

PROJECT MANUAL FOR: AIR HANDLER BAS UPGRADES IN CCA AND UMTH

PROJECT NUMBER: CP210353

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END OF SECTION

SECTION 1.A

BID FOR LUMP SUM CONTRACT

Date: _____

BID OF _____
(hereinafter called "Bidder") a corporation* organized and existing under laws of the State of _____

_____ ,
a partnership* consisting of _____ ,
an individual* trading as _____ ,
a joint venture* consisting of _____

*Insert Corporation(s), partnership or individual, as applicable.

TO: Curators of the University of Missouri
c/o Associate Vice Chancellor - Facilities
Room L100, General Services Building
University of Missouri
Columbia, Missouri 65211

- 1. Bidder, in compliance with invitation for bids for construction work in accordance with Drawings and Specifications prepared by IMEG, entitled "Air Handler BAS Upgrades in CCA and UMTH", project number CP210353, dated May 13, 2021 having examined Contract Documents and site of proposed work, and being familiar with all conditions pertaining to construction of proposed project, including availability of materials and labor, hereby proposes to furnish all labor, materials and supplies to construct project in accordance with Contract Documents, within time set forth herein at prices stated below. Prices shall cover all expenses, including taxes not covered by the University of Missouri's tax exemption status, incurred in performing work required under Contract documents, of which this Bid is a part.

Bidder acknowledges receipt of following addenda:

Addendum No. _____ Dated _____
Addendum No. _____ Dated _____
Addendum No. _____ Dated _____

- 2. In following Bid(s), amount(s) shall be written in both words and figures. In case of discrepancy between words and figures, words shall govern.

3. **BID PRICING**

- a. Base Bid: Project consists of replacing existing outdated DX-9100 controllers located in Critical Care Addition at the University of Missouri Teaching Hospital.

The Bidder agrees to furnish all labor, materials, tools, and equipment required to complete the project; all as indicated on the Drawings and described in these Specifications for sum of:

_____ DOLLARS (\$_____).

- b. Additive Alternate Bids:

Above Base Bid may be changed in accordance with following Alternate Bids as Owner may elect. Alternates are as described in Section 1.H of Project Manual. Alternates are written in a priority order, but Owner is not required to accept or reject in order listed. This is a one (1)

contract project, therefore, Alternates shall be studied by each Bidder to determine effect on Bids of Contractor and each Subcontractor and/or Material supplier.

(1) Additive Alternate No. 1: Add new control points and devices to various AHUs as noted on the drawings. All for sum of:

_____ DOLLARS (\$_____).

(2) Additive Alternate No. 2: Replace pneumatic outputs on CCA AHU-1 with new electronic outputs and actuators as noted on the drawings. All for sum of:

_____ DOLLARS (\$_____)

4. PROJECT COMPLETION

- a. Contract Period - Contract period begins on the day the Contractor receives unsigned Contract, Performance Bond, Payment Bond, and "Instructions for Execution of Contract, Bonds, and Insurance Certificates." Bidder agrees to complete project within one hundred fifty 150 calendar days from receipt of aforementioned documents. Fifteen (15) calendar days have been allocated in construction schedule for receiving aforementioned documents from Bidder.
- b. Commencement - Contractor agrees to commence work on this project after the "Notice to Proceed" is issued by the Owner. "Notice to Proceed" will be issued within seven (7) calendar days after Owner receives properly prepared and executed Contract documents listed in paragraph 4.a. above.
- c. Special scheduling requirements: Work shall be completed and billed prior to December 31, 2021. See special conditions for more details.

6. SUPPLIER DIVERSITY PARTICIPATION GOALS

- a. The Contractor shall have as a combined goal, subcontracting with Minority Business Enterprise (MBE), Women Business Enterprise (WBE), Disadvantage Business Enterprise (DBE), and/or Veteran Owned Business (VOB) of TEN PERCENT (10%); and with Service Disabled Veteran Owned Business (SDVE) of THREE PERCENT (3%) of awarded contract price for work to be performed.
- b. Requests for waiver of this goal shall be submitted on the attached Application For Waiver form. A determination by the Director of Facilities Planning & Development, UM, that a good faith effort has not been made by Contractor to achieve above stated goal may result in rejection of bid.
- c. The Undersigned proposes to perform work with following Supplier Diversity participation level:

**MBE, WBE, DBE AND VOB PERCENTAGE PARTICIPATION: _____percent (%)
(PREBID ADD 002 - 06/11/2021)**

SDVE PERCENTAGE PARTICIPATION: _____percent (%)
- d. A Supplier Diversity Compliance Evaluation form shall be submitted with this bid for each diverse subcontractor to be used on this project.

7. BIDDER'S ACKNOWLEDGMENTS

- a. Bidder declares that he has had an opportunity to examine the site of the work and he has

examined Contract Documents; therefore, that he has carefully prepared his bid upon the basis thereof; that he has carefully examined and checked bid, materials, equipment and labor required thereunder, cost thereof, and his figures, therefore. Bidder hereby states that amount, or amounts, set forth in bid is, or are, correct and that no mistake or error has occurred in bid or in Bidder's computations upon which this bid is based. Bidder agrees that he will make no claim for reformation, modifications, revisions or correction of bid after scheduled closing time for receipt of bids.

- b. Bidder agrees that bid shall not be withdrawn for a period of Sixty (60) days after scheduled closing time for receipt of bids.
- c. Bidder understands that Owner reserves right to reject any or all bids and to waive any informalities in bidding.
- d. Accompanying the bid is a bid bond, or a certified check, or an irrevocable letter of credit, or a cashier's check payable without condition to "The Curators of the University of Missouri" which is an amount at least equal to five percent (5%) of amount of largest possible total bid herein submitted, including consideration of Alternates.
- e. Accompanying the bid is a Bidder's Statement of Qualifications. Failure of Bidder to submit the Bidder's Statement of Qualifications with the bid may cause the bid to be rejected. Owner does not maintain Bidder's Statements of Qualifications on file.
- f. It is understood and agreed that bid security of two (2) lowest and responsive Bidders will be retained until Contract has been executed and an acceptable Performance Bond and Payment Bond has been furnished. It is understood and agreed that if the bid is accepted and the undersigned fails to execute the Contract and furnish acceptable Performance/Payment Bond as required by Contract Documents, accompanying bid security will be realized upon or retained by Owner. Otherwise, the bid security will be returned to the undersigned.

8. BIDDER'S CERTIFICATE

Bidder hereby certifies:

- a. His bid is genuine and is not made in interest of or on behalf of any undisclosed person, firm or corporation, and is not submitted in conformity with any agreement or rules of any group, association or corporation.
- b. He has not directly or indirectly induced or solicited any other bidder to put in a false or sham bid.
- c. He has not solicited or induced any person, firm or corporation to refrain from bidding.
- d. He has not sought by collusion or otherwise to obtain for himself any advantage over any other Bidder or over Owner.
- e. He will not discriminate against any employee or applicant for employment because of race, color, religion, sex or national origin in connection with performance of work.
- f. By virtue of policy of the Board of Curators, and by virtue of statutory authority, a preference will be given to materials, products, supplies, provisions and all other articles produced, manufactured, mined or grown within the State of Missouri. By virtue of policy of the Board of Curators, preference will also be given to all Missouri firms, corporations, or individuals, all as more fully set forth in "Information For Bidders."

9. BIDDER'S SIGNATURE

Note: All signatures shall be original; not copies, photocopies, stamped, etc.

Authorized Signature	Date
Printed Name	Title
Company Name	
Mailing Address	
City, State, Zip	
Phone No.	Federal Employer ID No.
Fax No.	E-Mail Address
Circle one: Individual Partnership Corporation Joint Venture	
If a corporation, incorporated under the laws of the State of _____	
Licensed to do business in the State of Missouri? ___yes ___no	

(Each Bidder shall complete bid form by manually signing on the proper signature line above and supplying required information called for in connection with the signature. Information is necessary for proper preparation of the Contract, Performance Bond and Payment Bond. Each Bidder shall supply information called for in accompanying "Bidder's Statement of Qualifications.")

END OF SECTION

9. BIDDER'S SIGNATURE

Note: All signatures shall be original; not copies, photocopies, stamped, etc.

Authorized Signature	Date
Printed Name	Title
Company Name	
Mailing Address	
City, State, Zip	
Phone No.	Federal Employer ID No.
Fax No.	E-Mail Address
Circle one: Individual Partnership Corporation Joint Venture	
If a corporation, incorporated under the laws of the State of _____	
Licensed to do business in the State of Missouri? ___yes ___no	

(Each Bidder shall complete bid form by manually signing on the proper signature line above and supplying required information called for in connection with the signature. Information is necessary for proper preparation of the Contract, Performance Bond and Payment Bond. Each Bidder shall supply information called for in accompanying "Bidder's Statement of Qualifications.")

END OF SECTION

SECTION 1.E
SPECIAL CONDITIONS

1. DEFINITIONS

a. "Drawings"

Drawings referred to in and accompanying Project Manual consist of Drawings prepared by and bearing name of below defined Engineer, bearing May 13, 2021. Air Handler BAS Upgrades in CCA and UMTH.

b. Mechanical & Electrical Engineer

IMEG

Tony D. Zehnle

15 Sunnen Drive, Suite 104

St. Louis MO, 63143

Phone: (314) 951-2520

Fax: (314) 645-1173

c. Other Definitions: See Article 1., General Conditions.

2. SPECIAL SCHEDULING REQUIREMENTS

a. Contractor shall coordinate any utility outage with the Owner's Representative at least 14 days prior, **unless noted otherwise**. Outages shall occur outside of normal working hours. **(PREBID ADD 002 - 06/11/2021)**

b. Normal working hours are defined as weekdays between the hours of 7:00 AM and 6:00 PM.

c. Allowable AHU downtime windows:

(1) CCA AHU-1, 3, 4, 5, 6, 7: 1800 to 0700 hours.

(2) CCA AHU-2 and 9: 0500 to 0900 hours.

(3) CCA AHU-8: Anytime.

(4) ER AHU-1: 0500 to 0900 hours.

(5) ER AHU-2: Case by case as approved by **Owner's Representative** (Plan for outside of normal working hours). **(PREBID ADD 002 - 06/11/2021)**

(6) ER AHU-3: Anytime.

(7) AHU S3-1 and ORs 15-17: Case by case as approved by **Owner's Representative** (Plan for outside of normal working hours). **(PREBID ADD 002 - 06/11/2021)**

3. SCOPE OF WORK

a. The Contractor shall furnish all labor, materials, tools, equipment necessary for, and incidental to, construction of this project as indicated on Drawings and specified herein.

- b. Work shall include everything requisite and necessary to finish work properly, notwithstanding that every item of labor or materials or accessories required to make project complete may not be specifically mentioned.
- c. General Description of Work:
 - (1) Project consists of replacing existing outdated DX-9100 controllers located in Critical Care Addition, Emergency Department, and ORs 15-17 in the University of Missouri Teaching Hospital.
 - (2) Demolition shall consist of removing existing DX-9100 controllers and associated N2 Bus.
 - (3) Mechanical work shall consist of installing new DX-FAC-Adapter controllers, BACnet MSTP bus, and associated programming.
 - (4) Electrical work shall consist of any associated scope required for the routing of control wiring and bus.

4. LOCATION

Work shall be performed under this Contract on campus of the University of Missouri - Columbia, at the Teaching Hospital and Critical Care Addition.

5. NUMBER OF CONSTRUCTION DOCUMENTS

- a. The Owner's Representative will furnish the Contractor a copy of executed Contract and Five (5) complete sets of Drawings and Specifications.
- b. Additional sets may be obtained from the architect at cost of reproduction.
- c. The Owner will furnish five (5) sets of explanatory and changed Drawings at no cost to Contractor as issued during project.
- d. The Owner will provide electronic data files to the Contractor for their convenience and use in progressing the Work and the preparation of shop drawings or other submittal requirements required for construction of the referenced project. The electronic data files shall reflect Construction Documents and Bid Addenda only. These files will be transmitted subject to the following terms and conditions:
 - (1) The Owner makes no representation as to the compatibility of these files with the Contractor's hardware or software.
 - (2) Data contained on these electronic files shall not be used by the Contractor or anyone else for any purpose other than as a convenience in progressing the Work or in the preparation of shop drawings or other required submittals for the referenced project. Any other use or reuse by the Contractor or by others will be at their own sole risk and without liability or legal exposure to Owner. The Contractor agrees to make no claim and hereby waive, to the

fullest extent permitted by law, any claim or cause of action of any nature against the Owner and its consultants, contractors, agents, employees, and representatives that may arise out of or in connection with the use of the electronic files transmitted.

- (3) Furthermore, the Contractor shall, to the fullest extent permitted by law, indemnify and hold harmless the Owner and its consultants, contractors, agents, employees, and representatives, against all damages, liabilities or costs, including reasonable attorney's fees and defense costs, arising out of or resulting from the use of these electronic files.
- (4) These electronic files are not contract documents. Differences may exist between these electronic files and corresponding hard-copy construction documents. The Owner makes no representation regarding the accuracy or completeness of the electronic files you receive. In the event that a conflict arises between the signed or sealed hard-copy construction documents prepared by the Consultant and the electronic files, the signed and sealed hard-copy construction documents shall govern. The Contractor is responsible for determining if any conflict exists. By use of these electronic files, the Contractor is not relieved of their duty to fully comply with the contract documents.
- (5) Because information presented on the electronic files can be modified, unintentionally or otherwise, the Owner reserves the right to remove all indications of ownership and/or involvement from each electronic display.
- (6) Under no circumstances shall delivery of the electronic files be deemed a sale by the Owner and no warranties are made, either expressed or implied, of merchantability and fitness for any particular purpose. In no event shall the Owner be liable for any loss of profit, or any consequential damages as a result of use or reuse of these electronic files.

6. SUBMITTALS

- a. The Contractor shall submit for approval to the Architect, equipment lists and Shop Drawings, as expediently as possible. Failure of the Contractor to submit Shop Drawings in a timely manner will result in the Owner holding back Contractor payments. (See General Conditions)
- b. The material and equipment lists shall be submitted and approved before any material or equipment is purchased and shall be corrected to as-built conditions before the completion of the project.
- c. The Contractor shall submit electronic versions of all required Shop Drawings, material and equipment lists. The Contractor shall upload all Shop Drawings to a secure information sharing website determined by the Owner notifying the Owner and Consultant that these shop drawings are available for review. Each submittal shall have the General Contractors digital stamp affixed to the first page signifying their review and acceptance. Review comments, approvals, and rejections will be posted on this same site with notification to the contractor. Submittals requiring a professional seal shall be submitted hard copy with a manual seal affixed.

- (1) The Contractor shall identify each submittal item with the following:
 - (a) Project Title and Location
 - (b) Project Number
 - (c) Supplier's Name
 - (d) Manufacturer's Name
 - (e) Contract Specification Section and Article Number
 - (f) Contract Drawing Number
 - (g) Acrobat file name: Spec Section Times Submitted-Spec Title:
033000_01-Cast In Place Concrete.pdf
 - (2) Reference the accompanying Shop Drawing and Submittal Log at the end of this section (1.E.3) for required submittal information.
- d. The Contractor shall submit to the Architect four (4) bound copies of all required Operating Instructions and Service Manuals for the Architect's and the Owner's sole use prior to completing 50% of the adjusted contract. Payments beyond 50% of the contract amount may be withheld until all Operating Instructions and Service Manuals are received as referenced in the accompanying Operating Instructions and Service Manual Log at the end of this section (1.E.4).
 - e. The Contractor shall submit to the Owner's Representative all items referenced in the accompanying Closeout Log (1.E.5) within 30 days following substantial completion of the work. The Owner's Representative will maintain the closeout log and include as an agenda item at all coordination meetings.

7. USE OF PREMISES

- a. Access: Access to construction site shall be as indicated on Drawings and as directed by the Owner's Representative.
- b. Parking:
 - (1) **Contractor parking for one vehicle is available at the corner of Virginia Avenue and Hospital Drive. Additional parking may be allocated for the project as available. (PREBID ADD 002 - 06/11/2021)**
 - (2) Parking or driving on sidewalks, landscaped areas, within fire and service lanes or generally in areas not designated for vehicular traffic is prohibited except as allowed in the contract documents. Violation of this requirement may result in ticketing and/or towing at the vehicle owner's expense and suspension of progress payments.
 - (3) Free parking for contractor employees is available at the ~~corner of Ashland Road~~ contractor lot on an as available basis. This space is for use by contractor employees for parking their personal vehicles only and is not to be used for staging or storage. **(PREBID ADD 002 - 06/11/2021)**
 - (4) Vendor Permits may be purchased by contractor management personnel on

an as available basis by contacting the Parking and Transportation office in the Turner Avenue Parking Structure. These permits will allow contractor management personnel to park in various University lots while conducting business on University construction projects.

- (5) Temporary University parking permits may be purchased by contractor employees for use with their personal vehicles on an as available basis by contacting the Parking and Transportation office in the Turner Avenue Parking Structure.
- c. Storage of materials: The Contractor shall store all materials within project limits. The Contractor shall confine apparatus, materials, and operation of workers to location established by the Owner's Representative. The Contractor shall not unreasonably encumber premises with materials. In addition, storage trailer locations may be available within 1-1/2 miles of project site as directed by the Owner's Representative. Storage trailer locations shall be subject to approval by the Owner's Representative and are available to the Contractor without cost.
- d. Utilities: Drinking water, water required to carry on work, and 120 volt electrical power required for small tool operation may be obtained without cost to the Contractor from existing utilities at locations designated by the Owner's Representative. Provisions for obtaining power, including temporary extensions, shall be furnished and maintained by the Contractor. Upon completion of work such extensions shall be removed and any damage caused by use of such extensions shall be repaired to satisfaction of the Owner's Representative, at no cost to the Owner.
- e. Restroom: Existing toilet facilities within Project Limits or Restrooms designated by the Owner's Representative for use by the Contractor will be available. Failure of the Contractor to maintain restrooms in a clean condition will be cause for the Contractor's discontinued use of the restroom.
- f. Smoking is prohibited at the University of Missouri and all properties owned, operated, leased or controlled by the University of Missouri. Violation of the policy is defined as smoking any tobacco products, including e-cigarettes.
- g. Landfill: The Contractor shall not use the Owner's landfill. Dumping or disposal of excavated or demolition materials on Owner's property shall not be permitted. The Contractor shall remove and legally dispose of excavated or demolished materials off the Owner's property.
- h. Care of Project Work Site: The contractor shall be responsible for maintaining the construction site in a reasonably neat and orderly condition by regular cleaning and mowing of the premises as determined by the Owner's Representative.
- i. Discharge to Sewer Request: The University of Missouri's MS4 permit and NPDES Storm Water Discharge Permits along with the City of Columbia's POTW Operating Permit as well as local ordinances, and state and federal environmental regulations prohibit hazardous materials from being disposed into either the storm

water or sanitary sewer systems. Unless specifically approved, all chemical products such as paints, dyes, lawn care products, maintenance products, and oil is are prohibited from drain disposal. Any product, including contaminated water, being discarded into the storm water or sanitary sewer systems requires written approval from the Owner through a formal "Discharge to Sewer Request" form obtained at Discharge to Sewer Request Form. The contractor should submit the form to the Owner's Representative, not to the Department of Environmental Health and Safety as the form indicates.

- j. Artifacts Found During Construction: Contractor shall immediately notify the Owner's Representative when artifacts are uncovered or found during the demolition or construction process. Artifacts include, but are not limited to, tools, drawings (construction or other), photographs, books and other objects/devices which may hold historical importance/significance. Do not remove or disturb the object(s) in question. Artifacts are not considered part of demolished materials and shall remain the property of the University of Missouri.

- k. **"Permit Required Confined Space" Entry Communication and Coordination** (See OSHA 1926 subpart aa – Construction Confined Space for the definition of "permit required confined spaces" - Note: OSHA does not apply to the University. However, the University will provide a list of all known "permit required confined spaces")

There are no known "permit required confined spaces" within the project limits. Each contractor shall conduct a survey to confirm whether or not any confined spaces exist within the project limits. It is incumbent upon each contractor to list all "permit required spaces".

The Contractor shall notify the Owner's Representative if 1) conditions change resulting in a non-permit required confined space being reclassified to a "permit required confined space" after evaluation of the space by a competent person; 2) a space previously thought to be non-permit required space is classified as a "permit required confined space"; or 3) during the course of construction a "permit required confined space" is created after evaluation by a competent person.

The Contractor shall submit to the Owner's Representative a copy of the cancelled confined space entry permit and a written report summarizing the permit space program followed and all hazards confronted or created during entry operations. This information shall be submitted within one week of cancelling the permit.

8. PROTECTION OF OWNER'S PROPERTY

- a. The Contractor shall be responsible for repair of damage to building exterior and interior, drives, curbs, streets, walks, grass, shrubbery and trees, which was caused by workmen or equipment employed during progress of work. All such repairs shall be made to satisfaction of the Owner's Representative, at no cost to the Owner, or reimburse the Owner if the Owner elects to make repairs. For landscape damage, the Owner shall make such repairs. Compensation for these repairs shall be determined by the Owner's Representative using the "Valuation of Landscape

Trees, Shrubs, and other Plants" as published by the International Society of Arboriculture, as last revised.

b. Construction Project Fencing:

- (1) Fencing will not be required as a part of work.

9. PERMITS

- a. The Contractor shall comply with applicable codes and standards as listed in the Contract Documents, General Conditions, and the Healthcare Construction Guidelines.
- b. All permits, including, but not limited to Infection Control, Hot Work, Fire Alarm, Energized Work and HVAC interruption shall be coordinated and scheduled with the Owner's Representative and/or his designee prior to commencement of the work.
- c. Permits for Boilers, Water Heaters and Pressure Vessels require an installation permit from the State of Missouri. Contractors must obtain this permit. Applications are available via the State of Missouri website.

10. SPECIALTIES

- a. The Owner has elected to pre-purchase the following equipment:
- (1) Johnson NAE/FEC/IOM controllers.
- (2) Johnson DX-FAC adapter controllers.
- b. A complete Bill of Materials will be available to the bidders upon request for reference.
- c. The Contractor shall be responsible for coordinating the delivery, receiving, and installing the equipment as if they had made the purchase. If there is a problem with the equipment regarding compliance with the order of the submittals, start-up, or warranty, then the Contractor shall act for the Owner and arrange for the necessary corrections, replacement parts, back charges, technical support, etc. The installed equipment shall carry the warranty specified herein as specified in the other portions of the specifications. It shall be the responsibility of the Contractor during the warranty period to respond to the evident malfunction or failure of the equipment as though they had directly purchased the equipment. This includes conducting the necessary diagnostic efforts and, if the malfunction is deemed by the Contractor to be an equipment liability issue, to so resolve the problem with the supplier as the Owner's agent.

11. CODES AND STANDARDS

The Contractor shall comply with applicable codes and standards as listed in General Conditions.

12. PRE-BID INSPECTION

All pre-bid inspections of work areas shall be scheduled with pre-bid inspection guide, telephone: (573) 882-2228

13. SAFETY PRECAUTIONS AND PROGRAMS

- a. The Bidder's Statement of Qualifications includes a requirement that the Bidder provide its Worker's Compensation Experience Modification Rates (EMR) and Incidence Rates for the three recent years. The Bidder shall also include the EMR and Incidence Rates of listed major subcontractors on the Bid for Lump Sum Contract. If the EMR exceeds 1 or the Incidence Rate exceeds 13, the Contractor or major subcontractor shall take additional safety measures including, but not limited to, developing a site-specific safety plan and assigning a Safety Manager to the Project to perform inspections on a schedule as determined acceptable by the Owner with written reports to be submitted to the Owner. The Owner reserves the right to reject a Bidder or major subcontractor whose rates exceed these stated rates.
- b. The contractor shall provide Emergency Contact Information for the Contractor's on-site staff and home office management as well as contact information for all major subcontractor personnel. This information shall contain business and personal phone numbers for each individual for contact during or after hours in case of an emergency. This information shall be submitted within 15 days of the Notice to Proceed.

14. CONSTRUCTION WASTE MANAGEMENT (for projects without a Division 02 specification)

The goal of Construction Waste Management is to divert waste from the sanitary landfill. This shall be accomplished through reuse, recycling and/or salvage of non-hazardous construction and demolition debris to the greatest extent practical. Track and report all efforts related to reuse, recycling and/or salvage materials from the project (including clean fill material). Report all material types and weights, where material was diverted, type of diversion, documentation of diversion (eg: waste or recycling tickets), and applicable dates. In order to calculate the diversion percentage, total weights of all non-hazardous landfill material must be reported. This information shall be updated monthly utilizing the [Construction Waste Management Worksheet](#) provided here: [for MU] http://www.cf.missouri.edu/cf/pdc/contractor_information. Copies of all applicable receipts, tickets and tracking logs shall be uploaded to the Owner's information sharing website or reported as required by the Construction Project Manager.

(A summary worksheet is required prior to substantial completion).

END OF SECTION

SECTION 23 09 00
CONTROL SYSTEMS

PART 1 GENERAL**1.01 SUMMARY**

- A. University of Missouri Controls Specification.
- B. This section contains requirements for pneumatic, electric and digital control systems as indicated on the contract drawings.
- C. Contractor is responsible for providing, installing and connecting all sensors, pneumatic actuators, control valves, control dampers, electrical components and all interconnecting pneumatic tubing and electrical wiring between these devices and up to the Direct Digital Controller (DDC).
- D. DDC systems consist of Johnson Controls METASYS controllers. Contractor shall ~~provide~~ **utilize existing and install** control enclosures. Owner will provide controllers for contractors to install. After all equipment has been installed, wired and piped, ~~Owner Contractor~~ will provide controller programming. Contractor will be responsible for all termination connections at the DDC controller's and for checking, testing, and start-up of the control system. Contractor must be on site at start-up to make any necessary hardware adjustments as required. **(PREBID ADD 002 - 06/11/2021)**
- E. Once each mechanical system is completely operational under the new control system, contractor shall make any final connections and adjustments. For controls renovation jobs, contractor shall remove all unused sensors, operators, panels, wiring, tubing, conduit, etc. Owner shall have the option of retaining any removed controls.
- F. **Owner will provide programming submittal information to contractor within 45 days of contract award. (PREBID ADD 002 - 06/11/2021)**

1.02 RELATED SECTIONS

- A. Drawings and general provisions of Contract, including General and Special Conditions apply to work of this section.

1.03 QUALITY ASSURANCE

- A. Contractor's Qualifications:
 - 1. Contractor shall be regularly engaged in the installation of digital control systems and equipment, of types and sizes required. Contractor shall have a minimum of five years' experience installing digital control systems. Contractor shall supply sufficient and competent supervision and personnel throughout the project in accordance with General Condition's section 3.4.1 and 3.4.4.
- B. Codes and Standards:
 - 1. Electrical Standards: Provide electrical components of control systems which have been UL-listed and labeled, and comply with NEMA standards.
 - 2. NEMA Compliance: Comply with NEMA standards pertaining to components and devices for control systems.
 - 3. NFPA Compliance: Comply with NFPA 90A "Standard for the Installation of Air

Conditioning and Ventilating Systems" where applicable to controls and control sequences.

4. NFPA Compliance: Comply with NFPA 70 "National Electric Code."

1.04 SUBMITTALS

- A. Shop Drawings: Submit shop drawings for each control system, containing the following information:
 - B. Product data for each damper, valve, and control device.
 - C. Schematic flow diagrams of system showing fans, pumps, coils, dampers, valves, and control devices.
 - D. Label each control device with setting or adjustable range of control.
 - E. Indicate all required electrical wiring. Clearly differentiate between portions of wiring that are factory-installed and portions to be field-installed.
 - F. Provide details of faces on control panels, including controls, instruments, and labeling.
 - G. Include written description of sequence of operation.
 - H. Provide wiring diagrams of contractor provided interface and I/O panels.
 - I. Provide field routing of proposed network bus diagram listing all devices on bus.

PART 2 PRODUCTS

2.01 MATERIALS AND EQUIPMENT

- A. Air Piping:
 1. Copper Tubing: Seamless copper tubing, Type M or L, ASTM B 88; wrought-copper solder-joint fittings, ANSI B16.22; except brass compression-type fittings at connections to equipment.
 2. Flex Tubing: Virgin Polyethylene non-metallic tubing, ASTM D 2737, with flame-retardant harness for multiple tubing. Use compression or push-on polyethylene fittings. Tubing used above suspended ceilings to be plenum rated per NFPA 90A. See section 3.1.b for locations where flex tubing can be used.
 3. Copper to polyethylene connections shall be compression barbed fittings or solder barbed fittings.
- B. Conduit and Raceway:
 1. Electrical Metallic Tubing: EMT and fittings shall conform to ANSI C80.3.
 2. Surface Metal Raceway and Fittings: Wiremold 500, Ivory, or approved equal.
 3. Flexible Metal Conduit: Indoors, per National Electric Code for connection to moving or vibrating equipment.
 4. Liquidtight Flexible Conduit: Outdoors, per National Electric Code for connection to moving or vibrating equipment.
- C. Control Valves: Provide factory fabricated pneumatic or electric control valves of type, body material, and pressure class as indicated on the drawings. Butterfly style control valves are not acceptable except for two position applications. Equip control valves with heavy-duty actuators, with proper shutoff rating for each individual application.
 1. Steam and Hot Water
 - a) Manufacturer: Do not allow KMC valves and actuators.

- b) Water Service Valves: Equal percentage characteristics.
 - c) Steam Service Valves: Equal percentage characteristics.
 - d) Single Seated Valves: Cage type trim, providing seating and guiding surfaces for plug on "top and bottom" guided plugs.
 - e) Valve Trim and Stems: Polished stainless steel.
 - f) Packing: Spring-loaded Teflon, self-adjusting.
 - g) Control valves should have a minimum 100 psi close-off rating for chilled water applications.
2. Hydronic Chilled Water and Heating Water
- a) At minimum, hydronic control valves shall be pressure independent. The flow through the valve shall not vary more than +/- 5% due to system pressure fluctuations across the valve in the selected operating range. The control valve shall accurately control the flow from 1 to 100% full rated flow.
 - b) The valve bodies shall be of cast iron, steel or bronze and rated for 150 PSI working pressure. All internal parts shall be stainless steel, steel, Teflon, brass, or bronze.
 - c) Delta P Valves manufactured by Flow Control Industries, Belimo, Danfoss Series, or approved equal.
 - d) The valves shall have pressure taps across the valve for measuring the pressure drop across the valve. The pressure taps shall have ½-inch extensions for accessibility.
 - e) Control valves shall be installed with unions or flanges as necessary for easy removal and replacement.
 - f) Valve Tag shall include the model number, AHU being served, design flow, and maximum flow for that valve.
 - g) The control valves shall be delivered preset to the scheduled design flow and should be capable of reaching 110% of the design flow to allow for field adjustment for capacity changes.
- D. Electric Actuators: Johnson Controls, Bray, Belimo, TAC or approved equal. KMC actuators are not approved. Size electric actuators to operate their appropriate dampers or valves with sufficient reserve power to provide smooth modulating action or 2-position action as specified. If mixed air AHU has return air, exhaust air and outside air dampers that are not mechanically linked then static safety switch must be installed and wired to safety circuit. Spring return actuators should be provided on heat exchanger control valves or dampers or as specified on the drawings. Control signal shall be 0 to 10 VDC unless otherwise specified on drawings. Actuators with integral damper end switch are acceptable. For VAV reheat valves, actuators shall have a manual override capability to aid in system flushing, startup, and balancing.
- E. Air and Hot Water Electronic Temperature Sensors:
- 1. All electronic temperature sensors shall be compatible with Johnson METASYS systems.
 - 2. Sensors shall be 1,000 ohm platinum, resistance temperature detectors (RTDs) with two wire connections. Duct mounted sensors shall be averaging type. Contractor may install probe type when field conditions prohibit averaging type, but must receive permission from Owner's Representative.
 - 3. Coordinate thermowell manufacturer with RTD manufacturer. Thermowells that are installed by the contractor, but are to have the RTD installed by owner, must be Johnson Controls Inc. series WZ-1000.
- G. Electronic Temperature Sensors and Transmitters:
- 1. Chilled Water, Tower Water, Heating Hot Water, and Steam Temperature Sensors
 - a) General: The RTD/Temperature Transmitter/Thermowell assembly shall come as a complete assembly from a single manufacturer. The Assembly shall be suitable for use in the accurate measurement of Chilled/Tower/Hot Water and steam temperatures in a mechanical room environment.

- b) Calibration: Each RTD must be match calibrated to the Transmitter via NIST traceable calibration standards. Results are to be programmed into the transmitter. Results are to be presented on report as after condition at the specified calibration points. Assembly shall not be approved for installation until Owner has received all factory calibration reports.
- c) RTD:
 - (1) RTD type: 2-wire or 3-wire 100 ohm platinum class A
 - (2) Outside Diameter: 0.25 inch
 - (3) Tolerance: +/- 0.06% Type A
 - (4) Stability: +/- 0.1 % over one year.
 - (5) TCR: 0.00385 (ohm/ohm/°C).
 - (6) RTD shall be tip sensitive.
 - (7) Resistance vs. Temperature table for the RTD must be provided to the Owner.
- d) Transmitter:
 - (1) Transmitter shall be match calibrated to the RTD and assembled as a matched pair.
 - (2) Type: 2 wire (loop powered)
 - (3) Input: 2 or 3 wire 100 ohm platinum class A or class B RTD
 - (4) Output: Output shall be a 4-20 mA signal linear to temperature
 - (5) Calibrated Span:
 - (a) Chilled Water: 30 °F to 130 °F.
 - (b) Tower Water: 30 °F to 130 °F.
 - (c) Hot Water: 100 °F to 250 °F.
 - (d) Steam: 150 °F to 450 °F
 - (6) Calibration Accuracy, including total of all errors, of the Transmitter & RTD matched pair over the entire span shall be within +/- 0.2% of the calibrated span or +/- 0.18 °F, whichever is greater.
 - (7) Supply Voltage: 24 VDC.
 - (8) Ambient Operating Temp.: 32 to 122 °F
 - (9) Epoxy potted for moisture resistance.
 - (10) Mounting: Transmitter shall be mounted in the RTD connection head.
- e) Thermowell
 - (1) Thermowell shall be suitable for immersion in chilled/hot water and steam.
 - (2) Thermowell shall be reduced tip.
 - (3) Thermowell shall be one piece stainless steel machined from solid bar stock.
 - (4) Thermowell shall have 1/2" NPT process connection to pipe thred-o-let.
 - (5) Thermowell Insertion depth shall be ½ the inside pipe diameter but not to exceed 10".
- f) Assembly:
 - (1) Assembly configuration: Spring loaded RTD with thermowell-double ended hex-connection head.
 - (2) Connection head shall be cast aluminum with chain connecting cap to body, have 1/2" NPT process and 3/4" NPT conduit connections, and a sealing gasket between cap and body.
- g) RTD/Temperature Transmitter/Thermowell assembly shall be the following or approved equal:
 - (1) Manufacturer: Pyromation, Inc.
 - (2) Chilled Water: RAF185L-S4C[length code]08-SL-8HN31,TT440-385U-S(30-130)F with calibration SMC(40,60)F
 - (3) Tower Water: RAF185L-S4C[length code]08-SL-8HN31,TT440-385U-S(5130)F with calibration SMC(55,85)F
 - (4) Hot Water: RAF185L-S4C[length code]08T2-SL-8HN31,TT440-385U-S(100-250)F with calibration SMC(140,180)F
 - (5) Steam: RAT185H-S4C[length code]08T2-SL-8HN31,TT440-385U-S(150-450)F with calibration SMC(300,350)F

- H. Humidistats: Humidistats must be contamination resistant, capable of $\pm 2\%$ RH accuracy, have field adjustable calibration and provide a linear proportional signal.
 1. HD20K-T91 or equivalent.
- I. Fan/Pump Status: Status points for fan or pump motors with a VFD must be connected to the terminal strip of the VFD for status indication.
Current switches: Current switches are required for fan and pump statuses that are not connected to a VFD. The switches must have an adjustable trip setpoint with LED indication and be capable of detecting broken belts or couplings. Units shall be powered by monitored line, UL listed and CE certified, and have a five year warranty.
 1. Kele, Hawkeye or approved equal.
- J. Relays Used for Fan and Pump Start/Stop: Must have LED indication and be mounted externally of starter enclosure or VFD.
 1. Kele, RIBU1C or approved equal.
- K. Power Supply Used to Provide Power to Contractor-Provided Control Devices: Shall have adjustable DC output, screw terminals, overload protection and 24 VAC and 24 VDC output.
 1. Kele, DCPA-1.2 or approved equal.

