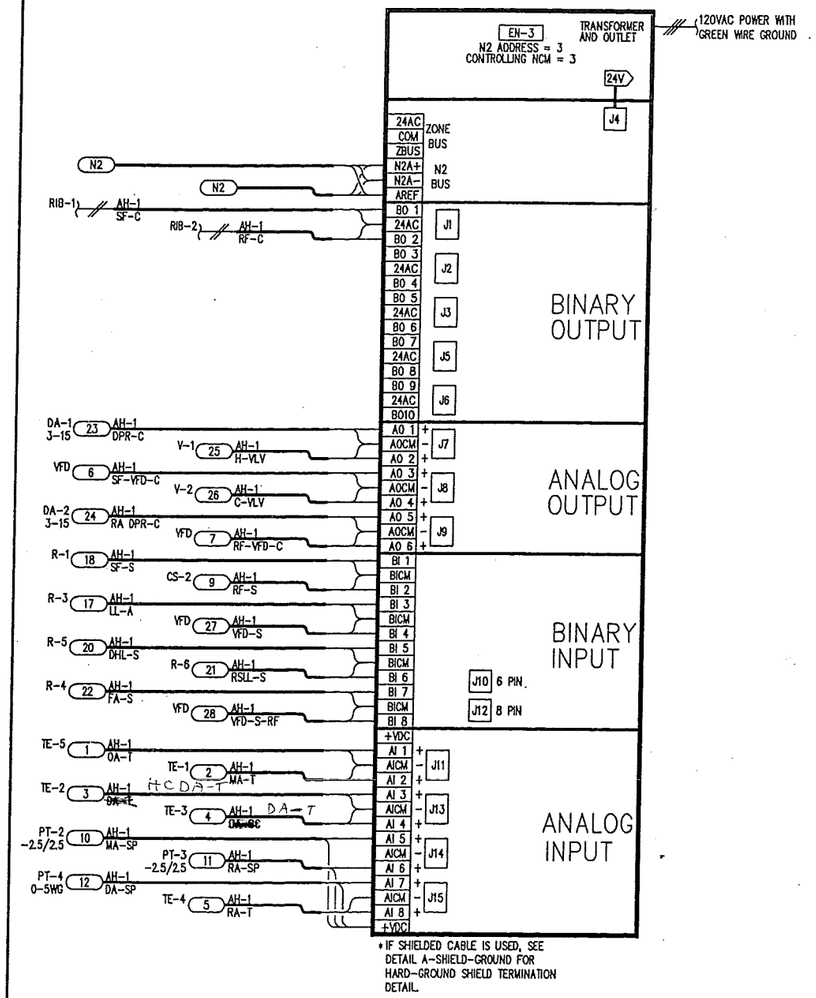
CONTRACT NUMBER
5109-5089

DRAWING NUMBER
1



* IF SHIELDED CABLE IS USED, SEE DETAIL A-SHIELD-GROUND FOR HARD-GROUND SHIELD TERMINATION DETAIL.

SIDE LOOPS
1. CLG VLV CTRL
2. MA-STATIC
3. RA-STATIC
4. CLG INTERLOCK

PANEL HATERIAL

DEVICE TAG	QTY	CODE NUMBER	DESCRIPTION
EN-3	1	AS-AHU101-1	AIR HANDLING UNIT ENC/TER
	1	AS-AHU102-0	AIR HANDLING UNIT LOGIC B
	1	AS-XFR100-1	TRANSFORMER KIT;120/240

BAY	TERM	XDUCER	DEVICE	SYSTEM	OBJECT	EXPANDED ID	REFERENCE DETAIL
**	CONTROLLER:	EN-3					
AI	AI1	----	TE-5	AH-1	OA-T	OUTSIDE AIR TEMP	A-RTD-PHONE
AI	AI2	----	TE-1	AH-1	MA-T	MIXED AIR TEMP	A-RTD-PHONE
AI	AI3	----	TE-2	AH-1	DA-HC	DISCHARGE AIR HTG COIL	A-RTD-PHONE
AI	AI4	----	TE-3	AH-1	DA-CC	DISCH AIR COOLING COIL	A-RTD-PHONE
AI	AI5	----	PT-2	AH-1	MA-SP	MIXED AIR STATIC PRESS	A-mA-IN-P-PHONE
AI	AI6	----	PT-3	AH-1	RA-SP	RET FAN DISCH STATIC PRS	A-mA-IN-P-PHONE
AI	AI7	----	PT-4	AH-1	DA-SP	DISCH AIR STATIC PRESS	A-mA-IN-P-PHONE
AI	AI8	----	TE-4	AH-1	RA-T	RETURN AIR TEMP	A-RTD-PHONE
AO	AO1	----	DA-3	AH-1	DPR-C	AH-1 OSA/EA DPR CONTROL	A-EPP-mA-PHONE
			DA-3				
AO	AO2	----	V-1	AH-1	H-VLV	AH-1 HTG VLV CONTROL	A-mA-OUTP-PHONE
AO	AO3	----	VFD	AH-1	SF-VFD-C	SUPPLY FAN VFD CONTROL	A-mA-OUTP-PHONE
AO	AO4	----	V-2	AH-1	C-VLV	AH-1 CLG VLV CONTROL	A-mA-OUTP-PHONE
AO	AO5	----	DA-2	AH-1	RA DPR-C	AH-1 RET AIR DPR CONTRL	A-EPP-mA-PHONE
AO	AO6	----	VFD	AH-1	RF-VFD-C	RETURN FAN VFD CONTROL	A-mA-OUTP-PHONE
BI	BI1	----	R-1	AH-1	SF-S	SUPPLY FAN STATUS	A-BIN-PHONE-N
BI	BI2	----	CS-2	AH-1	RF-S	RETURN FAN STATUS	A-BIN-PHONE-N
BI	BI3	----	R-3	AH-1	LL-A	LOW LIMIT ALARM	A-BIN-PHONE-N
BI	BI4	----	VFD	AH-1	VFD-S	AH-1 VFD STATUS	A-BIN-PHONE-N
BI	BI5	----	R-5	AH-1	DHL-S	DISCH STATIC HI LIM STAT	A-BIN-PHONE-N
BI	BI6	----	R-6	AH-1	RSLL-S	RA STATIC LOW LIM STATUS	A-BIN-PHONE-N
BI	BI7	----	R-4	AH-1	FA-S	FIRE ALARM STATUS	A-BIN-PHONE-N
BI	BI8	----	VFD	AH-1	VFD-S-RF	RETURN FAN VFD STATUS	A-BIN-PHONE-N
BO	BO1	----	RIB-1	AH-1	SF-C	SUPPLY FAN CONTROL	A-BOUT-24V-2WIRE
BO	BO2	----	RIB-2	AH-1	RF-C	RETURN FAN CONTROL	A-BOUT-24V-2WIRE

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DRAWING TITLE
AHU ENCLOSURE EN-3
AHU

PROJECT
HVAC MODIFICATIONS TO AH-1 & AH-13, MECH ROOM GR-9
CITY-COUNTY BLDG
MADISON, WI.

REVISION DATE: 10/11/95 08:57

FILE: EN-3

REFERENCE DRAWING		NO.	REVISION-LOCATION	ECN	DATE	BY
SALES ENGR	PROJECT MGR	APPL. ENGR	DRAWN	APPROVED		
ART	TLS	TLS	BY TLS DATE 10/04/95	BY	DATE	

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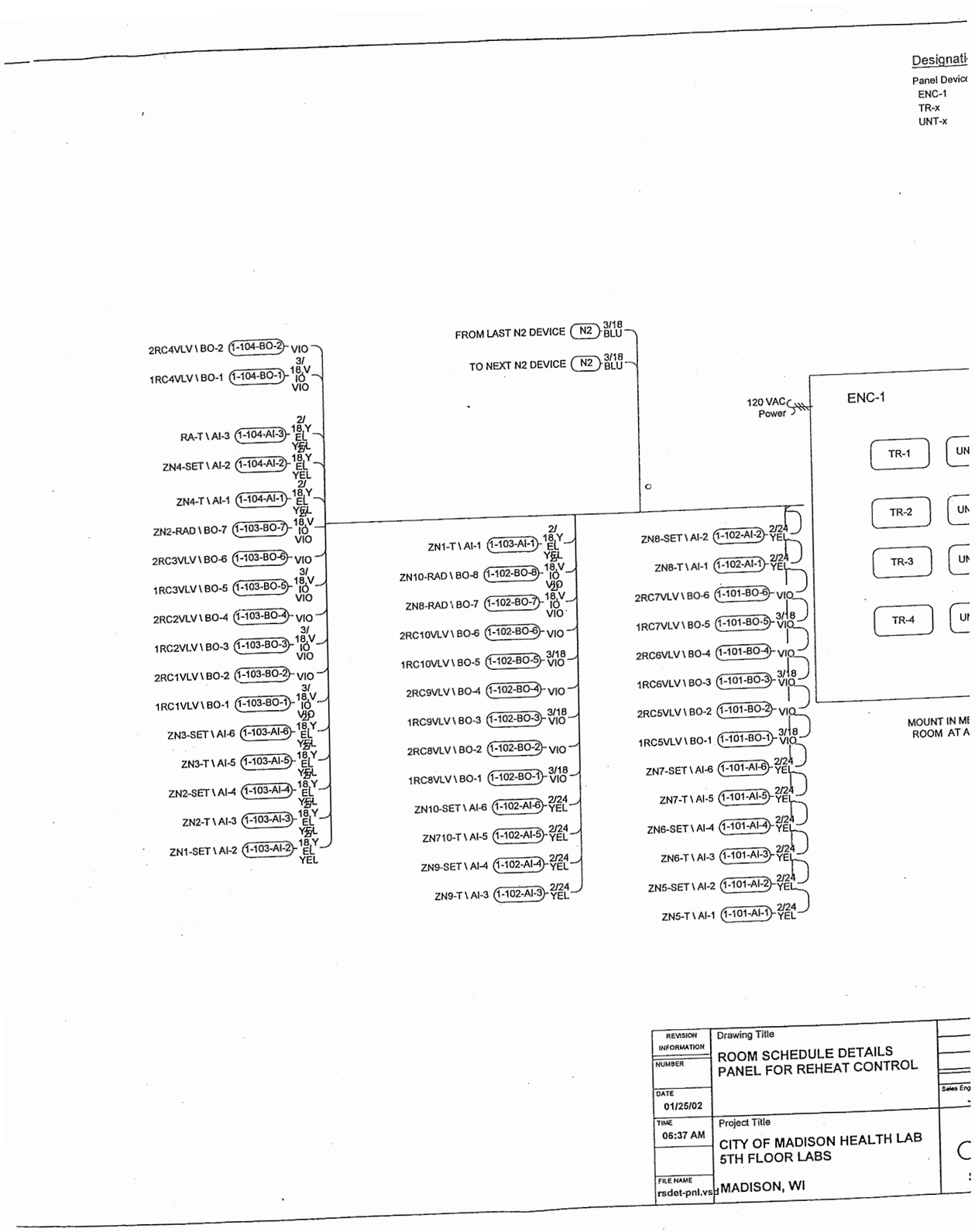
CONTRACT NUMBER
85109-5089

DRAWING NUMBER
3



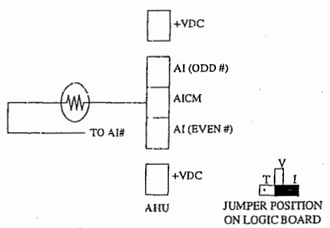
Notes:

1. Ten reheat control valves to be replaced with 0-10vdc control from original floating point control.
2. Heat exchanger controls are listed in the AHU-1 point table. Drawing number 3.4.
3. All 5th floor Lab controls to communicate with JACE 3 in rm GR-24 panel 5.
4. JACE 3 is currently a Niagara FX-60 and is to be replaced with a JACE 8000 or approved equal that will allow for the upgrade to N4.
5. Ceilings are all 2X2 lay in so access to control valves and stat wiring is not an issue.