PART 3 EXECUTION

3.01 INSTALLATION OF CONTROL SYSTEMS

- A. General: Install systems and materials in accordance with manufacturer's instructions, roughing-in drawings and details shown on drawings.
- B. Control Air Piping:
 1. All control air piping shall be copper. Exception: Flexible Tubing may be used for a maximum of two (2) feet at connections to equipment [except for steam control valves] and inside control cabinets.
 2. Provide copper tubing with a maximum unsupported length of 3'-0".
 3. Pressure Test control air piping at 30 psi for 24 hours. Test fails if more than 5 PSI loss occurs.
 4. Fasten flexible connections bridging cabinets and doors, neatly along hinge side, and protect against abrasion. Tie and support tubing neatly.
 5. Number-code or color-code tubing, except local individual room control tubing, for future identification and servicing of control system.
 6. All control tubing at control panel shall be tagged and labeled during installation to assist owner in making termination connections at control panel.
 7. Provide pressure gages on each output device.
 8. Paint all exposed control tubing to match existing.
- C. Raceway: Raceway is to be installed in accordance with the National Electric Code. Use of flexible metal conduit or liquidtight flexible conduit is limited to 36" to connect from EMT to devices subject to movement. Flexible raceway is not to be used to compensate for misalignment of raceway during installation.
- D. Control Wiring: Install control wiring in raceway, without splices between terminal points, color-coded. Install in a neat workmanlike manner, securely fastened. Install in accordance with National Electrical Code.
 1. Install circuits over 25-volt with color-coded No. 12 stranded wire.
 2. Install electronic circuits and circuits under 25-volts with color-coded No. 18 stranded twisted shielded pair type conductor.
 3. N2 communications bus wire shall be 18 AWG, plenum rated, stranded twisted shielded,

- 3 conductor, with blue outer casing, described as 18-03 OAS STR PLNM NEON BLU JK distributed by Windy City Wire, constructed by Cable-Tek, or approved equivalent.
- a) Metastat wiring shall be minimum 20 AWG, plenum rated, stranded, 8 conductor stranded wire.
4. FC communications bus wire shall be 22 AWG, plenum rated, stranded twisted shielded, 3 conductor, with blue outer casing, described as 22-03 OAS STR PLNM NEON BLU JK distributed by Windy City Wire, constructed by Cable-Tek, or approved equivalent.
 - a) Network sensor wiring (SA Bus) shall be 22 gauge plenum rated stranded twisted wire, 4 conductor.
 5. All control wiring at control panel shall be tagged and labeled during installation to assist owner in making termination connections at control panel. Label all control wires per bid documents.
- E. All low voltage electrical wiring shall be run as follows:
1. Route electrical wiring in concealed spaces and mechanical rooms whenever possible.
 2. Provide EMT conduit and fittings in mechanical rooms and where indicated on drawings.
 3. Low voltage electrical wiring routed above acoustical ceiling is not required to be in conduit, but wire must be plenum rated and properly supported to building structure.
 4. Provide surface raceway, fittings and boxes in finished areas where wiring cannot be run in concealed spaces. Route on ceiling or along walls as close to ceiling as possible. Run raceway parallel to walls. Diagonal runs are not permitted. Paint raceway and fittings to match existing conditions. Patch/repair/paint any exposed wall penetrations to match existing conditions.
- F. All devices shall be mounted appropriately for the intended service and location.
1. Adjustable thermostats shall be provided with base and covers in occupied areas and mounted 48" above finished floor to the top of the device. Tubing and/or wiring shall be concealed within the wall up to the ceiling where ever possible. Surface raceway may only be used with approval of Owners Representative. Wall mounted sensors such as CO2, RH, and non-adjustable temperature sensors shall be mounted 54" above finished floor. Duct mounted sensors shall be provided with mounting brackets to accommodate insulation. Mounting clips for capillary tubes for averaging sensors are required.
 2. All control devices shall be tagged and labeled for future identification and servicing of control system.
 3. Preheat and mixed air discharge sensors must be of adequate length and installed with capillary tube horizontally traversing face of coil, covering entire coil every 24 inches bottom to top.
 4. All field devices must be accessible or access panels must be installed.
- G. Install magnehelic pressure gage across each air handling unit filter bank. If the air handling unit has a prefilter and a final filter, two magnehelic pressure gages are required.

3.02 ADJUSTING AND START-UP

- A. Start-Up: Temporary control of Air Handling Units shall be allowed only if approved by the owner's representative to protect finishes, etc., AHUs may be run using caution with temporary controls installed by contractor early in the startup process. All safeties including a smoke detector for shut down must be operational. Some means of discharge air control shall be utilized and provided by the contractor such as a temporary temperature sensor and controller located and installed by the Contractor.
- B. The start-up, testing, and adjusting of pneumatic and digital control systems will be conducted by ~~owner~~ **the contractor**. ~~Once all items are completed by the Contractor for each system, Contractor shall allow time in the construction schedule for owner to complete commissioning of controls before project substantial completion. This task should be included in the original schedule and updated to include the allotted time necessary to complete it.~~ As a minimum, the following items are required to be completed by the Contractor ~~for Owner~~ **prior to begin** controls commissioning. **(PREBID ADD 002 - 06/11/2021)**

1. Process Control Network
 - a) The control boards and enclosures need to be installed in the mechanical rooms.
 - b) The fiber optic conduit and box for the process control network needs to be installed. Once in place, Owner needs to be contacted so the length of the owner provided fiber cable can be determined and ordered, if required. Coordinate with Owner to schedule the pull in and termination of the fiber cable. Power should be in place at that time. (Fiber for the process control network is required to allow metering of utilities prior to turn on.)
2. Heating System
 - a) Pumps, heat exchangers, steam pressure reducing station, piping, control valves, steam and/or hot water meter, feeder conduit and wire, VFDs, control panels and control wiring installed in the mechanical room. The house keeping pads must be poured before pump operation. All must be in place in working order (pumps aligned, VFDs set up by vendor, motors checked for rotation, steam regulators set to required pressure, condensate pumps operational, heating system ready to circulate (all piping pressure tested, flushed, and insulated) with differential pressure sensors in place.
3. Cooling System
 - a) Pumps, heat exchangers, piping, control valves, chilled water meter, feeder conduit and wire, VFDs, control panels and control wiring installed in the mechanical room. The house keeping pads must be poured before pump operation. All must be in place in working order (pumps aligned, VFDs set up by vendor, motors checked for rotation, cooling system ready to circulate (all piping pressure tested, flushed, and insulated) with differential pressure sensors in place.
4. Air Handlers
 - a) Prior to owner commissioning, at a minimum, the following items shall be complete: Power wiring, motor rotation check, fire/smoke dampers open, control wiring including all safeties, IO cabinet, air handler cleaned, and filters installed as required. To protect the systems from dirt, outside air with no return will be used until the building is clean enough for return air operation.
5. Exhaust and Energy Recovery Systems
 - a) Exhaust fans need to be operational and under control before labs can be commissioned.
6. Some balance work can be done alongside the control work as long as areas are mostly complete and all diffusers are in place.

3.03 CLOSEOUT PROCEDURES

- A. Contractor shall provide complete diagrams of the control system including flow diagrams with each control device labeled, a diagram showing the termination connections, and an explanation of the control sequence. The diagram and sequence shall be framed and protected by glass and mounted next to controller.
- B. Contractor shall provide as built diagram of network bus routing listing all devices on bus, once wiring is complete prior to scope completion.

END OF SECTION

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Shop Drawing Cover Sheet

Project Name and Number:

University Teaching Hospital
OR Renovation 3rd Floor East
University of Missouri-Columbia
Columbia, Missouri

Project Number: CP050161

General Contractor:

McAfee Construction Inc.
4671 E. Heller Rd.
Columbia, Mo. 65202
Phone: 573-474-4397
Fax: 573-474-0160

Section: 15973 Controls

Subcontractor/Vendor:

Officer Mechanical, Inc.
2306 N. Oakland Gravel Rd.
Columbia, MO 65202
Phone: 573-474-3554
Fax: 573-474-0463

Manufacturer of Product:

REVIEWED

By Mike Murray at 8:40 am, Oct 18, 2005

Invensys

24 October 2005

Project: UMC OR Remodel

Project No.: 04095a

Submittal Name: Controls

Submittal No.: M-11

9503 East 63rd Street
Suite 214
Raytown, MO 64133-4939
Office: 816.356.6569
Fax: 816.356.9145
www.bredson.com

<input type="checkbox"/> NO EXCEPTION TAKEN	<input checked="" type="checkbox"/> MAKE CORRECTIONS NOTED
<input type="checkbox"/> REJECTED	
<input type="checkbox"/> SUBMIT SPECIFIED ITEM	<input checked="" type="checkbox"/> REVISE AND RESUBMIT

Corrections or comments made on the shop drawings during this review do not relieve contractor from compliance with requirements of the drawings and specifications. This check is only for review of the general conformance with the design concept of the project and general compliance with the information given in the contract documents. The contractor is responsible for: Confirming and correlating all quantities and dimensions; selecting fabrication processes and techniques of construction; coordinating his or her work with that of all other trades and performing all work in a safe and satisfactory manner.

Bredson & Associates, Inc.
Consulting Engineering

Date 10/21/2005 No. M-11

By DOV

Remarks:

1. Submit control dampers for review.
2. AHU-S3-1
 - A. Control diagram's steam coil shall indicate integral face and bypass, not full face or full bypass dampers.
 - B. Sequence of operation, preheat control does not indicate 1/3 – 2/3 valve operation as shown. Valve schedule did indicate 1/3 – 2/3 valves.
 - C. Sequence of operation, item H, safety interlocks, item #1, the air handler shall NOT shut down upon freeze conditions. DDC system shall alarm conditions but NOT shut unit down. See item H.3.
3. Chilled water cooling system – provide sequence of operation.
4. Submit thermostat with display and setpoint adjustment for OR room mount, with remote temperature sensor, to be located in return duct.
5. Submit room thermostat for non-OR rooms.

Shop Drawing Form

NO
EXCEPTIONS

REJECTED

EXCEPTIONS
NOTED

RESUBMIT

This review is only for the limited purpose of checking for general conformance with information given and the design concept expressed in the Contract Documents. These shop Drawings have been reviewed by the Consultants of record for the project. The consultants comments and review stamp are applicable for their portion of the work. Review is not conducted for the purpose of determining the accuracy and completeness of other details such as dimensions and quantities, or for substantiating instructions for installation or performance of equipment or systems, all of which remain the responsibility of the Contractor as required by the Contract Documents.

BY BK

DATE 10.24.05

HMN Architects, Inc.



C&C Group

www.c-cgroup.com
2414-B Hyde Park Road
Jefferson City, Missouri 65109
Office: 573.632.4247 Fax: 573.632.4242

- Temperature Controls
- NEBB Test and Balance
- Security Solutions
- Access Floors
- Standby Generators

OFFICER
MECH. CONTRACTORS, INC.
PROJECT NO. <u>C1050161</u>
SPEC. SECT. <u>15973</u>
DATE <u>10-14-05</u>
CHECKED <u>[Signature]</u>

University of Missouri - Columbia
3rd Floor East
OR Renovation

Job No. J1051019

Submittal

Please Return One Approved Copy To:

C&C Group
2414 Hyde Park Road
Suite B
Jefferson City, MO 65109



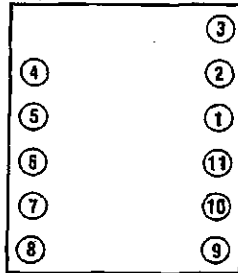
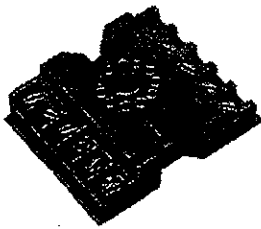
Table of Contents

<u>Description</u>	<u>Part No.</u>
Relay & Control Panel Accessories	P-127-1-4 & P-100-4
Multi-Voltage Control Relays	MR-801-T
Pressure Sensing Tip	AP-302
DC Power Supply	DCP-250-P
Control Cabinets	AE-630
Current Status Switches	H908
Damper End Switch	P-370
Duct Mounted Humidity Sensor	HD2XMSX
Platinum Averaging Sensors	ST-AV91H
Manual Reset Air Sensing Switch	AFS-460-DSS
Solid State Timer	438USA-Int
Low & High Temperature Cut Out Controls	A70HA-1
Transformer	T-208
Solenoid Air Valves	AL-170 & AL-180
Differential Pressure Transmitter	M264
Differential Pressure	PXP-X-X-02-X
Differential Pressure Filter Switch	1910-1
Magnehelic Gauge	2002
Electric to Pneumatic Transducer	CP-8551
Remote Temperature Sensors	TS-5821
Damper Actuators, Proportional Valve Schedule	MK-7121

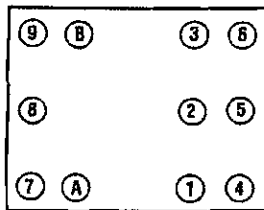
**P-100 Series, P-200 Series
P-300 Series, P-600 Series
Relays and Control Panel Accessories
Installation Warehouse
General Instructions**

Part No.	Contacts	Coil	Std. Pkg. Quantity	Use with Socket Part No.	Terminals	Std. Pkg. Quantity
P-125-1-3	SPDT	24 Vac 2 VA	1	P-100-4	11 Square	1
P-125-2-3	SPDT	120 Vac 2 VA	1	P-100-4	11 Square	1
P-127-1-4	3PDT	24 Vac 2.2 VA	1	P-100-4	11 Square	1
P-127-2-4	3PDT	120 Vac 2.2 VA	1	P-100-4	11 Square	1
P-127-4-4	3PDT	24 Vdc 1.2 W	1	P-100-4	11 Square	1
P-127-7-4	3PDT	240 Vac 2.2 VA	1	P-100-4	11 Square	1
P-128-2-M	4PDT	120 Vac 2.2 VA	1	P-110-8-M	14 Square	1
P-186-8-2	DPDT (TDR) 0.3 sec. to 134 min.	24 Vac/Vdc 120 Vac 1.5 W	1	P-100-2	11 Round	1

P-100's Sockets



P-100-2 Use with P-186 Time Delay Relay
Requires P-603 2-7/8" Mounting Track

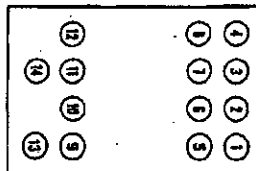


P-100-4 (11 pin) Use P-605 Mounting Track
P-101-4 (11 pin) Use P-610 Mounting Track (Din Rail)

Note:

1. Sockets may be surface mounted or track mounted.
2. Sockets may be used for 5 pin SPDT, 8 pin DPDT or 11 pin 3PDT P-125, P-126 and P-127 style relays.

P-110-8-M Sockets (14 Pin)

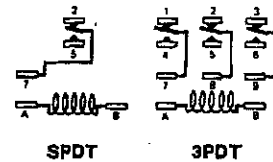


Use with P-128 Control Relay
Use P-610 Mounting Track (Din Rail) or base mount without Din Rail

NOTE

Relay sockets can be mounted directly without mounting track if desired.

P-120's Enclosed Plug-in Relay



Contacts: 10 amps silver CAD oxide gold flash;
1/3 hp at 120 Vac, 1/2 hp at 240 Vac

Coils: 120 Vac or 24 Vac, 24 Vdc — VA rating 2.0 SPDT,
2.2 3PDT

Connections: Square base plug-in mounting

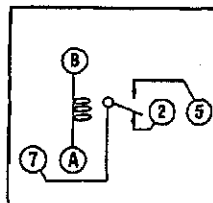
P-125 requires P-100-4 Socket

P-126 requires P-100-4 Socket

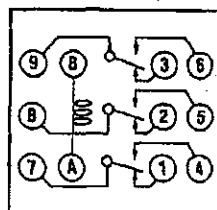
P-127 requires P-100-4 Socket

P-128 requires P-110-8 Socket

Installation Wiring Diagrams

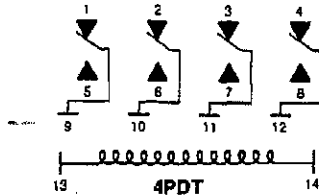
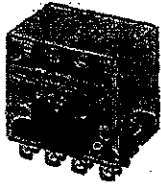


P-125 Relay
P-100-4 Socket



P-127 Relay
P-100-4 Socket

P-128 Enclosed Plug-In Relay (Compact)

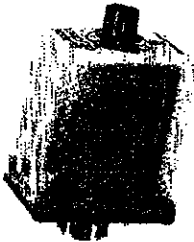


Contacts: 10 amps silver gold flash; 110 Vac

Coils: 120 Vac, 2.2 VA

Connections: Square base plug-in mounting
P-128-2-M requires P-110-8-M Socket

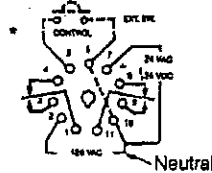
P-186-8-2 Solid State UL Listed Guardian Electric (PET 1481)



Time Delay Relay
.3 sec. to 134 min.

Contacts: DPDT 10A,
120 Vac Resistive

Coils: Selectable 24 Vac
and 24 Vdc or 120 Vac



CAUTION

Socket is wired in reverse order (1 to 11 going CCW from 5:00 o'clock).

NOTE

Pin 2 tied to pin 7; pin 6 tied to pin 10 (INT.). Pin 5 and 6 may use jumper for Delay on Operate Mode in lieu of EXT Sw. Do **not** apply power to pins 5 and 6. Pin 10 must be neutral for 120 Volt application.

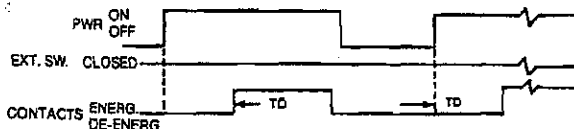
TIMING RANGES

Switch #	1	4	5	6	7	8	Timing Range (T)
	O	O	O	O	O	X	.3 to 2.75 Secs.
	O	O	O	X	O	X	1.5 to 8.75 Secs.
	O	X	X	X	O	O	8.4 to 49.0 Secs.
	X	O	O	O	X	X	47.0 to 260.0 Secs.
X = ON	X	O	O	X	O	X	235.0 to 1300.0 Secs.
O = OFF	X	X	X	O	X	X	1269.0 to 7020.0 Secs.
	X	X	X	X	X	X	1457.0 to 8060.0 Secs.

OPERATING MODES

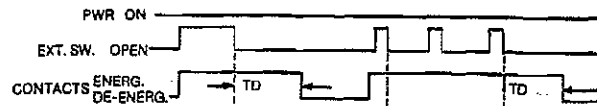
1. Delay on Operate

(SW2 "ON", SW3 "OFF"). Upon application of power to the input terminals, the time delay is initiated. At the end of the time delay period, the output contacts transfer. Reset is accomplished by removal of input power.



2. Delay on Release

(SW2 "OFF", SW3 "ON"). Power is applied at all times. Upon closure of the EXT. SW., the output contacts immediately transfer and remain in this position if no further action is taken. Immediately upon opening of the EXT. SW., the time delay begins. At the end of the preset time delay, the output reverts to its original position and the unit is now ready for the next cycle.



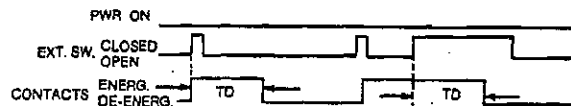
3. Interval On

(SW2 "ON", SW3 "ON"). Upon application of power to the input terminals, the output contacts transfer immediately and the timing period begins. At the completion of the preselected time delay, the output contacts de-energize. Reset is accomplished by removal of the input power.



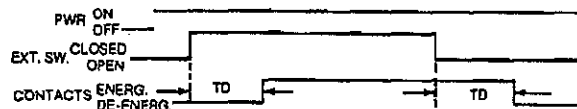
4. One Shot

(SW2 "ON", SW3 "ON"). (Same program as Interval On.) Closing the external switch energizes the external relay and starts a time delay at the conclusion of which the internal relay de-energizes. If the external switch is opened and re-closed during a timing cycle, a fresh delay is initiated at the conclusion of which the internal relay de-energizes.

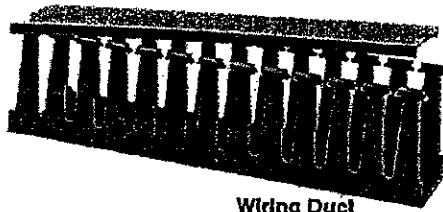


5. Delay on Operate/Delay on Release

(SW2 "OFF", SW3 "OFF"). Closing the external switch will initiate a delay on operate (internal relay will energize after set delay period). The internal relay will remain energized as long as the external switch remains closed. Upon opening the external switch a delay on release is started (same delay time as on operate). At the conclusion of the delay period the internal relay de-energizes and is ready for re-cycle. The above delay cycles may be aborted by removing input power.



Wiring Duct



Wiring Duct

Specifications/Features

Gray rigid PVC plastic.
High dielectric strength.
Self-extinguishing will not support combustion.
Includes bottom mounting holes.

Duct Only

Part No.	Dimensions			Std. Pkg. Qty.	Shpg. Wt./Pkg. Lbs.
	W	H	L		
P-211-2-01	1"	1-1/2"	6'	12	12
P-211-4-01	1"	3"	6'	12	31
P-213-4-01	2"	3"	6'	12	35

Cover Only

Part No.	Dimensions		Std. Pkg. Qty.	Shpg. Wt./Pkg. Lbs.
	W	L		
P-221-0-01	1"	6'	12	7
P-223-0-01	2"	6'	12	10

Rivet Installation Tool

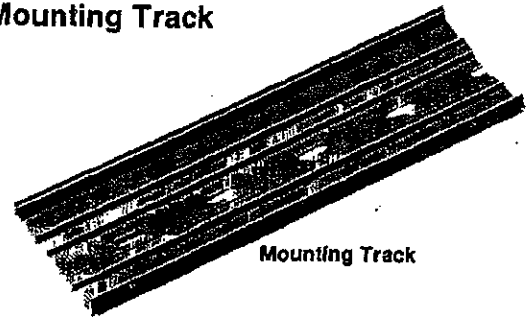
For inserting rivets when securing duct with nylon rivets.
Provides completely insulated installation.
Can be used to mount other panel equipment.
Requires 3/16" hole.
Material thickness 1/64" to 1/4".



Rivet Installation Tool

	Part No.	Std. Pkg. Qty.
Tool	P-280	1 each
Rivets	P-290	100/box

Mounting Track



Mounting Track

P-603 2-7/8" Track for use with P-100-2 Socket
P-605 3-3/8" Track for use with P-100-4 Socket

Part No.	Dimensions		Std. Pkg. Qty.	Shpg. Wt./Pkg. Lbs.
	W	L		
P-603	2-7/8"	4'	1	1
P-605	3-3/8"	4'	1	1



P-610 36" Long Rail (Din Rail) for use with P-101-4 & P-110-8-M Socket

NOTE

P-310 and P-311 Time Clocks may also be mounted on P-610 Din Rail. Request Din Rail mounting when ordering P-310 and P-311's.

P-350 Circuit Breakers

Part No.	Amp
P-350-1	5.
P-350-2	12.5
P-350-3	20.





RELAYS & CONTACTORS

MULTI-VOLTAGE CONTROL RELAYS MR SERIES



DESCRIPTION

The **MR Series Multi-Voltage Control Relays** offer SPDT or DPDT contacts, which may be operated by multiple input control voltages.

Each relay section contains a red LED, which indicates the relay coil is energized. Relay sections may be snapped apart from standard four- or eight-section assemblies and used independently.

These relays are ideal for applications where local or remote contacts are required for control of electrical loads and general-purpose switching. They are suitable for use with HVAC, temperature control, fire alarm, security, building automation, and lighting control systems.

FEATURES

- Multi-voltage input, SPDT or DPDT control relays
- LED indication when relay is energized
- Snap-apart relay sections for standard four- or eight-section assemblies
- Track, spacer, or enclosed mounting options



MR-101/T



MR-601/T



MR-801/S



MR-101/C



MR-104/T

- Dust-proof housing with LED viewing holes on enclosed models
- Relays rated for 10,000,000 mechanical operations

RELAYS & CONTACTORS

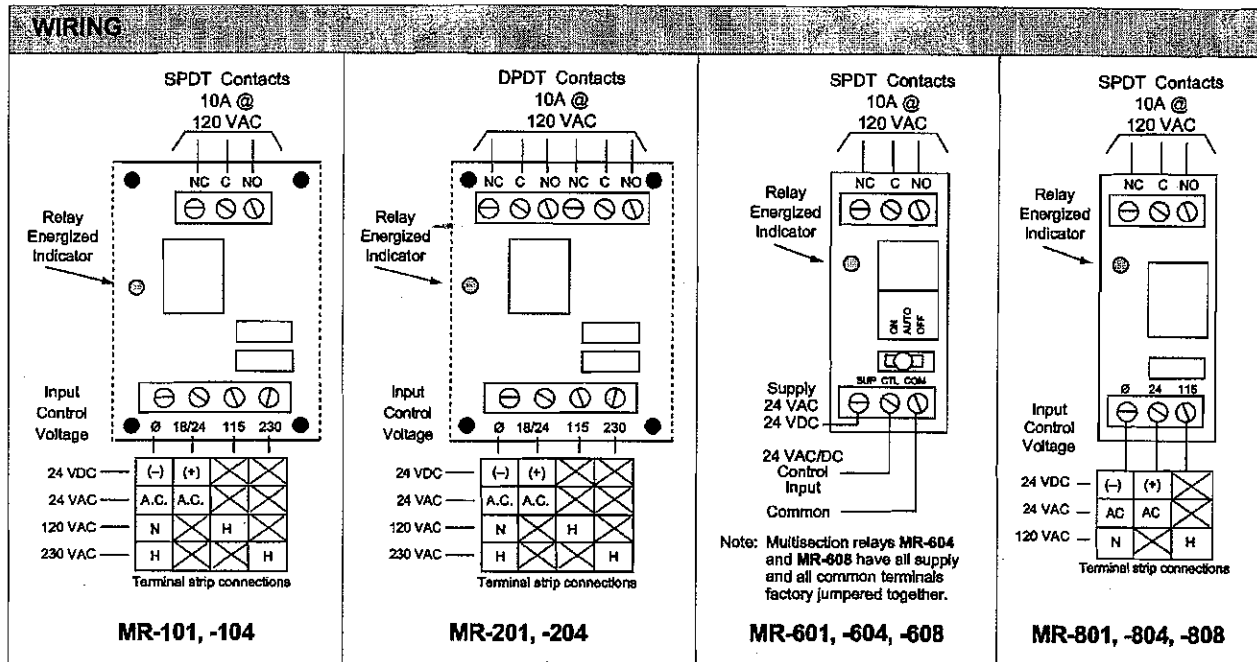
SPECIFICATIONS				
	SERIES			
	MR-100	MR-200	MR-600	MR-800
Relay sections (snap-apart)	1 or 4		1, 4, or 8	
Voltage Input	24 VDC @ 15 mA 24 VAC @ 30 mA 120 VAC @ 20 mA 230 VAC @ 20 mA	24 VDC @ 30 mA 24 VAC @ 39 mA 120 VAC @ 35 mA 230 VAC @ 35 mA	24 VAC, 24 VDC @ 15 mA	24 VAC, 24 VDC @ 15 mA
Contact type	SPDT	DPDT	SPDT	
Contact rating	10A Res. @ 120 VAC 7A Res. @ 230 VAC/28 VDC N.O.: 1/8 hp @ 120 VAC N.C.: 1/8 hp @ 120 VAC		10A @ 120 VAC 7A @ 24 VDC	10A @ 120 VAC 7A @ 30 VDC/277 VAC 1/4 hp @ 120 VAC 1/3 hp @ 230 VAC
Temp	-60° to 185°F (-50° to 85°C)		-22° to 140°F (-30° to 60°C)	
Indication	LED			
Mounting	Track or enclosed		Track	Track or spacer
Enclosure option	18-gauge metal back, ABS-94VO plastic cover 1/2" knockouts		-	
Manual override	-		On/Auto/Off Switch	-
Dimensions	3.25"H x 2.13"W x 1.5"D (8.25 x 5.39 x 3.81 cm)		3.5"H x 2.13"W x 1.38"D (8.9 x 5.4 x 3.5 cm)	
Enclosure dimensions	5.13"H x 3.13"W x 2.5"D (13.46 x 7.95 x 6.35 cm) or 5.13"H x 9.5"W x 2.5"D (13.46 x 24.13 x 6.35 cm)		-	
Approvals	UL recognized component Enclosed model UL listed		UL recognized component	

*Specifications are for each relay section.



RELAYS & CONTACTORS

MULTI-VOLTAGE CONTROL RELAYS MR SERIES



RELAYS & CONTACTORS

ORDERING INFORMATION

MODEL	COIL VOLTAGE				SECTIONS		MOUNTING			SWITCH	APPROVALS		
	24 VDC	24 VAC	120 VAC	230 VAC	SPDT (10A)	DPDT (10A)	Track (Included)	Spacers (Included)	Enclosure (Included)	Manual Override On/Auto/Off	UL	MEA	CSFM
MR-101/T	X	X	X	X	1		X				Recognized		X
MR-101/C	X	X	X	X	1				X		Listed	X	X
MR-104/T	X	X	X	X	4		X				Recognized		X
MR-104/C	X	X	X	X	4				X		Listed	X	X
MR-201/T	X	X	X	X		1	X				Recognized		X
MR-201/C	X	X	X	X		1			X		Listed	X	X
MR-204/T	X	X	X	X		4	X				Recognized		X
MR-204/C	X	X	X	X		4			X		Listed	X	X
MR-601/T	X	X			1		X			X	Recognized		
MR-604/T	X	X			4		X			X	Recognized		
MR-608/T	X	X			8		X			X	Recognized		
MR-801/T	X	X	X		1		X				Recognized		
MR-801/S	X	X	X		1			X			Recognized		
MR-804/T	X	X	X		4		X				Recognized		
MR-804/S	X	X	X		4			X			Recognized		
MR-808/T	X	X	X		8		X				Recognized		
MR-808/S	X	X	X		8			X			Recognized		

Accessories

Application

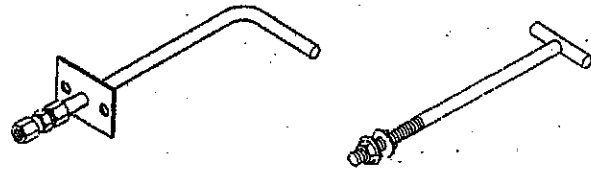
Duct static pressure sensing tips.

AP-302, AP-305

Pressure Sensing Tips

Specifications

- Mounting hardware: Provided.



Model No.	Type of End Fitting	Construction	Mounting Location	Dimensions in. (mm)	For Use with
AP-302	1/4 in. for plastic or copper	Brass	Areas with air turbulence caused by filters, dampers, etc.	Insertion length 4 (102); 5 L x 2-1/2 W (127 x 64)	P323 Series, PC-301, PF-300 Series, PP-1012, PP-3013, PP-3113, PP-8121, PP-8518, PP-8818, PP-8821, PKS-323, R435, R436.
AP-305	1/8 in. pipe thread	Brass with S.S. tee end	Very low actuating pressure	8-3/4 L x 2-1/2 W (222 x 64)	

Application

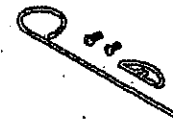
Lock cover screw kit modifies TK Series room thermostats to prevent unauthorized tampering of either the dial setting or the internal mechanism.

AT-101

Lock Cover Screw Kit

Specifications

- Two kits are required for duplex type thermostats.
- Used on all TK-1XXX and TK-5XXX except TK-17XX, TK-18XX.



Application

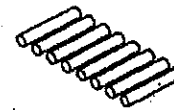
Package of 100 dial stop pins to insert in dial ends to limit the high or low setting of room thermostats.

AT-104

Dial Stop Pins

Specifications

- Used on all TK-1XXX and TK-5XXX except TK-17XX, TK-18XX.



POWER SUPPLIES

ENCLOSED DC POWER SUPPLY MODEL DCP-250

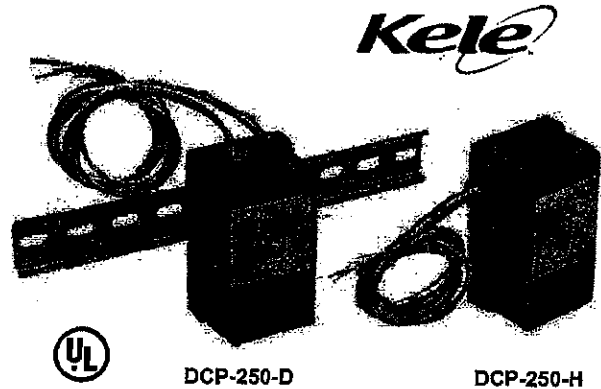


DESCRIPTION

The Model DCP-250 is a unique DC power supply that provides regulated 24 VDC power from a 120 VAC input. It is well suited for powering transmitters, transducers, actuators, and other equipment in building automation and temperature control systems. The Model DCP-250 can be ordered for hub mounting, surface mounting in a panel, or DIN rail mounting.

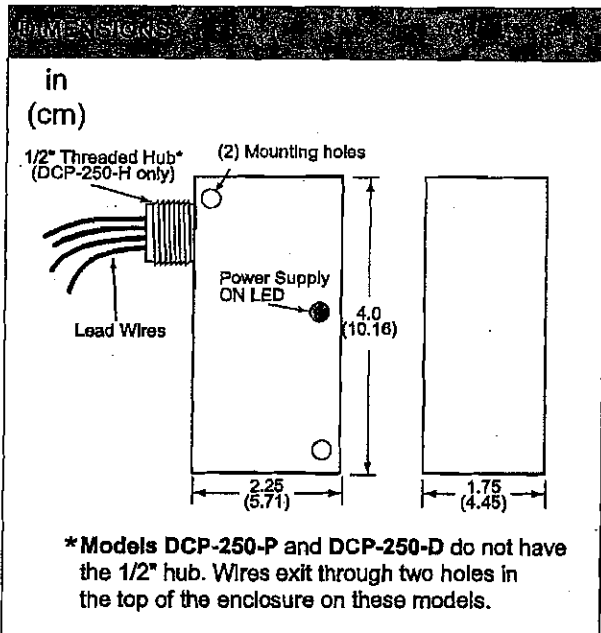
FEATURES

- Flexible mounting for hub, panel/surface, DIN rail
- Compact size
- Fully enclosed
- Color-coded wiring
- LED Indication
- UL listed



SPECIFICATIONS	
Voltage Input	110-125 VAC, 50/60 Hz, 10 VA
Output	23.5-24.5 VDC (regulated)
Max load	250 mA
Mounting	1/2" hub, panel/surface, DIN rail
Lead wires	20" (50.8 cm)
Supply input	16 AWG
Load	18 AWG
Temp	-22° to 104°F (-30° to 40°C)
Weight	1.0 lb (0.5 kg)
Approvals	UL listed, File #E185225

Black	—	L	} - 120 VAC
White	—	N	
White/Red	—	+	} - 24 VDC
White/Black	—	-	



MODEL	DESCRIPTION
DCP-250-H	DC Power Supply, Hub Mount
DCP-250-P	DC Power Supply, Panel/Surface Mount
DCP-250-D	DC Power Supply, DIN Rail Mount

Related Products	
DIN-3F, BAM-1000	DIN rail

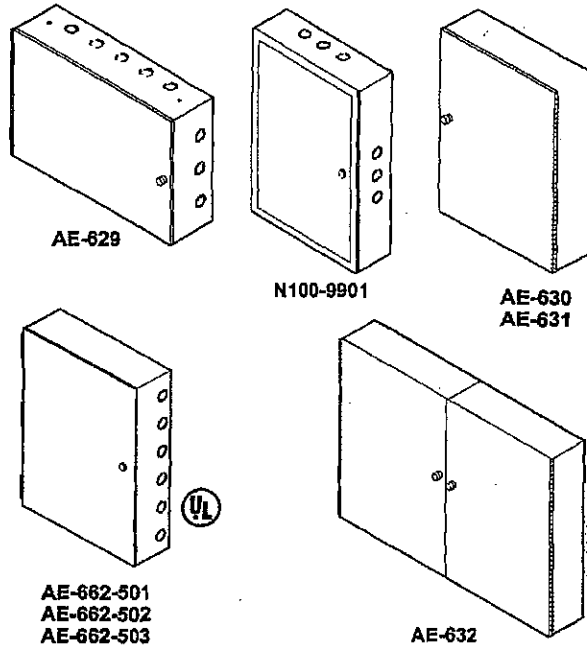
AE-600 Series

Control Cabinets

Control cabinets for mounting of electric, electronic, and pneumatic controls.

Features:

- A variety of control cabinets permits selection of the best one to suit the application.
- N100-9901 cabinet mounts up to 16 PNEUMODULAR components.
- Also see PNEUMODULAR Control Panels (PCP) on page 668.



Model Chart							
Model No.	Door		Steel Gage	Subpanel	Finish	Knockouts	Dimensions W x H x D In. (mm)
	Type	Opening					
AE-629	Single, continuously hinged	Right or left-handed	18	AE-630-101 or obtain locally	Belge paint	For 3/4 in. conduit, two on each side	24 x 16 x 7 (610 x 406 x 178)
AE-630							16 x 24 x 7 (406 x 610 x 178)
AE-631							24 x 32 x 7 (610 x 813 x 178)
AE-632	Double, continuously hinged	Right and left-handed	16	Obtain locally, one or two subpanels may be used			42 x 36 x 7 (1067 x 914 x 178)
AE-662-501	Single, three hinges	Left-handed	14	16 gage, perforated for #8 Type A sheet metal screws, flanged	White paint	Five on top and bottom, six on each side for 3/4 in. or 1 in. conduit. Eight 3/8 in. dia. on top and bottom, ten on each side for 3/8 bulkhead barbed pneumatic fittings.	24 x 30 x 7-1/2 (610 x 762 x 191)
AE-662-502				16 gage, solid, flanged			
AE-662-503				None, mounting studs for subpanel not provided			
N100-9901	Removable, reversible	Right or left-handed	16	16 gage, holes on 2 in. centers horizontally and vertically	Brown Paint	Top, bottom and sides	24 x 32 x 8 (610 x 813 x 203)

AE-600 Series

Model Chart (Continued)

N100-9901 Subpanels (T10).

Model No.	Description	Dimensions W x H In. (mm)
AE-630-101	Subpanel for AE-629 and AE-630, 16 gage, perforated for #8 Type A sheet metal screws, flanged	14-1/2 x 20 (368 x 508)
AE-631-101	Subpanel for AE-631, 16 gage, perforated for #8 Type A sheet metal screws, flanged	22-1/2 x 28 (572 x 711)

Specifications

Construction

Doors	Locking type, supplied with keys, rigidly supported. The doors are easily removed for protection on job site installation or mounting of components. Refer to Description Model Chart.
Steel Gage	Refer to Description Model Chart and N100-9901 Subpanels (T10) Model Chart.
Knockouts	Aligned so that a short nipple may be used to couple the panels. Refer to Description Model Chart.
Appearance	Refer to Description Model Chart.
Locations	NEMA Type 1.
Mounting	Four extruded mounting holes 1/4 In. (6mm).
Dimensions	Refer to Description Model Chart and N100-9901 Subpanels (T10) Model Chart.

H708-908

Adjustable Set-Point



THE INDUSTRY STANDARD!

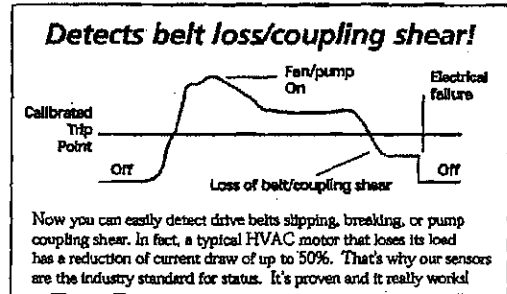
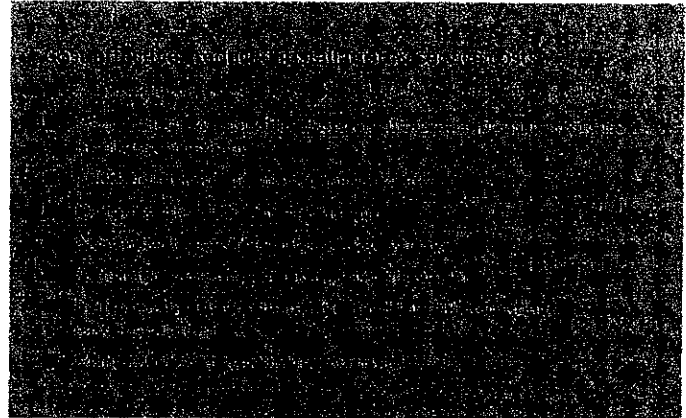
DESCRIPTION

The H708/808 solid and split core adjustable current sensors provide accurate, reliable and maintenance free fan and pump status indication.

APPLICATIONS

Monitor fans, pumps, motors & electrical loads for proper operation

- Detect belt loss and motor failure...ideal for fan and pump status
- Replace pressure switches and other electro-mechanical devices
- Verify lighting circuit loads
- Monitor critical motors (compressor, fuel, etc.)
- Industrial process equipment status (OEM)



CURRENT STATUS SWITCHES

Ordering INFORMATION

MODEL	AMPERAGE RANGE	OUTPUT TYPE	OUTPUT RATING (Max.)	Trip Point Adjustment	TRIP LED	POWER LED*
H708	0-100	Relay	10A	Adjustable	Yes	No
H808	0-100	Relay	10A	Adjustable	Yes	No
H708	0-100	Relay	10A	Adjustable	Yes	Yes
H808	0-100	Relay	10A	Adjustable	Yes	Yes

* Do not use the Power LED for indication of applied voltage

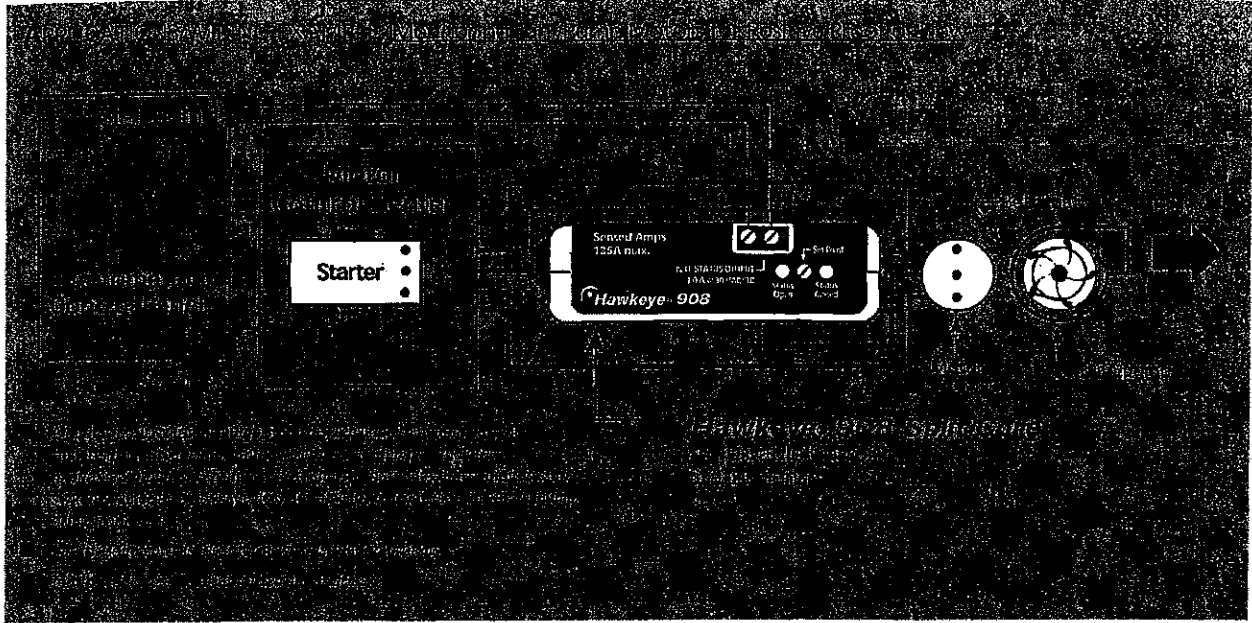
Optional Ordering INFORMATION

MODEL	DESCRIPTION
H708-908	Adjustable Set-Point

SEE PAGE 30 FOR THE LABOR SAVING MINI H608!

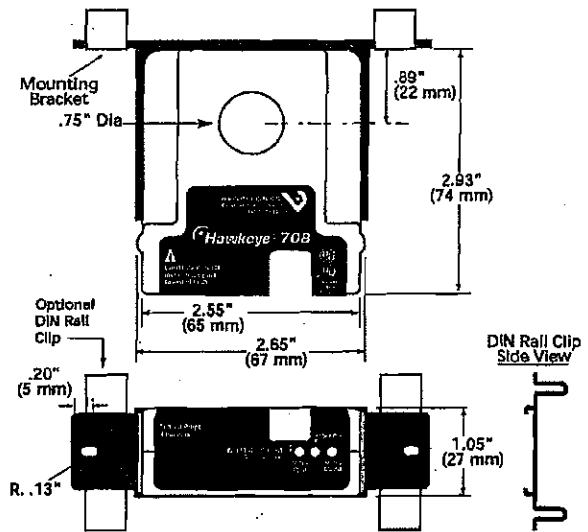
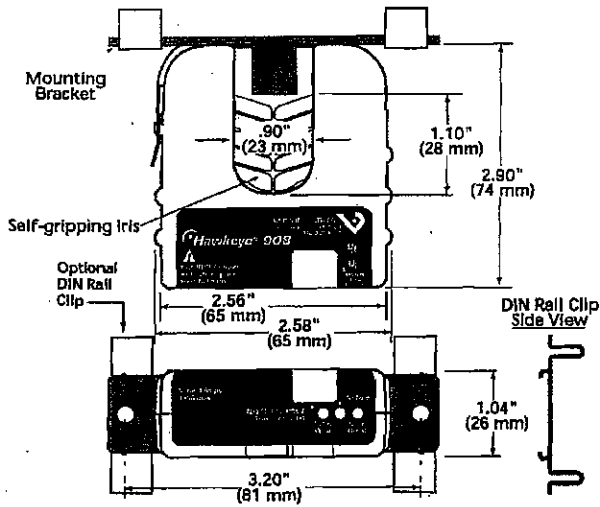
SEE PAGE 44 FOR THE RELAY COMBO H738

H708/908



CURRENT STATUS SWITCHES

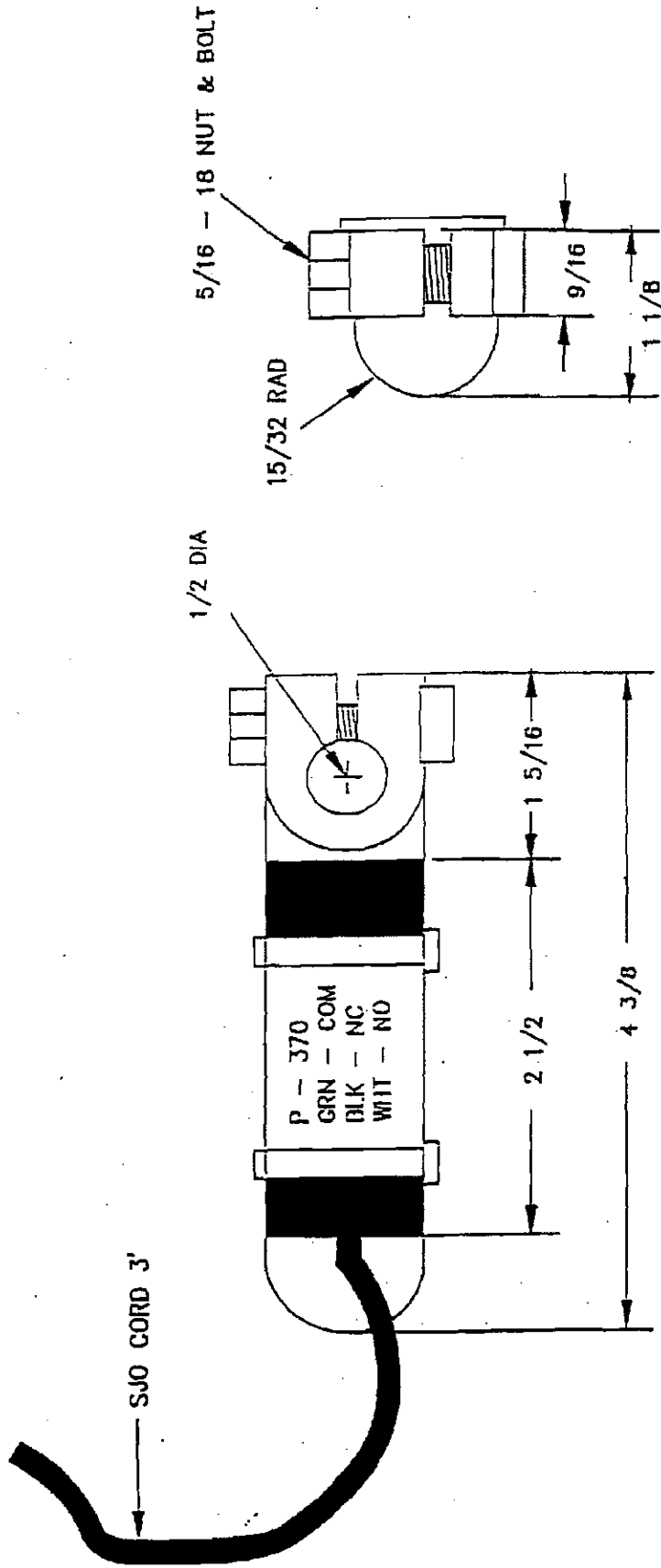
DIMENSIONAL DRAWINGS



SPECIFICATIONS

Sensor Power	Induced from line
Isolation	600 VAC rms
Temperature Range	-15° to 60°C
Humidity Range	0 - 95% non-condensing
Dimensions (708)	(L x W x H) 2.93" x 2.65" x 1.05"
Sensor Hole Size (708)	0.75" diameter
Dimensions (908)	(L x W x H) 2.90" x 2.58" x 1.04"
Sensor Opening Size (908)	(L x W) 1.10" x .90"

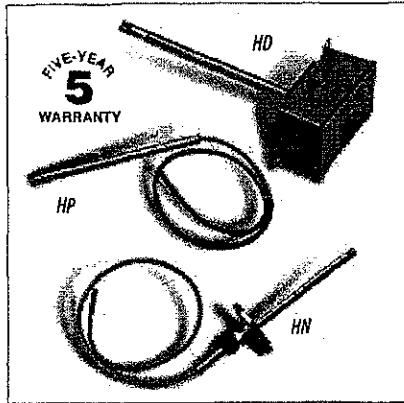
ENCAPSULATED MERCURY SWITCH
 SPDT - 1 AMP AT 125/0.7 AMPS @ 240V
 150° MAX INCLUDED ANGLE
 BETWEEN MAKE & BREAK



PART NAME	DAMPER END SWITCH
PART NO.	P - 370
DRAWN BY	ACAD
DATE	1-11-89

Calman PURCHASED MATERIAL

HD Series Duct Mount Humidity Sensors 1% and 2% NIST, or Standard 2%, 3%, or 5%



HD Series duct mount humidity transmitters provide outstanding installation savings, exceptional accuracy, long-term stability and are best in the industry for serviceability. The electronics are sealed inside the duct probe, thereby preventing failures resulting from condensation. The thin-film capacitive HS sensor elements are factory calibrated using NIST certified calibration equipment, are field replaceable and never require field calibration. Field replacement of the sensor element is a snap with the patented removable sensor.

Sense humidity in harsh environments

- Thin-film polymer capacitive sensor element recovers from 100% saturation
- Electronics are encapsulated in stainless probe to resist corrosion
- Fully interchangeable element to 1%, 2%, 3% or 5% accuracy. Calibration-free!

Applications

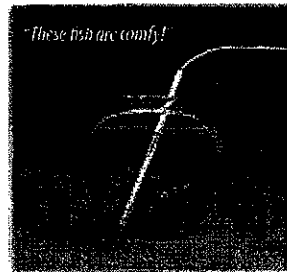
- Energy management systems
- HVAC control for improved comfort & energy savings
- Museums, schools, printing shops and other locations requiring humidity control
- Facilitate compliance with ASHRAE standards for environmental control and indoor air quality

Rugged industrial design

- Pendant, duct and insertion versions for application flexibility
- Duct sensor element can be serviced without disturbing conduit
- Polarity insensitive, two-wire 4-20mA, or 3-wire, 0-5/0-10VDC versions...flexible systems compatibility

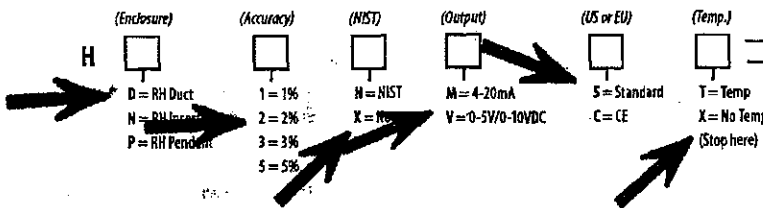
Calibration-free interchangeable NIST traceable HS element

- Replace digital sensor quickly without calibration... maintain accuracy and eliminate downtime
- HS element is microprocessor profiled with on-board nonvolatile memory
- Multi-point digital calibration to NIST standards
- NIST certification available
- Recovers from 100% saturation...no damage to sensor



68

ORDERING INFORMATION



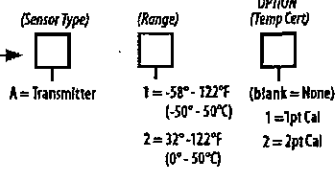
Example: (No Temp)

H P 2 X V S X

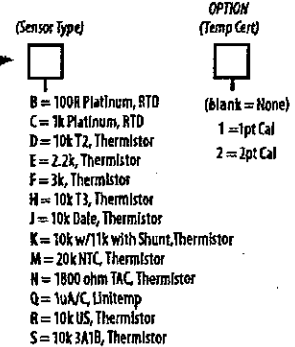
Example: (With Temp)

H D 2 X V S T C 2

Humidity Transmitter Combination



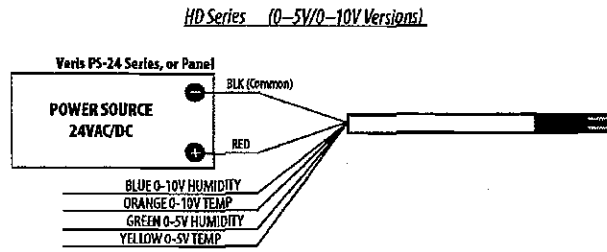
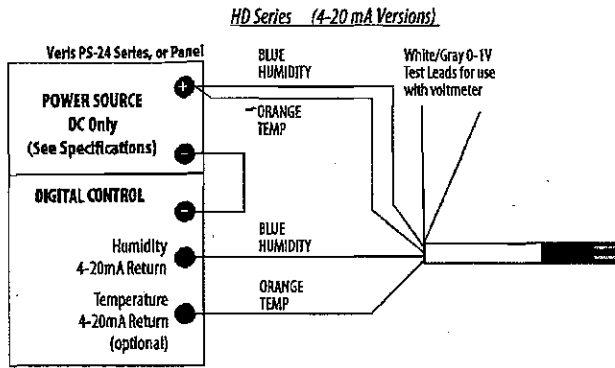
Humidity RTD/Thermistor Combination



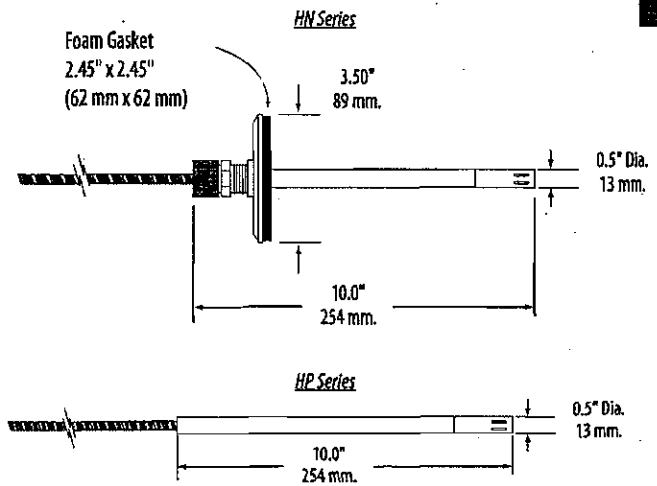
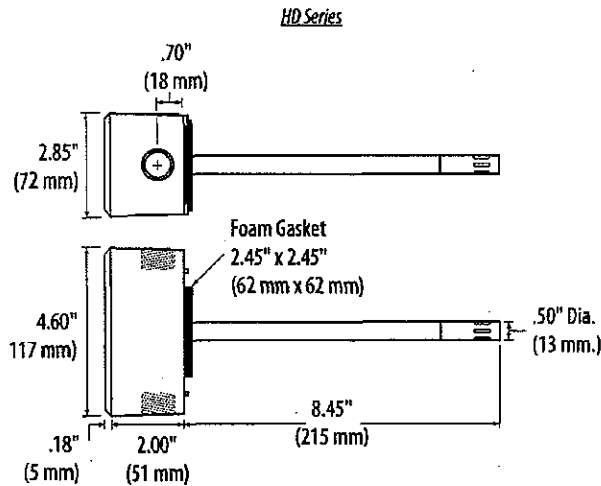
ACCESSORIES

Water guard... See page 205

WIRING DIAGRAMS



DIMENSIONAL DRAWINGS



SPECIFICATIONS

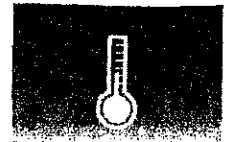
HS Element	Digitally profiled thin-film capacitive (32 bit mathematics) U.S. Patent 5,844,138
Accuracy	±1%, 2%, 3%, or 5% (specify) @ 10 to 90% RH; Four-point calibration, Multi-point certification, NIST traceable
Reset Rate*	24 hours
Stability	±1% @ 20°C (68°F) annually, for two years
Operating Humidity Range	0 to 100% RH
Temperature Coefficient	+0.1% RH/°C below 25°C; -0.1% RH/°C above 25°C
Analog Output	4-20mA version; 2-wire, polarity insensitive, (clipped and capped) 0-5V/0-10V versions; 3-wire, observe polarity
Scaling	0-100% RH
Input Power	4-20mA version; loop powered 12-30VDC only, 30mA max. 0-5V/0-10V versions; 12-30VDC/24VAC, 15mA max.
Optional Temperature Transmitter	Digital, 4-20mA, (clipped and capped) or 0-5V/0-10V output; accuracy ±0.5°C (±1°F). Range specified on sensor
EMC Conformance - CE Option	EN 50081-1, EN 50082-1, EN 61000-4-4, EN 61000-4-5, EN 61000-4-3, EN 50204, EN 61000-4-6

*Reset Rate is the time required to recover to 50% RH after exposure to 90% RH for 24 hours.

One side of transformer secondary is connected to signal common, so an isolation transformer or dedicated power supply may be required.

Shielded cabling is required for conformance to EMC standards. Technical information is available from factory upon request or is available on our website: www.veris.com

TEMPERATURE



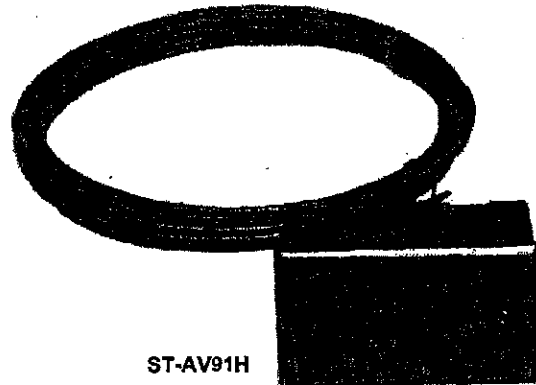
1000 OHM 375 PLATINUM AVERAGING SENSORS MODEL ST-AV91H

DESCRIPTION

The continuous resistance element **Model ST-AV91H 1000Ω 375 Platinum Averaging Sensors** provide accurate sensing of duct temperatures when a large area must be covered. They average temperatures over their entire length and terminate in a weatherproof housing.

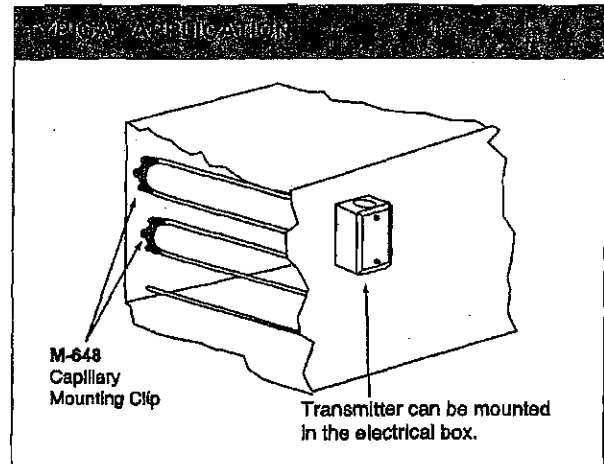
The **Model ST-AV91H** uses an element that closely matches platinum resistance/temperature characteristics over the specified range.

The sensors have a copper case bendable to a radius of 4" (10.2 cm), and they can crisscross a duct or plenum to average out temperature stratification.




ST-AV91H

Sensing element	1000Ω ±0.25% @ 32°F (0°C) TCR 0.00375 Ω/Ω°C platinum curve
Temp range	-40° to 240°F (-40° to 115°C)
Approx sensitivity	2.1Ω/°F @ 32°F (0°C)
Lead wires	22 AWG teflon insulated, white/black
Element length	24' (7.3m) or 12' (3.7m) 50' (15.2m)
Element casing	Copper 0.187" dia (0.475 cm)
Housing	Weatherproof



ORDERING INFORMATION

MODEL	DESCRIPTION
ST-AV91H	Platinum Averaging Duct Sensor 24' (7.3m)
ST-AV91H12	Platinum Averaging Duct Sensor 12' (3.7m)
ST-AV91H50	Platinum Averaging Duct Sensor 50' (15.2m)


ST-AV91H *Example: ST-AV91H 1000Ω 375 Platinum averaging duct sensor, with 24' (7.3m) element*

Related Products

T91U	4-20 mA temperature transmitter for 1000Ω platinum sensors
TT-807	4-20 mA temperature transmitter for 1000Ω platinum sensors
M-648	Capillary mounting clip

PRESSURE



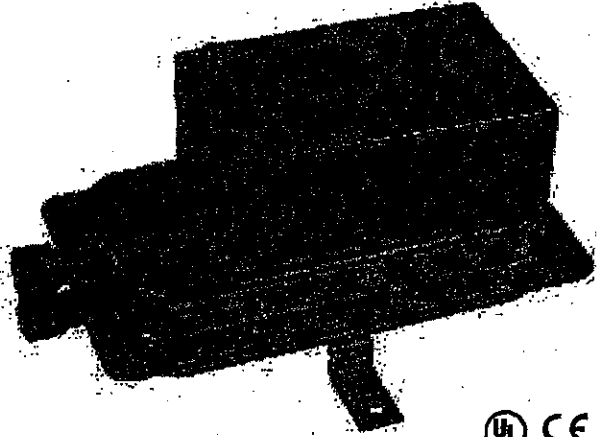
MANUAL RESET AIR SENSING SWITCH MODELS AFS-460, AFS-460-DSS

DESCRIPTION

The Model AFS-460 Manual Reset Air Sensing Switch is designed to sense static or differential pressure and to break an electrical circuit when the set point is exceeded. The electrical circuit will remain open until the reset button on the switch is pressed.

The Model AFS-460 is furnished with 1/4" compression fittings for copper or plastic tubing. The set point is adjustable from 0.4" to 12" W.C.

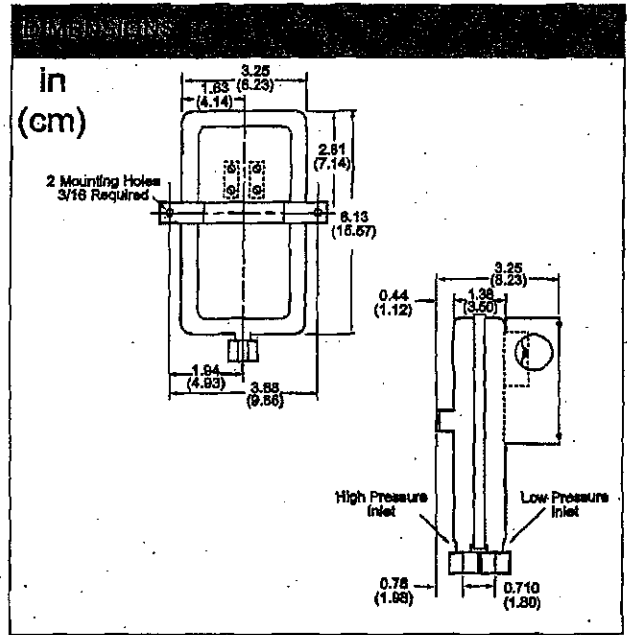
The Model AFS-460-DSS is the same reliable air sensing switch as the Model AFS-460 with the addition of a second SPST normally closed contact. The Model AFS-460-DSS is ideal for the application that requires status as well as an indication of condition.



FEATURES

- Manual reset
- SPST contact (normally closed)
- 1/4" compression fittings
- Adjustable range
- Optional double SPST contact arrangement

Set point range	0.4" to 12.0" W.C. (99.6 to 2989 Pa)
DSS option	2.0" to 12.0" W.C. (498 to 2989 Pa)
Reset	Manual push button
Mounting position	Diaphragm in any vertical plane
Contacts	SPST (normally closed)
DSS option	2 SPST (normally closed)
Electrical rating	15A @ 125-277 VAC 1/4 HP @ 125 VAC 1/2 HP @ 250 VAC 1/2A @ 125 VDC
Pressure connectors	1/4" compression, suitable for use with 1/4" copper or plastic tubing
Overpressure	0.5 psig (2.5 kPa)
Operating temp	-40° to 180°F (-40° to 82°C)
Approval	UL listed, CE
Weight	
Life	6,000 cycles min @ 0.5 psig (3.5 kPa) max pressure and at max rated load each cycle



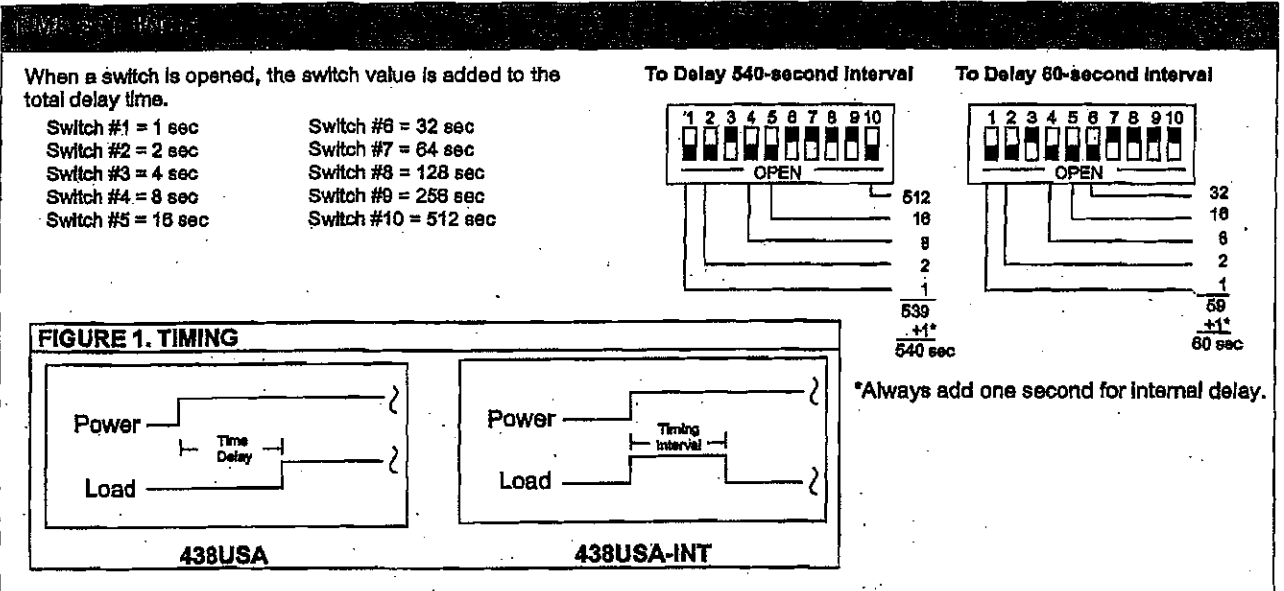
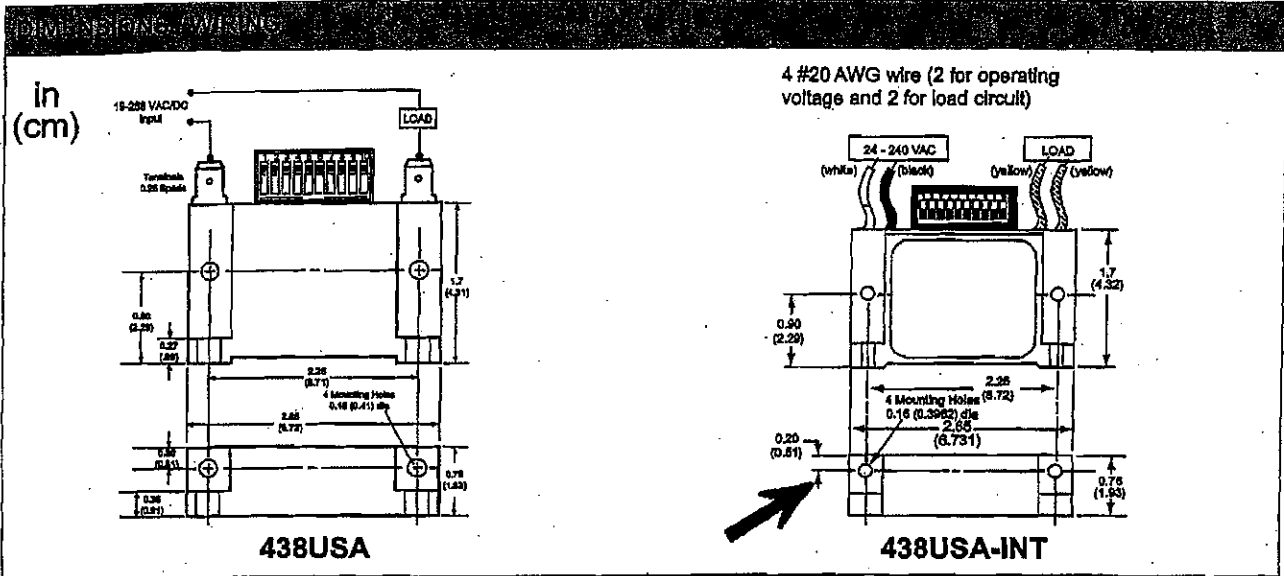
MODEL	DESCRIPTION
→ AFS-460	Manual Reset Air Sensing Switch
→ AFS-460-C	Kele Calibrated for Your Application (specify set point)
→ AFS-460-DSS	Manual Reset Air Sensing Switch with 2 SPST Contacts
→ AFS-460-DSS-C	Kele Calibrated for Your Application (specify set point)

Related Product
#21121
A-301, A-302
Duct Impact tube
Static pressure tip

RELAYS & CONTACTORS



DELAY ON MAKE / INTERVAL TIMERS MODELS 438USA, 438USA-INT



MODEL	DESCRIPTION
438USA	Universal Switch-Adjustable Time Capsule, Delay on Make (On-Delay) Timer
438USA-INT	Universal Switch-Adjustable Time Capsule, Interval Timer

MISCELLANEOUS CONTROLS

LOW & HIGH TEMPERATURE CUT-OUT CONTROLS

A70 SERIES

DESCRIPTION

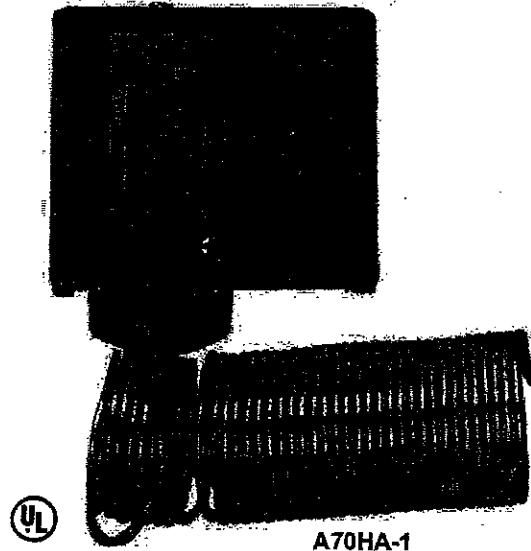
The **A70 Series** heavy-duty temperature cut-out controls incorporate a vapor-charged sensing element. The **A70G**, **A70H**, and **A70K** have a four-wire, two-circuit contact block that contains two isolated sets of contacts. The contacts are designed to transfer at set point so that when the main contact opens, the auxiliary contact closes simultaneously.

FEATURES

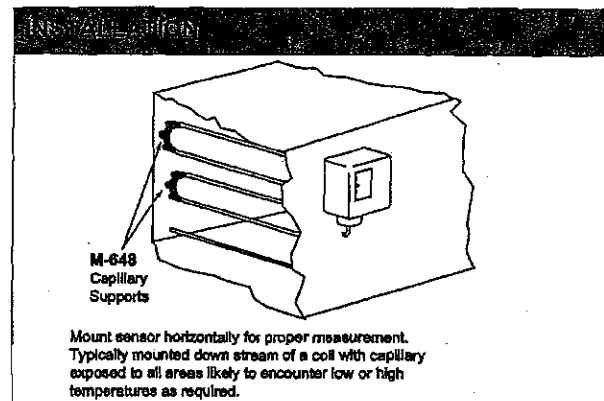
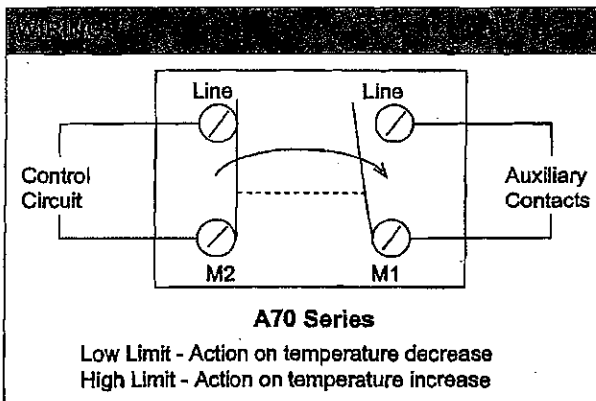
- *Automatic or manual reset models*
- *Long-life, snap-acting contacts*
- *Easy set point adjust*

APPLICATIONS

Typical applications include shutdown of a ventilation system and BAS alarm indication upon low or high temperature cut-out.