Electrician/Fitter	Point Information				Controller Information						Panel Information					Field Device						
Tag	Point Type	System Name	Object Name	Expanded ID	Controller Type	NCM Addr.	Trunk Addr.	Cable Destination Bay/Terminal	Module Type	Termination Out	Panel	Panel Location	Slot Number	Reference Drawing	Cable Number	Wiring /Tubing	Termination In	Device	Location	Ref Detail Shape	Comment	
		AHU-1			AHU	1	100				P-100	5TH FLR MECH ROOM	0								N2 Trunk	
	BO-1	AHU-1	SF-C	Supply Fan	AHU	1	100	BO-1		BO1,24V	P-100	5TH FLR MECH ROOM	0		100-100-BO-1	2/18	-,+	Hawkeye 735/738 Coil w	AT STARTER	AHU43		
	BO-2	AHU-1	P1-C	Hot Water Pump P-1	AHU	1	100	BO-2		BO2,24V	P-100	5TH FLR MECH ROOM	0		100-100-BO-2	2/18	-,+	Hawkeye 735/738 Coil w	AT STARTER	AHU43		
	BO-3	AHU-1	P2-C	Hot Water Sys Pump P2	AHU	1	100	BO-3		BO3,24V	P-100	5TH FLR MECH ROOM	0		100-100-BO-3	2/18	-,+	Hawkeye 735/738 Coil w	AT STARTER	AHU43		
	BO-4	AHU-1			AHU	1	100	BO-4			P-100	5TH FLR MECH ROOM	0		100-100-BO-4							
	BO-5	AHU-1			AHU	1	100	BO-5			P-100	5TH FLR MECH ROOM	0		100-100-BO-5							
	BO-6	AHU-1			AHU	1	100	BO-6			P-100	5TH FLR MECH ROOM	0		100-100-BO-6							
	BO-7	AHU-1			AHU	1	100	BO-7			P-100	5TH FLR MECH ROOM	0		100-100-BO-7							
	BO-8	AHU-1			AHU	1	100	BO-8			P-100	5TH FLR MECH ROOM	0		100-100-BO-8							
	BO-9	AHU-1			AHU	1	100	BO-9			P-100	5TH FLR MECH ROOM	0		100-100-BO-9							
	BO-10	AHU-1			AHU	1	100	BO-10			P-100	5TH FLR MECH ROOM	0		100-100-BO-10							
	AO-1	AHU-1	DPR-C	Damper Command	AHU	1	100	AO-1		AO1,AOCOM	P-100	5TH FLR MECH ROOM	0		100-100-AO-1	2/18	See Detail	M9216 (0-10VDC) Mstr/Slv w	AT UNIT	AHU111	NEED 499 OHM RESISTOR	
	AO-2	AHU-1	HTG-VLV	Heating Valve	AHU	1	100	AO-2		AO2,AOCOM	P-100	5TH FLR MECH ROOM	0		100-100-AO-2	2/18	4,1	M9216 4-20mA	AT UNIT	AHU32		
	AO-3	AHU-1	CLG-VLV	Cooling Valve	AHU	1	100	AO-3		AO3,AOCOM	P-100	5TH FLR MECH ROOM	0		100-100-AO-3	2/18	4,1	M9216 4-20mA	AT UNIT	AHU32		
	AO-4	AHU-1	CV-VLV	Convertor Valves	AHU	1	100	AO-4		AO4,AOCOM	P-100	5TH FLR MECH ROOM	0		100-100-AO-4	2/18	See Detail	M9216 (0-10VDC) Mstr/Slv w	AT CONV	AHU111	NEED 499 OHM RESISTOR	
	AO-5	AHU-1			AHU	1	100	AO-5			P-100	5TH FLR MECH ROOM	0		100-100-AO-5							
	AO-6	AHU-1			AHU	1	100	AO-6			P-100	5TH FLR MECH ROOM	0		100-100-AO-6							
	BI-1	AHU-1	SF-S	Supply Airflow	AHU	1	100	BI-1		BI1,BICOM	P-100	5TH FLR MECH ROOM	0		100-100-BI-1	2/18	9,6	Contact (NO)	PANEL	AHU40		
	BI-2	AHU-1	P1-S	Hot Water Pump P-1Status	AHU	1	100	BI-2		BI2,BICOM	P-100	5TH FLR MECH ROOM	0		100-100-BI-2	2/18	N.O. Status Output	Hawkeye 735/738 w	AT STARTER	AHU43		
	BI-3	AHU-1	FE-EF1-S	Fume Exh Fan 1 Status	AHU	1	100	BI-3		BI3,BICOM	P-100	5TH FLR MECH ROOM	0		100-100-BI-3	2/18	9,6	Contact (NO)	PANEL	AHU40		
	BI-4	AHU-1	FE-EF2-S	Fume Hood EF 2 Status	AHU	1	100	BI-4		BI4,BICOM	P-100	5TH FLR MECH ROOM	0		100-100-BI-4	2/18	9,6	Contact (NO)	PANEL	AHU40		
	BI-5	AHU-1	LL-ALM	Low Limit Alarm	AHU	1	100	BI-5		BI5,BICOM	P-100	5TH FLR MECH ROOM	0		100-100-BI-5	2/18	9,6	Contact (NO)	PANEL	AHU40		
	BI-6	AHU-1	SMK-ALM	Duct Detector Alarm	AHU	1	100	BI-6		BI6,BICOM	P-100	5TH FLR MECH ROOM	0		100-100-BI-6	2/18	9,6	Contact (NO)	PANEL	AHU40		
	BI-7	AHU-1	FILTER-S	Filter Status	AHU	1	100	BI-7		BI7,BICOM	P-100	5TH FLR MECH ROOM	0		100-100-BI-7	2/18	Y,R	P32 (NO)	AT UNIT	AHU40		
	BI-8	AHU-1	P2-S	HW Sys Pump P-2 Status	AHU	1	100	BI-8		BI8,BICOM	P-100	5TH FLR MECH ROOM	0		100-100-BI-8	2/18	N.O. Status Output	Hawkeye 735/738 w	AT STARTER	AHU43		
	AI-1	AHU-1	OA-T	Outdoor Air Temp	AHU	1	100	AI-1			P-100	5TH FLR MECH ROOM	0		100-100-AI-1			GLOBAL POINT				
	AI-2	AHU-1	MA-T	Mixed Air Temp	AHU	1	100	AI-2		AI2,AICM	P-100	5TH FLR MECH ROOM	0		100-100-AI-2	2/18	2-Wire	TE	AT UNIT	AHU4		
	AI-3	AHU-1	DA-T	Disch Air Temp	AHU	1	100	AI-3		AI3,AICM	P-100	5TH FLR MECH ROOM	0		100-100-AI-3	2/18	2-Wire	TE	AT UNIT	AHU4		
	AI-4	AHU-1	HWS-T	Hot Water Supply Temp	AHU	1	100	AI-4		AI4,AICM	P-100	5TH FLR MECH ROOM	0		100-100-AI-4	2/18	2-Wire	TE	AT CONV	AHU4		
	AI-5	AHU-1	RA-H	Rerturn Air Humidity	AHU	1	100	AI-5		AI5,AICOM,+VDC	P-100	5TH FLR MECH ROOM	0		100-100-AI-5	3/18	Device dependent	0-10V IN INT-PWR	AT UNIT	AHU11		
	AI-6	AHU-1	RA-T	Return Air Temp	AHU	1	100	AI-6		AI6,AICM	P-100	5TH FLR MECH ROOM	0		100-100-AI-6	2/18	2-Wire	TE	AT UNIT	AHU4		
	AI-7	AHU-1	HC-T	Heating Coil Disch Temp	AHU	1	100	AI-7		AI7,AICM	P-100	5TH FLR MECH ROOM	0		100-100-AI-7	2/18	2-Wire	TE	AT UNIT	AHU4		
	AI-8	AHU-1			AHU	1	100	AI-8			P-100	5TH FLR MECH ROOM	0		100-100-AI-8							

DETAIL AHU4:

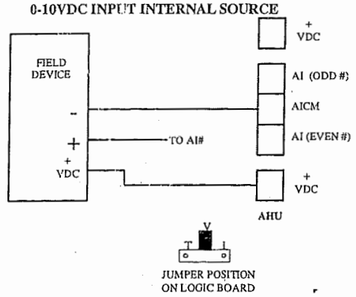
TEMPERATURE SENSOR INPUT



NOTE: IF SHIELDED CABLE IS USED SEE DETAIL A-GROUND-SHIELD FOR SHIELD TERMINATION

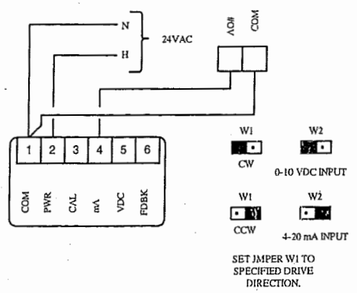
DETAIL AHU11:

0-10VDC INPUT INTERNAL SOURCE



DETAIL AHU32:

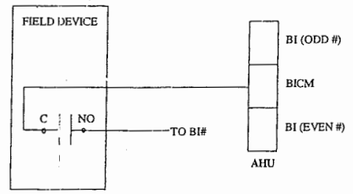
4-20mA OUTPUT TO M9216



SET JMPER W1 TO SPECIFIED DRIVE DIRECTION.

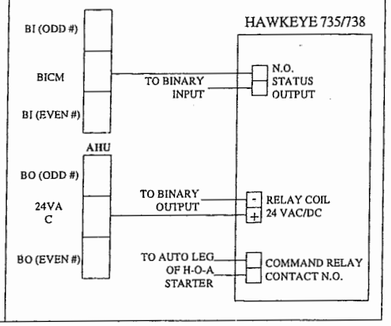
DETAIL AHU40:

N.O. BINARY INPUT



NOTE: IF SHIELDED CABLE IS USED SEE DETAIL A-GROUND-SHIELD FOR SHIELD TERMINATION

DETAIL AHU43:



Notes:

1. This points list covers both AHU and Heat exchanger control points for the 5th floor lab.
2. Reheat and perimeter convector control not covered here.

REVISION INFORMATION	Drawing Title										
NUMBER	AHU-1 POINT SCHEDULE										
DATE 12/20/01		REFERENCE DRAWING		NO.	REVISION-LOCATION		ECN	DATE	BY		
TIME 08:20 AM	Project Title	Sales Engineer JCP	Project Manager TRC	Application Engineer MJM	DRAWN BY	DATE	APPROVED BY	DATE			
FILE NAME ahu1-ps.vsd	CITY OF MADISON HEALTH LAB 5TH FLOOR LABS MADISON, WI	JOHNSON CONTROLS Systems & Services Division	Branch Information: Johnson Controls, Inc. 2400 Kilgust Road Madison WI 53713-4842 Phone: (608) 222-9100 Fax: (608) 222-9490	CONTRACT NUMBER 0 2109-0010	DRAWING NUMBER 3..4						

AIR HANDLER SEQUENCE

OCCUPIED MODE:

SUPPLY FAN: When indexed to the occupied mode, the supply fan (AHU-1-C) will run continuously.