A70HA-1



MODEL NUMBER	SWITCH ACTION (Main contacts) LINE-M2	TEMP RANGE °F (°C)	RESET °F (°C)	BULB/ CAPILLARY	MAX BULB TEMP °F (°C)	RANGE ADJUSTER	ELECTRICAL RATING (all A70's shown)								
							MOTOR RATINGS (VAC)	LINE-M2 (Main)				LINE-M1 (Auxiliary)			
								120	208	240	277	120	208	240	277
A70GA-1* Low Limit	Open Low	15 to 55 (-10 to 15)	Auto 5 (2.8)	20' of 1/8" (8m of 0.32 cm) O.D. tubing	400 (280)	Screwdriver Slot	AC Full Load Amp	16.0	9.2	8.0	-	6.0	3.3	3.0	-
A70HA-1* Low Limit	Open Low	15 to 55 (-10 to 15)	Manual Reset	20' of 1/8" (8m of 0.32 cm) O.D. tubing	400 (280)	Screwdriver Slot	AC Non-Inductive Amp	16.0	9.2	8.0	-	6.0	6.0	6.0	6.0
A70HA-2* Low Limit	Open Low	35 to 80 (0 to 25)	Manual Reset	3/8" x 3" (0.95 x 7.6 cm) 6' (1.9m) cap	250 (121)	Screwdriver Slot	Pilot Duty	125 VA, 24-600 VAC 57.5 VA, 120-300 VDC							
A70KA-1* High Limit	Open High	100 to 170 (38 to 77)	Manual Reset	3/8" x 10" (0.95 x 25.4 cm) 6' (1.9m) cap	240 (116)	Screwdriver Slot									

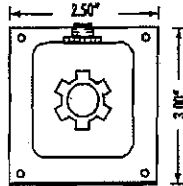
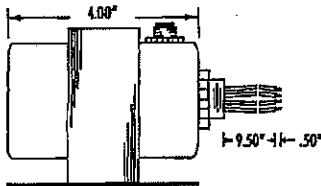
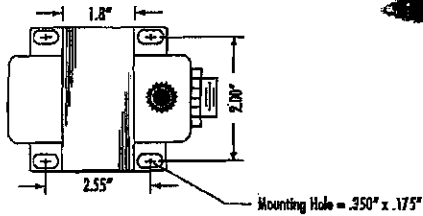
*Shipped with set point at 35°F (1.6°C). Control responds to the coldest 12" (30.5 cm) section of the sensor. Avg. weight 2.6 lb (1.2 kg)

Model TR100VA001

Transformer, 100VA, 120 to 24 Vac, Circuit Breaker, foot and single threaded hub mount

us Class II

Functional Devices, Inc. A568A 10/1/01



Ratings

VA Rating	100
Mounting	Foot & Single Threaded Hub
Circuit Breaker	Yes
Dimensions	3.00" x 2.50" x 4.00" (w/ .5" NPT Hub)
Wire Length	9.5" Typical w/ .5" Strip
Weight	4.06 lbs.
Approvals	Class II UL1585 Recognized US / Canada

Primary Wires

White	120 Vac
Black	Common

Secondary Wires

Yellow	24 Vac
Yellow	24 Vac

Note: Specifications may vary. See website for most recent specifications.

T-208

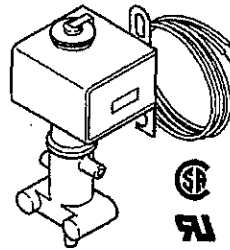
AL-170 Series, AL-180 Series

Solenoid Air Valves

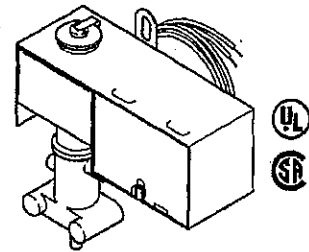
For applications where an electrical circuit is used to control a pneumatically-operated device. Used to direct supply air to a pneumatic device when the coil is energized or de-energized, depending on the supply and exhaust air connects.

Features:

- Open frame or junction box construction accommodates a wide variety of NEMA 1 mounting locations.
- Available in 24, 120, 208, 240, or 480 Vac models.
- Supplied with 18 in. electrical leads for ease of installation.
- Corrosion-resistant plastic body.
- Barbed fittings for 1/4 in. O.D. plastic tubing.



AL-170



AL-180

Model No.		Voltage (AC 60 Hz)	Replacement Coil Part Numbers
Open Frame	J-Box		
AL-170	AL-180	24	PNR-325-24
AL-171	AL-181	120	PNR-325-120
N/A	AL-181-201 ^a	120	—
N/A	AL-182	208	PNR-325-208
N/A	AL-183	240	PNR-325-240
N/A	AL-185	480	PNR-325-480

^a with wire harness.

Specifications

Valve inputs

Power Input 6.5 Watts (energized).
17.3 VA Inrush.
9.2 VA Holding.

Voltage For available voltages, refer to Model Chart.

Electrical connections 18 in. (457 mm) leads on the coil.

Maximum Inlet air pressure 30 psig (207 kPa). Clean, dry, oil free air is required (reference EN-123).

Air connections Three plastic ferrules included for plastic 1/3 in. tubing (PKG-1141).
N.C., Normally closed, Port 1.
N.O., Normally open, Port 2.
COM, Common, Port 3.

Valve outputs

Flow capacity 0.3 scfm (142 ml/sec) at 15 psig (103 kPa) supply with 1 psig (6.9 kPa) drop.

Environment

Ambient temperature limits Shipping: -40 to 150°F (-40 to 65°C).
Operating: 40 to 130°F (4 to 54°C).
Supply air: 40 to 130°F (4 to 54°C).

Humidity 50 to 95% RH, non-condensing.

Location NEMA Type 1.

Mounting

Vertical with solenoid at top (as shown).

Dimensions

AL-170 3-5/16 H x 1-9/16 W x 1-7/32 D in. (84 x 40 x 31 mm).

AL-180 3-3/4 H x 3-13/16 W x 1-3/8 D in. (95 x 97 x 35 mm).

AL-170 Series, AL-180 Series

Typical Applications

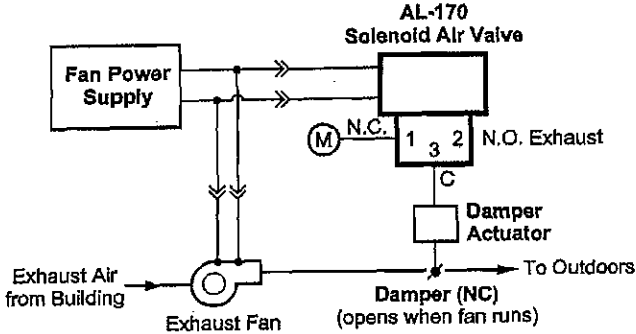


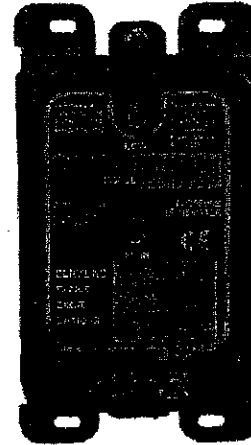
Figure 1 Typical Application Diagram.

PRESSURE

DIFFERENTIAL PRESSURE TRANSMITTER MODEL M264

DESCRIPTION

The Model M264 Differential Pressure Transmitter is a low air pressure transmitter able to sense differential pressure in both negative and positive ranges. The Model M264 incorporates a tensioned stainless steel diaphragm to form a variable capacitor that will produce variation in the output current. The Model M264's durable design will tolerate an overpressure of 10 psig (68.95 kPa) and is warranted for 3 years unconditionally.



FEATURES

- 4-20 mA output signal
- Voltage output signal optional
- 10 psig (68.70 kPa) overpressure
- Three-year unconditional warranty
- 1% accuracy
- Reverse wiring protected
- Stainless steel diaphragm
- Ideal for air and non-conducting gases
- $\pm 0.4\%$ and $\pm 0.25\%$ accuracies also available

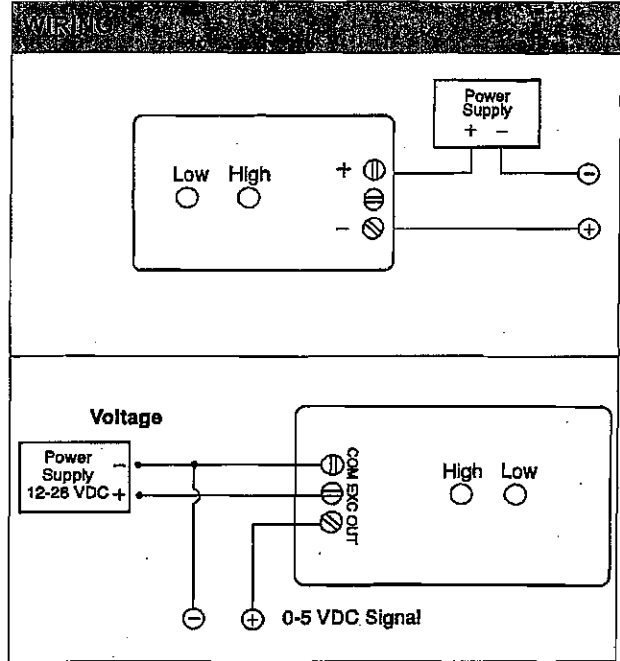
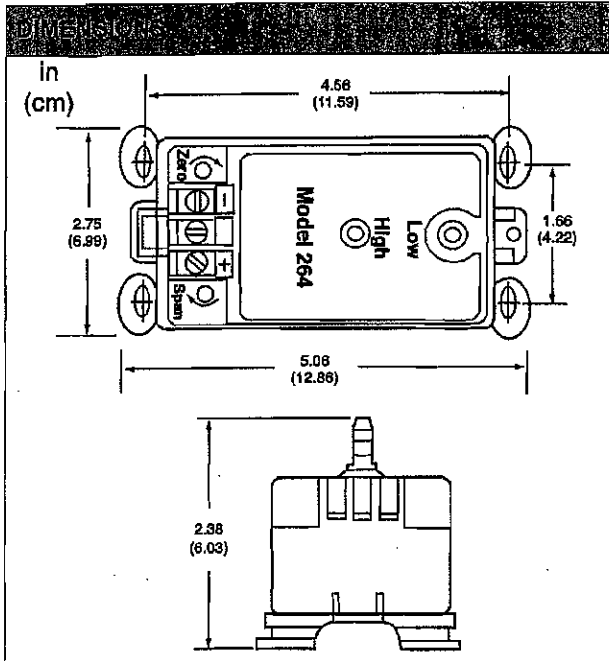
APPLICATIONS

- HVAC building automation
- Variable air volume control
- Environmental pollution control
- Lab and fume hood control
- Filter monitoring
- Medical instrumentation
- Velocity pressure measurement

Supply voltage		Operating humidity	0° to 175°F (18° to 79°C)
Current	Based on circuit resistance	Enclosure	Fire retardant, glass-filled polyester
Min	9 + (0.02 x circuit resistance)	Approvals	CE certified
Max	32 + (0.004 x circuit resistance)	Connections	3/16" OD barbed brass
Voltage output	9-30 VDC; 12-40 VDC	Dimensions	5.51"W x 3.00"H x 1.91"D (14.00 x 7.62 x 4.85 cm)
Power	0.7 VA	Weight	0.55 lb (0.25 kg)
Accuracy		Bidirectional output @ zero pressure	2.5 VDC
RSS (at constant temp)	$\pm 1\%$ FS	Circuit	Two-wire
Non-linearity	$\pm 0.96\%$ FS	Output	4-20 mA
Non-repeatability	0.1% FS	Bidirectional output @ zero pressure	12 mA
Hysteresis	0.2% FS	Circuit	Three-wire
Thermal effects		Position Effect	(Unit is factory calibrated at 0g effect with diaphragm vertical)
Compensated range	0° to 150°F (-18° to 65°C)	Range (In)	Zero offset (%FS/G)
Zero/Span shift	0.033°F (0.018°C)	0-10	0.12
Output	0-5 VDC	0-5	0.14
Analog		0-1.0	0.22
Voltage (three-wire)	0-5 VDC	0-0.1	2.10
Input impedance	$\geq 5000\Omega$		
Current (two-wire)	4-20 mA		
Max load	800 Ω		
Overpressure	± 10 psig (68.95 kPa)		
Temp			
Operating	0° to 175°F (-18° to 79°C)		
Storage	-65° to 250°F (-54° to 121°C)		

PRESSURE

DIFFERENTIAL PRESSURE TRANSMITTER MODEL M264



SPECIFICATION INFORMATION

MODEL	DESCRIPTION
M264	Differential Pressure Transmitter
XXX	RANGE CODE (see Figure 1)
C	4-20 mA output (stocked at Kele)
V	0-5 VDC output (call Kele for availability)

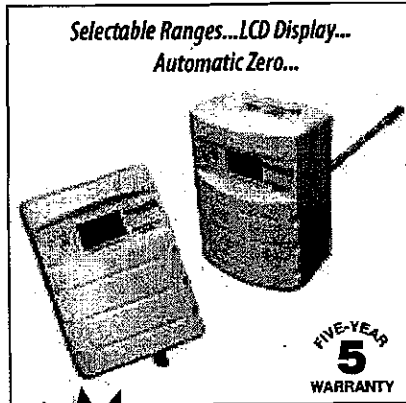
M264 - 2R5WB - C Example: M264-2R5WB-C Differential pressure transmitter with a 4-20 mA output proportional to a range of -2.5" W.C. to +2.5" W.C. (± 622.750 Pa)

FIGURE 1.

RANGE CODE	PRESSURE RANGE		RANGE CODE	PRESSURE RANGE	
	"W.C.	Pa		"W.C.	Pa
0R1WD	0-0.10	0-24.91	0R1WB	± 0.1	± 24.91
R25WD	0-0.25	0-62.28	R25WB	± 0.25	± 62.28
0R5WD	0-0.50	0-124.55	0R5WB	± 0.5	± 124.55
00100D	0-1.00	0-249.10	00100B	± 1.0	± 249.10
2R5WD	0-2.50	0-622.75	2R5WB	± 2.5	± 622.750
00500D	0-5.00	0-1245.50	00500B	± 5.0	± 1245.50
010WD	0-10.0	0-2491.00	010WB	± 10.0	± 2491.00
025WD	0-25.0	0-6227.50	025WB	± 25.0	± 6227.50
050WD	0-50.0	0-12455.00			
100WD	0-100.0	0-24910.00			

Related Products
264-A1 Conduit Housing for M264

PX Series Differential Pressure Transducer—Dry Media



The digital PX Series differential pressure transducers utilize a highly accurate and stable sensor, which is microprocessor profiled for improved accuracy and reliability. The stability, accuracy and ease of use characteristics of the PX models make them the ideal product for differential pressure monitoring applications.

Designed to monitor duct and static pressure in commercial buildings and to provide exceptional job-site flexibility, all PX models feature four field-selectable range options allowing just two models to cover applications for 0-0.1" to 0-10" W.C. The directional mode jumper provides the means to configure the transducer in unidirectional or bidirectional mode for room and building static pressure applications.

All models feature a pushbutton and digital input terminal to zero the output. A microprocessor algorithm prevents accidental zero adjustment during normal operation.

Advanced pressure sensing technology

PX Series pressure transducers utilize an advanced ceramic capacitive sensing element which provides a highly stable linear output. Output offset errors due to changes in temperature, warm-up and long term drift are significantly reduced compared to conventional sensors.

Applications

- Static pressure in duct or room applications
- Variable air volume system
- Filter status monitoring

Exceptional accuracy and stability

- Improved tolerance to overpressure and vibration reduces field failures
- High accuracy digital sensor maintains calibration and reduces callbacks
- High reliability sensor technology for long-term maintenance-free operation

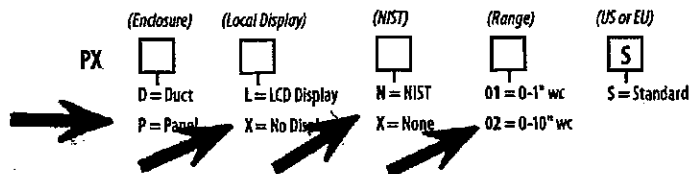
Lowest total installed cost

- Switch-selectable ranges reduce setup time and number of models to stock
- Microprocessor allows for a nine-point calibration increasing product accuracy and reliability
- Brass barb fittings prevent breakage and accommodate popular tubing sizes
- Built-in pickup tube simplifies installation and saves time (duct model)
- Circuit protection, prevents damage due to incorrect wiring

Low-differential room pressure sensor with LCD display

- Ideal for clean rooms, hospitals, fume hoods, computer rooms, and other very low differential pressure applications
- Monitors positive and negative pressure
- Field-adjustable ranges for maximum resolution
- Flush mount directly on wall or duct

ORDERING INFORMATION

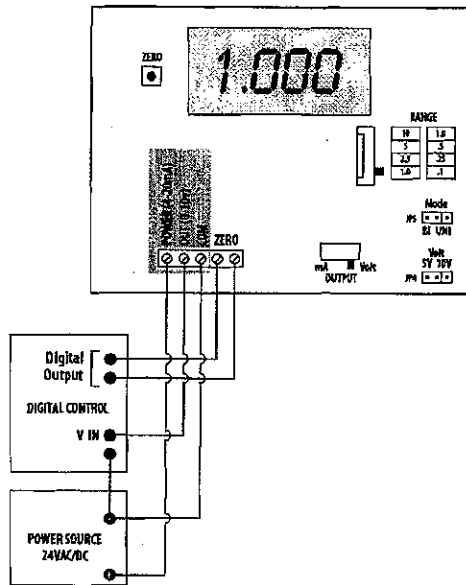


ACCESSORIES

Room and duct static pickup tubes...
See page 206

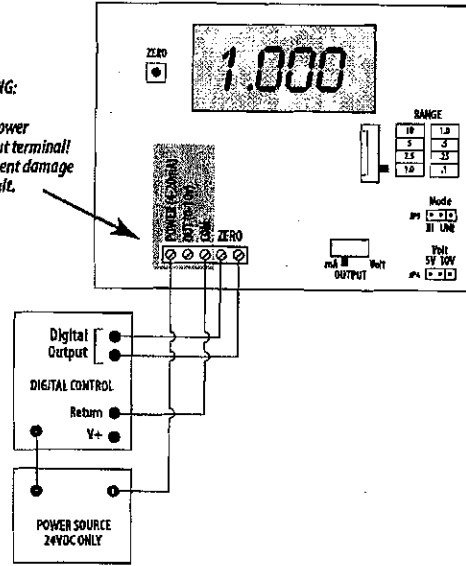
WIRING DIAGRAMS

3-wire, 0-5V/0-10V

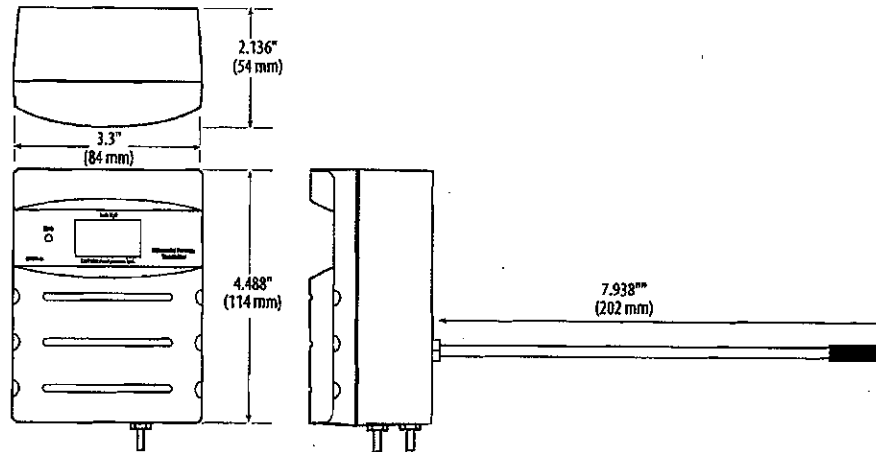


2-wire, 4-20mA

WARNING:
Do not
apply power
to output terminal!
Permanent damage
will result.



DIMENSIONAL DRAWINGS



SPECIFICATIONS

Media Compatibility	Dry air or inert gas
Input Power	12-30VDC, or 24VAC nominal
Output	Field selectable: 2-wire, loop-powered 4-20mA, (clipped and capped), or 3-wire 0-5V/0-10V
Pressure Ranges: 01	Unidirectional: 0.1/0.25/0.5/1.0" W.C. F.S., jumper-selectable
	Bidirectional: $\pm 0.1/\pm 0.25/\pm 0.5/\pm 1.0$ " W.C. F.S., jumper-selectable
02	Unidirectional: 1.0/2.5/5.0/10" W.C. F.S., jumper-selectable
	Bidirectional: $\pm 1.0/\pm 2.5/\pm 5.0/\pm 10$ " W.C. F.S., jumper-selectable
Mode	Unidirectional or bidirectional, jumper-selectable
Display (option)	Signed 3-1/2 digit LCD, indicates pressure in inches of water column
Proof Pressure	3 psid
Burst Pressure	5 psid
Accuracy	$\pm 1\%$ F.S. Combined linearity and hysteresis
Temperature Effect	1" models: 0.05%/°C; 10" models: 0.01%/°C (Relative to 25°C) 0° to 50°C
Zero Drift (1-year)	1" models: 2.0% max.; 10" models: 0.5% max.
Zero Adjust	Pushbutton auto-zero and digital input (2-pos terminal block)
Operating Environment	0° - 60°C; 0 to 90% RH non-condensing
Fittings	Brass barb; 1/8" o.d.
Physical	High-impact ABS plastic

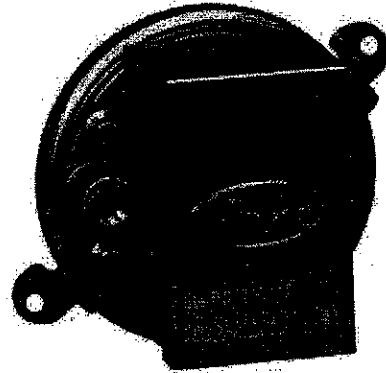


PRESSURE

DIFFERENTIAL & MANUAL RESET PRESSURE SWITCHES 1910 SERIES, MODEL 1900-5-MR

DESCRIPTION

1910 Series Differential Pressure Switches are designed to monitor the differential pressure of air in HVAC applications. These automatic reset switches are available in ranges from 0.07" to 20" W.C. (17.4-4982.0 Pa) and have SPDT screw-type electrical connections. The optional Model A-602 air filter kit includes two static pressure tips and aluminum tubing and fittings, and it allows the **1910 Series** to monitor filter pressure drop.



1910-5

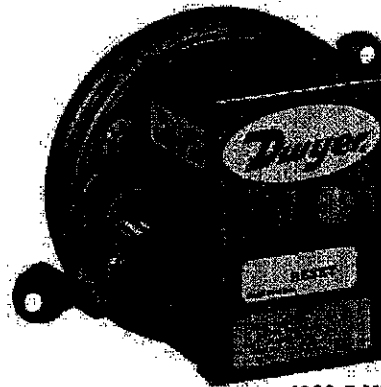
ORDERING INFORMATION			
MODEL	OPERATING RANGE	APPROXIMATE DEADBAND	
		at Min Set Point	at Max Set Point
	"W.C. (Pa)		
1910-00	0.07-0.15 (17.4-37.4)	0.04 (10.0)	0.05 (12.5)
1910-0	0.15-0.5 (37.4-124.6)	0.10 (24.9)	0.15 (37.4)
1910-1	0.4-1.6 (99.6-398.6)	0.15 (37.4)	0.20 (49.8)
1910-5	1.4-5.5 (378.7-1370.0)	0.3 (74.7)	0.4 (99.6)
1910-10	3.0-11.0 (747.3-2740.1)	0.4 (99.6)	0.5 (124.6)
1910-20	4.0-20.0 (996.4-4982.0)	0.4 (99.6)	0.6 (149.5)

Add a **-C** at the end of the model number to request specific calibration

DIMENSIONS
3-1/2" dia x 2-1/2" depth (8.9 x 6.4 cm)

DESCRIPTION

The **Model 1900-5-MR Manual Reset Pressure Switch** is designed to monitor duct static and shutdown the blower when excess pressure occurs. The switch must be manually reset before the system can start again. Switch contacts are SPDT with solder-type connections. The **Model 1900-5-MR** measures static pressure only, not differential pressure. Order the Model A-399 duct pressure kit separately if needed.



1900-5-MR

DIMENSIONS
3-1/2" dia x 2-1/2" depth (8.9 x 6.4 cm)

ORDERING INFORMATION	
MODEL 1900-5-MR	DESCRIPTION Manual Reset Pressure Switch Add a -C at the end of the model number to request specific calibration.
RELATED PRODUCTS	
A-602	Mounting kit for air filter applications
A-399	Duct pressure kit for 1900-5-MR

PRESSURE



PRESSURE

MAGNEHELIC® DIFFERENTIAL PRESSURE GAUGES 2000 SERIES

DESCRIPTION

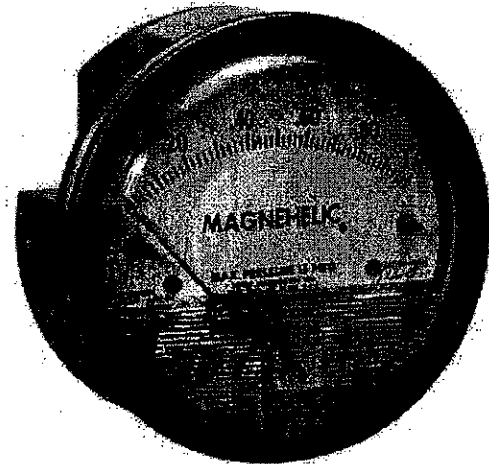
2000 Series Magnehelic® Differential Pressure Gauges provide an accurate, economical indication of positive, negative, or differential air pressure. The gauge includes a 4" (10.2 cm) easy-to-read dial and frictionless magnetic movement in a cast aluminum housing and is resistant to shock, vibration, and overpressure. The **2000 Series** has both back and side connections so that it may be either surface- or flush-mounted. Ranges are available from 0" to 0.25" W.C. up to 10" W.C.

FEATURES

- **2% FS accuracy**
- **Easy-to-read 4" (10.16 cm) white dial and red-tipped pointer**
- **Flush or surface mounting**
- **Easily accessible zero adjustment**
- **Corrosion-resistant cast aluminum housing**
- **Back and side connections**

APPLICATIONS

The **2000 Series** is ideal for monitoring fan and blower pressures, filter resistance, air velocity, and pressure drop across coils. It may be used to measure positive, negative, or differential pressures of air or compatible gases.

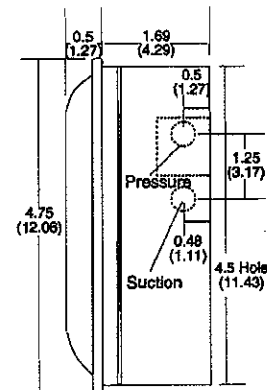
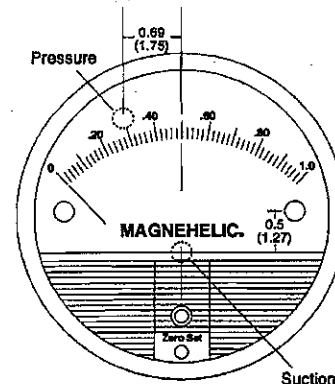


2001

SPECIFICATIONS	
Accuracy	±2% of full scale (3% on -0 and 4% on -00 ranges) throughout range @ 70°F (21°C)
Overpressure	Relief plug designed to open at 25 psig (172 kPa)
Ambient temp	20° to 140°F (-7° to 60°C)
Rated total pressure	-20" Hg to 15 psig (103 kPa)
Connections	1/8" NPT female high and low pressure taps, duplicated—one pair side and one pair back
Housing	Die-cast aluminum, case and aluminum parts Iridite-dipped to withstand 168-hour salt spray test, baked dark gray hammerloid exterior finish
Standard accessories	Two 1/8" NPT plugs for duplicate pressure taps, two 1/8" pipe thread to rubber tubing adapters, and three flush mounting adapters with screws
Weight	1.0 lb (2.0 oz)

DIMENSIONS

in
(cm)



Note: Dimensions are slightly different on medium and high pressure models.

PRESSURE



PRESSURE

MAGNEHELIC® DIFFERENTIAL PRESSURE GAUGES

2000 SERIES

INSTALLATION

Mount the **Series 2000 Magnehelic® Gauge** with the dial in a vertical position in a location free of excessive vibration or pulsating pressures. Sensing lines may be run any distance necessary, but long tubing lengths will increase response time slightly. If the pointer is not exactly on the zero mark with both the high and low pressure connections open to the atmosphere, adjust with the external zero adjust screw.

To monitor positive pressure, connect tubing from the source of pressure to either of the two high pressure ports. Plug the other high pressure port, and vent one or both low pressure ports to atmosphere.

To monitor negative pressure, connect tubing from the source of negative pressure to either of the two low pressure ports. Plug the other low pressure port, and vent one or both high pressure ports to atmosphere.

To monitor differential pressure, connect tubing from the source of the higher pressure to either of the two high pressure ports. Connect tubing from the source of the lower pressure to either of the low pressure ports. Plug both unused ports.

PRESSURE

ORDERING INFORMATION

MODEL	RANGE "W.C.	MINOR DIV.	MODEL	RANGE ZERO CENTER "W.C.	MINOR DIV.
2000-00*	0-0.25	0.005	2300-0*	0.25-0-0.25	0.01
2000-0*	0-0.50	0.01	2301	0.5-0-0.5	0.02
2001	0-1.0	0.02	2302	1-0-1	0.05
2002	0-2.0	0.05	*These ranges are calibrated for vertical scale position		
2003	0-3.0	0.10			
2004	0-4.0	0.10			
2005	0-5.0	0.10			
2006	0-6.0	0.20			
2008	0-8.0	0.20			
2010	0-10	0.20			



Order by model number from selection chart above. Contact Kele for pressure ranges, metric ranges, and air velocity scales other than those shown.

RELATED PRODUCTS

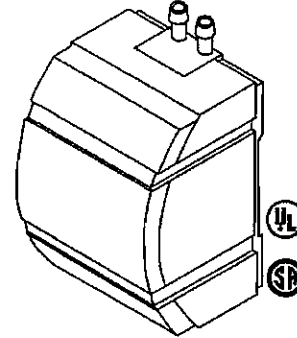
- A-368 Surface mounting plate
- A-301 Static pressure tip, compression fitting
- A-302 Static pressure tip, barb fitting
- A-605 Mounting kit for air filter applications

Electronic to Pneumatic Transducer

The CP-8551 and CP-8552 transducers receive a variable electronic input signal and produce a 3 to 15 psig (21 to 103 kPa) pneumatic output signal to position pneumatic damper and valve actuators in HVAC systems.

Features:

- Durable enclosure with easily accessible wiring terminations.
- Panel or DIN rail mounting for quick, snap-on installation.
- Two-wire loop powered or three-wire voltage input.
- High accuracy with low hysteresis.
- Long-term driftless operation with high repeatability.
- Low air consumption and large air flow capacity.
- Control input protection from short circuit or reverse polarity.



Model Chart			
Model No. ^a	Input Signal	Input Impedance Ohms	Power Requirements
CP-8551	4 to 20 mA	550 maximum, 400 minimum	None
CP-8552	4 to 20 mA	550 maximum, 400 minimum, 4 to 20 mA input, >10,000 Vac Input	None
	6 to 9 Vdc, 0 to 10 Vdc		20 to 30 Vac, 24 to 30 Vdc, 3.9 VA, 1.6 W

^a CAUTION: This product contains a half-wave rectifier power supply and must not be powered off transformers used to power other devices utilizing non-isolated full-wave rectifier power supplies.

CP-8551, CP-8552

Specifications	
Input signal	Refer to Model Chart.
Input range Adjustment	CP-8551: Fixed, 16 mA dc. CP-8552: Jumper selectable. Refer to Model Chart.
Power supply	0 to 10 and 6 to 9 V; Requires 20 to 30 Vac, 3.9 VA (CP-8552), 50/60 Hz, or 24 to 30 Vdc power supply, 1.6 watts maximum.
Air supply required	20 psig (138 kPa) nominal, 30 psig (207 kPa) maximum. Clean, dry, oil free air required (reference EN-123, F-22516).
Air consumption for sizing air compressor	Maximum 0.012 scfm (5.66 ml/s) at 20 psig (138 kPa) supply.
Air capacity for sizing air mains	Minimum 550 scfm (150.24 mL/s).
Air connections	Male barbed fittings for flexible 1/4" O.D. pneumatic tubing.
Wiring connections	Screw terminals for 16 to 22 AWG wire.
Output signal	3 to 15 psig (21 to 103 kPa) nominal, direct acting.
Adjustments	CP-8551: None. CP-8552: 4 to 20 mA range, none; 0 to 10 and 6 to 9 V range, adjustable start point and span potentiometers.
Maximum pneumatic output	1 to 18 psig (7 to 124 kPa).
Maximum air capacity	515 scfm (141 ml/s) maximum with a 20 psig (138 kPa) supply.
Operating characteristics	
Linearity	±1% of span at 75°F (24°C).
Hysteresis	0.75% of span at 75°F (24°C).
Environment	
Ambient temperature limits	Shipping and storage: -40 to 160°F (-40 to 71°C). Operating: 32 to 140°F (0 to 60°C).
Humidity	5 to 95% RH, non-condensing.
Locations	NEMA Type 1.
Dimensions	4-1/4 H x 2-13/16 W x 2-5/32 D in. (108 x 71 x 55 mm)

Typical Applications

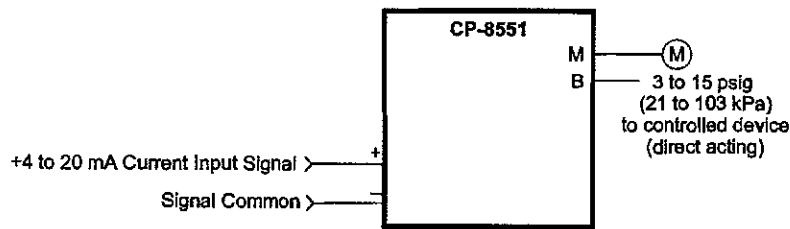
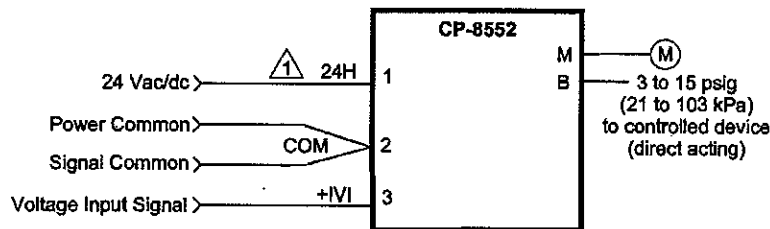


Figure 1 CP-8551 Typical Wiring.



⚠ When multiple CP-8552s or other devices are powered by a common source, uniform wiring polarity must be maintained between all 24H and COM terminals. Check to ensure that the controller's COM terminal is not connected to any other ground reference.

Figure 2 CP-8552 Typical Wiring for Voltage Input.

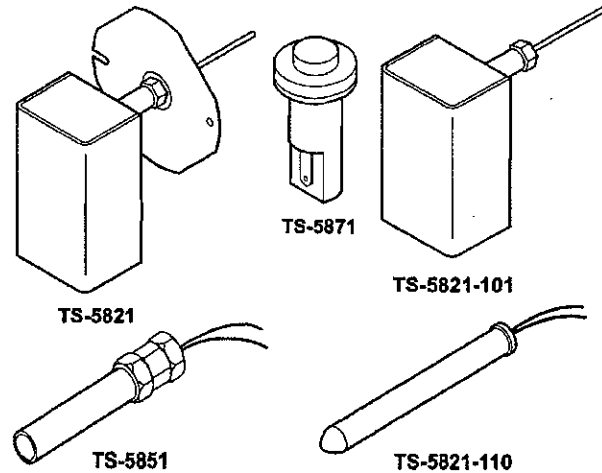
TS-5800 Series

Remote Platinum Temperature Sensors

These electronic devices provide remote temperature sensing at sites such as room locations, ducts, liquid lines, tanks, outdoor air, and others.

Features:

- Din class 43760 platinum elements.
- $\pm 0.12\%$ error at 32°F (0°C).
- Pure metal providing long term stability.
- Universally accepted measured technology.
- Extremely linear capability.