EXHAUST FAN: When indexed to the occupied mode, the exhaust fan (EF-1-C) will run continuously.

CONTROL STRATEGY: A discharge air sensor (DA-T) will control the dampers and heating coil valve in sequence to maintain discharge air setpoint of 55F. All set points will be adjustable.

MIXED AIR LOW LIMIT: Whenever the mixed air temperature (MA-T) decreases below 45°F (adjustable), the mixed air low limit will override the mixed air damper (MA-DPR) toward the minimum position.

HEATING: On a call for heating, the outdoor air (D-1) will be modulated to the minimum position with the return air damper(D-2) modulated open proportionately. The exhaust air damper(D-3) will be closed. On a further call for heating, the heating coil valve (V-1) will be modulated open to maintain discharge air setpoint.

COOLING: On a call for cooling, the outdoor air damper (D-1) and exhaust air damper(D-3) will be modulated open with the return air damper(D-2) modulate closed to maintain the desired setpoint. When the outside air temperature rises above the cooling lock out setpoint of 65F(adjustable) the DX cooling will be allowed to operate and the dampers will be in minimum position, the DX cooling, through relays DX-1-C & DX-2-C, will maintain return air temperature setpoint of 75F.

SAFETY CIRCUITS: Whenever the manual reset low limit exceeds its limit of 35F, AHIU-1 and Exhaust Fan -1 will shut down. When the supply fan is off: the outdoor air damper (D-1) and the exhaust air damper (D-3) will be closed with the return air damper (D-2) open; the heating valve(V-1) will be open, the DX cooling will be off.

SMOKE CONTROL : Whenever the discharge air smoke detector (SD-1) is in alarm, AHU-1 will stop and Exhaust Fan-1 will continue to operate. If an adjoining smoke zone is in alarm, AHU-1 will switch to full economizer mode and Exhaust Fan -1 will stop.

REHEAT COIL CONTROL: Reheat coil control valves RC-1, RC-2, RC-3 will be controlled by pneumatic transducers RC-1-C, RC-2-C & RC-3-C. See page 3.1 for additional control information.

Notes:

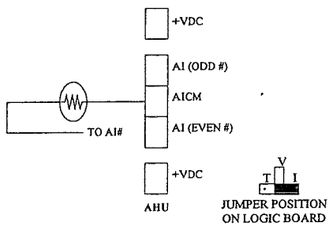
1. This panel is located in a mechanical room inside the seventh floor jail.
2. JACE 3 located on Ground floor will be the supervisory controller.

Drawing Title: AHU-1 DESCRIPTION OF OPERATION					1/1/1999	
					1/1/1999	
					1/1/1999	
	REFERENCE DRAWING	NO.	REVISION-LOCATION	ECN	DATE	BY
	Sales Engineer: JIM PROCKNOW; Project Manager: TERRY L. STREICH; Application Engineer: TERRY L. STREICH		DRAWN BY / DATE: 0		APPROVED BY / DATE: 0	
Project Title: CITY/COUNTY JAIL RENOVATION 6TH & 7TH FLOOR MADISON, WI. 53704	JOHNSON CONTROLS Systems & Services Division	Branch Information: Johnson Controls Inc. 2400 Kilgust Road Madison WI 53713 Phone: 1-608-222-9100 Fax: 1-608-222-9490			CONTRACT NUMBER: 0109-0043	
					DRAWING NUMBER: 2.2	

		Point Information			Controller Information									Panel Information				Intermedi	Field Device					
Tag	Point Type	System Name	Object Name	Expanded ID	Controller Type	Controller Details	Trunk Type	Trunk Nbr	Trunk Addr.	Cable Destination Bay/Terminal	DO Type	Module Type	Termination Out	Panel	Panel Location	Slot Number	Reference Drawing	Cable Number	Wiring /Tubing	Termination In	Device	Location	Ref Detail Shape	Comment
		AHU-1			AHU	AHU 100	N2	1	1					EN-1	Mech Room 7E24	0								N2 Trunk
	BO-1	AHU-1	AHU-1-C	Ahu-1 Control	AHU	AHU 100	N2	1	1	BO-1			BO1,24V	EN-1	Mech Room 7E24	0		1-1-BO-1	2/18	24VAC OUT	PD-109-61(R-5)		AHU50	
	BO-2	AHU-1	EF-1-C	Exh Fan 1 Control	AHU	AHU 100	N2	1	1	BO-2			BO2,24V	EN-1	Mech Room 7E24	0		1-1-BO-2	2/18	24VAC OUT	PD-109-61(R-6)		AHU50	
	BO-3	AHU-1	DX-1-C	Cooling Stage 1	AHU	AHU 100	N2	1	1	BO-3			BO3,24V	EN-1	Mech Room 7E24	0		1-1-BO-3	2/18	24VAC OUT	CVR-11C-0		AHU50	
	BO-4	AHU-1	DX-2-C	Cooling Stage 2	AHU	AHU 100	N2	1	1	BO-4			BO4,24V	EN-1	Mech Room 7E24	0		1-1-BO-4	2/18	24VAC OUT	CVR-11C-0		AHU50	
	BO-5	AHU-1			AHU	AHU 100	N2	1	1	BO-5				EN-1	Mech Room 7E24	0		1-1-BO-5						
	BO-6	AHU-1			AHU	AHU 100	N2	1	1	BO-6				EN-1	Mech Room 7E24	0		1-1-BO-6						
	BO-7	AHU-1			AHU	AHU 100	N2	1	1	BO-7				EN-1	Mech Room 7E24	0		1-1-BO-7						
	BO-8	AHU-1			AHU	AHU 100	N2	1	1	BO-8				EN-1	Mech Room 7E24	0		1-1-BO-8						
	BO-9	AHU-1			AHU	AHU 100	N2	1	1	BO-9				EN-1	Mech Room 7E24	0		1-1-BO-9						
	BO-10	AHU-1			AHU	AHU 100	N2	1	1	BO-10				EN-1	Mech Room 7E24	0		1-1-BO-10						
	AO-1	AHU-1	DPR-C	Damper Command	AHU	AHU 100	N2	1	1	AO-1			AO1,AOCOM	EN-1	Mech Room 7E24	0		1-1-AO-1	2/18	0-20mA OUT	KELE UCP-422		AHU21	
	AO-2	AHU-1	HTG-VLV	Heating Coil Valve	AHU	AHU 100	N2	1	1	AO-2			AO2,AOCOM	EN-1	Mech Room 7E24	0		1-1-AO-2	2/18	0-20mA OUT	KELE UCP-422		AHU21	
	AO-3	AHU-1			AHU	AHU 100	N2	1	1	AO-3				EN-1	Mech Room 7E24	0		1-1-AO-3						
	AO-4	AHU-1	RC-1-C	Reheat Coil Valve 1 Ctl	AHU	AHU 100	N2	1	1	AO-4			AO4,AOCOM	EN-1	Mech Room 7E24	0		1-1-AO-4	2/18	0-20mA OUT	KELE UCP-422		AHU21	
	AO-5	AHU-1	RC-2-C	Reheat Coil Valve 2 Ctl	AHU	AHU 100	N2	1	1	AO-5			AO5,AOCOM	EN-1	Mech Room 7E24	0		1-1-AO-5	2/18	0-20mA OUT	KELE UCP-422		AHU21	
	AO-6	AHU-1	RC-3-C	Reheat Coil Valve # Ctl	AHU	AHU 100	N2	1	1	AO-6			AO6,AOCOM	EN-1	Mech Room 7E24	0		1-1-AO-6	2/18	0-20mA OUT	KELE UCP-422		AHU21	
	BI-1	AHU-1	AHU-1-S	Ahu-1 Status	AHU	AHU 100	N2	1	1	BI-1			BI1,BICOM	EN-1	Mech Room 7E24	0		1-1-BI-1	2/18	N.O. Status Output	Hawkeye 708		AHU44	
	BI-2	AHU-1	EF-1-C	Exhaust Fan 1 Status	AHU	AHU 100	N2	1	1	BI-2			BI2,BICOM	EN-1	Mech Room 7E24	0		1-1-BI-2	2/18	N.O. Status Output	Hawkeye 708		AHU44	
	BI-3	AHU-1	LT-ALM	Low Temperature Alm	AHU	AHU 100	N2	1	1	BI-3			BI3,BICOM	EN-1	Mech Room 7E24	0		1-1-BI-3	2/18	Contact (NO)(C)	PD-109-61(R-1)		AHU40	
	BI-4	AHU-1	SD-ALM	Smoke Dect. Alarm	AHU	AHU 100	N2	1	1	BI-4			BI4,BICOM	EN-1	Mech Room 7E24	0		1-1-BI-4	2/18	Contact (NO)(C)	PD-109-61(R-2)		AHU40	
	BI-5	AHU-1	ZN-ALM	Smoke Zone Alarm	AHU	AHU 100	N2	1	1	BI-5			BI5,BICOM	EN-1	Mech Room 7E24	0		1-1-BI-5	2/18	Contact (NO)(C)	PD-109-61(R-3)		AHU40	
	BI-6	AHU-1			AHU	AHU 100	N2	1	1	BI-6				EN-1	Mech Room 7E24	0		1-1-BI-6						
	BI-7	AHU-1			AHU	AHU 100	N2	1	1	BI-7				EN-1	Mech Room 7E24	0		1-1-BI-7						
	BI-8	AHU-1			AHU	AHU 100	N2	1	1	BI-8				EN-1	Mech Room 7E24	0		1-1-BI-8						
	AI-1	AHU-1			AHU	AHU 100	N2	1	1	AI-1				EN-1	Mech Room 7E24	0		1-1-AI-1						
	AI-2	AHU-1	MA-T	Mixed Air Temp	AHU	AHU 100	N2	1	1	AI-2			AI2,AICM	EN-1	Mech Room 7E24	0		1-1-AI-2	2/18	2-Wire	TE		AHU4	
	AI-3	AHU-1	DA-T	Discharge Air Temp	AHU	AHU 100	N2	1	1	AI-3			AI3,AICM	EN-1	Mech Room 7E24	0		1-1-AI-3	2/18	2-Wire	TE		AHU4	
	AI-4	AHU-1			AHU	AHU 100	N2	1	1	AI-4				EN-1	Mech Room 7E24	0		1-1-AI-4						
	AI-5	AHU-1			AHU	AHU 100	N2	1	1	AI-5				EN-1	Mech Room 7E24	0		1-1-AI-5						
	AI-6	AHU-1	RC-1-EAT	RH COIL #1 EXH AIR TEMP	AHU	AHU 100	N2	1	1	AI-6			AI6,AICM	EN-1	Mech Room 7E24	0		1-1-AI-6	2/18	2-Wire	TE		AHU4	
	AI-7	AHU-1	RC-2-RAT	RH COIL #2 RET AIR TEMP	AHU	AHU 100	N2	1	1	AI-7			AI7,AICM	EN-1	Mech Room 7E24	0		1-1-AI-7	2/18	2-Wire	TE		AHU4	
	AI-8	AHU-1	RC-3-EAT	RH COIL #3 EXH AIR TEMP	AHU	AHU 100	N2	1	1	AI-8			AI8,AICM	EN-1	Mech Room 7E24	0		1-1-AI-8	2/18	2-Wire	TE		AHU4	

DETAIL AHU4:

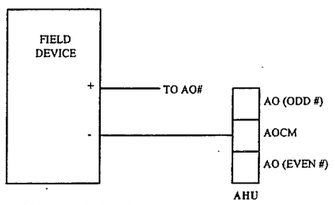
TEMPERATURE SENSOR INPUT



NOTE: IF SHIELDED CABLE IS USED SEE DETAIL A-GROUND-SHIELD FOR SHIELD TERMINATION

DETAIL AHU21:

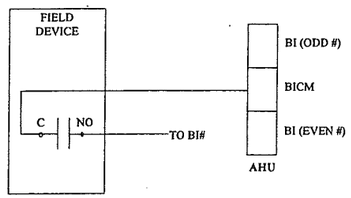
0-20 mA ANALOG OUTPUT



NOTE: IF SHIELDED CABLE IS USED SEE DETAIL A-GROUND-SHIELD FOR SHIELD TERMINATION

DETAIL AHU40:

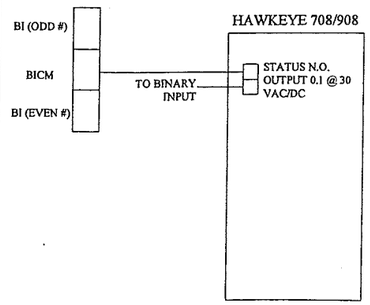
N.O. BINARY INPUT



NOTE: IF SHIELDED CABLE IS USED SEE DETAIL A-GROUND-SHIELD FOR SHIELD TERMINATION

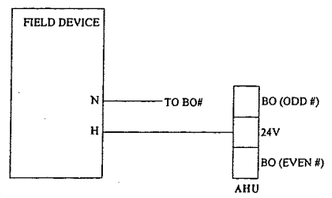
DETAIL AHU44:

HAWKEYE 708/908



DETAIL AHU50:

24VAC BINARY OUTPUT



NOTE: IF SHIELDED CABLE IS USED SEE DETAIL A-GROUND-SHIELD FOR SHIELD TERMINATION

Drawing Title

AHU-1 POINT SCHEDULE

Project Title

CITY/COUNTY JAIL RENOVATION
6TH & 7TH FLOOR
MADISON, WI. 53704

				1/1/1999	
				1/1/1999	
				1/1/1999	
REFERENCE DRAWING	NO.	REVISION-LOCATION	ECN	DATE	BY

Sales Engineer: JIM PROCKNOW | Project Manager: TERRY L. STREICH | Application Engineer: TERRY L. STREICH

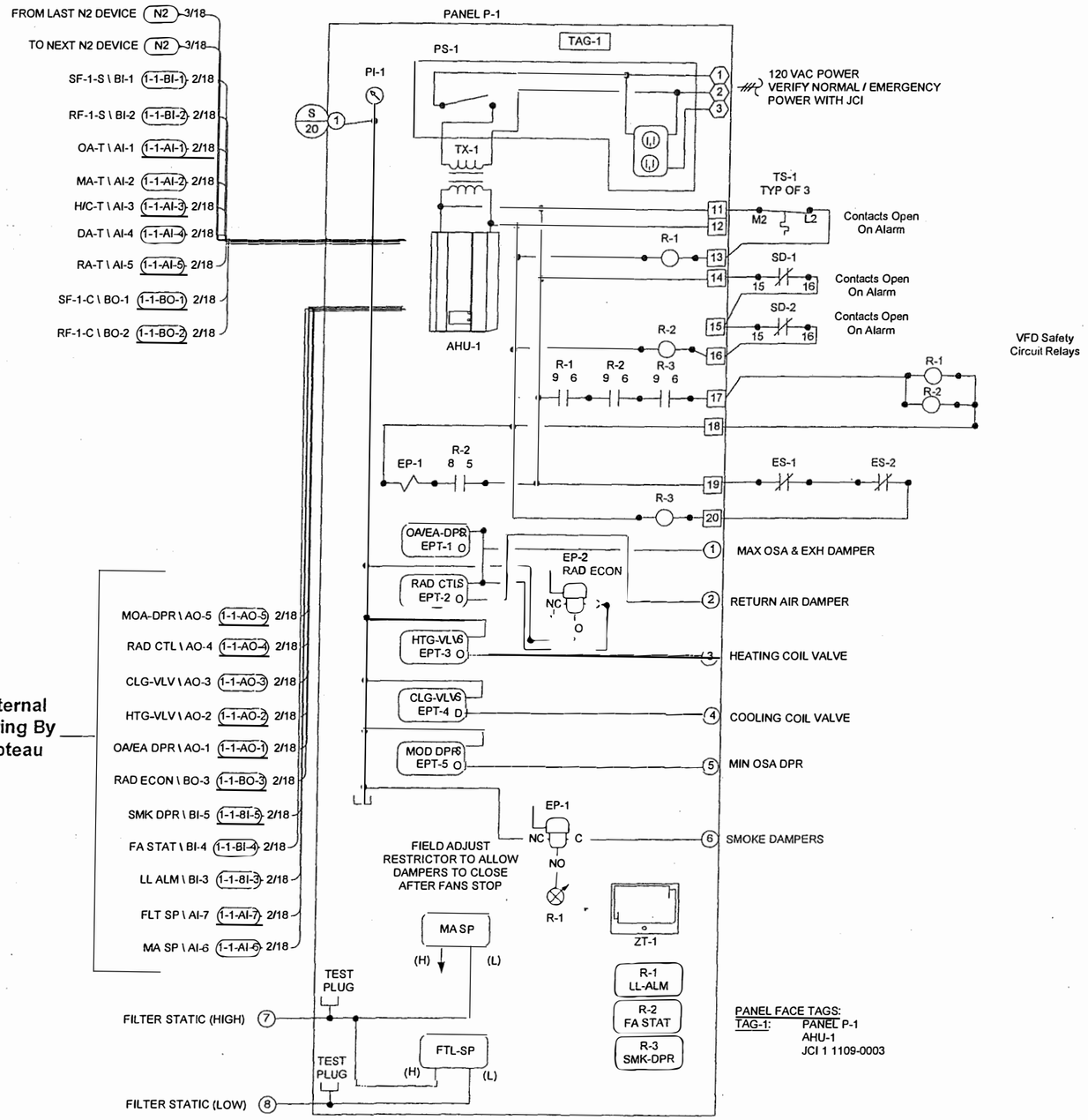
DRAWN BY | DATE 0 | APPROVED BY | DATE 0

JOHNSON CONTROLS
Systems & Services Division

Branch Information
Johnson Controls Inc.
2400 Kilgust Road
Madison
WI 53713
Phone: 1-608-222-9100
Fax: 1-608-222-9490

CONTRACT NUMBER: 0109-0043

DRAWING NUMBER: 2.3



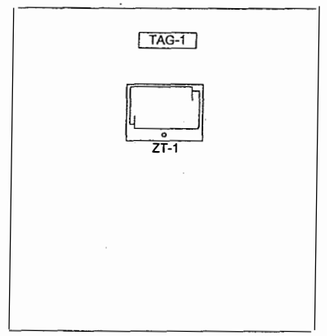
BILL OF MATERIALS

Designation	Qty	Part Number	Description
Panel Devices:			
ACC-1	3	PD-113-29	TERM BLK,MED,600V
	10	PD-113-3	TERM BLK,MED,300V
	4	PD-113-30	TERM BLK,MED,600V,END SEC
AHU-1	1	AS-AHU100-0	KIT,AHU TERMINATION MOTHERBOARD
	1	AS-AHU102-0	AHU,CONTROL LOGIC BOARD ONLY,NO TERM BD
	1	PD-AHUCVR-0	CLEAR COVER FOR AHU BOARD
EP-1,2	2	V11HGA-100	SOLENOID VLV,3W,W/OVERIDE,24 VAC
EPT-1,2,3,4,5	5	UCP-422-43	KELE TRANSDUCER, 4-20MA,3-15 PSI
FTL-SP	1	DPT2641-005B	XMTR,DIFF PR,AIR,-5 TO 5"WC,4-20MA,0.5%
MA SP	1	DPT2641-0R5B	XMTR,DIFF PR,AIR,-0.5/0.5"WC,4-20MA,0.5%
P-1	1	M-8100-3042	PANEL,STANDARD,22 UNITS
PI-1	1	G-2010-11	GAGE,2IN,0-30 PSIG,STEM
PS-1	1	PD-117-9	4" S/S COVER W/ RECEP/SW/FUSE BOX
R-1,2,3	3	PD-101-35	RLY BASE,3PDT,11PIN,10A
	3	PD-109-61	RELAY PLUG-IN 3PDT 24VAC 10A W/LED
RSTR-1	1	R-3710-2010	RESTRICTOR INLINE ADJ
TAG-1	1	M-8000-393	NAMEPLT,LAMICOID,3 LINE
TX-1	1	PD-114-2	TRANSFORMER 100VA, 120/24
ZT-1	1	AS-ZTU100-1	ZTU,ZONE TERM,DISPLAYS SYS DIAGNOSTICS
	1	AS-ZTUWMB-0	ZTU,ZONE TERM,WALL MTG BASE

Notes:

1. **Controller located in east penthouse (8th floor).**
2. **Communication with JACE 3 located on Ground floor.**

PANEL FACE



DRAWING INFORMATION	Drawing Title: AHU-1 PANEL								
NUMBER									
DATE: 02/20/01						RECORD DRWG		2/20/01	
TIME: 09:09 AM		REFERENCE DRAWING		NO.	REVISION-LOCATION		ECN	DATE	BY
	Project Title: City / County Building - 6th & 7th Floor Hvac Modifications	Sales Engineer: JE	Project Manager: TLS	Application Engineer: TLS	DRAWN: BY TLS DATE 02/20/01			APPROVED: BY DATE	
FILE NAME: ahu-1 PANEL.vsd	210 Martin Luther King Jr. Blvd Madison, Wi. 53709	JOHNSON CONTROLS Systems & Services Division			Branch Information: Johnson Controls Inc. 2400 Kilgust Road Madison, Wi. 53713 Phone: 608-222-9100 Fax: 608-222-9490			CONTRACT NUMBER: 1 1109-0003	
								DRAWING NUMBER: 2.1	

AIR HANDLER SEQUENCE

OCCUPIED MODE:

SUPPLY FAN: When indexed to the occupied mode, the supply fan (SF-C) will run continuously.

RETURN FAN: When indexed to the occupied mode, the return fan (RF-C) will run continuously. The return fan will start first. The return fan will be interlocked with the supply fan.

SUPPLY FAN CAPACITY: The supply fan speed will be manually set, at the supply fan VFD, to maintain a predetermined amount of air flow.

RETURN FAN CAPACITY: The return fan speed will be manually set, at the return fan VFD, to maintain a predetermined amount of air flow.

MIXED AIR LOW LIMIT: Whenever the mixed air temperature (MA-T) decreases below 40°F (adjustable), the mixed air low limit will override the maxinum outdoor air damper (MAX OA DPR) and exhaust air damper (EA DPR) toward the minimum position.

ECONOMIZER: Whenever the outdoor air temperature (OA-T) increases above 70°F (adjustable), the maxinum outdoor air damper(MAX OA DPR) and exhaust air damper (EA-DPR) will be overridden to the closed position with the return air damper (RA-DPR) to the open position. Solenoid air valve EP-2 will control the return air damper. The minimum outside air damper will be 100% open.