Model Chart						
Model No.	Description	Mounting Connection	Dimensions in. (mm)		Wiring Connections	
			Element	Wiring Enclosure		
TS-5821	Duct/Immersion ^a	Plate 1/4 in. (6.3 mm) NPT ^a	1/4 D x 8 L (6.3 x 203.2)	3-1/2 H x 2-1/4 W x 2-1/4 D (88.9 x 57.1 x 57.1) with 2-1/2 (63) extension to element 1/2 (12.7) knockouts (top & bottom)	12 in. (304.8 mm) grey pigtail leads	
TS-5821-101	Immersion ^b	1/4 in. (6 mm) NPT nut ^b	1/4 D x 4 L (6 x 102)			
TS-5821-110	Strap-on	Nylon wire tie ^c	1/4 D x 2-1/4 L (6 x 57)			
TS-5851	Outdoor	1/2 in. (13 mm) conduit	1-1/8 D x 5 L (29 x 127)		None	3 ft. (4 m) grey pigtail leads
TS-5871	Unitary ^d	17/32 in. (13.5 mm) dia. mtg. hole ^d	3/4 D x 1-1/4 L (19 x 32)			1/4 in. (6.3 mm) spade connections (2 female connectors provided)

- ^a Immersion requires AT-226 bulb well.
- ^b Immersion requires AT-225 bulb well.
- ^c Factory supplied, 2-1/2 x 2 in. (63.5 x 50.8 mm) foam insulation tape and 30 in. (762 mm) nylon wire tie for 1-1/2 through 6 in. (38.1 through 203.2 mm) diameter pipes.
- ^d For mounting through fan coil of unit ventilator cabinet or similar application. Ambient humidity limits, 5 to 95% RH, non-condensing.

Specifications	
Sensing element	Platinum RTD, 1000 Ω at 0°C.
Maximum error	-40 to 250°F (-40 to 121°C), $\pm 1.6^\circ\text{F}$ (1.0°C) over 290°F (161°C) span.
Ambient temperature limits °F (°C)	
TS-5821, TS-5821-101, TS-5821-110	Shipping and storage: -40 to 250 (-40 to 121). Operating: -40 to 250 (-40 to 121).
TS-5851	Shipping and storage: -40 to 220 (-40 to 104). Operating: -40 to 140 (-40 to 60).
TS-5871	Shipping and storage: -40 to 160 (-40 to 71). Operating: 40 to 140 (4 to 60).
Nominal Resistance Values	Refer to Temperature vs. Resistance Table.

TS-5800 Series

Temperature vs. Resistance

Temperature °F (°C)	Nominal Resistance Values In Ω
	TS-5821, TS-5821-101, TS-5821-110, TS-5851, TS-5871
-40 (-40)	842.7
-22 (-30)	882.2
- 4 (-20)	921.6
14 (-10)	960.9
32 (0)	1000
50 (10)	1039
68 (20)	1077.9
77 (25)	1097.3
86 (30)	1116.7
104 (40)	1155.4
122 (50)	1194
140 (60)	1232.4
158 (70)	1270.7
176 (80)	1308.9
194 (90)	1347
212 (100)	1385
230 (110)	1422.9
248 (120)	1460.6

Accessories

Model No.
AT-211
AT-226
AT-225

Description
Sun shield for TS-5851.
Brass bulb well for TS-5X21.
Stainless steel bulb well for TS-5X21-101.

Typical Applications

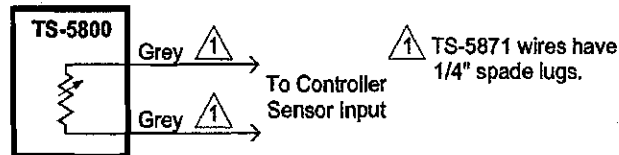
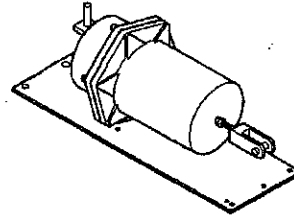


Figure 1 TS-5800 Series Sensor Connections.

Damper Actuators, Proportional

For proportional pneumatic actuator with 20 sq. in. (129 cm²) effective area used to control damper and air valves in heating, ventilating, and air conditioning systems.



Features:

- Rugged cast aluminum body.
- Completely enclosed spring.
- Long lasting rolling diaphragms.

Model Chart

Model No.	Nominal Operating Range	Starting Pressure Adjustable	Maximum Force ^a				Nominal Torque ^b Proportional Control ^a		
			Return Stroke	Power Stroke			15 psi Supply Dual Press. System	15 psi Supply Single Press. System ^c	20 psi Supply Single or Dual Press. System ^c
			Based on 1.5 psi Pressure to Actuator	15 psi Supply Dual Press. System	15 psi Supply Single Press. System ^c	20 psi Supply Single or Dual Press. System ^c			
psig	psig	lb	lb	lb	lb	lb-in.	lb-in.	lb-in.	
MK-7101	3 to 8	3 ± 5	30	110	140	240	67.5	67.5	67.5
MK-7121	8 to 13	8 ± 0.5	130	10	40	140	22.5		
MK4-7121 ^d								90	293

^a Force and torques based on factory set stroke and starting pressure.

^b Nominal torque for actuators without positioner is based on 1.5 psi (10 kPa) pressure change at the actuator. MK-7121 requires 15 psi (103 kPa) be available to actuator.

^c Adjust pressure reducing valve so that listed pressures are available at the actuator. MK4-7121 requires 20 psi (138 kPa) be available to actuator.

^d Factory installed positive positioner (AK-42309-500) start point adjustable 1 to 12 psi (7 to 83 kPa) with span adjustable 2 to 13 psi (14 to 90 kPa).

MK-7100 Series, MK4-7121

Specifications

Construction	
Housing	Die cast aluminum.
Diaphragm	Replaceable beaded molded neoprene.
Stroke	Nominal 4-1/2 in. (114 mm), adjustable 4 to 5 in. (102 to 127 mm).
Nominal Damper Area	Actuator sizing should be done in accordance with damper manufacturer's specifications.
Start point	Adjustable, refer to Description Model Chart.
Spring	Retracts actuator crank arm on loss of air pressure.
Maximum air pressure	30 psig (207 kPa).
Ambient temperature limits	
Shipping	-40 to 160°F (-40 to 71°C).
Operating	-20 to 160°F (-29 to 71°C).
Air connections	1/8 in. FNPT.
Mounting	In any position.
Dimensions	17-5/8 H x 7-3/4 W x 7-5/8 D in. (448 x 197 x 194 mm).

Accessories

Model No.	Description
AK-42309-500	Positive positioner and linkage.
AM-301	90 degree mounting bracket for floor mounting.
AM-530 ^a	Crank arm for 1/2 in. diameter damper shaft. Holes for 4-1/2 in. stroke.
AM-532	Bolt-on frame lug and damper blade clip kit.
AM-538	Actuator brace kit.
AM-542	Rod end connector for 5/16 in. (10 mm) rod. ^b
AM-543	Actuator shaft extension.
TOOL-95-1	Pneumatic calibration tool kit.
PND-245-103	3 to 8 green spring.
PND-245-108	8 to 13 blue spring.
PND-202	Diaphragm.

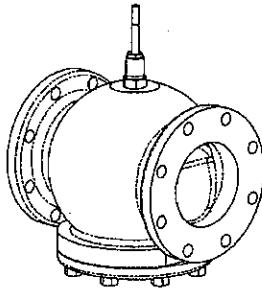
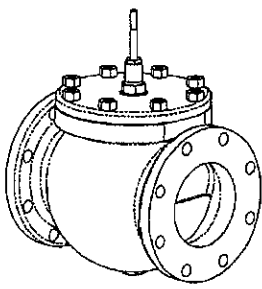
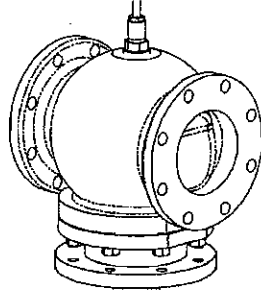
^a Required to connect damper actuator to damper.

^b NOTE: Maximum length of 5/16 in. (8 mm) rod which can be used with AM-542, 15 in. (381 mm).

Globe Valve Bodies



Table-1 Specifications for Globe Valve Bodies

		Application			
		Chilled or Hot Water, Steam		Chilled or Hot Water	
		Flanged			
					
		VB-8213	VB-8223	VB-8303	
Size		2-1/2" to 6"	2-1/2" to 6"	2-1/2" to 6"	
Valve Body		VB-8213-0-5-P	VB-8223-0-5-P	VB-8303-0-5-P	
Valve Body Action		2-Way Stem Open (Normally open if spring return actuator)	2-Way Stem Up Closed (Normally closed if spring return actuator)	3-Way Mixing/Diverting ^a (Normally stem up if spring return actuator)	
Material	Flow Type	Equal %	Equal %	Modifier Linear	
	Body	Cast Iron	Cast Iron	Cast Iron	
	Seat	Forged Brass	Forged Brass	Forged Brass	
	Stem	Stainless Steel	Stainless Steel	Stainless Steel	
	Plug	Forged Brass	Forged Brass	Forged Brass	
	Packing	Spring Loaded TFE/EPDM	Spring Loaded TFE/EPDM	Spring Loaded TFE/EPDM	
	Seat Ring	EPDM	EPDM	None	
ANSI Pressure Class, psig		125			
Maximum Inlet Pressure Steam psig (kPa)		35 (240)			
Allowable Control Media Temperature, °F (°C)^b		20°F to 281°F (-7°C 138°C)			
Close-Off Pressure, psi (kPa)		125 (856) ^c		35 (240) ^c	
P Code	Valve Size, In.	C_v (K_{vs})		C_v (K_{vs}) Mixing^d	C_v (K_{vs}) Diverting^d
12	2-1/2	56 (48)	56 (48)	80 (69)	95 (82) ^e
13	3	85 (74)	85 (74)	110 (95)	115 (99) ^f
14	4	145 (125)	145 (125)	190 (164)	190 (164) ^g
15	5	240 (208)	240 (208)	290 (251)	290 (251) ^g
16	6	370 (320)	370 (320)	500 (433)	500 (433) ^g

- ^a VB-8303 valves will also operate satisfactorily as two-way angle valves if either end (side) port is closed off.
- ^b CAUTION: Freeze protection required for temperatures below 32°F (0 °C). Avoid ice formation on stems.
- ^c Valve in closed position. See Table-8 to Table-13 for maximum allowable differential pressure for valve in any open position.
- ^d VB-8303 may be piped as either mixing or diverting, bottom (AB) port common.
- ^e Diverting configuration, flow AB to A ports.
- ^f Diverting configuration, flow AB to B ports.
- ^g All diverting flow configurations, flow AB to either A or B ports.

Table-5 Two Position, Floating, and Proportional Spring Return Electric 150 lb-in DuraDrive Actuators

Actuator Part Number	Actuator Code	Control Signal Type	Power Input				Approximate Timing, Seconds @ 70°F (21°C) with no Load		Actuator Output Torque Rating, lb-in (N-m) ^a	Manual Override
			Voltage	Running		Watts	Powered	Spring Return		
				Running	Holding					
MA40-7170 ^b	572	2-Position (SPST)	120 Vac ±10%	11.4	9.4	7.2	<145	<75	150 (17)	No
MA40-7171	574		240 Vac ±10%	11.8	9.5	7.4				
MA40-7173	576		24 Vac ±20%	9.6	4.1	5.4				
MF40-7173	576	Floating	24 Vac ±20%	10.0	4.3	5.5				
MS40-7170	572	Proportional (Vdc or mAdc)	120 Vac ±10%	11.1	9.1	7.1				
MS40-7171	574		240 Vac ±10%	11.8	10.1	7.2				
MS40-7173	576		24 Vac ±20%	9.4	5.4	7.1				

- ^a De-rating required for spring return actuators at low temperatures
- ^b The CE Directive is not applicable to this model

Table-6 Proportional Spring Return Pneumatic Actuators

Actuator Part Number ^a	Actuator Code	Nominal Spring Range, psig (kPa) ^b	Effective Area, in ² (cm ²)
MK-6811	602	5 to 10 (34 to 69)	50 (323)
MK-6911 w/AK-42309-500	652	5 to 10 (34 to 69)	50 (323)

- ^a AK-42309-500 Positive Positioner (order separately) optional for 2-1/2" to 5" valves, required for 6" valves. VK4 factory valve assemblies include positive positioner.
- ^b Field adjustable with positive positioner.

Table-7 Linkage Kits and Actuator/Linkage Assemblies for Field Assembly

Application	Actuator	Linkage Kit ^a	Actuator/Linkage Assembly
2-1/2" to 5" 2-Way & 3-Way	MK-6811 ^b	AV-497	—
6" 2-Way & 3-Way	MK-6911 ^b		—
2-1/2" to 5" 2-Way and 3-Way (1" nominal stroke)	MA41-7150	AV-607	MA41-7150-220
	MA41-7151		MA41-7151-220
	MA41-7153		MA41-7153-220
	MA40-7170		MA40-7170-220
	MA40-7171		MA40-7171-220
	MA40-7173		MA40-7173-220
	MF41-6343 ^a		MF41-7153-220
	MF41-7153		MF40-7173-220
	MS41-6340 ^a		MS41-7153-220
	MS41-6341 ^a		MS40-7170-220
	MS41-6343 ^a		MS40-7171-220
	MS41-7153		MS40-7173-220
	MS40-7170		MA41-7150-230
	MS40-7171		MA41-7151-230
MS40-7173	MA41-7153-230		
6" 2-Way & 3-Way (1-3/4" nominal stroke)	MF41-6343 ^a	AV-609	MA40-7170-230
	MF41-7153		MA40-7171-230
	MF40-7173		MA40-7173-230
	MS41-6340 ^a		MF41-6343-230
	MS41-6341 ^a		MF41-7153-230
	MS41-7153		MF40-7173-230
	MS40-7170		MS41-6340-230
	MS40-7171		MS41-6341-230
	MS40-7173		MS41-6343-230
	MS40-7173		MS41-7153-230
2-1/2" to 5" 2-Way & 3-Way (1" nominal stroke)	MF-63103	AV-672	—
	MF-63123		—
	MF-63123-211		—
	MF-63123-411		—

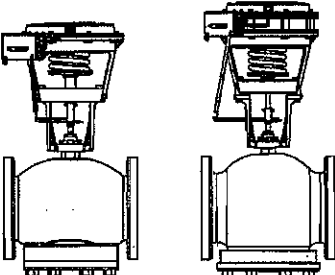


- ^a Mx61-720x Actuators require no separate linkage. Mx41-634x is not compatible with AV-607.
- ^b AK-42309-500 (order separately) optional for 2-1/2" to 5" valve, required for 6" valve. VK4 factory valve assemblies include positive positioner.

2-Way and 3-Way Globe Valve Assemblies

Note: Choose a valve assembly with a maximum operating differential pressure capability sufficient for the application. Consult Table-1 on page 5 for close-off pressure ratings. Not all actuator and valve body combinations are offered as factory assemblies.

Two-Way Pneumatic Spring Return Models

Table-12 2-Way Globe Valve Assemblies with Pneumatic Spring Return Actuators

Spring Return					MK-6811 ^b	MK-6911 ^b
2-Way Globe Valve Assemblies 						
Actuator Models (Actuator Codes)					MK-6811 (602)	MK-6911 (652)
Linkage Kit Part Number					AV-497	AV-497
Spring Range, psig (kPa)					5 to 10 (34 to 69) ^a	5 to 10 (34 to 69) ^a
Valve Assembly Part Number ^b	P Code	Valve Size In.	C _v ^c	k _{vs} ^c	Maximum Allowable Operating Differential Pressure^d, psi (kPa)	
VK-8213-602-5-12 VK-8223-602-5-12 VK4-8213-602-5-12 VK4-8223-602-5-12	12	2-1/2	56	48	35 (240)	—
VK-8213-602-5-13 VK-8223-602-5-13 VK4-8213-602-5-13 VK4-8223-602-5-13	13	3	85	74		—
VK-8213-602-5-14 VK-8223-602-5-14 VK4-8213-602-5-14 VK4-8223-602-5-14	14	4	145	125		—
VK-8213-602-5-15 VK-8223-602-5-15 VK4-8213-602-5-15 VK4-8223-602-5-15	15	5	240	208		—
VK4-8213-652-5-16 VK4-8223-652-5-16	16	6	370	320	—	35 (240)

^a Spring range field adjustable with positive positioner.

^b AK-42309-500 positive positioner optional for 2-1/2" to 5" valve, required for 6" valve. Supplied as standard on VK4 factory valve assemblies. See Globe Valve Assembly Part Numbering System and Selection Procedure to determine a specific part number.

^c $k_{vs} = m^3/h$ ($\Delta P = 100$ kPa) $k_{vs} = C_v / 1.156$ $C_v = gpm / \sqrt{\Delta P}$ (in psi).

^d Maximum allowable differential across the valve in any open position. Less than 20 psi recommended for quieter service. Consult Table-1 on page 5 for close-off pressure ratings.

Dimensions - 2-1/2" to 6" Flanged Globe Valve Assemblies

Valve Assembly Part Number ^a	Valve Size	P Code	Valve Dimensions in inches (millimeters)									
			2-Way (Refer to Figure-18 and Figure-20)					3-Way (Refer to Figure-19 and Figure-21)				
			A	C	E	F	G	A	C	E	F	G
	2-1/2"	12	8-9/16 (217)	4 (102)	15-7/8 (403)	7 (178)	5-1/2 (140)	8-9/16 (217)	5-7/16 (138)	15-5/8 (397)	7 (178)	5-1/2 (140)
2-Way VK-8213-602-5-P VK4-8213-6x2-5-P	3"	13	9-1/2 (241)	4-5/8 (117)	16-1/4 (413)	7-1/2 (191)	6 (152)	9-1/2 (241)	6-3/8 (162)	16-1/4 (413)	7-1/2 (191)	6 (152)
	4"	14	11-1/2 (292)	5-1/2 (140)	16-7/8 (429)	9 (229)	7-1/2 (191)	11-1/2 (292)	8-7/16 (214)	16-7/8 (429)	9 (229)	7-1/2 (191)
3-Way VK-8303-602-5-15 VK4-8303-6x2-5-P	5"	15	13 (330)	6-15/16 (176)	18-3/16 (462)	10 (254)	8-1/2 (216)	13 (330)	8-13/16 6 (224)	18-3/16 (462)	10 (254)	8-1/2 (216)
	6"	16	14 (356)	7-1/2 (190)	21-9/16 (548)	11 (280)	9-1/2 (241)	14 (356)	9-3/4 (248)	21-9/16 (548)	11 (280)	9-1/2 (241)
2-Way VK-8223-602-5-P VK4-8223-6x2-5-P	2-1/2"	12	8-9/16 (217)	4 (102)	16-1/4 (413)	7 (178)	5-1/2 (140)	—	—	—	—	—
	3"	13	9-1/2 (241)	4-1/4 (108)	16-5/8 (422)	7-1/2 (191)	6 (152)	—	—	—	—	—
	4"	14	11-1/2 (292)	4-15/16 (125)	17-7/8 (454)	9 (229)	7-1/2 (191)	—	—	—	—	—
	5"	15	13 (330)	5-7/16 (138)	19-3/8 (492)	10 (254)	8-1/2 (216)	—	—	—	—	—
	6"	16	14 (356)	6-1/4 (159)	22-15/16 (583)	11 (280)	9-1/2 (241)	—	—	—	—	—

^a VK4 factory assemblies include AK-42309-500 positive positioner. Positive positioner optional for 2-1/2" to 5", required for 6".

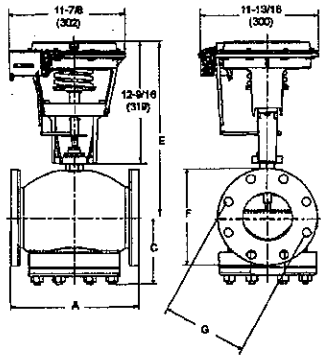


Figure-18 MK-6811 with Flanged 2-Way Globe Valves

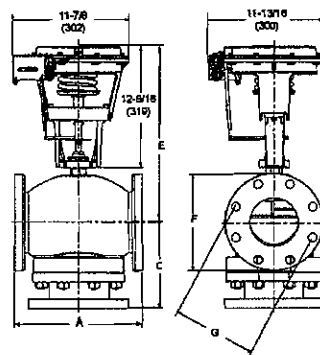


Figure-19 MK-6811 with Flanged 3-Way Globe Valves

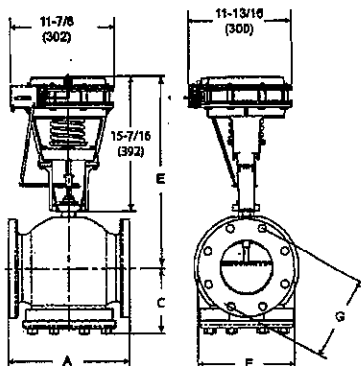


Figure-20 MK-6911 with Flanged 2-Way Globe Valves

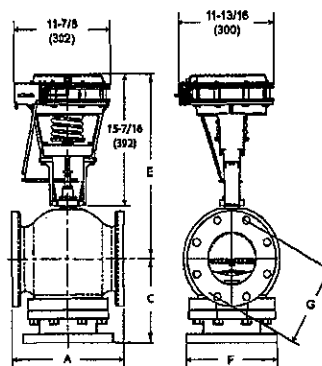
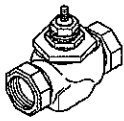
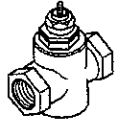
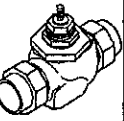
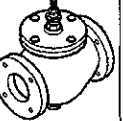
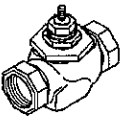


Figure-21 MK-6911 with Flanged 3-Way Globe Valves

2-Way Globe Valves, Screwed (1/2 to 3 in.), Union Sweat (1/2 to 2 in.) and Flanged (2-1/2 to 6 in.) with Pneumatic Actuators

TABLE 1. Select Valve Body including P Code (Valve Size, Cv Rating, Port Code) or select Valve Assembly with correct Input Signal (refer to Table 3 also) less Actuator Code (XXX) including the P Code (Size, Cv Rating, Port Code). (Refer to Pages 846 to 853 for Valve Sizing.)

		Application						
		Chilled or Hot Water 281°F Max. 35 psig Steam				Hot Water 340°F Max. 100 psig Steam	Hot Water 400°F Max. 150 psig Steam	
		Screwed NPT	Screwed NPT	Union Sweat	Flanged	Screwed NPT		
								
Size		1/2 to 2 in.	2-1/2 & 3 in.	1/2 to 2 in. I.D.	2-1/2 to 6 in.	1/2 to 2 in.	1/2 to 2 in.	
Normally Open Valves	Valve Body	VB-7213-0-4-P	VB-9213-0-4-P	VB-7214-0-4-P	VB-9213-0-5-P	VB-7253-0-4-P	VB-7273-0-4-P	
	Valve Assembly Pneumatic	VK-7213-XXX-4-P	VK-9213-XXX-4-P	—	VK-9213-XXX-5-P	—	—	
	Valve Assembly Pneumatic w/Pos. Positioner	VK4-7213-XX1-4-P	VK4-9213-XX1-4-P	—	VK4-9213-XX1-5-P	—	—	
Normally Closed Valves	Valve Body	VB-7223-0-4-P	VB-9223-0-4-P	VB-7224-0-4-P	VB-9223-0-5-P	VB-7263-0-4-P	VB-7283-0-4-P	
	Valve Assembly Pneumatic	VK-7223-XXX-4-P	VK-9223-XXX-4-P	—	VK-9223-XXX-5-P	—	—	
	Valve Assembly Pneumatic w/Pos. Positioner	VK4-7223-XX3-4-P	VK4-9223-XX3-4-P	—	VK4-9223-XX3-5-P	—	—	
Flow Type		Equal % (Refer to page 844)				Modified Linear (Refer to page 844)		
Material	Body	Bronze	Bronze	Bronze	Cast Iron	Bronze	Bronze	
	Seat	Bronze	Bronze	Bronze	Bronze	Stainless Steel	Stainless Steel	
	Stem	Stainless Steel	Stainless Steel	Stainless Steel	Stainless Steel	Stainless Steel	Stainless Steel	
	Plug	Brass	Brass	Brass	Brass	Stainless Steel	Stainless Steel	
	Packing	Spring Loaded TFE	Spring Loaded TFE	Spring Loaded TFE	Spring Loaded TFE	Spring Loaded TFE	Spring Loaded TFE	
	Disc	Composition	Composition	Composition	Composition	Teflon	None	
ANSI Pressure Class (psig) Refer to page 843		250 (up to 400 psig below 150°F)				125 (200 psig below 150°F)	250 (400 psig below 150°F)	
Maximum Inlet Pressure Steam psig (kPa)		35 (241)				100 (690)	150 (1034)	
Allowable Control Media Temp ^a		20 to 281°F (-7 to 138°C)	40 to 281°F (4 to 138°C)	20 to 281°F (-7 to 138°C)	40 to 281°F (4 to 138°C)	20 to 340°F (-7 to 171°C)	20 to 400°F (-7 to 205°C)	
Allowable Differential Pressure for Water psig (kPa)		35 psi (241) Max. for normal life (Refer to page 846 for cavitation limits) ^b						
Allowable Differential Pressure for Steam		20 psi (138 kPa)	20 psi (138 kPa)	20 psi (138 kPa)	20 psi (138 kPa)	35 psi (241 kPa)	50 psi (345 kPa)	

NOTE: These charts are color coded as shown below to assist valve selection. Note it is possible to select either a valve assembly or component parts (actuator, valve linkage, valve body).


1. **Valve Assembly:**
VK4-9213-611-4-11

2. **Valve Body:**
VB-9213-0-4-11

Actuator: MK-6601

Linkage: 

Positive Positioner:
AK-42309-500

- Valve Body Data less P Code (Size, Cv Rating, Port Code) or Valve Assembly less Actuator Code (XXX) and less P Code (Size, Cv Rating, Port Code)
- P Code (Size, Cv Rating, Port Code)
- Actuator or Actuator Code (XXX) for Valve Assemblies
- 

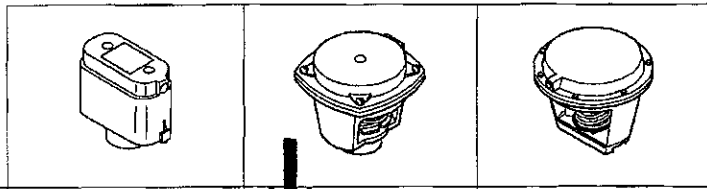
TO SELECT A PORT CODE (P).

P Code	Valve Size in.	Cv					
-1	1/2	0.4	—	0.4	—	0.4	0.4
-2		1.3	—	1.3	—	1.3	1.3
-3		2.2	—	2.2	—	2.2	2.2
-4		4.4	—	4.4	—	4.4	4.4
-5	3/4	5.5	—	5.5	—	5.5	5.5
-6		7.5	—	7.5	—	7.5	7.5
-7	1	10	—	10	—	10	10
-8		14	—	14	—	14	14
-9		20	—	20	—	20	20
-10	1-1/4	28	—	28	—	28	28
-11	2	40	—	40	—	40	40
-12	2-1/2	—	65	—	65	—	—
-13	3	—	85	—	85	—	—
-14	4	—	—	—	145	—	—
-15	5	—	—	—	235	—	—
-16	6	—	—	—	350	—	—

^a CAUTION: Freeze protection required for fluid temperatures below 32°F (0°C). Avoid ice formation on stems.
^b Less than 20 psi recommended for quiet service.

2-Way Globe Valves, Screwed (1/2 to 3 in.), Union Sweat (1/2 to 2 in.) and Flanged (2-1/2 to 6 in.) with Pneumatic Actuators

TABLE 2. 1/2 to 2 in. Valves, select Actuator or Actuator Code (XXX) with correct Input Signal having sufficient close-off for the application. If selecting Component Parts, select [redacted] and Positive Positioner if required.



Effective Area	6 Sq. In.			11 Sq. In.			50 Sq. In.			
Positive Positioner	AK-42309-500			AK-42309-500			AK-42309-500			
Factory Available Assembly with Positive Positioner	N.O. Valves	Yes	No	No	Yes	No	No	Yes	No	No
	N.C. Valves	No	No	Yes	No	No	Yes	No	No	Yes
Actuator Code (XXX)	201	202	203	301	302	303	611	612	613	
Actuator	MK-2690			MK-4601	MK-4611	MK-4621	MK-6601	MK-6611	MK-6621	
Spring Range (psig)	3 to 7	5 to 10	8 to 13	3 to 8	5 to 10	10 to 13	3 to 8	5 to 10	8 to 13	

ACTUATOR CLOSE-OFF PRESSURE RATING (psi) ^{a b}

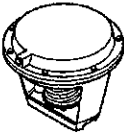


N.P.	Factory Available Valve Assemblies	Valve Body	P Code	Size In.	Supply Air Pressure (psig)						Supply Air Pressure (psig)						Supply Air Pressure (psig)					
					15	20	15	20	15	20	15	20	15	20	15	20	15	20	15	20		
N.O.	VK-7213-XXX-4-P VK4-7213-XX1-4-P VK-7214-XXX-4-P VK4-7214-XX1-4-P	VB-7213-0-4-P VP-7214-0-4-P VB-7253-0-4-P VB-7273-0-4-P	-1-2-3-4	1/2	130	220	80	170	—	90	250	250	120	250	10	200	—	—	—	—	—	—
			-5-8	3/4	80	130	40	120	—	80	180	250	80	180	—	120	—	—	—	—	—	—
			-7-8	1	35	70	15	50	—	25	90	150	35	100	—	65	—	—	—	—	—	—
			-9	1-1/4	20	40	6	30	—	15	50	90	20	80	—	40	—	—	—	—	—	—
			-10	1-1/2	14	29	5	20	—	9	30	80	10	40	—	25	170	250	110	230	40	180
			-11	2	8	14	—	10	—	—	15	30	—	20	—	10	90	160	80	120	20	90
N.C.	VK-7223-XXX-4-P VK4-7223-XX3-4-P VK-7224-XXX-4-P VK4-7224-XX1-4-P	VB-7223-0-4-P VB-7224-0-4-P VB-7263-0-4-P VB-7283-0-4-P	-1-2-3-4	1/2	—	—	50	130	30	100	250	—	—	—	—	—	—	—	—	—		
			-5-6	3/4	—	—	30	80	20	70	160	—	—	—	—	—	—	—	—	—		
			-7-8	1	—	—	9	30	5	30	60	—	—	—	—	—	—	—	—	—		
			-9	1-1/4	—	—	—	15	—	15	40	—	—	—	—	—	—	—	—	—		
			-10	1-1/2	—	—	—	10	—	10	35	40	80	170	—	—	—	—	—	—		
			-11	2	—	—	—	—	—	—	15	20	50	90	—	—	—	—	—	—		

^a Close-off rated ANSI IV (.01%) for soft seats and ANSI III for metal-to-metal seats with pressure at Inlet (port A). Ratings for normally open valves are with indicated supply air pressure applied to actuator. Ratings for normally closed valves are with 1 psi or less applied to actuator (for kPa multiply C_v by 6.89). See "Valve General Information" section for seat leakage ratings.

^b Close-off pressure ratings describe only the differential pressure which the actuator can close-off with adequate seating force. Consult valve body specifications for other limitations.

2-Way Globe Valves, Screwed (1/2 to 3 in.), Union Sweat (1/2 to 2 in.) and Flanged (2-1/2 to 6 in.) with Pneumatic Actuators

TABLE 3. 2-1/2 to 6 in. Valves, select Actuator or Actuator Code (XXX) with correct Input Signal having sufficient close-off for the application. If selecting Component Parts, select XXXXXXXXXX and Positive Positioner if required.

																					
Effective Area		50 Sq. In.	100 Sq. In.	100 Sq. In.																	
Positive Positioner																					
		AK-42309-500		AK-42309-500		AK-42309-500															
Factory Available Assembly with Positive Positioner	N.O. Valves	Yes	No	No	Yes	No	No	Yes	No	No											
	N.C. Valves	No	No	Yes	No	No	Yes	No	No	Yes											
Actuator Code (XXX)		601	602	603	801	802	803	811	812	813											
Actuator		MK-8801	MK-8811	MK-8821	MK-8801	MK-8811	MK-8821	MK-8901	MK-8911	MK-8921											
Spring Range (psig)		3 to 8	5 to 10	8 to 13	3 to 8	5 to 10	8 to 13	3 to 8	5 to 10	8 to 13											
ACTUATOR CLOSE-OFF PRESSURE RATING (psi) ^{a b c}																					
N.P.	Factory Available Valve Assemblies	Valve Body	P Code	Size In.	Supply Air Pressure (psig)						Supply Air Pressure (psig)										
					15	20	15	20	15	20	15	20	15	20	15	20					
N.O.	VK-9213-80X-4-P	VB-9213-0-4-P	-12	2-1/2	50	110	35	80	—	50	125	125	91	125	30	125	—	—	—	—	
	VK4-9213-801-4-P		-13	3	40	70	25	60	—	40	90	125	62	125	19	90	—	—	—	—	
	VK4-9213-801-4-P ^c		-12	2-1/2	50	110	35	80	—	50	125	125	91	125	30	125	—	—	—	—	
	VK-9213-60X-5-P	VB-9213-0-5-P	-13	3	40	70	25	80	—	40	90	125	62	125	19	90	—	—	—	—	
	VK4-9213-801-5-P		-14	4	20	40	14	30	—	20	48	89	33	73	10	48	—	—	—	—	
	VK4-9123-801-5-P ^c		-15	5	—	—	—	—	—	—	—	—	—	—	—	—	27	50	17	40	—
VK4-9213-811-5-P ^c	-18		6	—	—	—	—	—	—	—	—	—	—	—	—	18	35	11	30	—	20
N.C.	VK-9223-60X-4-P	VB-9223-0-4-P	-12	2-1/2	12	33	60	30	60	120	—	—	—	—	—	—	—	—	—		
	VK4-9223-803-4-P		-13	3	7	22	40	20	40	90	—	—	—	—	—	—	—	—	—		
	VK4-9223-803-4-P ^c	-12	2-1/2	12	33	60	30	60	120	—	—	—	—	—	—	—	—	—	—		
	VK-9223-60X-5-P	VB-9223-0-5-P	-13	3	7	22	40	20	40	90	—	—	—	—	—	—	—	—	—		
	VK4-9223-803-5-P		-14	4	—	11	20	10	25	49	—	—	—	—	—	—	—	—	—		
	VK4-9223-803-5-P ^c		-15	5	—	—	—	—	—	—	—	—	—	—	—	—	4	17	30	—	
VK4-9223-813-5-P ^c	-16		6	—	—	—	—	—	—	—	—	—	—	—	—	2	11	20	—		

- ^a Close-off rated ANSI IV (.01%) for soft seats and ANSI III for metal-to-metal seats with pressure at inlet (port A). Ratings for normally open valves are with indicated supply air pressure applied to actuator. Ratings for normally closed valves are within 1 psi or less applied to actuator (for kPa multiply C_v by 8.89). See "Valve General Information" section for seat leakage ratings.
- ^b Close-off pressure ratings describe only the differential pressure which the actuator can close-off with adequate seating force. Consult valve body specifications for other limitations.
- ^c Factory valve assemblies only available with positive positioner.

TABLE 4. Optional Input Signal Interface to Pneumatic.

Input Signal Type	Interface Module Required
Two-Position, SPST (Electric)	AL-1XX
Two-Position, SPDT Snap acting (Electric)	AL-1XX
Voltage 2 to 15 Vdc System 8000	CP-8511-XXX
Current Input 4 to 20 mA etc.	CP-8511-XXX, CP-8551

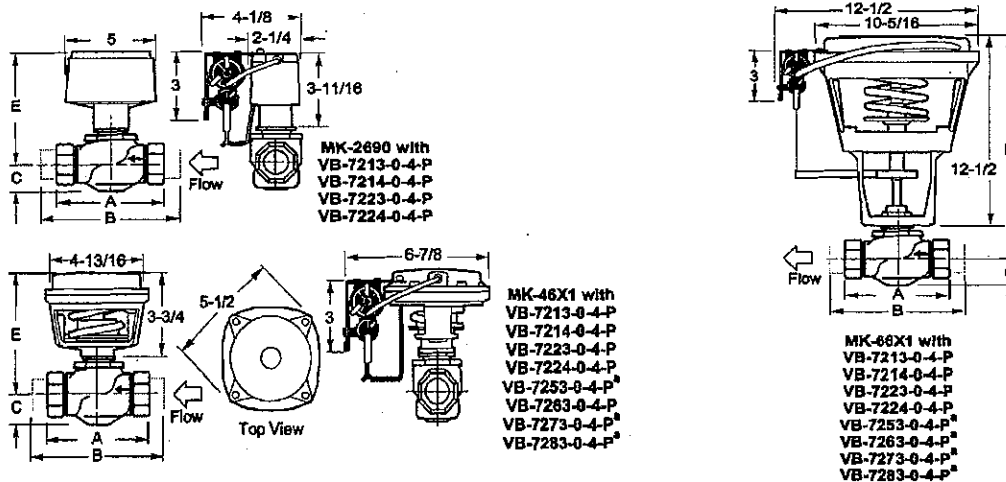
2-Way Globe Valves, Screwed (1/2 to 3 in.), Union Sweat (1/2 to 2 in.) and Flanged (2-1/2 to 6 in.) with Pneumatic Actuators

TABLE 5. Dimensions in Inches (Millimeters).

Part Number	Valve Body				Actuator Series			
	Size In.	A	B ^a	C	200	300	600	8XX
					MK-2690	MK-46X1	MK-6XX1	MK-8XX1
VB-7213-0-4-P VB-7214-0-4-P	1/2	3 (76)	4-3/16 (106)	1-1/16 (27)	4-13/16 (122)	4-7/8 (124)	13-5/8 (346)	—
	3/4	3-5/8 (92)	5-7/16 (138)	1-1/16 (27)	4-13/16 (122)	4-7/8 (124)	13-5/8 (346)	—
	1	4-5/8 (117)	6-5/8 (168)	1-1/8 (29)	5-1/2 (140)	5-1/2 (140)	14-5/16 (364)	—
	1-1/4		6-13/16 (173)	1-3/8 (35)	5-1/2 (140)	5-1/2 (140)	14-5/16 (364)	—
	1-1/2		8-5/16 (211)	1-1/2 (38)	5-9/16 (141)	5-5/8 (143)	14-3/8 (365)	—
VB-7253-0-4-P VB-7273-0-4-P	2	6-1/8 (156)	9-3/16 (233)	1-9/16 (40)	5-13/16 (148)	5-7/8 (149)	14-5/8 (371)	—
	1/2	3 (76)	4-3/16 (106)	1-3/16 (30)	4-13/16 (122)	4-7/8 (124)	13-5/8 (346)	—
	3/4	3-5/8 (92)	5-7/16 (138)	1-3/16 (30)	4-13/16 (122)	4-7/8 (124)	13-5/8 (346)	—
	1	4-5/8 (117)	6-5/8 (168)	1-1/8 (29)	5-1/2 (140)	5-1/2 (140)	14-5/16 (364)	—
	1-1/4		6-13/16 (173)	1-3/8 (35)	5-1/2 (140)	5-1/2 (140)	14-5/16 (364)	—
VB-9213-0-4-P	1-1/2	5-3/8 (137)	8-5/16 (211)	1-1/2 (38)	5-9/16 (141)	5-5/8 (143)	14-3/8 (365)	—
	2	6-1/8 (156)	9-3/16 (233)	1-9/16 (40)	5-13/16 (148)	5-7/8 (149)	14-5/8 (371)	—
	2-1/2	8-1/2 (216)	—	3-3/4 (95)	—	—	16-3/16 (411)	20-15/16 (532)
	3	9-1/2 (241)	—	4-1/4 (108)	—	—	17-3/16 (437)	21-5/16 (541)
	2-1/2	8-1/2 (216)	—	3-1/2 (89)	—	—	16-1/4 (413)	20-3/4 (527)
VB-9213-0-5-P	3	9-1/2 (241)	—	3-3/4 (95)	—	—	16-5/8 (422)	21-1/2 (546)
	4	11-1/2 (292)	—	4-1/2 (114)	—	—	17-7/8 (454)	22-3/8 (568)
	5	13 (330)	—	5 (127)	—	—	—	25-7/8 (657)
	6	14 (356)	—	5-1/2 (140)	—	—	—	26-1/2 (673)
	1/2	3 (76)	4-3/16 (106)	1-1/4 (32)	4-13/16 (122)	4-7/8 (124)	13-5/8 (346)	—
VB-7223-0-4-P VB-7224-0-4-P VB-7263-0-4-P VB-7283-0-4-P	3/4	3-5/8 (92)	5-7/16 (138)	1-1/4 (32)	4-13/16 (122)	4-7/8 (124)	13-5/8 (346)	—
	1	4-5/8 (117)	6-5/8 (168)	1-3/4 (44)	4-13/16 (122)	4-15/16 (125)	13-11/16 (347)	—
	1-1/4		6-13/16 (173)	1-3/4 (44)	5-1/16 (129)	5-1/8 (130)	13-15/16 (354)	—
	1-1/2		8-5/16 (211)	1-13/16 (46)	5-3/16 (132)	5-5/16 (135)	14-1/16 (357)	—
	2	6-1/8 (156)	9-3/16 (233)	2-1/16 (52)	5-5/16 (135)	5-7/16 (138)	14-1/8 (358)	—
VB-9223-0-4-P	2-1/2	8-1/2 (216)	—	3-3/4 (95)	—	—	16-13/16 (427)	20-15/16 (532)
	3	9-1/2 (241)	—	4 (102)	—	—	17-3/16 (436)	21-5/16 (541)
	2-1/2	8-1/2 (216)	—	4-1/8 (105)	—	—	15-7/8 (403)	20-3/4 (527)
VB-9223-0-5-P	3	9-1/2 (241)	—	—	—	—	16-1/4 (413)	21 (533)
	4	11-1/2 (292)	—	5-1/16 (129)	—	—	16-7/8 (429)	21-5/8 (549)
	5	13 (330)	—	6-3/4 (171)	—	—	—	24-1/2 (622)
	6	14 (356)	—	7-3/8 (187)	—	—	—	25-1/2 (648)

^a Use B dimension for VB-7214 and VB-7224 valve bodies.

NOTE: Allow 3 inches clearance above actuator for removal.



^a Not available factory assembled.

3-Way Globe Valves, Mixing (1/2 to 6 in.), Diverting (1/2 to 6 in.), Screwed (1/2 to 3 in.), Union Sweat (1/2 to 2 in.) and Flanged (2-1/2 to 6 in.) with Pneumatic Actuators

TABLE 1. Select Valve Body including P Code (Valve Size, Cv Rating, Port Code) or select Valve Assembly with correct Input Signal (refer to Table 2B also) less Actuator Code (XXX) including the P Code (Size, Cv Rating, Port Code). (Refer to Pages 846 to 853 for Valve Sizing.)

	Application							
	Chilled or Hot Water							
	Screwed NPT	Screwed NPT	Union Sweat	Flanged	Screwed NPT	Flanged		
Size	1/2 to 2 in.	2-1/2 & 3 in.	1/2 to 2 in. I.D.	2-1/2 to 6 in.	1/2 to 2 in.	2-1/2 to 6 in.		
Valve Body	VB-7313-0-4-P	VB-9313-0-4-P	VB-7314-0-4-P	VB-9313-0-5-P	VB-7323-0-4-P	VB-9323-0-5-P ^a		
Valve Assembly Pneumatic without Positive Positioner	VK-7313-XXX-4-P	VK-9313-XXX-4-P	—	VK-9313-XXX-5-P	—	—		
Valve Assembly Pneumatic with Positive Positioner	VK4-7313-XXX-4-P	VK4-9313-XXX-4-P	VK4-7314-XXX-4-P	VK4-9313-XXX-5-P	—	—		
Normal Position	Stem Up Flow "B" to "AB"	Stem Up Flow "B" to "AB"	Stem Up Flow "B" to "AB"	Stem Up Flow "B" to "AB"	Stem Up Flow "B" to "AB"	Stem Up Flow "C" to "L"		
NOTE: These charts are color coded as shown below to assist valve selection. Note it is possible to select either a valve assembly or component parts (actuator, valve linkage, valve body).	Flow Type	Mixing	Mixing	Mixing	Mixing	Diverting	Diverting ^a	
	Material	Body	Bronze	Bronze	Bronze	Iron	Bronze	Iron
		Seat	Bronze	Bronze	Bronze	Bronze	Bronze	Bronze
		Stem	Stainless Steel	Stainless Steel	Stainless Steel	Stainless Steel	Stainless Steel	Stainless Steel
		Plug	Brass	Brass	Brass	Brass	Brass	Stainless Steel
		Packing	Spring Loaded TFE	Spring Loaded TFE	Spring Loaded TFE	Spring Loaded TFE	Spring Loaded TFE	Grafoil
Disc	None	None	None	None	None	None		
ANSI Pressure Class (psig) Refer to page 843	250 (up to 400 psig below 150°F)			125 (200 psig below 150°F)	250 (up to 400 psig below 150°F)	125 (200 psig below 150°F)		
Allowable Control Media Temp ^b	20 to 300°F (-7 to 149°C)	40 to 300°F (4 to 149°C)	20 to 300°F (-7 to 149°C)	40 to 300°F (4 to 149°C)	20 to 300°F (-7 to 149°C)	40 to 300°F (4 to 149°C)		
Allowable Differential Pressure for Water psig (kPa) ^c	35 psi (241) max. for normal life (Refer to page 846 for cavitation limits)							

ORDERING EXAMPLES:

- Valve Assembly:
VK-7313-611-4-11
- Valve Body:
VB-7313-0-4-11

Actuator: MK-6601

Linkage:

- Valve Body Data less P Code (Size, Cv Rating, Port Code), Valve Assembly less Actuator Code (XXX) and less P Code (Size, Cv Rating, Port Code)
- P Code (Size, Cv Rating, Port Code)
- Actuator or Actuator Code (XXX) for Valve Assemblies
-

TO SELECT A PORT CODE (P).

P Code	Valve Size ^d	Cv				Port	
-2		2.2		2.2	—	—	
-4	1/2	4.4		4.4	4.4	—	
-6	3/4	7.5		7.5	7.5	—	
-8	1	14	—	14	15	—	
-9	1-1/4	20		20	20	—	
-10	1-1/2	28		28	28	—	
-11	2	41		41	40	—	
-12	2-1/2		67		74	68	75
-13	3		91		101	85	95
-14	4				170	160	180
-15	5	—		—	290	195	220
-16	6	—		—	390	250	275

^a Leakage ratings on 2 1/2 to 6 inch VB-9323 diverting valves are ANSI II (0.5%). Maximum differential pressure between opposite end ports is 50 psi.

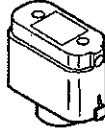
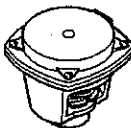
^b CAUTION: Freeze protection required for fluid temperatures below 32°F (0°C). Avoid ice formation on stems.

^c Less than 20 psi recommended for quiet service.

^d CAUTION: Solder, tubing and/or pipe schedules must meet or exceed working static pressure requirements.

3-Way Globe Valves, Mixing (1/2 to 6 in.), Diverting (1/2 to 6 in.), Screwed (1/2 to 3 in.), Union Sweat (1/2 to 2 in.) and Flanged (2-1/2 to 6 in.) with Pneumatic Actuators

TABLE 2. 1/2 to 1-1/4 in. Valves, select Actuator or Actuator Code (XXX) having sufficient close-off for the application. If selecting Component Parts, select [] and Positive Positioner if required.

				 6 Sq. In.						 11 Sq. In.												
Effective Area				6 Sq. In.						11 Sq. In.												
Positive Positioner				AK-42309-500						AK-42309-500												
Factory Assembly with Positive Positioner				No		Yes		Yes		No		Yes		Yes								
Actuator Code (XXX)				201		202		203		301		302		303								
Actuator				MK-2690						MK-4601		MK-4611		MK-4621								
Spring Range (psig)				3 to 7		5 to 10		8 to 13		3 to 6		5 to 10		10 to 13								
ACTUATOR CLOSE-OFF PRESSURE RATING^{a b c}																						
Supply Air Pressure (psig)				15/20	15	20	15/20	15	20	15/20	15	20	15/20	15	20	15/20	15	20				
Stem Position^d				SU	SD	SD	SU	SD	SD	SU	SD	SD	SU	SD	SD	SU	SD	SD				
Valve Assembly	Valve Body	P Code	Size In.	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—				
VK-7313-XXX-4-P VK4-7313-XXX-4-P VK-7314-XXX-4-P VK4-7314-XXX-4-P	VB-7313-0-4-P VB-7314-0-4-P	-4	1/2	—	150	150	50	60	170	100	—	90	30	250	250	100	150	250	250	35	200	
		-6	3/4	—	80	120	30	40	100	80	—	60	20	180	230	70	80	180	180	15	120	
		-8	1	—	30	60	9	15	50	30	—	25	5	90	150	30	40	100	60	5	65	
		-9	1-1/4	—	—	—	—	8	30	15	—	15	—	50	90	15	25	60	40	—	40	
		-10	1-1/2	—	—	—	—	20	10	—	9	—	30	60	10	15	40	35	—	—	25	
VK-7323-XXX-4-P VK4-7323-XXX-4-P	VB-7323-0-4-P	-4	1/2	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	
		-6	3/4	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	
		-8	1	—	250	250	250	250	250	250	250	250	250	250	250	250	250	250	250	250	250	250
		-9	1-1/4	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
		-10	1-1/2	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
-11	2	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—		

^a Close-off ratings for mixing or sequencing valves; (SU = "A", SD = "B" port). "A" port (SU) ratings equal pressure at port "A" minus pressure at port "B". "B" port (SD) ratings equal pressure at port "B" minus pressure at port "A". Close-off ratings in the table are true only when the indicated supply air pressure is applied to the actuator. A change in air pressure at the actuator alters the actual close-off pressure.

^b Close-off pressure ratings describe only the differential pressure which the actuator can close-off with adequate seating force. Consult valve body specifications for other limitations.

^c Mixing valves are not to be used in diverting applications. Diverting valves may be used in mixing applications with minor effects on flow.

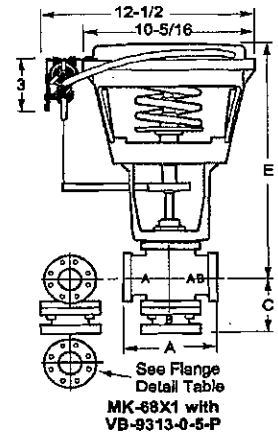
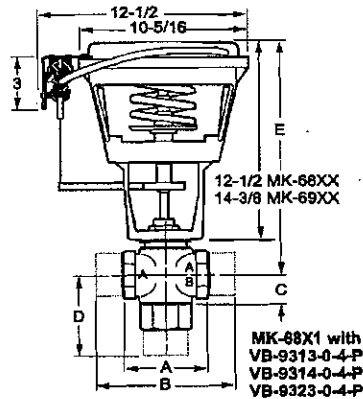
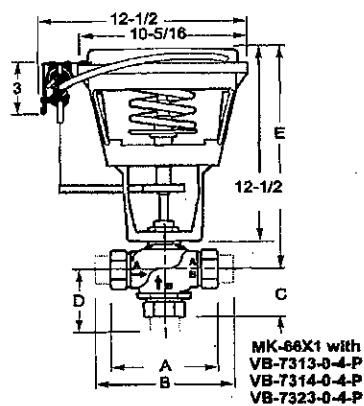
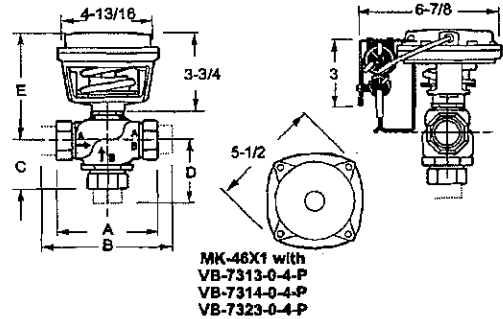
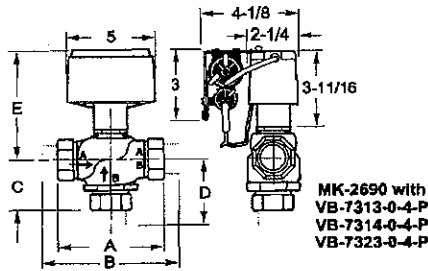
^d SU—Stem Up; SD—Stem Down. Refer to Table 5 for flow pattern, port designations and normal position.

3-Way Globe Valves, Mixing (1/2 to 6 in.), Diverting (1/2 to 6 in.), Screwed (1/2 to 3 in.), Union Sweat (1/2 to 2 in.) and Flanged (2-1/2 to 6 in.) with Pneumatic Actuators

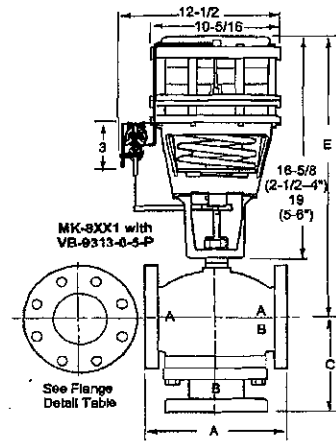
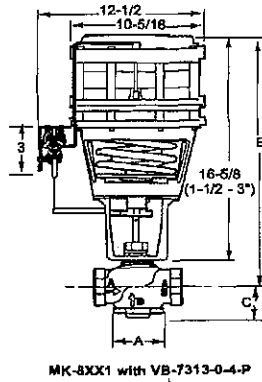
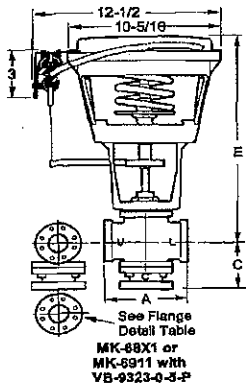
TABLE 4. Dimensions in Inches (Millimeters).

Valve Body						Actuator Code (XXX) (Actuator)				
						2XX (MK-2690)	30X (MK-46X1)	6XX (MK-6XX1)	652 (MK-6911)	81X (MK-8XX1)
Part Number	Size In.	A	B ^a	C	D ^a	E	E	E	E	E
VB-7313-0-4-P	1/2	3 (76)	4-3/16 (106)	1-3/8 (35)	2-5/16 (59)	4-13/16 (122)	4-7/8 (124)	13-5/8 (346)	—	—
	3/4	3-5/8 (92)	5-7/16 (138)	1-11/16 (43)	2-5/8 (67)	4-13/16 (122)	4-7/8 (124)	13-5/8 (346)	—	—
VB-7314-0-4-P ^a	1	4-5/8 (117)	6-5/8 (168)	1-9/16 (40)	3-1/8 (79)	4-7/8 (124)	4-15/16 (125)	13-11/16 (348)	—	—
VB-7323-0-4-P	1-1/4	6-13/16 (173)	8-13/16 (173)	1-5/8 (41)	3-7/16 (86)	5-1/8 (130)	5-1/8 (130)	13-15/16 (354)	—	—
	1-1/2	5-3/8 (137)	8-5/16 (211)	1-5/8 (41)	3-3/4 (95)	5-1/4 (133)	5-1/4 (133)	14-1/16 (357)	—	—
	2	6-1/8 (156)	9-3/16 (233)	1-7/8 (48)	4-3/16 (106)	5-5/16 (135)	5-3/8 (136)	14-1/8 (359)	—	—
VB-9313-0-4-P	2-1/2	8-1/2 (216)	—	4-5/8 (117)	—	—	—	16-13/16 (427)	—	20-15/16 (532)
	3	9-1/2 (241)	—	5 (127)	—	—	—	17-3/16 (437)	—	21-5/16 (541)
VB-9313-0-5-P	2-1/2	8-1/2 (216)	—	5-3/8 (136)	—	—	—	15-5/8 (397)	—	20-3/4 (527)
	3	9-1/2 (241)	—	6-3/8 (162)	—	—	—	16-1/4 (413)	—	21 (533)
	4	11-1/2 (292)	—	8-1/2 (216)	—	—	—	16-7/8 (429)	—	21-5/8 (549)
	5	13 (330)	—	8-3/4 (222)	—	—	—	—	—	24-1/2 (622)
	6	14 (356)	—	9-3/4 (248)	—	—	—	—	—	25-1/2 (648)
VB-9323-0-5-P	2-1/2	9 (229)	—	7 (178)	—	—	—	17-1/8 (435)	—	—
	3	10 (254)	—	8 (203)	—	—	—	18 (457)	—	—
	4	12 (305)	—	10 (254)	—	—	—	—	21-1/8 (537)	—
	5	13 (330)	—	10-1/2 (267)	—	—	—	—	21-3/4 (552)	—
	6	14-1/8 (359)	—	11-1/8 (283)	—	—	—	—	22-3/8 (568)	—

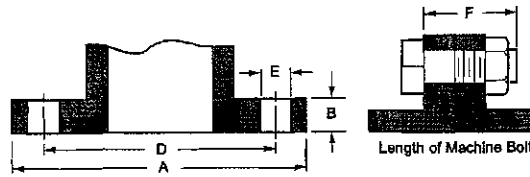
^a Use B and D dimensions for VB-7314 valve body.



3-Way Globe Valves, Mixing (1/2 to 6 in.), Diverting (1/2 to 6 in.), Screwed (1/2 to 3 in.), Union Sweat (1/2 to 2 in.) and Flanged (2-1/2 to 6 in.) with Pneumatic Actuators



American Standard 125 lb. Cast Iron Pipe Flanges.



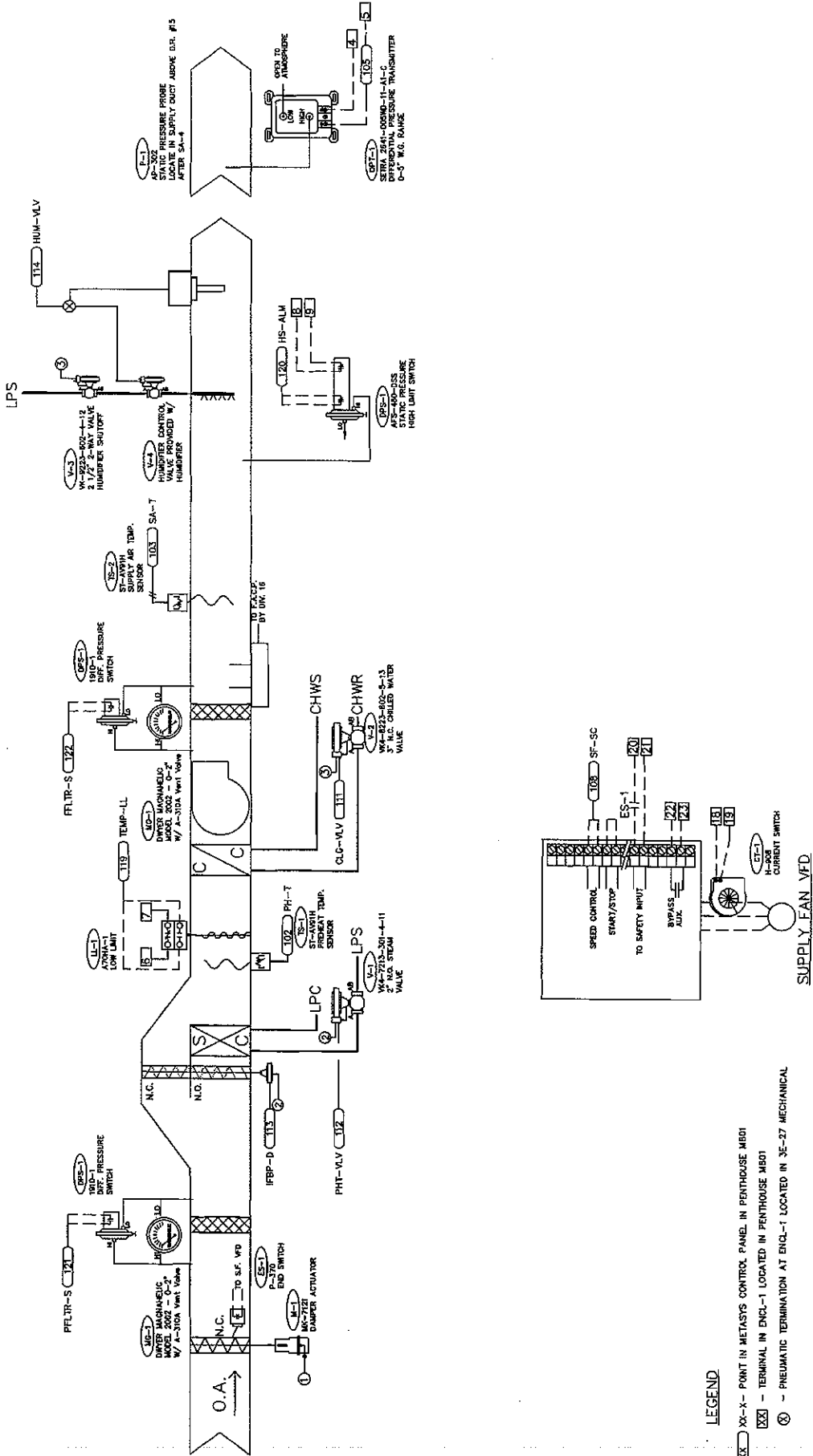
Flange Detail.

Nominal Pipe Size	Flanges		Drilling		Bolting		Length of Machine Bolts F
	Flange Diameter A	Flange Thickness B	Diameter of Bolt Circle D	Diameter of Bolt Holes E	Number of Bolts	Diameter of Bolts	
2-1/2	7	11/16	5-1/2	3/4	4	5/8	2-1/2
3	7-1/2	3/4	6				
4	9	15/16	7-1/2	7/8	8	3/4	3
5	10		8-1/2				
6	11	1	9-1/2				3-1/4

TABLE 5. Flow Pattern.

Body Part Number	Flow Type	Stem Up (SU) (Normal Position)		Stem Down (SD)	
		Flow	Closed Port	Flow	Closed Port
VB-7313-0-4-P VB-7314-0-4-P VB-9313-0-4-P	Mixing	B to AB	A	A to AB	B
VB-7323-0-4-P VB-9323-0-4-P	Diverting			B to A	AB
VB-9313-0-5-P	Mixing			A to AB	B
VB-9323-0-5-P	Diverting	C to L	U	C to U	L

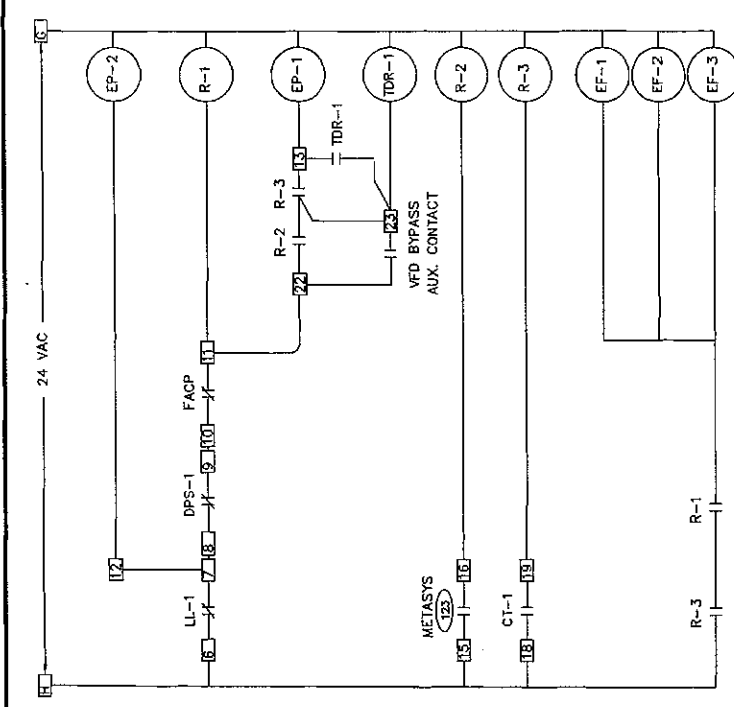
AHU-S3-1



LEGEND

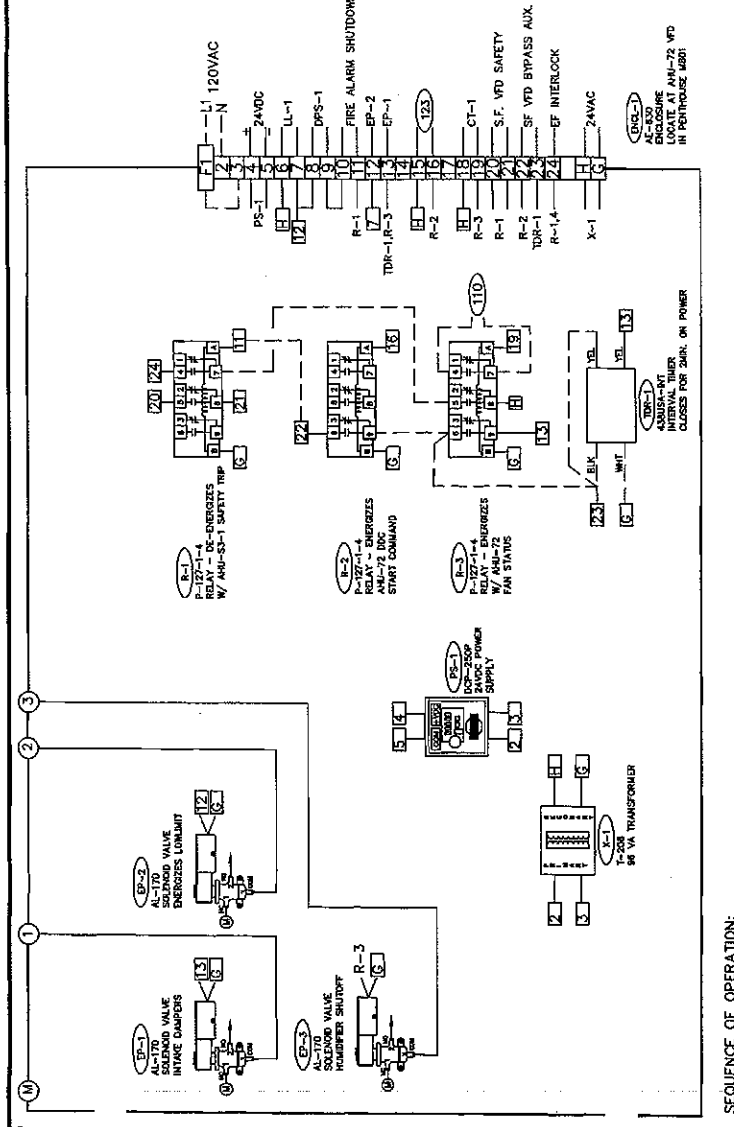
- XX-X - POINT IN METASTAS CONTROL PANEL IN PENTHOUSE MBO1
- XX - TERMINAL IN ENCL-1 LOCATED IN PENTHOUSE MBO1
- PNEUMATIC TERMINATION AT ENCL-1 LOCATED IN 35-27 MECHANICAL

<p>PROJECT UMC - University Hospital OR Renovation 3rd Floor East</p>	<p>ARCHITECT HNM Architects, Inc.</p>	<p>CONTRACTOR Bradson and Associates, Inc.</p>	<p>OFFICE MECHANICAL</p>
<p>DATE 10/12/05</p>	<p>REVISION 1051019</p>	<p>DESIGNER J. J. ...</p>	<p>C & C Group 2414-B Hyde Park Rd. Lafayette, CA 94508 Phone: (925) 632-4247</p>
<p>DRAWING NO. 3 OF 9</p>	<p>PROJECT UMC - University Hospital OR Renovation 3rd Floor East</p>		



ENCL-1 STARTER CIRCUIT WIRING SCHEMATIC

- F. HUMIDITY CONTROL:** In response to the central exhaust duct mounted humidistat, unit shall maintain the OR support spaces relative humidity at a minimum of 30% at all times.
- When the duct humidity level drops below 30%, the unit's main humidifier (H-1) steam control valve shall modulate as required to add moisture to the air in order to maintain the desired air moisture level of 30% humidity level at 65%.
 - When the outdoor air temperature is above 55°F, the steam isolation valve, serving the humidifier control valve, shall remain fully closed. Upon a call for humidity, addition, the isolation valve shall be fully open.
 - Since the air handling unit is required to maintain a constant discharge air temperature of 53°F, no additional controls for moisture removal is required.
- G. FILTERS:** Both the pre-filters and final filters shall be provided with magnahelix pressure differential gauges mounted on the air handling unit and signaled back to the DDC system. The pressure differential sensor shall alarm the DDC system upon high limit for filter replacement.
- H. SAFETY INTERLOCKS:**
- Low limit stat shall be set at 35°F and shall alarm the DDC system if freezing conditions are sensed. The air handling unit shall shut-down upon freeze conditions.
 - The high limit static pressure sensor shall alarm the DDC system when the static pressure exceeds the set point of 5.0" w.c. (adj). This set point shall be adjusted and set based on filter loading.
 - Only when any one of the operating rooms smoke detectors or the air handlers smoke detector is activated, the building fire alarm system shall de-energize the air handler based on its approved programmed sequence. Contacts shall be provided by the Division 16 Contractor and connected to the DDC system by the Division 15 Contractor.
 - Hard wire exhaust fans EF-1, EF-2 and EF-3 to shut down if AHU-S3-1 supply fan fails.



- A. SCHEDULED START/STOP:** Air handler shall normally operate in the occupied mode. Start-up of unit shall be as follows: The motorized outside air and exhaust air dampers shall be proven open prior to start of fan. The supply fan shall run continuously. When the unit is manually shut-down, the supply fan shall de-energize and the motorized outside air and exhaust air dampers shall be fully closed when the loss of airflow is proven.
- B. AIR HANDLER VOLUME CONTROL:** The adjustable speed drive shall be modulated by the DDC system based on input from the pressure differential transmitter as required to maintain the supply duct static pressure setpoint (adj) during all periods.
- C. PREHEAT CONTROL:** When the outside air temperature drops below 38°F, the steam control valve shall modulate to full open. The integral face and bypass dampers shall modulate as required to maintain a coil discharge air temperature of 49°F (adj). When the outside air temperature is 38°F or above the integral face and bypass dampers shall modulate to fully open and the steam control valve shall modulate as required to maintain a coil discharge air temperature of 49°F (adj). When the outside air temperature is 49°F or above the integral face and bypass dampers shall modulate to full bypass and both steam control valves shall modulate to fully closed.
- D. CHILLED WATER COOLING COIL:** When the outside air temperature drops below 49°F (adj), the chilled water control valve shall modulate to fully closed. When the outside air temperature is 49°F or above the chilled water control valve shall modulate as required to maintain on air handling unit discharge air temperature of 53°F (adj). Temperature settings are based on an estimated fan heat pick-up of 4°F. Cooling and heating shall not occur simultaneously. When all three operating rooms are in the unoccupied mode, the cooling coil shall maintain a unit discharge air temperature of 57°F (adj).
- E. EXHAUST FAN CONTROL:** Exhaust fans EF-1, EF-2 and EF-3 shall be interlocked and run in conjunction with AHU-S3-1. The adjustable speed drives shall be modulated by the DDC system based on input from the pressure differential transmitter as required to maintain the exhaust duct static pressure setpoint (adj) during all periods. AHU-S3-1 shall not shut down if fan EF-3 fails.

PROJECT	UMC - University Hospital
DESCRIPTION	O.R. Renovation 3rd Floor East
ENGINEER	HMN Architects, Inc.
ARCHITECT	Bradson and Associates, Inc.
CONTRACTOR	Officer Mechanical
DATE	10/13/05
JOB #	J050109
ISSUE DATE	10/13/05
REVISION	11/20/04
RESUBMITTAL	12/21/04
DRAWING NO.	6 OF 9

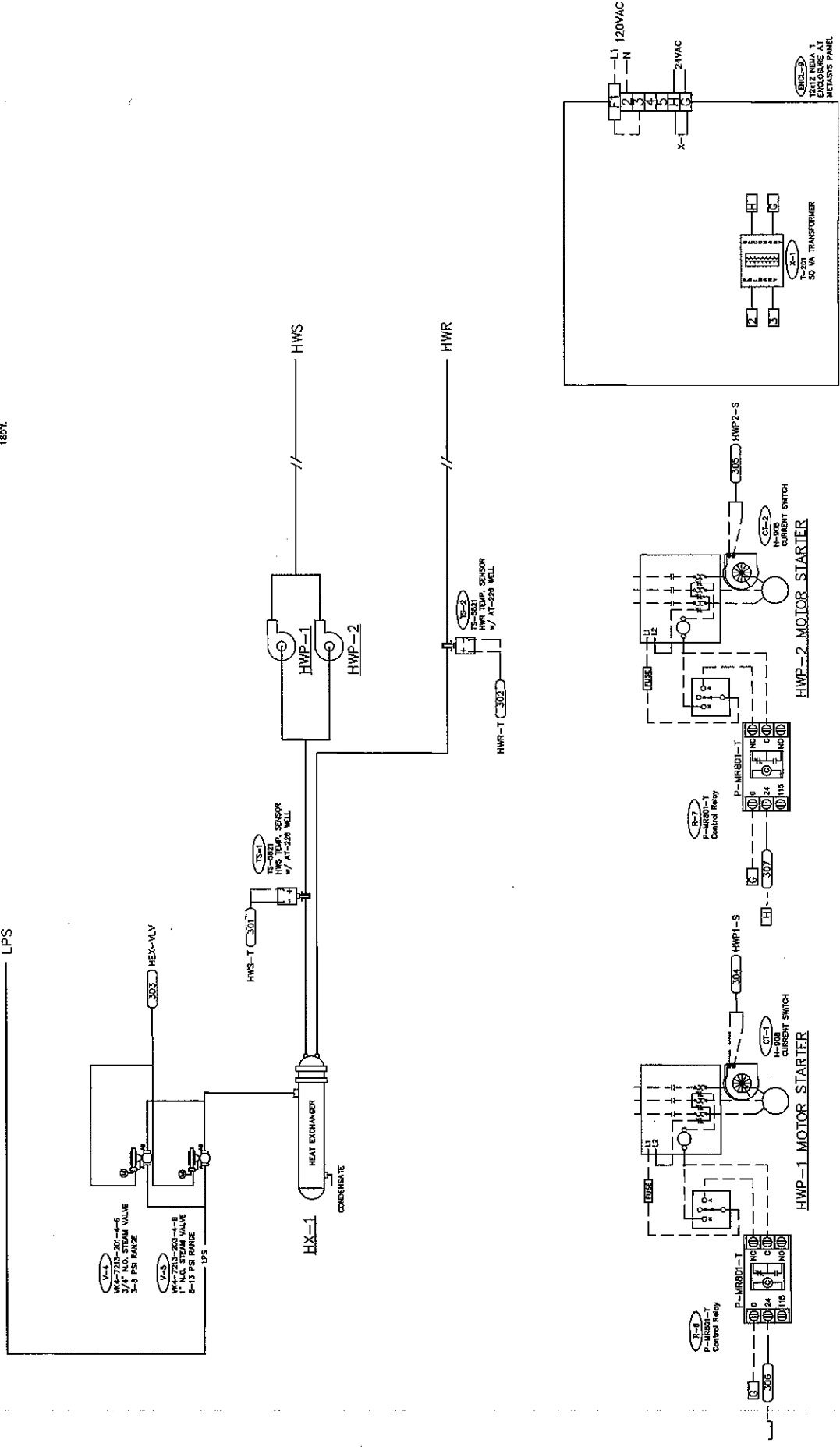
SEQUENCE OF OPERATION:

Hot Water Heating System:

A. The hot water pump shall run continuously. If the hot water pump fails, its float switch shall be set to start, the hot pump shall be commanded off and the log pump shall be commanded on.