RETURN AIR DAMPER CONTROL: Mixed air static pressure controller (MA STATIC) will modulated the return air damper to maintain –0.2" wg. In the mixed air plenum.

HEATING: Heating coil discharge air sensor (H/C-T) will modulate the heating coil valve (V-1) in sequence with the maximum outside air damper and the exhaust air damper to maintain 52F discharge air temperature. The heating coil valve will be closed with outside air temperature above 60F. When heating coil discharge temperature drops below 40F, the maxinum outside air damper, minimun outside air damper and eahaust air damper will be modulated towards the closed position.

COOLING: Discharge air sensor (DA-T) will modulate the cooling coil valve (V-2) to maintain 52F discharge air temperature . The cooling coil valve (V-2) will be closed with outside air below 50F.

SMOKE DAMPERS AND FAN SHUT DOWN: The smoke dampers will be controlled by solenoid air valve (EP-1) and smoke duct detectors located in the supply air and return air. When the duct smoke detectors are in alarm, the supply fan and the return fan will stop. The smoke dampers will gradually close through restrictor (REST-1). Damper end switches ES-1 and ES-2 will not allow the supply fan and the return fan to start until the smoke dampers are proven open. The smoke dampers will be reset when the duct smoke detectors are reset. The supply fan and the return fans will also be allowed to operate when the duct smoke detectors are reset and the smoke dampers are proven open through end switch ES-1 & ES-2.

GENERAL:

SAFETY CIRCUITS: Whenever a manual reset safety device exceeds its limit, the supply fan and return fan will be shut down. Safety device by type: low limit thermostat (TS-1) and smoke detector (SD-1,2)..

CONTROLLED DEVICES: When the supply fan and return fan is off, the outside air dampers and exhaust air damper will be closed with the return air damper open, the heating coil valve will be open and the cooling coil valve will be closed.

REVISION INFORMATION	Drawing Title					1/1/99	
NUMBER	DESCRIPTION OF OPERATION					1/1/99	
DATE 2/20/2001						1/1/99	
		REFERENCE DRAWING	NO.	REVISION-LOCATION	ECN	DATE	BY
TIME 8:46 AM		Sales Engineer: Jim Easland; Project Manager: Terry Streich; Application Engineer: Terry Streich		DRAWN BY / DATE 0		APPROVED BY / DATE 0	
	Project Title: City - County Building - 6th & 7th Floor HVAC Modifications, 210 Martin Luther King Blvd., Madison, Wi. 53709	JOHNSON CONTROLS, Systems & Services Division		Branch Information: Johnson Controls Inc, 2400 Kilgust Road, Madison, Wi 53713, Phone: 1-608-222-9100, Fax: 1-608-222-9490		CONTRACT NUMBER: 1 1109-0003	
FILE NAME ehvac000.vsd						DRAWING NUMBER: 2.2	

JACE 4 Scope of Work

Control Drawings

Page 1 : Heat exchanger input/ output table.

Page 2-4 : AHU 3 located in West Penthouse serving West 6th and 7th floor.

DDC INPUT / OUTPUT SUMMARY TABLE

DFD PROJECT NO: 11X1X — **DDC CONTROLLERS PROVIDED UNDER SPECIFICATION SECTION 23 09 2x**

PROJECT: CCB JACE 4 Ht Ex

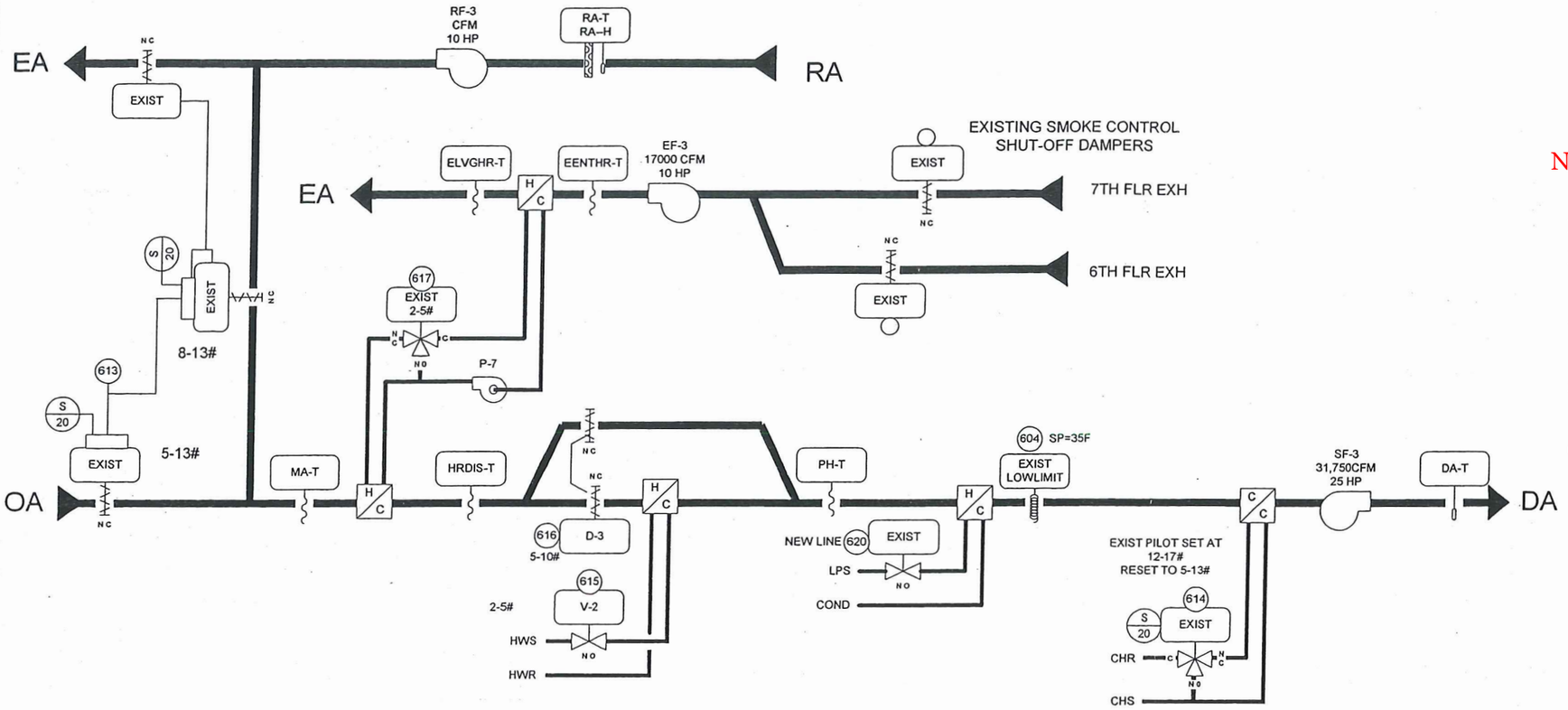
LOCATION: CCB west penthouse

SYSTEM: STEAM TO HOT WATER HEAT EXCHANGER HX-x (electrically actuated)

POINT DESCRIPTION	HARDWARE: OUTPUT / DIGITAL: Control Relay	24VAC	Contactor	2-Pos Actuator	OUTPUT / ANALOG: Tri-State Actuator	Duration Adjust Actuator	4-20 mA	0-10 VDC	INPUT / DIGITAL: Current Sensing Switch	Control Relay Contact	Switch Closure	Auxiliary Contact	Diff Pressure Switch	Flow Switch	INPUT / ANALOG: Temperature	Relative Humidity	Differential Pressure	Gauge Pressure	Static Pressure	Flow	ALARMS / DIGITAL: Equipment Status	Maintenance	Pressure	ALARMS / ANALOG: High Limit	Low Limit			SOFTWARE / ENERGY MANAGEMENT SYSTEM FUNCTIONS: Day/Night Setback	Demand Limiting	Dial-up I/O	Duty Cycling	Optimum Start/Stop	Scheduled Start/Stop	Totalization	Trend		Equipment Integration	Fire Alarm Integration	Security/Access Integration	Elect PQM Integration	Chiller Integration	Dry-bulb Economizer	HW/OA Reset	CHW Reset	Smoke Control	Fire Alarm Override	Comments
HOT WATER																																												
Outside Air Temperature															X																			X						X				Globally shared point.
Hot Water Pump 1 S/S	X																																										
Hot Water Pump 1 Status									X												X												X	X									
Hot Water Pump 2 S/S	X																																										
Hot Water Pump 2 Status									X												X												X	X									
HW Supply Temp															X									X	X									X						X				
HW Return Temp															X																			X										
Hot Water Pump 3S/S	X																																										
Hot Water Pump 3 Status									X												X												X	X									
Hw Heat Exch Valve								X																										X										
Hot Water Pump 4S/S	X																																										
Hot Water Pump 4 Status									X												X												X	X									

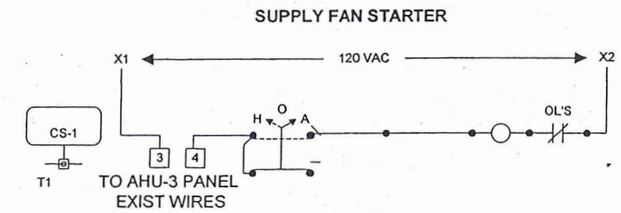
BILL OF MATERIALS

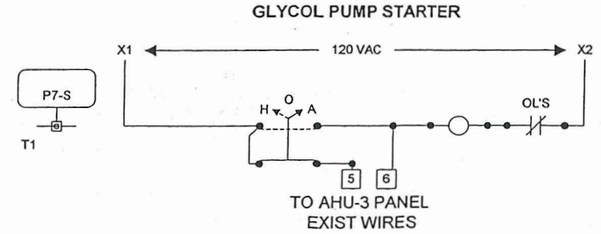
Designation	Qty	Part Number	Description
Field Devices:			
CS-1, X-S	4	H-708	SW,CURRENT,1-135A,ADJ,SOLID,W/LED
DA-T	1	TE-6311P-1	SENSOR,T-NI,0.1%,8IN DUCT
RA-H, RA-T	1	HE-6310-2	XMTR,RH/T-Ni,DUCT,AC/DC
X-T	20	TE-6001-8	CLIP F/AVG ELEM (10/PKG)
	5	TE-6316P-1	SENSOR,T-NI,0.1%,17FT AVG

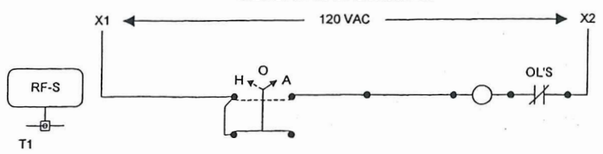


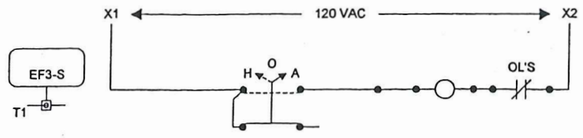
Notes:

1. Panel located in west penthouse (8th floor).
2. Communicates with JACE 4 located in same room.
3. JACE 4 currently FX-60 and is to be replaced with N4 compatible device.
4. Existing Alerton trunks on FX-60 must remain functional.
5. I/O device and associated sensors/ hardware for sequence replication must be provided.
6. Damper and valve actuators to remain.