B. The hot pump shall alternate whenever the hot water system is enabled and at a minimum of once per week intervals (off). Manual override shall be available for maintenance.

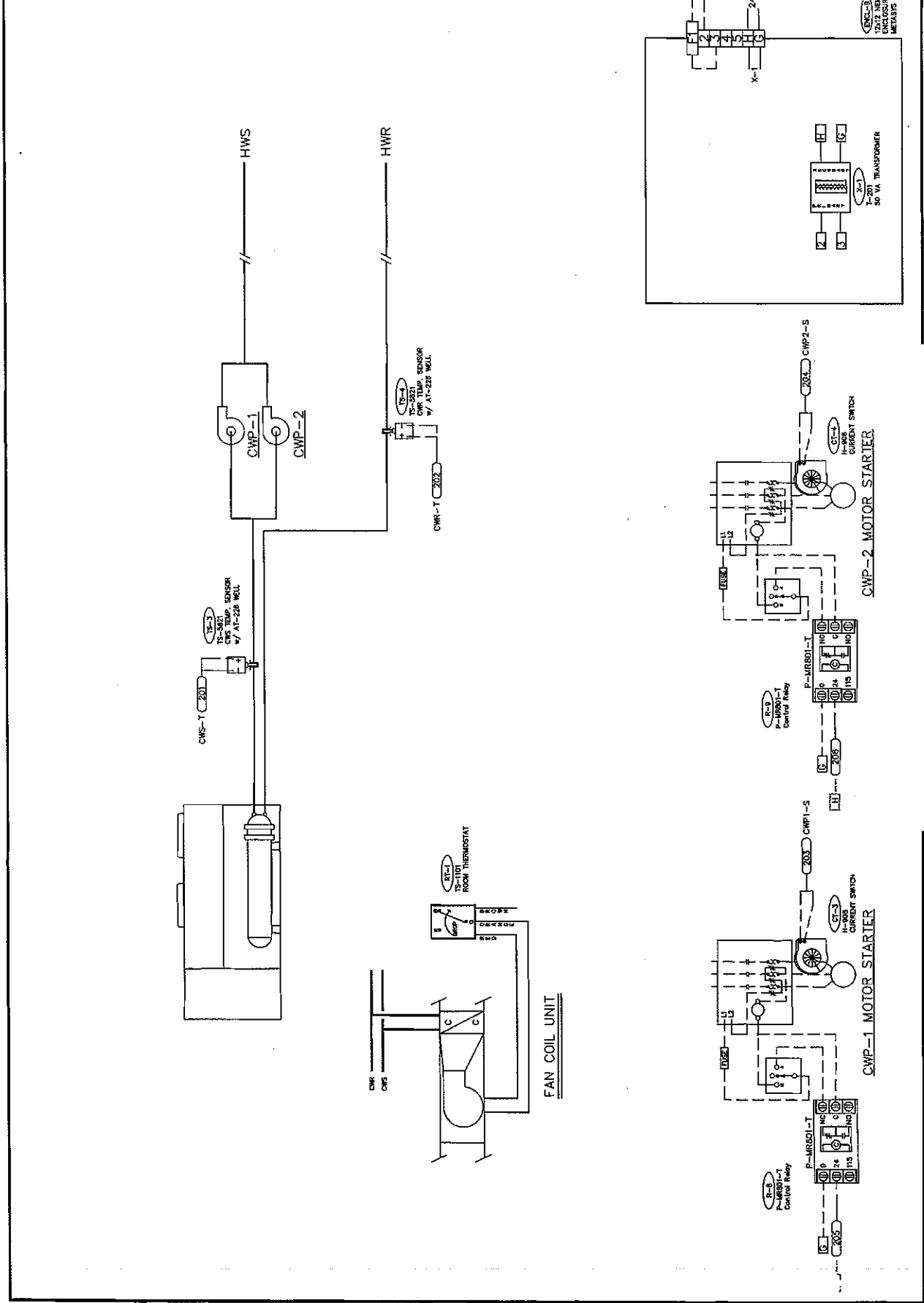
C. Once a hot water pump proves status, the hot water supply/return temperature shall modulate in sequence to maintain the constant hot water supply temperature setpoint of 180°F.



C & C Group
 2414-B Hyde Park Rd.
 Jefferson City, MO 65109
 Phone: (573) 632-4247

ARCHITECT HMN Architects, Inc. ENGINEER Eredson and Associates, Inc. CONTRACTOR Officer Mechanical	PROJECT UMC - University Hospital O.R. Renovation 3rd Floor East Chilled Water Control	DRAWING NO. 7 OF 9
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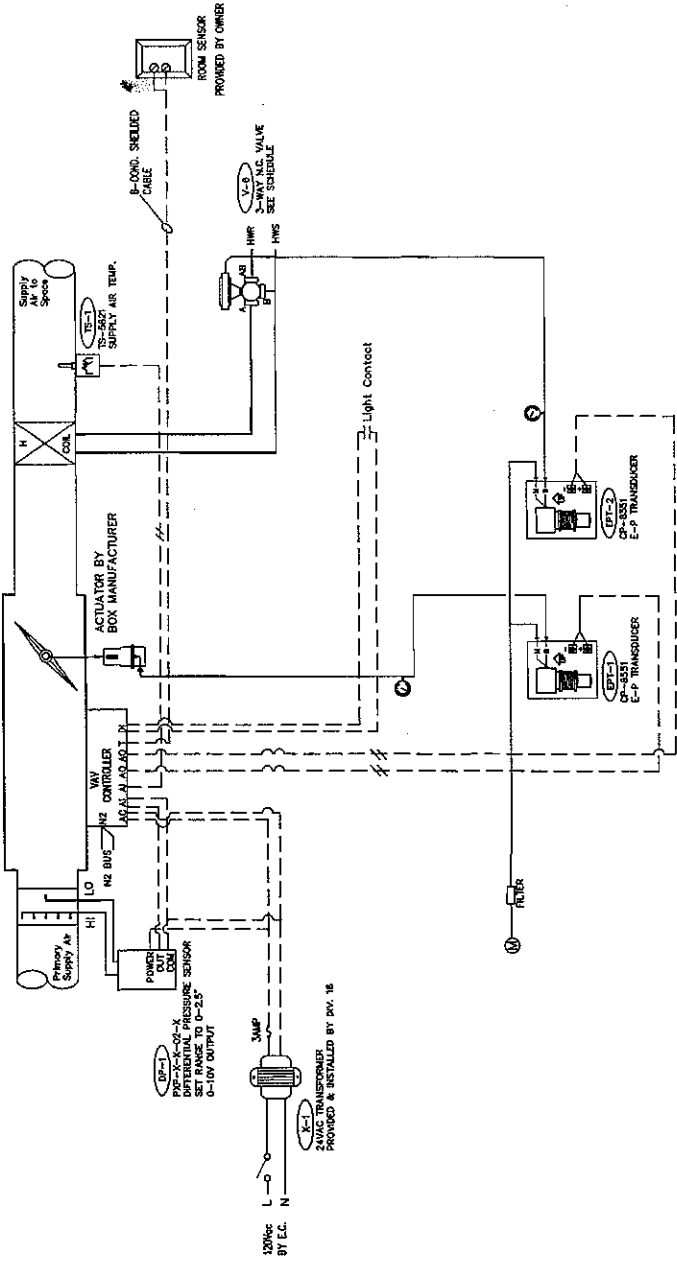
C & C Group 2414-B Hyde Park Rd. Jefferson City, MO 65109 Phone: (573) 632-4247	CHECKED DATE 10/13/05 APP # REVISION DATE REV. NO. REVISION DATE
------------------------------------------------------------------------------------------	------------------------------------------------------------------------------------



C & C Group
 2414-B Hyde Park Rd.
 Jefferson City, MO 65108
 Phone: (573) 632-4247

ARCHITECT
 HMN Architects, Inc.
 DRAWER
 Bredson and Associates, Inc.
 CONTRACTOR
 Officer Mechanical

PROJECT
 UNC - University Hospital
 O.R. Renovation 3rd Floor East
 DESCRIPTION
 Air Terminal
 DRAWING NO. 9 OF 9



VAV CONTROL DIAGRAM
 TYPICAL OF CV-01 - CV-05

SEQUENCE OF OPERATION:
 1. Single Duct Constant Volume Terminal Boxes (CV):
 2. The primary valve shall maintain airflow setpoints of all lines.
 3. The bypass valve shall modulate as required to maintain occupied mode space setpoint temperature.
 4. The hot water control valve shall modulate as required to maintain the unoccupied mode space setpoint temperature.

"CRITICAL CARE ADDITION" UNIVERSITY OF MISSOURI, COLUMBIA MISSOURI (HOSPITAL AND CLINICS)

CONTROL DRAWING INDEX:

DRAWING NUMBER	DRAWING CONTENT
01	1. TEMPERATURE CONTROL AIR COMPRESSOR 2. REFRIGERATED AIR DRYER 3. PNEUMATIC AIR RISER 4. DESSICANT AIR DRYER
02	1. TAB -- TERMINAL AIR BOXES 2. RHC -- DUCT REHEAT COILS 3. FTR -- FINNED TUBE RADIATION 4. SUH -- SUSPENDED UNIT HEATERS
03	1. FAN COIL UNIT FC-2-1 AND DUCT HUMIDIFIER H-2-1 2. FAN COIL UNITS FC-1-1 AND FC-2-2 3. DUCT HUMIDIFIERS H-4-1, H-4-2, H-4-3 4. SMOKE DAMPERS AND SMOKE/FIRE DAMPERS
04	1. ISOLATION ROOMS -- PRESSURE CONTROL 2. ETO ROOM -- PRESSURE CONTROL
05	1. ISOLATION ROOMS -- METASYS (STAND-A-LONE) DAMPER CONTROL
06	1. AHU-1 CONTROL 2. AHU-3 CONTROL 3. AHU-4 AND AHU-5 CONTROL 4. AHU-6 AND AHU-7 CONTROL
07	1. AHU-2 CONTROL
08	1. AHU-8 CONTROL
09	1. AHU-9 CONTROL
10	1. HEATING HOT WATER SYSTEM #1 CONTROL (CONVERTERS #C-1 AND C-2) 2. HEATING HOT WATER SYSTEM #2 CONTROL (CONVERTERS #C-3 AND C-4)
11	1. CHILLERS #C-8 AND C-9 CONTROL 2. COOLING TOWERS #CT-1, 2, 3 AND 4 CONTROL
12	1. EF-11A AND EF-11B 'ETO ROOM EXHAUST' 2. EF-12A AND 12B 'ISOLATION ROOMS EXHAUST' 3. EF-15A AND 15B 'GENERAL EXHAUST SYSTEM' 4. EF-18A AND 18B 'GENERAL EXHAUST SYSTEM'
13	1. SF-13 AND EF-13 '8TH FLOOR MECH ROOM VENT SYSTEM' 2. SF-14 AND EF-14 '8TH FLOOR MECH ROOM VENT SYSTEM' 3. SF-16 AND EF-16 'GROUND FLOOR MECH ROOM VENT SYSTEM'

FOR COORDINATION PURPOSES, WE HAVE REQUESTED APPROVED SUBMITTAL DATA (FROM THE MECHANICAL, SHEET METAL AND ELECTRICAL CONTRACTORS), ON THE FOLLOWING EQUIPMENT:

1. CHILLERS #8 AND #9 (WIRING SCHEMATICS)
2. COOLING TOWERS #CT-1,2,3,4
3. 'EF' (ALL EXHAUST FANS)
4. 'AV' AIR VALVES
5. 'TAB' UNITS
6. 'FC' UNITS
7. AHU-1 THRU AHU-9
8. AHU AND DUCT HUMIDIFIERS
9. VARIABLE FREQUENCY DRIVES
10. 'SF' (ALL SUPPLY FANS)

IN ADDITION, WE HAVE REQUESTED 'METASYS' TERMININATION DRAWINGS FROM THE OWNER. TO DATE, NONE OF THE ABOVE ITEMS HAVE BEEN RECEIVED.

THE TEMPERATURE CONTROL SUBMITTAL DRAWINGS IN THIS PACKAGE, MAY REQUIRE SOME MINOR REVISIONS BASED ON EQUIPMENT BEING FURNISHED. ANY CHANGES REQUIRED WILL BE INCORPORATED IN 'AS INSTALLED' DRAWINGS AT COMPLETION OF THIS PROJECT.

APPROVED APPROVED AS CORRECTED

If checked above, fabrication MAY be undertaken. Approval does not authorize changes to Contract Sum unless stated in separate letter or Change Order. If checked below fabrication MAY NOT be undertaken. Resubmit corrected copies to: final approval

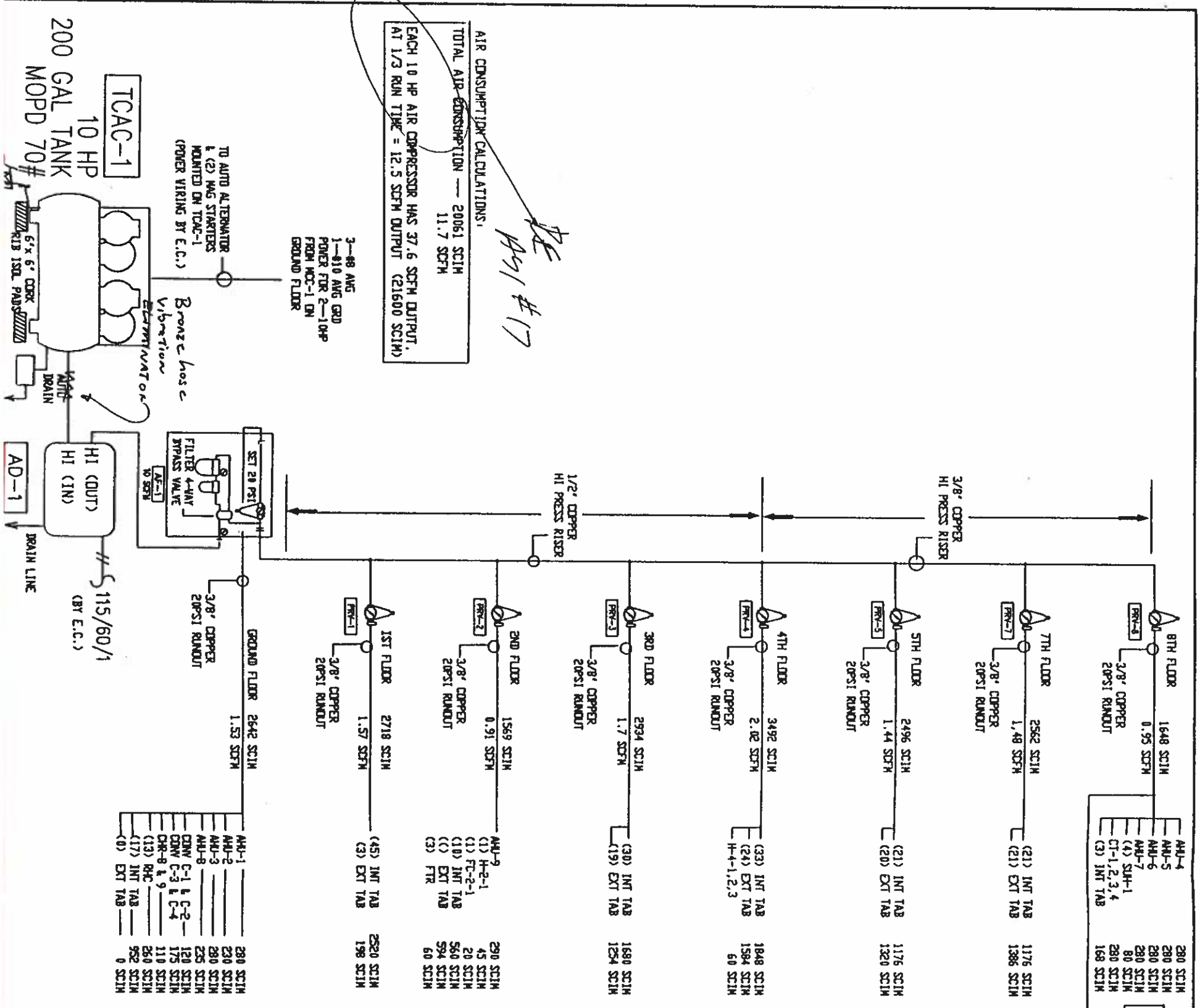
NOT APPROVED REVISE AND REAPPRAISE

Project NO: 91104, 00
 ETO NO: 15950
 R/R

Reviewing is only for conformance with the drawings and compliance with the specifications. The Contractor is responsible for all conditions not correlated at the site. Information is not to be used for processes or in the means, methods, techniques, and procedures of construction, and for coordination of the work of all trades.

DATE: 3-10-97 BY: HANSEY LIND MEYER AND [Signature]

Project CRITICAL CARE ADDITION UNIVERSITY OF MISSOURI COLUMBIA, MO 65205	
Architect ARCHITECTURAL CONSULTANTS, INC 4306 DOCTOR PREWES ROAD GRANDVIEW, MISSOURI 64030	Engineer HANSEY LIND MEYER, INC. PLAZA CENTER ONE 125 S. DUBOISE ST., SUITE 500 JMW CITY, IOWA 52240-4003
Contractor L. LOUIS CRUM CORP. 1312 CHESTNUT SPRINGS ROAD COLUMBIA, MISSOURI 65205	
REVISION	DATE
JOHNSON CONTROLS, INC 2188 WELSH INDUS CT ST. LOUIS, MO. 63146 PHONE 314-569-1570 FAX 314-569-1394	



AIR CONSUMPTION CALCULATIONS:
 TOTAL AIR CONSUMPTION — 20061 SCFH
 11.7 SCFH
 EACH 10 HP AIR COMPRESSOR HAS 37.6 SCFH OUTPUT,
 AT 1/3 RUN TIME = 12.5 SCFH OUTPUT (21600 SCFH)

Handwritten: 12/17

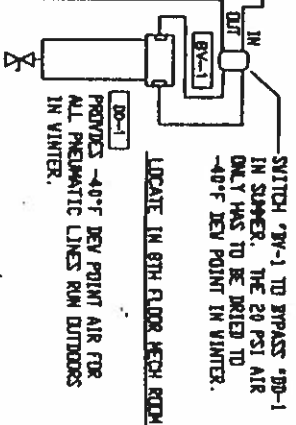
TO AUTO ALTERNATOR
 & (2) MAG STARTERS
 MOUNTED ON TCAC-1
 (PROPER WIRING BY E.C.)

3-#8 AWG
 1-#10 AWG GND
 POWER FOR 2-10HP
 FROM MCC-1 ON
 GROUND FLOOR

Bronze has c
 Vibration

AMU-1	280 SCFH
AMU-2	230 SCFH
AMU-3	280 SCFH
AMU-8	235 SCFH
CONV C-1 & C-2	120 SCFH
CONV C-3 & C-4	175 SCFH
CHR-8 & 9	110 SCFH
(13) RAC	260 SCFH
(17) INT TAB	952 SCFH
(0) EXT TAB	0 SCFH

DESSICANT AIR DRYER FOR PNEUMATIC
 LINES RUN OUTDOORS:



- DESSICANT DRIED AIR TO:
 1. EF-11A & 11B, EF-12A & 12B, EF-15A & 15B
 ROOF MOUNTED EXHAUST AIR DAMPERS.
 (SEE CONTROL DRWG-11)
- COILING TOWERS CT-1, 2, 3, 4
 ROOF MOUNTED VALVES V-C1, C2, C3, C4.
 (SEE CONTROL DRWG-11)

DEVICE TAG	QTY	CODE NUMBER	DESCRIPTION
A-1	1	2-7100-410	DUPLEX 10HP AIR COMP-INNER RAND
	1	H48470	ALTERNATOR PACKAGE-2-STARTERS-1R
	1	XXX	ELEC AUTO DRAIN-1R
AD-1	1	A-4412-1	AIR DRYER-12 SCFH, V-AUTO DRAIN
AF-1	1	A-4100-139	FILTER STATION, REDUCING
PRV-1-PRV-5, PRV-7-PRV-8	7	A-4100-138	REDUCING, PRESSURE 3/8"
DD-1	1	ND-4-SV	DESSICANT AIR DRYER-VAN AIR
W-1	1	A-1110-601	4-WAY BYPASS VALVE-C1

IN CONSERVATION OF THE RESPECT OF THIS
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 THEREIN CONTAINED, IN WHOLE OR IN
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 BY OTHERS, FOR ANY PURPOSES, EXCEPT
 WITH THE WRITTEN PERMISSION OF JOHNSON
 CONTROLS, INC. AND PARTNER AGREES TO
 SURRENDER SAME TO JOHNSON CONTROLS,
 INC. UPON DEMAND.

PROJECT TITLE
 1. TEMP. CONTROL AIR COMP.
 2. REFRIG AIR DRYER
 3. PNEUMATIC AIR RISER

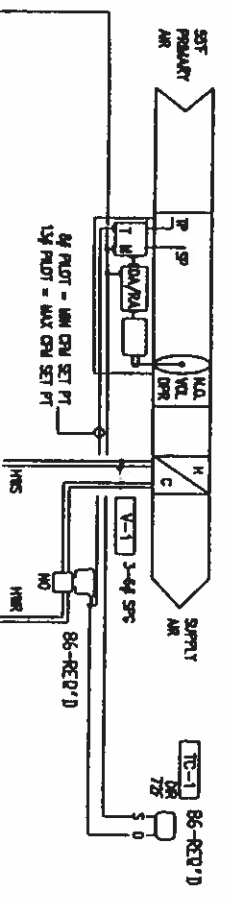
JOHNSON CONTROLS

PROJECT: CRITICAL CARE ADDITION
 UNIVERSITY OF MISSOURI
 COLUMBIA, MO 65205

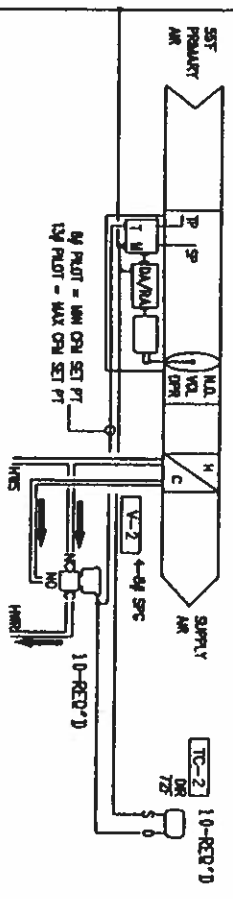
DATE: 01/20/07

CONTRACT NUMBER: B7524-0002
 DRAWING NUMBER:

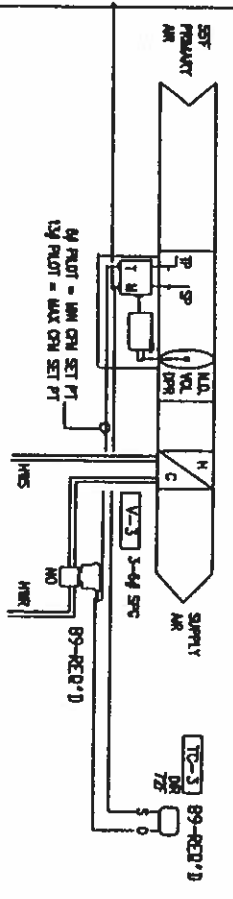
'TAB' VARIABLE AIR VOLUME BOXES W/2-WAY CONTROL VALVE (86-REQUIRED) SERVES 'EXTERIOR ZONES' **A**



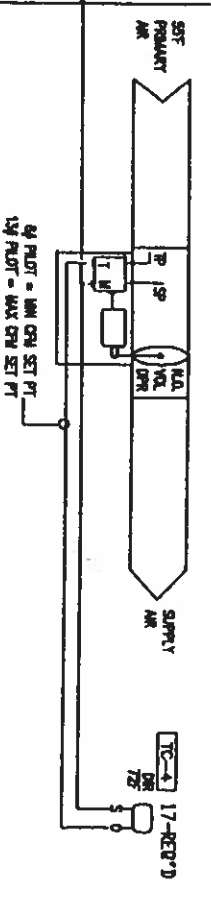
'TAB' VARIABLE AIR VOLUME BOXES W/3-WAY CONTROL VALVE (10-REQUIRED) SERVES 'EXTERIOR ZONES' **B**



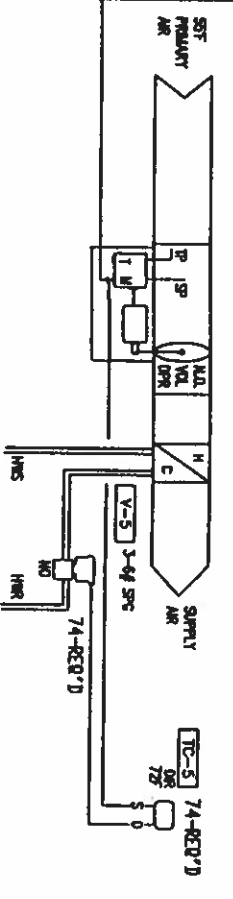
'TAB' VARIABLE AIR VOLUME BOXES W/2-WAY CONTROL VALVE (89-REQUIRED) SERVES 'INTERIOR ZONES' **C**



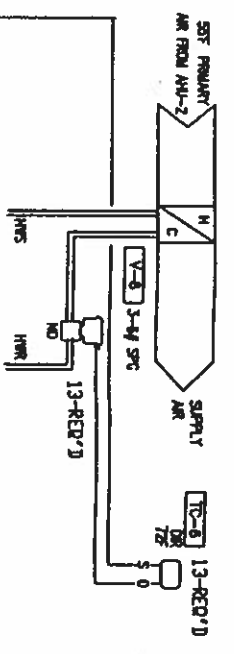
'TAB' VARIABLE AIR VOLUME BOXES W/O REHEAT COIL (17-REQUIRED) **D**



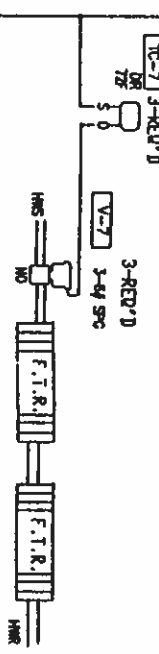
'TAB' CONSTANT AIR VOLUME BOXES W/2-WAY CONTROL VALVE (74-REQUIRED) **E**



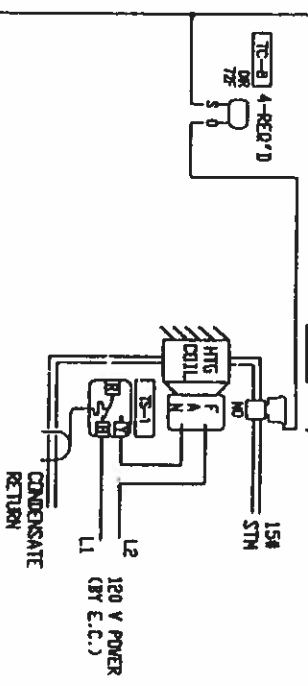
RHC-1,2,3,4,5,7,8,9,10,11,13,14,15 DUCT REHEAT COILS MECH PLANS ME.00 AND MA.00 (13-REQ'D) RHC-6 AND 12 NOT USED **F**



FINNED TUBE RADIATION, 2-MECH PLAN ME.02 AND MA.02 1-MECH PLAN ME.02A AND MA.02A **G**



SLH-1 SUSPENDED UNIT HEATERS (4-REQUIRED) MECH PLAN MS.03 **H**



DEVICE TAG	QTY	CODE NUMBER	DESCRIPTION	FIELD MATERIAL
TC-1-TC-8	296	T-4002-201	THERMOSTAT, DIR HORIZ F	
	296	T-4000-3142	COVER, WHITE PLASTIC, HRZ	
	296	T-4002-124	HTG. BRACKET, THERM.	
TS-1	4	A19DAC-1C	SPDT STRAP-ON MECH I	
V-1-V-3,	279		SEE VALVE SCHEDULE	
V-5-V-8				

A EXTERIOR ZONE 'TAB' UNITS:

ON A DROP IN SPACE TEMPERATURE, UNIT VOLUME DAMPER IS MODULATED TO MINIMUM OPEN POSITION. ON CONTINUED DROP IN SPACE TEMPERATURE, REHEAT COIL VALVE IS MODULATED TO AN OPEN POSITION. AS THE VALVE IS MODULATED OPEN THE VOLUME DAMPER IS MODULATED TOWARD AN OPEN POSITION.

B NOTE: TEN (10) EXTERIOR TAB UNITS HAVE 3-WAY MIXING VALVES V-2 IN LIEU OF 2-WAY VALVES V-1.

C INTERIOR ZONE 'TAB' UNITS:

ON A DROP IN SPACE TEMPERATURE, UNIT VOLUME DAMPER IS MODULATED TO MINIMUM OPEN POSITION. ON CONTINUED DROP IN SPACE TEMPERATURE, REHEAT COIL VALVE IS MODULATED TO AN OPEN POSITION. AS THE VALVE IS MODULATED OPEN THE VOLUME DAMPER REMAINS AT MINIMUM OPEN POSITION.

D 'TAB' UNITS WITHOUT REHEAT COILS:

ON A DROP IN SPACE TEMPERATURE, ROOM THERMOSTAT TC-4 RESETS UNIT FURNISHED FLOW CONTROLLER FROM MAXIMUM CFM SET POINT TO MINIMUM CFM SET POINT.

E CONSTANT VOLUME 'TAB' UNITS WITH REHEAT COILS:

UNIT FURNISHED FLOW CONTROLLER MAINTAINS CONSTANT CFM FLOW LEAVING THE UNIT. ROOM THERMOSTAT TC-5 MODULATES REHEAT COIL VALVE V-5 TO MAINTAIN DESIRED SPACE TEMPERATURE.

F 'RHC' DUCT REHEAT COILS:

ROOM THERMOSTAT TC-6 MODULATES REHEAT COIL VALVE V-6 TO MAINTAIN DESIRED SPACE TEMPERATURE.

G 'FTR' FINNED TUBE RADIATION:

ROOM THERMOSTAT TC-7 MODULATES H.V. SUPPLY VALVE V-7 TO MAINTAIN DESIRED SPACE TEMPERATURE.

H 'SUH' SUSPENDED UNIT HEATERS:

ROOM THERMOSTAT TC-8 MODULATES COIL VALVE V-8 TO PREVENT SPACE TEMPERATURE FROM DROPPING BELOW 70°F. WHEN COIL RETURN LINE TEMPERATURE SENSED BY STRAP-ON THERMOSTAT TS-1 RISES TO 100°F, THE SUPPLY FAN IS STARTED.