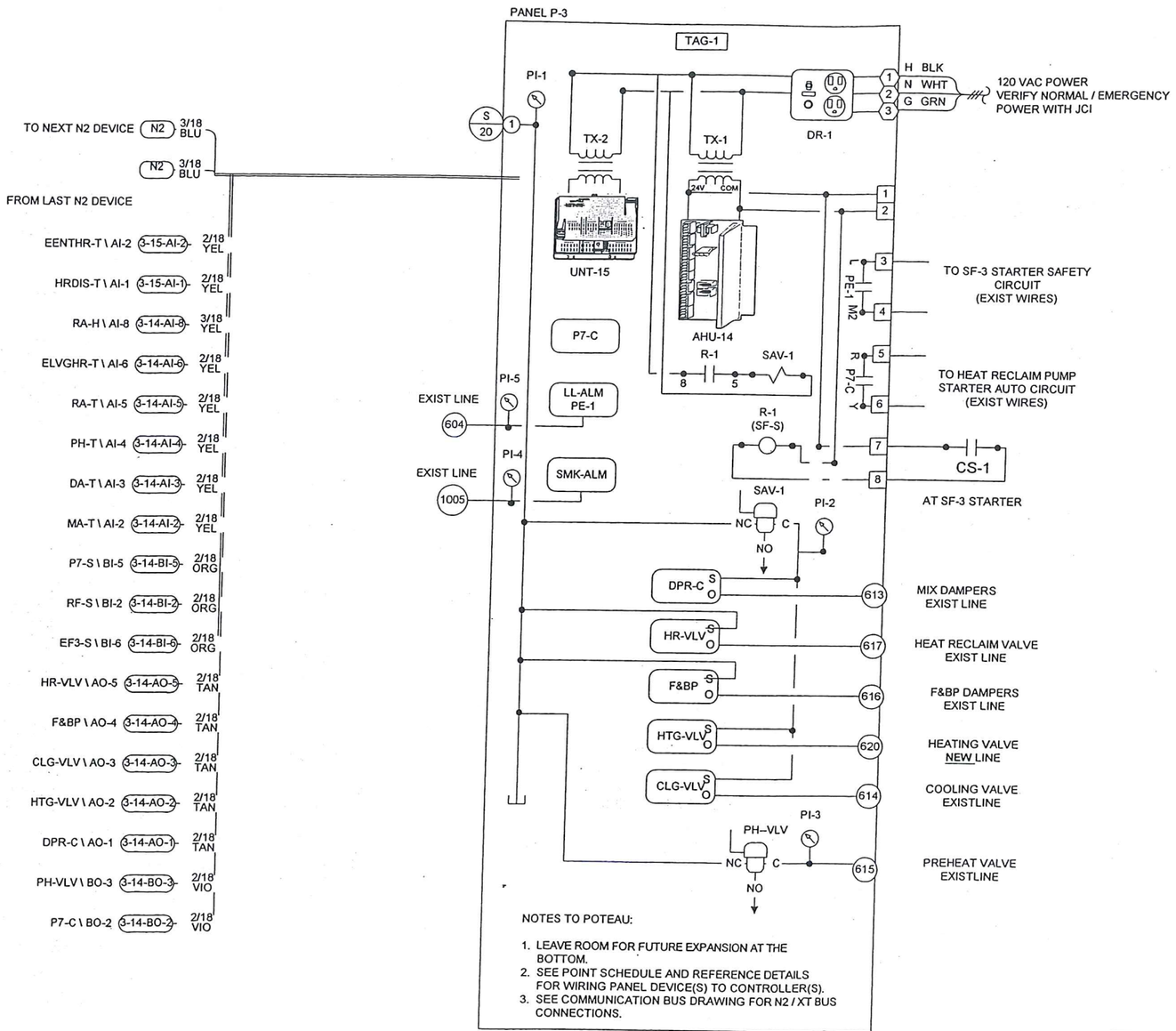






NOTE:
REMOVE ALL EXISTING
PNEUMATIC
TRANSMITTERS

REVISION INFORMATION	Drawing Title									
NUMBER	AHU-3 FLOW									
DATE 01/22/01		REFERENCE DRAWING		NO.	REVISION-LOCATION		ECN	DATE	BY	
TIME 04:00 PM		Sales Engineer: JE	Project Manager: TLS	Application Engineer: MJM	DRAWN BY	DRAWN DATE	APPROVED BY	APPROVED DATE		
FILE NAME ahu-3f.vsd	Project Title: CITY/COUNTY BLDG- WEST PENTHOUSE METASYS CONVERSION MADISON, WI	JOHNSON CONTROLS Systems & Services Division	Branch Information: Johnson Controls, Inc. 2400 Kilgust Road Madison WI 53713-4842 Phone: (608) 222-9100 Fax: (608) 222-9490	CONTRACT NUMBER: 1 1109-0016	DRAWING NUMBER: 6.1					



PANEL FACE TAGS:
TAG-1: PANEL P-3
AHU-3
JCI 1 1109-0016

BILL OF MATERIALS

Designation	Qty	Part Number	Description
Panel Devices:			
AHU-14	1	AS-AHU100-0	KIT,AHU TERMINATION MOTHERBOARD
	1	AS-AHU102-0	AHU,CONTROL LOGIC BOARD ONLY,NO TERM BD
	1	PD-AHUCVR-0	CLEAR COVER FOR AHU BOARD
DPR-C, X-VLV, F&BP	5	UCP-422-43	OUTPUT TRANSDUCER - KELE
DR-1	1	PD-117-9	4" S/S COVER W/ RECEP/SW/FUSE BOX
P-3	1	M-8100-3042	PANEL,STANDARD,22 UNITS
PE-1	1	P67AA-1C	LOW PRESS CNTRL,2NO,1.5-20#DIF
PI-x	5	G-2010-11	GAGE,2IN,0-30 PSIG,STEM
R-1, P7-C	2	KUP14A35-24	3PDT 24VAC 10A W/LED PLUG
	2	SR3B-05	11 PIN BLADE RELAY BASE
SAV-1, PH-VLV	2	V11HGA-100	SOLENOID VLV,3W,W/OVERIDE,24 VAC
SMK-ALM	1	P10BC-7C	LOW PRESS CNTRL,SPDT,3-20PSIG,BARB FIT
TAG-1	1	M-8000-393	NAMEPLT,LAMICOID,3 LINE
TX-x	2	PD-114-2	TRANSFORMER 100VA, 120/24
UNT-15	1	AS-UNT141-1	CNTRLR,DIG,UNT,6AI,4BI,6BO,2AO,SCR

NOTE:
REMOVE EXISTING
CONTROL PANELS AND
JCI DSC CONTROLLERS

REVISION INFORMATION	Drawing Title							
NUMBER	AHU-3 PANEL							
DATE 01/22/01		REFERENCE DRAWING	NO.	REVISION-LOCATION		ECN	DATE	BY
TIME 04:46 PM		Sales Engineer JE / Project Manager TLS / Application Engineer MJM	DRAWN BY MJM DATE	APPROVED BY DATE				
FILE NAME ahu-3p.vsd	Project Title: CITY/COUNTY BLDG-WEST PENTHOUSE METASYS CONVERSION MADISON, WI	JOHNSON CONTROLS Systems & Services Division	Branch Information: Johnson Controls, Inc. 2400 Kilgust Road Madison WI 53713-4842 Phone: (608) 222-9100 Fax: (608) 222-9490	CONTRACT NUMBER 1 1109-0016	DRAWING NUMBER 6.2			

The supply and return fans are started manually by the on-off switch on the starter and run continuously. The return fan is interlocked with the supply fan.

Whenever the enthalpy of the outside air is greater than the enthalpy of the return air, the outside air dampers will go to their minimum position as indexed by the Metasys system. When the return air has greater enthalpy, the outside air dampers will be allowed to be modulated to maintain the desired mixed air temperature.

The heat reclaim valve is modulated to maintain 35F leaving the exhaust reclaim coil (ELVGHR-T). The pump is started through the Metasys system.

The preheat coil valve is open below 35F outside air temperature (Adj.). The face an bypass dampers are modulated to maintain the desired leaving air temperature. (PH-T).

The heating valve and cooling valve are modulated to maintain the desired discharge air temperature. The cooling valve will be closed below 55F outside air temperature and the heating valve closed above 55F outside air temperature (Adj.)

Low limit will stop the supply fan whenever the temperature of the air leaving the heating coil drops below 35F.

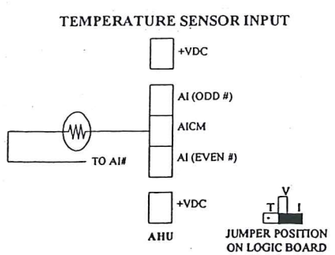
On a signal from the smoke control system through SMK-ALM pe in the panel, the outside air and exhaust dampers will open 100% and the return air dampers will close. The shutoff dampers in the exhaust air duct from the 6th and 7th floors are interlocked with the fire alarm system. The dampers will close on the floor where there is no fire alarm and remain open on the floor that has the fire alarm.

Whenever the supply fan is off, the outside air and exhaust dampers are closed, the return air damper is open, the heating valve is open and the cooling valve is closed.

REVISION INFORMATION	Drawing Title									
NUMBER	AHU-3 SEQUENCE									
		REFERENCE DRAWING		NO.	REVISION-LOCATION		ECN	DATE	BY
DATE 01/22/01		Sales Engineer JE	Project Manager TLS	Application Engineer MJM	DRAWN BY MJM	DATE	APPROVED BY	DATE	
TIME 10:45 PM	Project Title	JOHNSON CONTROLS			Branch Information		CONTRACT NUMBER		
	CITY/COUNTY BLDG- WEST PENTHOUSE METASYS CONVERSION MADISON, WI	Systems & Services Division			Johnson Controls, Inc. 2400 Kilgust Road Madison WI 53713-4842 Phone: (608) 222-9100 Fax: (608) 222-9490		1 1109-0016		
FILE NAME ahu-3 seq.vsd							DRAWING NUMBER 6.3		

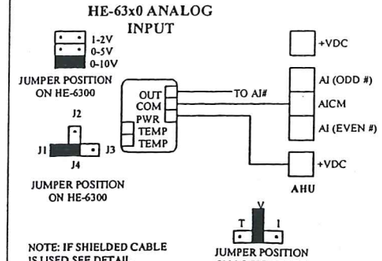
Electrician/Fitter		Point Information			Controller Information						Panel Information					Field Device					
Tag	Point Type	System Name	Object Name	Expanded ID	Controller Type	NCM Addr.	Trunk Addr.	Cable Destination Bay/Terminal	Module Type	Termination Out	Panel	Panel Location	Slot Number	Reference Drawing	Cable Number	Wiring /Tubing	Termination In	Device	Location	Ref Detail Shape	Comment
		AHU-3			AHU	1	14				P-3	WEST PENTHOUSE	0								N2 Trunk
	BO-1	AHU-3			AHU	1	14	BO-1			P-3	WEST PENTHOUSE	0		3-14-BO-1						
	BO-2	AHU-3	P7-C	Reclaim Pump Control	AHU	1	14	BO-2		BO2,24V	P-3	WEST PENTHOUSE	0		3-14-BO-2	2/18	A,B	24VAC OUT Relay	Panel	AHU50	
	BO-3	AHU-3	PH-VLV	Preheat Valve	AHU	1	14	BO-3		BO3,24V	P-3	WEST PENTHOUSE	0		3-14-BO-3	2/18	2-Wire	SAV-24VAC	Panel	AHU50	
	BO-4	AHU-3			AHU	1	14	BO-4			P-3	WEST PENTHOUSE	0		3-14-BO-4						
	BO-5	AHU-3			AHU	1	14	BO-5			P-3	WEST PENTHOUSE	0		3-14-BO-5						
	BO-6	AHU-3			AHU	1	14	BO-6			P-3	WEST PENTHOUSE	0		3-14-BO-6						
	BO-7	AHU-3			AHU	1	14	BO-7			P-3	WEST PENTHOUSE	0		3-14-BO-7						
	BO-8	AHU-3			AHU	1	14	BO-8			P-3	WEST PENTHOUSE	0		3-14-BO-8						
	BO-9	AHU-3			AHU	1	14	BO-9			P-3	WEST PENTHOUSE	0		3-14-BO-9						
	BO-10	AHU-3			AHU	1	14	BO-10			P-3	WEST PENTHOUSE	0		3-14-BO-10						
	AO-1	AHU-3	DPR-C	Damper Command	AHU	1	14	AO-1		AO1,AOCOM	P-3	WEST PENTHOUSE	0		3-14-AO-1	2/18	+,-	0-20mA OUT UCP	Panel	AHU21	
	AO-2	AHU-3	HTG-VLV	Heating Valve	AHU	1	14	AO-2		AO2,AOCOM	P-3	WEST PENTHOUSE	0		3-14-AO-2	2/18	+,-	0-20mA OUT UCP	Panel	AHU21	
	AO-3	AHU-3	CLG-VLV	Cooling Valve	AHU	1	14	AO-3		AO3,AOCOM	P-3	WEST PENTHOUSE	0		3-14-AO-3	2/18	+,-	0-20mA OUT UCP	Panel	AHU21	
	AO-4	AHU-3	F&BP	Face and Bypass Dampers	AHU	1	14	AO-4		AO4,AOCOM	P-3	WEST PENTHOUSE	0		3-14-AO-4	2/18	+,-	0-20mA OUT UCP	Panel	AHU21	
	AO-5	AHU-3	HR-VLV	Heat Recovery Valve	AHU	1	14	AO-5		AO5,AOCOM	P-3	WEST PENTHOUSE	0		3-14-AO-5	2/18	+,-	0-20mA OUT UCP	Panel	AHU21	
	AO-6	AHU-3			AHU	1	14	AO-6			P-3	WEST PENTHOUSE	0		3-14-AO-6						
	BI-1	AHU-3	SF-S	Supply Airflow	AHU	1	14	BI-1		BI1,BICOM	P-3	WEST PENTHOUSE	0		3-14-BI-1	2/18	7,4	Contact (NO) Relay	Panel	AHU40	
	BI-2	AHU-3	RF-S	Return Fan Status	AHU	1	14	BI-2		BI2,BICOM	P-3	WEST PENTHOUSE	0		3-14-BI-2	2/18	N.O. Status Output	Hawkeye 708/908 w	At Starter	AHU44	
	BI-3	AHU-3	LL-ALM	Low Limit Alarm	AHU	1	14	BI-3		BI3,BICOM	P-3	WEST PENTHOUSE	0		3-14-BI-3	2/18	L,M1	Contact (NO) PE	Panel	AHU40	
	BI-4	AHU-3	SMK-ALM	Smoke Alarm	AHU	1	14	BI-4		BI4,BICOM	P-3	WEST PENTHOUSE	0		3-14-BI-4	2/18	Y,R	P10 (NO)	Panel	AHU40	
	BI-5	AHU-3	P7-S	Reclaim Pump Status	AHU	1	14	BI-5		BI5,BICOM	P-3	WEST PENTHOUSE	0		3-14-BI-5	2/18	N.O. Status Output	Hawkeye 708/908 w	At Starter	AHU44	
	BI-6	AHU-3	EF3-S	Exhaust Fan Status	AHU	1	14	BI-6		BI6,BICOM	P-3	WEST PENTHOUSE	0		3-14-BI-6	2/18	N.O. Status Output	Hawkeye 708/908 w	At Starter	AHU44	
	BI-7	AHU-3			AHU	1	14	BI-7			P-3	WEST PENTHOUSE	0		3-14-BI-7						
	BI-8	AHU-3			AHU	1	14	BI-8			P-3	WEST PENTHOUSE	0		3-14-BI-8						
	AI-1	AHU-3	OA-T	Outdoor Air Temp	AHU	1	14	AI-1			P-3	WEST PENTHOUSE	0		3-14-AI-1			GLOBAL POINT			GLOBAL POINT
	AI-2	AHU-3	MA-T	Mixed Air Temp	AHU	1	14	AI-2		AI2,AICM	P-3	WEST PENTHOUSE	0		3-14-AI-2	2/18	2-Wire	TE	At Unit	AHU4	
	AI-3	AHU-3	DA-T	Disch Air Temp	AHU	1	14	AI-3		AI3,AICM	P-3	WEST PENTHOUSE	0		3-14-AI-3	2/18	2-Wire	TE	At Unit	AHU4	
	AI-4	AHU-3	PH-T	Preheat Lvg Air Temp	AHU	1	14	AI-4		AI4,AICM	P-3	WEST PENTHOUSE	0		3-14-AI-4	2/18	2-Wire	TE	At Unit	AHU4	
	AI-5	AHU-3	RA-T	Return Air Temp	AHU	1	14	AI-5		AI5,AICOM	P-3	WEST PENTHOUSE	0		3-14-AI-5	2/18	TEMP,TEMP	HE-63X0-TE	At Unit	AHU13	
	AI-6	AHU-3	ELVGHR-T	Exh Lving Rclm Air Temp	AHU	1	14	AI-6		AI6,AICM	P-3	WEST PENTHOUSE	0		3-14-AI-6	2/18	2-Wire	TE	At Unit	AHU4	
	AI-7	AHU-3	OA-H	OA Rel Humid	AHU	1	14	AI-7			P-3	WEST PENTHOUSE	0		3-14-AI-7			GLOBAL POINT			GLOBAL POINT
	AI-8	AHU-3	RA-H	Return Rel Humid	AHU	1	14	AI-8		AI8,AICOM,+VDC	P-3	WEST PENTHOUSE	0		3-14-AI-8	3/18	OUT,COM,PWR	HE-63X0-HE	At Unit	AHU13	
		AHU-3			UNT	1	15				P-3	WEST PENTHOUSE	0								N2 Trunk
	AI-1	AHU-3	HRDIS-T	Heat Recovery Disch Temp	UNT	1	15	AI-1		AI1,AICM	P-3	WEST PENTHOUSE	0		3-15-AI-1	2/18	2-Wire	TE	At Unit	UV1	
	AI-2	AHU-3	EENTHR-T	Air Enter Exh Heat Reclm	UNT	1	15	AI-2		AI2,AICM	P-3	WEST PENTHOUSE	0		3-15-AI-2	2/18	2-Wire	TE	At Unit	UV1	
	AI-3	AHU-3			UNT	1	15	AI-3			P-3	WEST PENTHOUSE	0		3-15-AI-3						
	AI-4	AHU-3			UNT	1	15	AI-4			P-3	WEST PENTHOUSE	0		3-15-AI-4						
	AI-5	AHU-3			UNT	1	15	AI-5			P-3	WEST PENTHOUSE	0		3-15-AI-5						
	AI-6	AHU-3			UNT	1	15	AI-6			P-3	WEST PENTHOUSE	0		3-15-AI-6						
	BI-1	AHU-3			UNT	1	15	BI-1			P-3	WEST PENTHOUSE	0		3-15-BI-1						
	BI-2	AHU-3			UNT	1	15	BI-2			P-3	WEST PENTHOUSE	0		3-15-BI-2						
	BI-3	AHU-3			UNT	1	15	BI-3			P-3	WEST PENTHOUSE	0		3-15-BI-3						
	BI-4	AHU-3			UNT	1	15	BI-4			P-3	WEST PENTHOUSE	0		3-15-BI-4						
	BO-1	AHU-3			UNT	1	15	BO-1			P-3	WEST PENTHOUSE	0		3-15-BO-1						
	BO-2	AHU-3			UNT	1	15	BO-2			P-3	WEST PENTHOUSE	0		3-15-BO-2						
	BO-3	AHU-3			UNT	1	15	BO-3			P-3	WEST PENTHOUSE	0		3-15-BO-3						
	BO-4	AHU-3			UNT	1	15	BO-4			P-3	WEST PENTHOUSE	0		3-15-BO-4						
	BO-5	AHU-3			UNT	1	15	BO-5			P-3	WEST PENTHOUSE	0		3-15-BO-5						
	BO-6	AHU-3			UNT	1	15	BO-6			P-3	WEST PENTHOUSE	0		3-15-BO-6						
	AO-1	AHU-3			UNT	1	15	AO-1			P-3	WEST PENTHOUSE	0		3-15-AO-1						
	AO-2	AHU-3			UNT	1	15	AO-2			P-3	WEST PENTHOUSE	0		3-15-AO-2						

DETAIL AHU4:



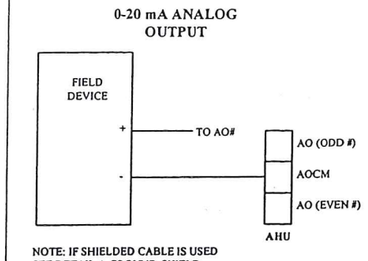
NOTE: IF SHIELDED CABLE IS USED SEE DETAIL A-GROUND-SHIELD FOR SHIELD TERMINATION

DETAIL AHU13:



NOTE: IF SHIELDED CABLE IS USED SEE DETAIL A-GROUND-SHIELD FOR SHIELD TERMINATION.

DETAIL AHU21:

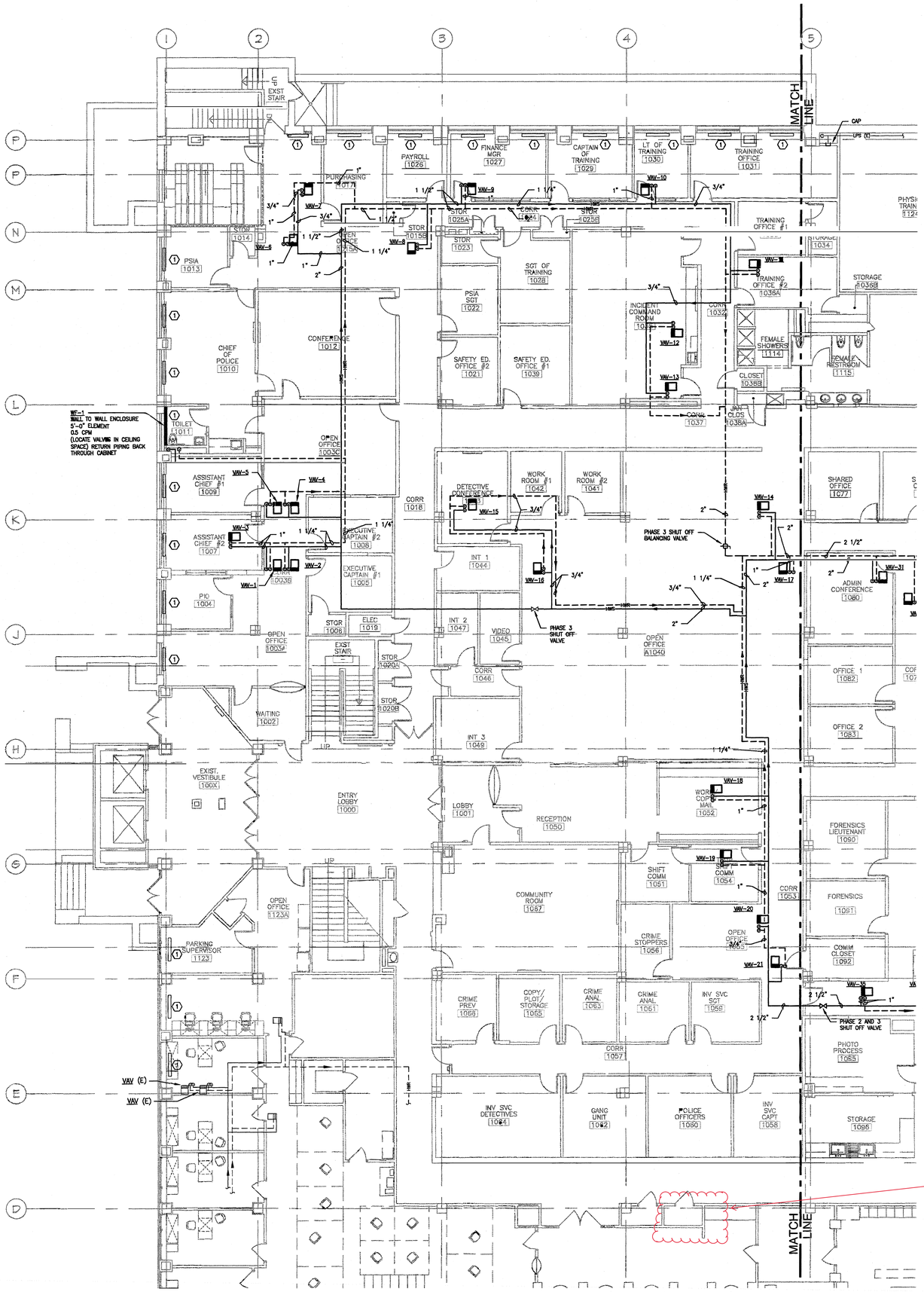


NOTE: IF SHIELDED CABLE IS USED SEE DETAIL A-GROUND-SHIELD FOR SHIELD TERMINATION

REVISION INFORMATION	Drawing Title									
NUMBER	AHU-3 POINTS									
DATE 01/18/01		REFERENCE DRAWING		NO.	REVISION-LOCATION		ECN	DATE	BY	
TIME 10:57 AM		Sales Engineer JE	Project Manager TLS	Application Engineer MJM	DRAWN BY MJM DATE	APPROVED BY DATE				
	Project Title	JOHNSON CONTROLS			Branch Information		CONTRACT NUMBER			
FILE NAME AHU-3 POINTS.vsd	CITY/COUNTY BLDG- WEST PENTHOUSE METASYS CONVERSION MADISON, WI	Systems & Services Division			Johnson Controls, Inc. 2400 Kilgust Road Madison WI 53713-4842 Phone: (608) 222-9100 Fax: (608) 222-9490		1 1109-0016			
							DRAWING NUMBER 6.4			

Alternate Bid #1 Scope of Work

Pages 1-2 : Floorplan of VAV and mechanical location.



Notes;

1. All ceilings are 2X2 lay in tiles so access throughout is not restricted. Certain office areas may need special scheduling considerations due to sensitive materials.

2 VAV sequence and control points can match second floor work. Seven zones will have perimeter convector control in addition to the reheat coil.

GENERAL NOTE:

1. CONTRACTOR SHALL FIELD VERIFY ALL EXISTING CONDITIONS BEFORE COMMENCING WORK. REPORT ANY DISCREPANCIES TO THE A/E IMMEDIATELY.
2. THE BUILDING IS TO REMAIN OCCUPIED DURING CONSTRUCTION AND THE AIR HANDLER SERVICING THIS AREA WILL CONTINUE TO OPERATE. SUPPLY AND RETURN AIR DUCTWORK SHALL BE PROTECTED FROM THE ENTRANCE OF CONSTRUCTION DUST, DIRT AND DEBRIS. INSTALL TEMPORARY MERV 7 FILTERS ON RETURN AIR OPENINGS DURING CONSTRUCTION. CHANGE FILTER FREQUENTLY (MINIMUM ONCE PER WEEK). SEE ARCHITECTURAL PLANS FOR PHASING SCHEDULE AND AREAS.
3. COORDINATE ALL INTERRUPTIONS WITH OWNERS REPRESENTATIVE PRIOR TO STARTING WORK.
4. ALL DUCTWORK, PIPING, EQUIPMENT, ETC. NOTED FOR DEMOLITION SHALL BE REMOVED COMPLETE.
5. ALL EXISTING ABANDONED DUCTWORK, PIPING, EQUIPMENT, ETC IN THE CEILING SHALL BE REMOVED COMPLETE.
6. PIPING NOTED FOR DEMOLITION SHALL BE REMOVED BACK TO THE POINT REQUIRED TO REMAIN ACTIVE AND CAPPED.
7. ANY DUCTWORK CONNECTIONS NOT TO BE REUSED SHALL BE SHEETMETAL PATCHED, SEALED AND INSULATED.
8. ALL EXISTING TO REMAIN GRILLES, REGISTERS, DIFFUSERS, CONVECTORS, ETC. SHALL BE PROTECTED DURING CONSTRUCTION.
9. SEE REFLECTED CEILING PLANS FOR AREAS WHERE EXISTING CEILINGS WILL BE REMOVED BY THE GC AND NEW CEILING WILL BE INSTALLED (BY GC). THE HC IS RESPONSIBLE FOR REMOVAL AND REINSTALLATION OF ALL OTHER CEILING REQUIRED TO PERFORM HVAC WORK.
10. PROVIDE PLENUM ON TOP OF FOR RETURN GRILLE FOR DUCT CONNECTIONS.
11. ALL EXISTING DUCTWORK IS TO BE CLEANED (REFER TO SPECIFICATION SECTION 15890B).
12. ALL BRANCH PIPING TO BE 3/4" UNLESS OTHERWISE INDICATED.

KEYED NOTES:

(1) EXISTING STEAM CONVECTOR AND TCV TO REMAIN.

Current JACE location. This controller will be left functional to serve areas outside the scope of this project. Comm trunk for VAV's within scope shall be removed from this device and run to new JACE in GR24 ENC5.

1 M103 PARTIAL GROUND FLOOR PLAN – HVAC PIPING
SCALE: 1/8"=1'-0"

PROJECT NORTH TRUE NORTH

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Consultants:

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JDR Project No. 070080

Notes:

KEY PLAN

Date	Issuance/Revisions	Symbol
03/28/08	Bid Set	
02/28/08	Dept. of Commerce Review Set	
01/21/08	Design Development Review Set	
11/15/07	Owner Review Meeting	

CENTRAL DISTRICT POLICE STATION

CITY OF MADISON

MADISON, WISCONSIN

Drawing Title:

PARTIAL GROUND FLOOR PLAN - HVAC PIPING

PL Project Number: 2006.15.03

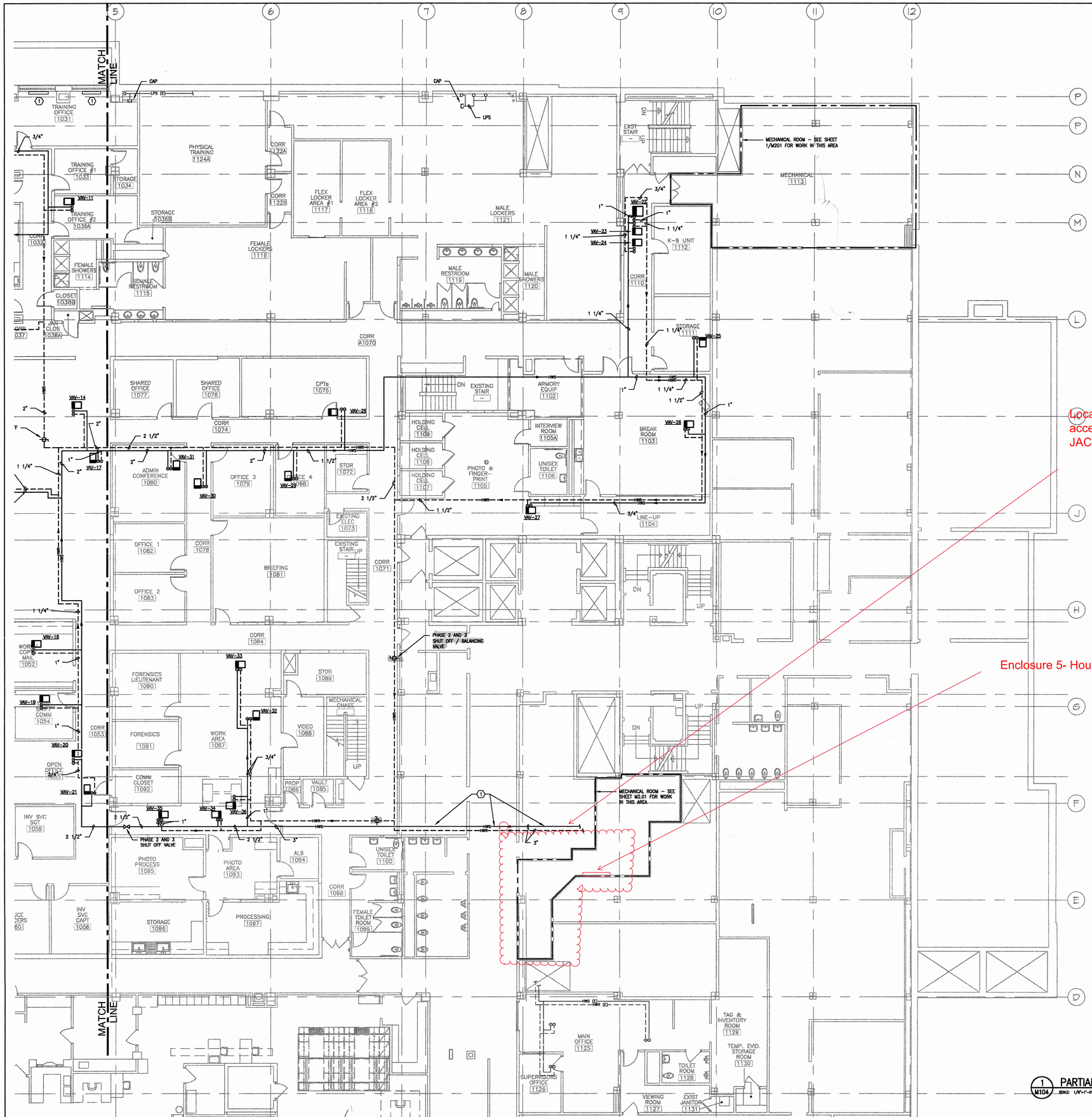
Drawn By: JDR

Drawing No. M103

Page 2

Location of room GR 24. If Alternate Bid 1 is accepted JACE will be located in ENC 5 in place of JACE 2 that will be moved to second floor.

Enclosure 5- Houses Jace 2,3 and 8 currently



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KEYED NOTES:

(1) HC TO REMOVE AND REINSTALL CEILING AS REQUIRED FOR INSTALLATION OF NEW PIPING.

1 M104 PARTIAL GROUND FLOOR PLAN – HVAC PIPING
SCALE: 1/8"=1'-0"

PROJECT NORTH
TRUE NORTH

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Drawing Title:
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PJ Project Number: 2006.15.03
Drawn By: JDR
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