20 PSI CONTROL AIR FROM HIGH PRESSURE RISER WITH PRESSURE REDUCING STATION LOCATED AT EACH FLOOR. (SEE AIR COMPRESSOR MAIN AIR RISER ON DRAWG-011)

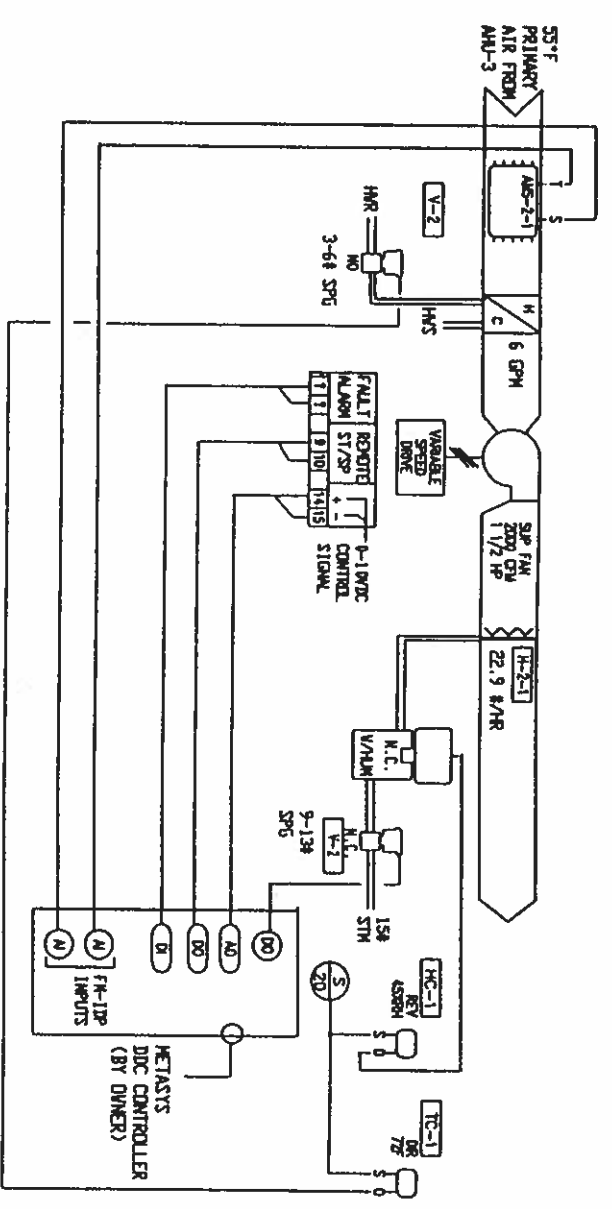
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DRAWING TITLE
1. TAB - TERMINAL AIR BOXES
2. RHC - DUCT REHEAT COILS
3. FTR - FINNED TUBE RADIATION
4. SUH - SUSPENDED UNIT HEATER

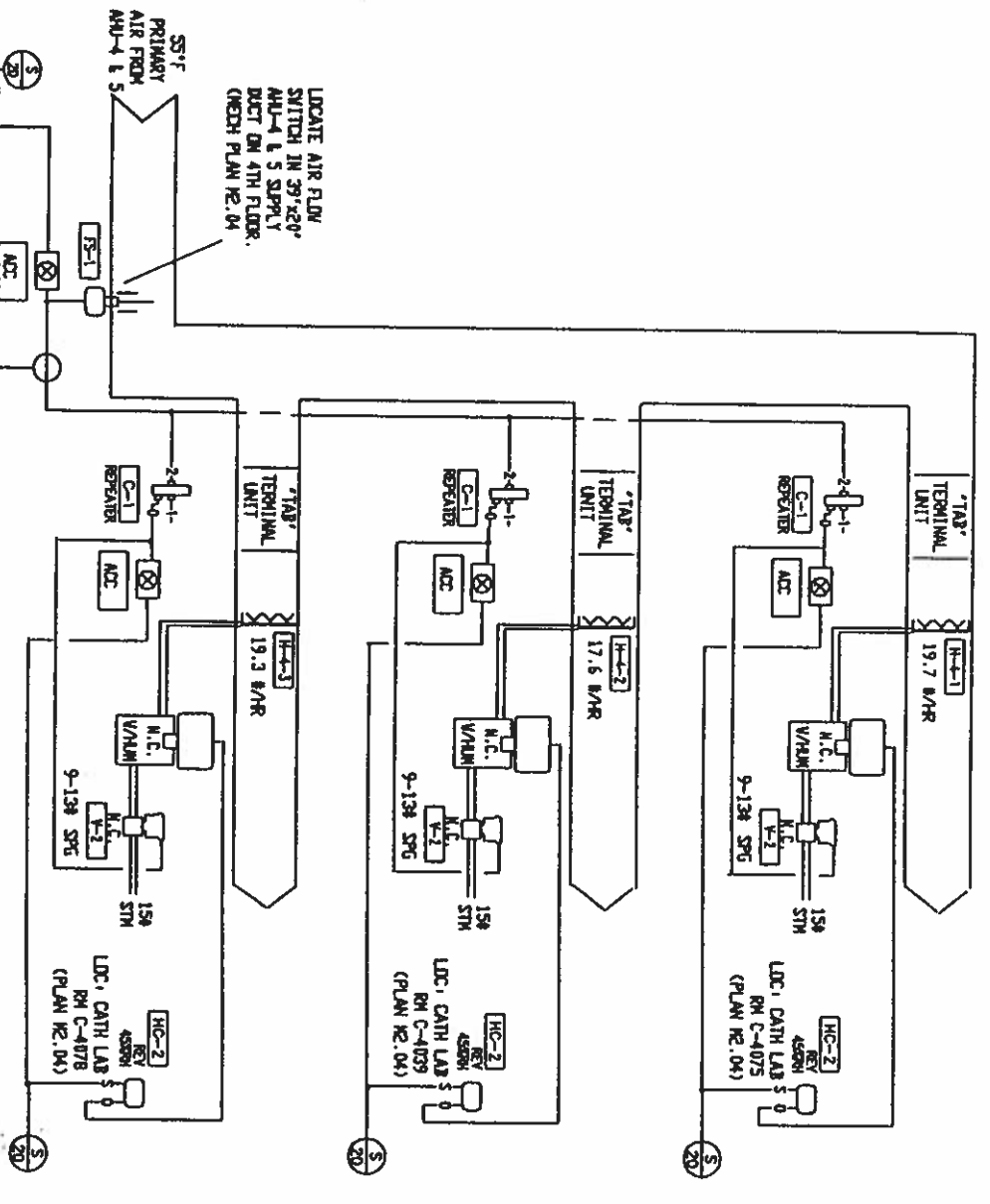
PROJECT	CUSTOMER	DATE	BY	CHKD	APP'D
PROJECT CARE ADDONUM	UNIVERSITY OF MISSOURI	COLUMBIA, MO 65205			

JOHNSON CONTROLS
87524-0002
DRAWING NUMBER

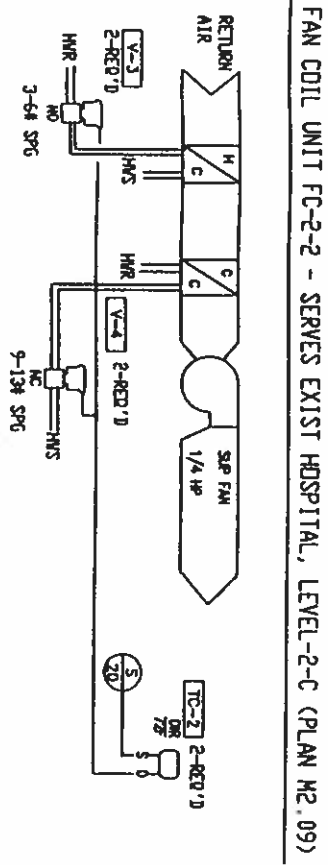
FAN COIL UNIT 'FC-2-1' AND DUCT HUMIDIFIER 'H-2-1'
SERVES: IV ADD, ROOM C-2075, 2ND FLOOR - A (MECH PLAN H2.02 & H4.02)



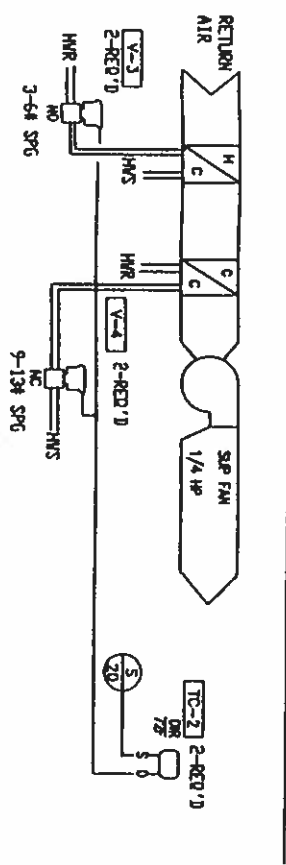
DUCT HUMIDIFIERS H-4-1-1, H-4-2 AND H-4-3: SERVES 4TH FLOOR CATH LABS



FAN COIL UNIT FC-1-1 - SERVES EXIST HOSPITAL, LEVEL-1-C (PLAN H2.09)

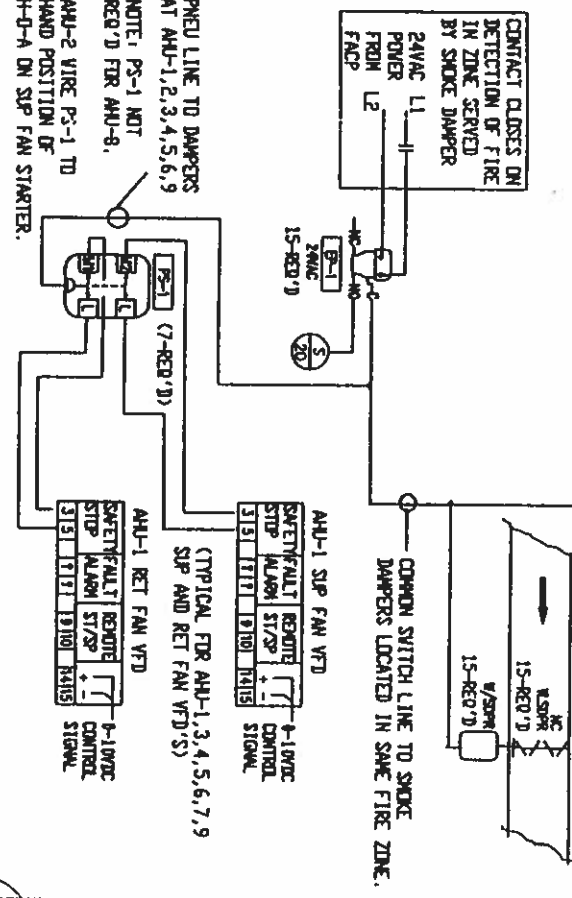


FAN COIL UNIT FC-2-2 - SERVES EXIST HOSPITAL, LEVEL-2-C (PLAN H2.09)



SMOKE DAMPERS & COMBINATION SMOKE/FIRE DAMPERS:

MECH PLAN	AREA	SMOKE QUANT	EP-1 QUANT
HS.00	AHU-1	2	1
HS.00	AHU-2	1	1
HS.00	AHU-3	1	1
HS.02	AHU-4	2	1
HS.02	AHU-5	2	1
HS.02	AHU-6	2	1
HS.02	AHU-7	2	1
HS.00A	AHU-8	0	0
HS.02A	AHU-9	2	1
HS.00	GDR FL. A/B	2	1
HS.00A	GDR FL. B	2	1
HS.02	2ND FL. A	4	1
HS.04	4TH FL. A/B	2	1
HS.05	5TH FL. A/B	2	1
HS.06	6TH FL. A/B	4	1
	TOTALS	33	15



CONTACT CLOSING ON DETECTION OF FIRE IN ZONE SERVED BY SMOKE DAMPER 24VAC L1 POWER FROM FACD

NOTE: PS-1 NOT REQUIRED FOR AHU-8. AHU-2 WIRE PS-1 TO HAND POSITION OF H-0-A ON SFP FAN STARTER.

DEVICE TAG	QTY	CODE NUMBER	DESCRIPTION
ACC	4	R-3710-1007	RESTRICTOR .007"
AMS-2-1	1	DAWD	AIR FLOW STATION-34"48" AIR
C-1	3	C-S26-3	SIGNAL TRANSMITTER
EP-1	15	V11HSA-1-00	3-WAY AIR VALVE/VARIABLE
FS-1	4	F40M-2C	PREU AIR FLOW SWITCH-2C
HC-1-HC-2	4	H-4100-203	HUMIDISTAT, REY
	4	T-4002-3139	COVER, WHITE PLASTIC, HRZ
	4	T-4002-124	HTG. BRACKET, THERM.
PS-1	7	PS7AA-1C	LOW PRESSURE CONTROL
TC-1-TC-2	3	T-4002-201	THERMOSTAT, DIR HORIZ F
	3	T-4002-3142	HTG. BRACKET, THERM.
TC-3	3	T-4002-124	HTG. BRACKET, THERM.
V-2-Y-4	1	T-9000-70	THERMOSTAT "B" 15" CAP
	5		SEE VALVE SCHEDULE

'FC-2-1 AND 'H-2-1' CONTROL SEQUENCE:

'FC-2-1 SUPPLY FAN WILL BE INTERLOCKED TO RUN CONTINUOUSLY WHEN AHU-3 SUPPLY FAN RUNS.
THE SPEED FC-2-1 SUPPLY FAN WILL BE MODULATED TO MAINTAIN CONSTANT CFM FLOW AS MEASURED BY AIR FLOW STATION AMS-2-1.
ROOM THERMOSTAT TC-1 MODULATES REHEAT COIL VALVE V-1 TO MAINTAIN 72°F SPACE TEMPERATURE.

ROOM HUMIDISTAT HC-1 MODULATES UNIT FURNISHED HUMIDIFIER VALVE TO MAINTAIN 45% RH SPACE HUMIDITY.

HUMIDIFIER SHUT-OFF VALVE V-2 WILL BE CLOSED WHEN OUTSIDE AIR TEMPERATURE RISES ABOVE 52°F OR WHEN AHU-3 SUPPLY FAN IS STOPPED.

'FC-1-1' AND 'FC-2-2' CONTROL SEQUENCE:

ROOM THERMOSTAT MODULATES HEATING COIL VALVE V-3 IN SEQUENCE WITH SMOKE/FIRE DAMPERS TO MAINTAIN 72°F SPACE TEMPERATURE.

DUCT HUMIDIFIERS SERVING 4TH FLOOR.

ROOM HUMIDISTAT HC-2 MODULATES UNIT FURNISHED HUMIDIFIER VALVE TO MAINTAIN 45% RH SPACE HUMIDITY.

HUMIDIFIER SHUT-OFF VALVE V-2 WILL BE CLOSED WHEN OUTSIDE AIR TEMPERATURE RISES ABOVE 52°F OR WHEN AHU-4 AND AHU-5

SMOKE & COMBINATION SMOKE/FIRE DAMPERS.

WHEN FIRE IS DETECTED IN AREA SERVED BY THE SMOKE DAMPER, EP-1 IS ENERGIZED TO EXHAUST AIR TO CLOSE THE N.C. SMOKE DAMPER.

THE DAMPER WILL REMAIN CLOSED UNTIL THE BUILDING 'FACP' INITIATING DETECTOR IS CLEARED AND THE 'FACP' IS RESET.

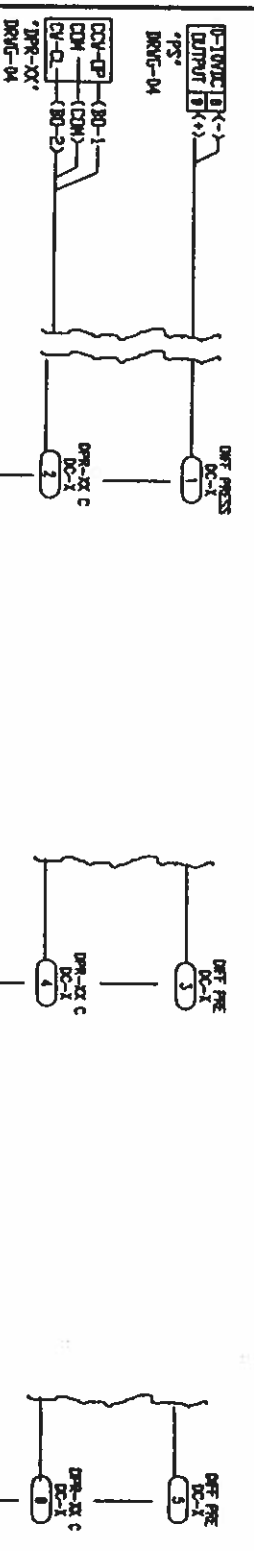
WHEN SMOKE DAMPERS AT AN AHU ARE CLOSED THE SUPPLY AND RETURN FANS OF THE RESPECTIVE AHU ARE STOPPED AND WILL REMAIN STOPPED UNTIL RESPECTIVE EP-1 IS DE-ENERGIZED.

Provide damper and switch on each smoke and combination smoke/fire damper. The damper and switches shall provide position indications to smoke control panel for all smoke and combination smoke/fire dampers.

HLN

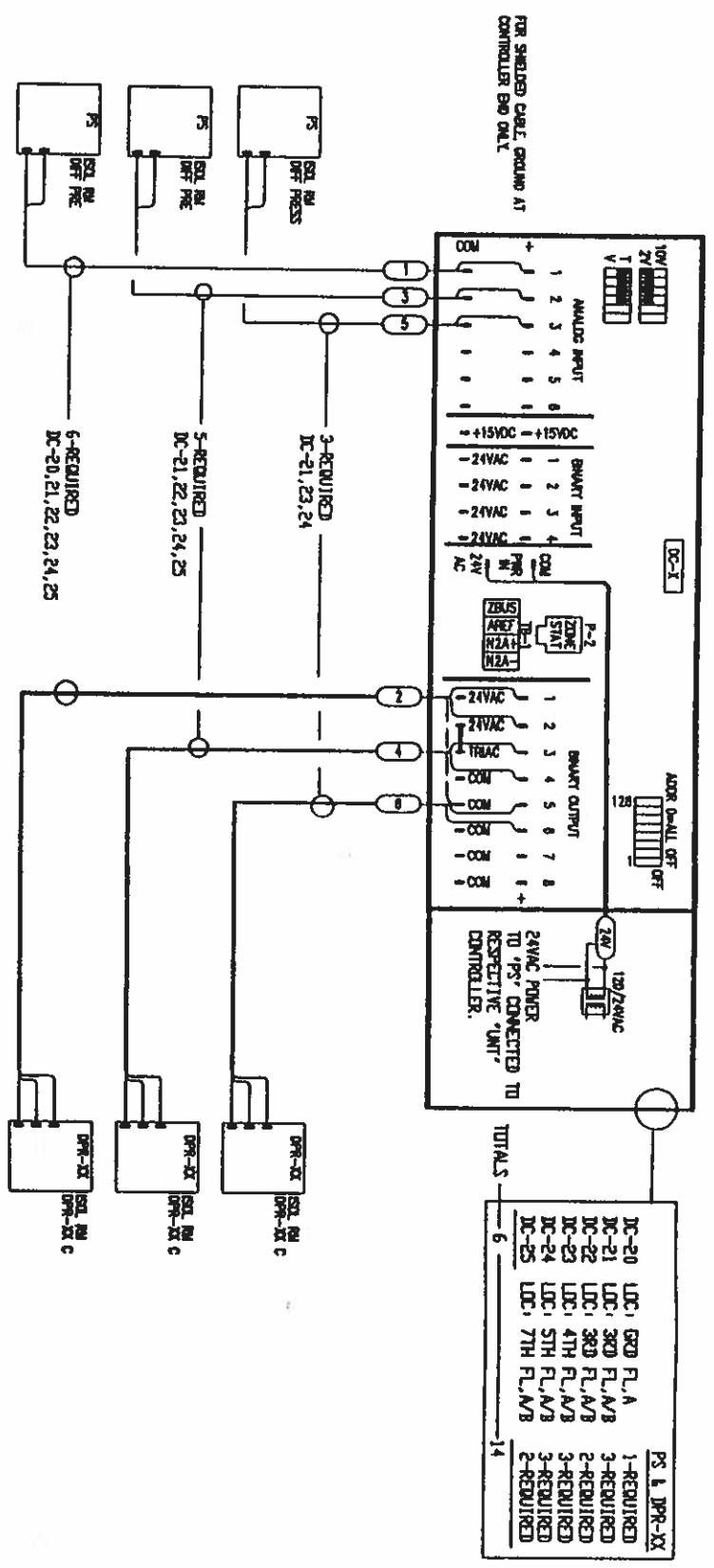
PROJECT: CONTROL CARE ADDITION UNIVERSITY OF MISSOURI
DRAWING TITLE: 1. FC-2-1 AND H-2-1
2. FC-1-1 & FC-2-2
3. DUCT HUMIDIFIERS
4. SMOKE & SMOKE/FIRE DAMPERS
DATE: 12/28/88
DRAWN BY: JAHNSON
CHECKED BY: JAHNSON
APPROVED BY: JAHNSON
CONTRACT NUMBER: 87524-0002
DRAWING NUMBER: 87524-0002

DEVICE TAG	QTY	CODE NUMBER	DESCRIPTION
DC-X	6	AS-JMT111-101	DDC UNIT-8-80, SOWA, IPM ENCL



DC-20 'A1-1' & 'B0-1 & 2' CONTROLS	A (1)	(NOT REQUIRED)	DC-21 'A1-2' & 'B0-3 & 4' CONTROLS	A (3)	(NOT REQUIRED)	DC-21 'A1-3' & 'B0-5 & 6' CONTROLS	A (4)
DC-21 'A1-1' & 'B0-1 & 2' CONTROLS	A (2)		DC-22 'A1-2' & 'B0-3 & 4' CONTROLS	A (6)	(NOT REQUIRED)	DC-23 'A1-3' & 'B0-5 & 6' CONTROLS	A (9)
DC-22 'A1-1' & 'B0-1 & 2' CONTROLS	A (5)		DC-23 'A1-2' & 'B0-3 & 4' CONTROLS	A (8)		DC-24 'A1-3' & 'B0-5 & 6' CONTROLS	A (12)
DC-23 'A1-1' & 'B0-1 & 2' CONTROLS	A (7)		DC-24 'A1-2' & 'B0-3 & 4' CONTROLS	A (11)			
DC-24 'A1-1' & 'B0-1 & 2' CONTROLS	A (10)		DC-25 'A1-2' & 'B0-3 & 4' CONTROLS	A (14)	(NOT REQUIRED)		
DC-24 'A1-1' & 'B0-1 & 2' CONTROLS	A (13)						

SEE DRAWING-04 FOR LOCATIONS OF POINTS TAGGED A (1) THRU A (14)

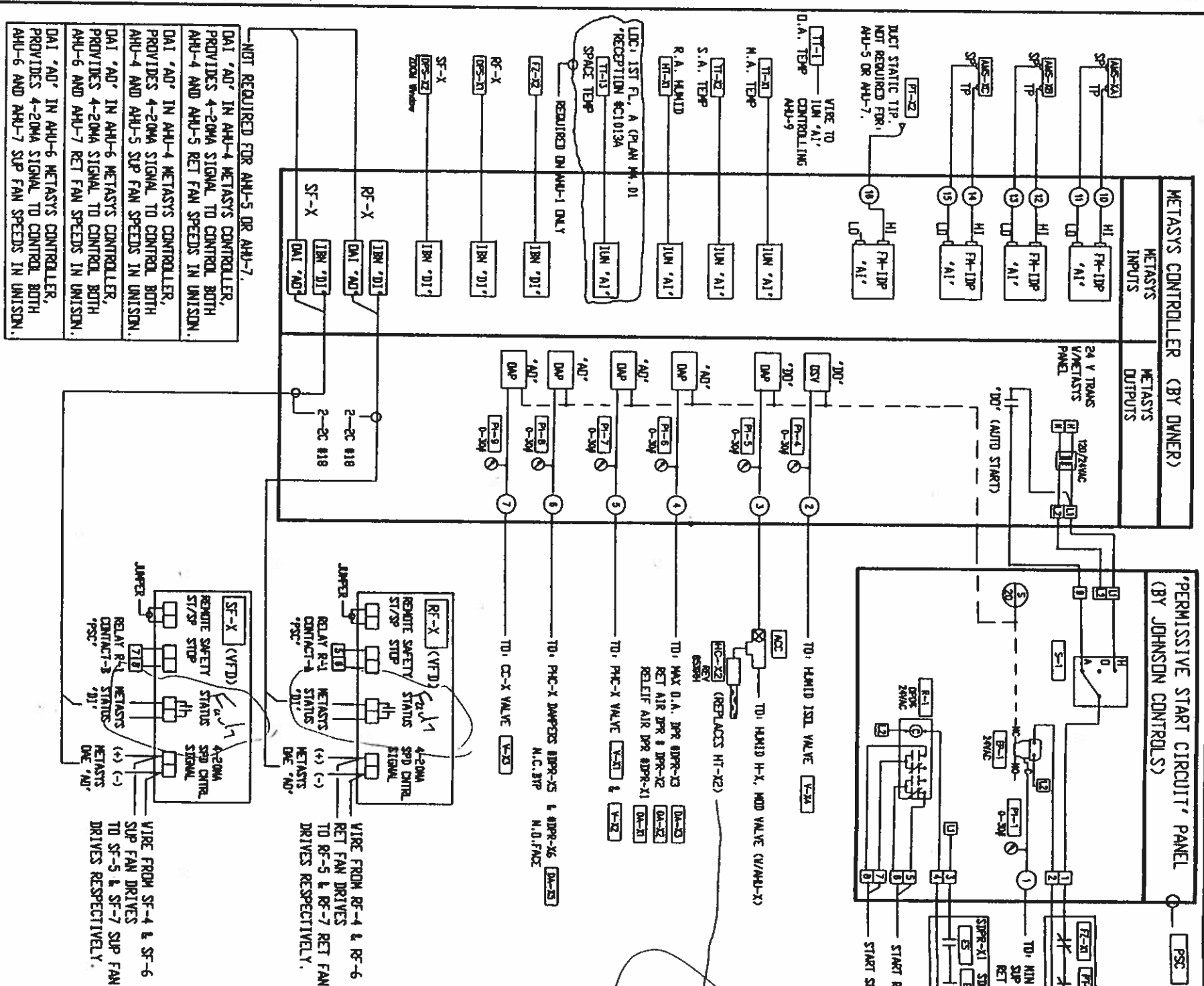


NOTE: SEE DRAWING-04 FOR LOCATIONS OF 'PS' AND 'DPR-XX'

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DRAWING TITLE		PROJECT	
1. METASTAS-JMT CONTROL OF DPR-XX FROM SOL ROOMS		CRITICAL CARE ADDITION UNIVERSITY OF MESSOURI	
DESIGNED BY	DATE	APPROVED BY	DATE
DR	8/28/87	JANSON	8/28/87
JANSOHN CONTROLS INC		CONTRACT NUMBER	
2100 WELSON BOULEVARD		87524-0002	
ST. LOUIS, MO. 63106			

FILE: SOL-DPR



MISSING HT-X2 as high Limit Humidity Sensor as AI Hum

NOTE-1: SEE MECH PLAN M5.04 FOR CONTROL SCHEMATIC OF AHU-X.

NOTE-2: SEE SPECIFICATION PAGES 19554-1 THRU 4 FOR AHU-X 'SEQUENCE OF CONTROL' DESCRIPTION.

NOTE-3: SEE OWNERS DRAWINGS FOR METASYS CONTROLLER TERMINATIONS.

DEVICE TAG	QTY	CODE NUMBER	DESCRIPTION	FIELD MATERIAL
ACC	1	R-3710-3007	BARRED TEE 1/4" .007	
AMS-XA, XB, XC	3	SEE AMS SCHED	AIR NON STATON-AIR NON	
DA-X1, X2, X3, X5	4	D-3153-1	DAMPER ACTUATOR V/PILLOT	
DA-X4	4	D-3153-2	DAMPER ACTUATOR 8-13#	
SMA-X1, X2	3	D-3153-2	DAMPER ACTUATOR 8-13#	
SPS-X1, X2	2	P-32AC-1C	DIFF PRESS SWITCH, 0.15 TO 12"	
ES	3	TE-4U-2S	DRP END SWITCH-DRONON	
FACP	1	BY E.C.	FIRE ALM CONTROL PANEL	
SD-X1, X2	2	BY E.C.	DUCT SMOKE DETECTOR	
FZ-X1	1	A11B-1C	LOW TEMP LIMIT NEHA 1	
FZ-X2	1	A11A-1C	LOW TEMP LIMIT NEHA 1	
HC-X2	1	H-3610-1001	HUMIDITY CONTR KEY (65X	
HT-X1	1	HE-6310-2	TRANS RV/TEMP/DUCT 0/100X	
PT-X1	1	P-32AC-1C	DIFF PRESS SWITCH, 0.15 TO 12"	
PT-X2	1	FTG18A-600R	REMOTE HTD PROBE	
TT-X1	1	TE-6314P-1	TEMP SENSOR, 1000 OHM, SPACE	
TT-X2	1	TE-6316P-1	TEMP SENSOR, 1000 OHM, 6' DUCT	
V-X1, X2, X3, X4	4	SEE VL SCHED	AUTO CONTROL VALVES V/PILLOTS	

THIS DRAWING IS TYPICAL FOR AHU-1, 3, 4, 5, 6 AND 7	AHU LOCATION	SERVES 'TAB' UNITS/FLOOR	PLAN	PT-X2 LOCATION UPSTREAM OF
AHU-1 EQUIPMENT TAGS, ETC—REPLACE ALL 'X' WITH '1'	GRD FL.—PLAN M5.00	101 THRU 132	1ST FL. A	HE.01
AHU-3 EQUIPMENT TAGS, ETC—REPLACE ALL 'X' WITH '3'	GRD FL.—PLAN M5.00	201 THRU 219	2ND FL. A	HE.02
AHU-4 EQUIPMENT TAGS, ETC—REPLACE ALL 'X' WITH '4'	8TH FL.—PLAN M5.02	30-1 THRU 30-29	3RD FL. A/B	HE.03
AHU-5 EQUIPMENT TAGS, ETC—REPLACE ALL 'X' WITH '5'	8TH FL.—PLAN M5.02	40-1 THRU 40-35	4TH FL. A/B	HE.04
AHU-6 EQUIPMENT TAGS, ETC—REPLACE ALL 'X' WITH '6'	8TH FL.—PLAN M5.02	50-1 THRU 50-25	5TH FL. A/B	HE.05
AHU-7 EQUIPMENT TAGS, ETC—REPLACE ALL 'X' WITH '7'	8TH FL.—PLAN M5.02	70-2 THRU 70-21	7TH FL. A/B	HE.06
		80-1 THRU 80-3	8TH FL. A	HE.07
		30-1 THRU 30-23	3RD FL. A/B	HE.03
		40-1 THRU 40-22	4TH FL. A/B	HE.04
		50-1 THRU 50-20	5TH FL. A/B	HE.05
		70-1 THRU 70-22	7TH FL. A/B	HE.06

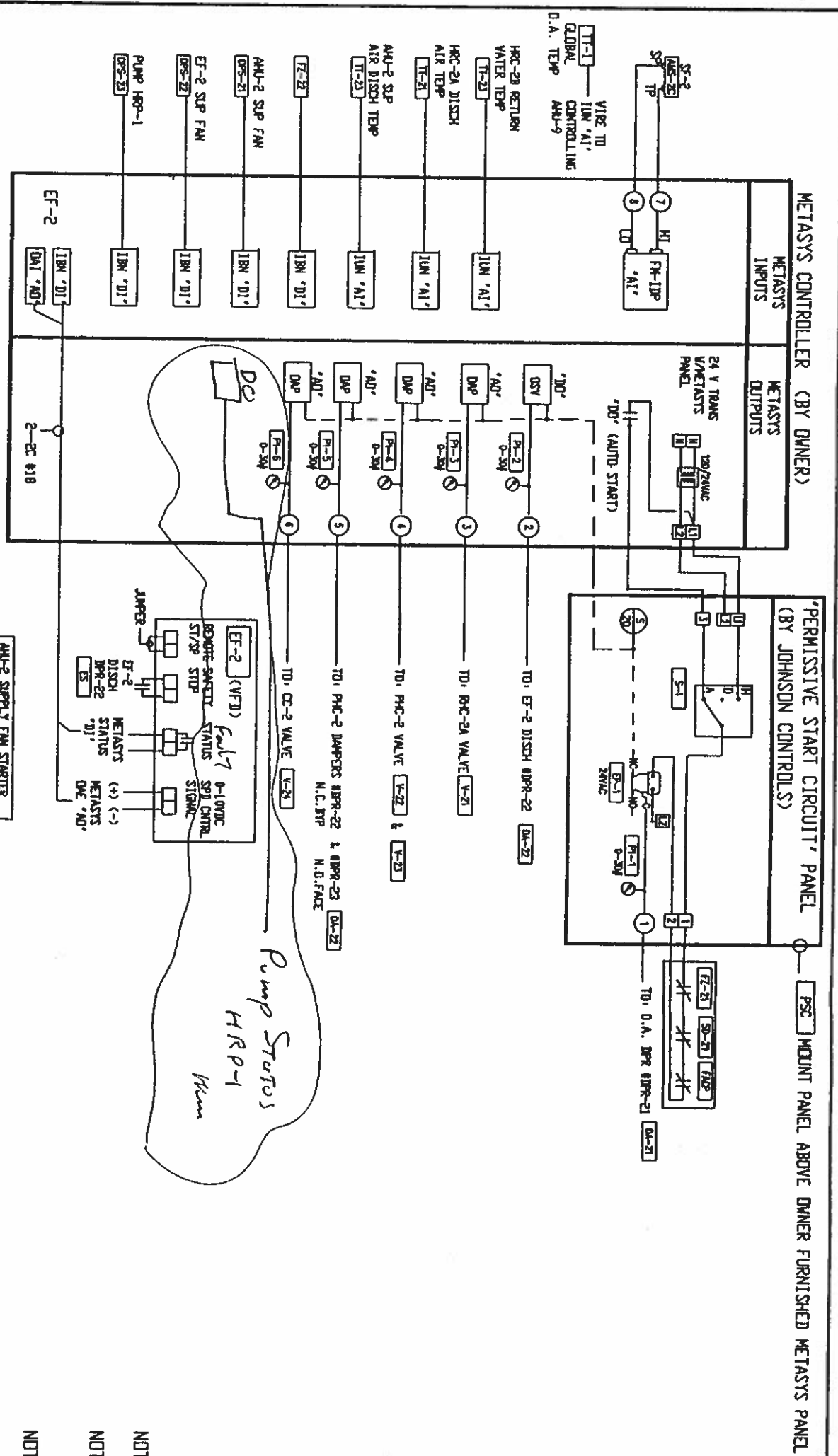
ALL DAMPER ACTUATORS WITH PILOTS AND VALVE ACTUATORS WITH PILOTS TO BE SET FOR 3-15# RANGE.

QUANTITIES LISTED ABOVE ARE FOR (1) AHU. TOTAL OF (6) AHU(S) ARE REQUIRED.

PROJECT: JAHNSON CONTROL S

DATE: 8/75

CONTRACT NUMBER: 87524-0002



DEVICE TAG	QTY	CODE NUMBER	DESCRIPTION	FIELD MATERIAL
AMS-2C	1	SEE AMS SCHED	AIR NON STATION-AIR NON	
DA-21, 24	2	D-3153-2	DAMPER ACTUATOR 8-13#	
DA-22	1	D-3153-1	DAMPER ACTUATOR V/P/110T	
DP-21-DP-22	2	P22AC-1C	SENSITIVE DIFF PRES CTL	
DP-23	2	P74FA-5C	DIFFERENTIAL PRES CONTROL	
ES	1	ZE-4L-2S	DR END SWITCH-DIVISION	
FADP	2	BY E.C.	FIRE ALM SWITCH-PANEL	
SD-21	1	BY E.C.	DUCT SMK DETECTOR	
FZ-21	1	AL1B-1C	LOW TEMP LIMIT NEMA 1	
FZ-22	1	AL1A-1C	LOW TEMP LIMIT NEMA 1	
TT-21	1	TE-6318P-1	TEMP SENSOR, 1000 OHM, 6' DUCT	
TT-22	1	TE-6311P-1	TEMP SENSOR, 1000 OHM, 6' DUCT	
TT-23	1	TE-631AP-1	TEMP SENSOR, 1000 OHM, 6' DUCT	
TT-24	1	VZ-1000-5	IMMERSION TEMP ELEMENT-JC	
V-21-V-24	4	SEE VL SCHED	VEL, BRASS, .299 I.D.	

DEVICE TAG	QTY	CODE NUMBER	DESCRIPTION	PANEL MATERIAL
EP-1	1	V11HGA-100	3-WAY AIR VALVE/V/BARBED	
P1-1-P1-6	6	G-2010-5	AIR GAGE 1-1/2"	
PSC	1	GM-ENC10-0	SINGLE 'UP' ENCLOSURE-JC	
S-1	1	PD-106-2	SELECTOR SWITCH 3-POS.	

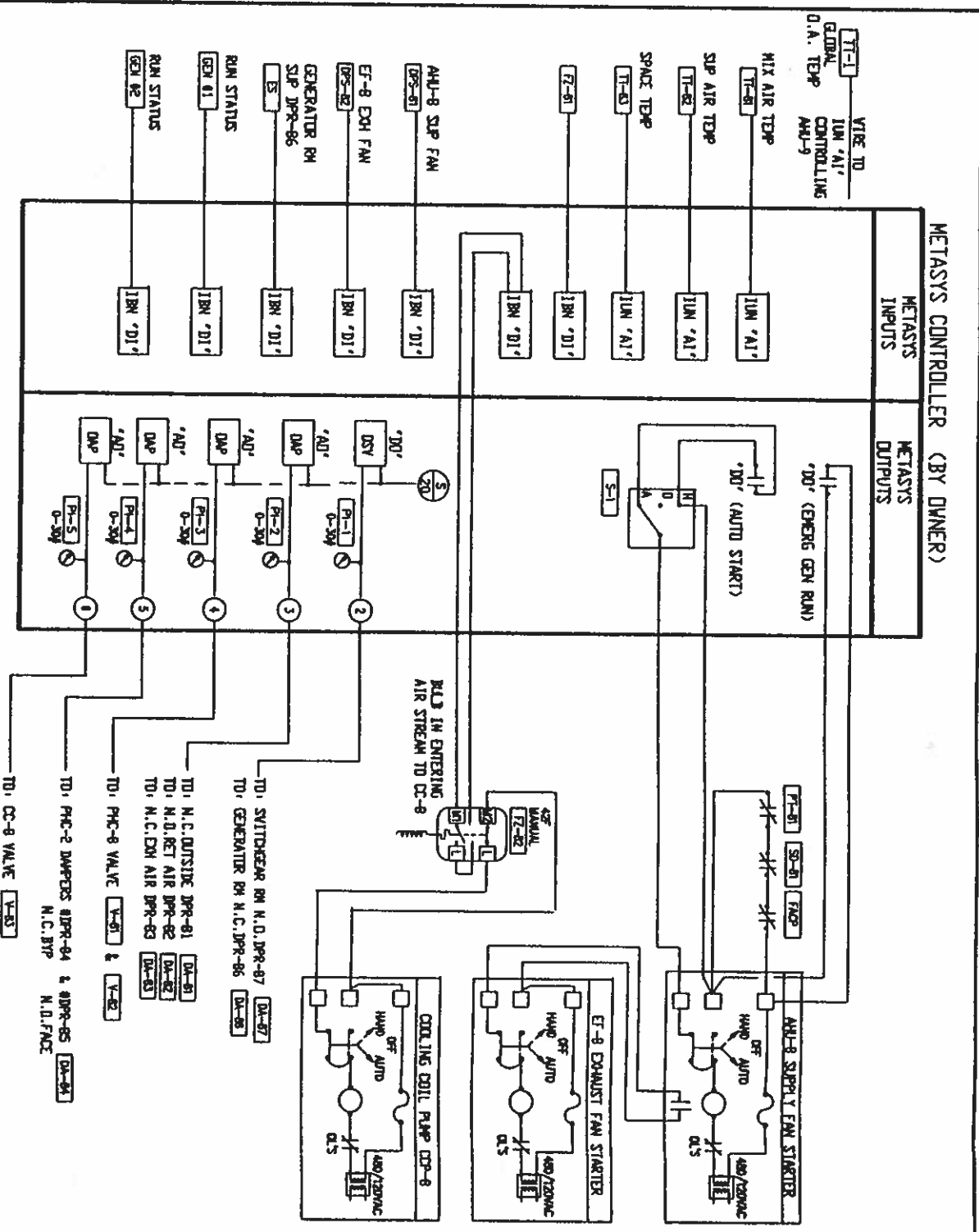
ALL DAMPER ACTUATORS WITH PILLOTS AND VALVE ACTUATORS WITH PILLOTS TO BE SET FOR 3-15# RANGE.

NOTE-1: SEE MECH PLAN WS. 04 FOR CONTROL SCHEMATIC OF AHU-2.

NOTE-2: SEE SPECIFICATION PAGES 15954-4 THRU 6 FOR AHU-X 'SEQUENCE OF CONTROL' DESCRIPTION.

NOTE-3: SEE OWNERS DRAWINGS FOR METASTASIS CONTROLLER TERMINATIONS.

<p>IN CONSIDERATION OF THE RECEIPT OF THIS DOCUMENT, THE REQUESTER AGREES NOT TO REPRODUCE, COPY, USE OR TRANSMIT THIS DOCUMENT AND/OR THE INFORMATION THEREIN CONTAINED, IN WHOLE OR IN PART, OR TO SUFFER SUCH ACTION BY OTHERS FOR ANY PURPOSE, EXCEPT WITH THE WRITTEN PERMISSION OF JOHNSON CONTROLS, INC. AND FURTHER AGREES TO SURRENDER SAME TO JOHNSON CONTROLS, INC. UPON DEMAND.</p>	
<p>DRAWING TITLE AIR HANDLING UNIT #2 1. LOC. GRD FL.-W. PLAN W5.00 2. SERVICES: RHC-1 THRU RHC-15 GRD FL.-A/B, PLAN W2.00</p>	<p>PROJECT CRITICAL CARE ADDITION UNIVERSITY OF MISSOURI COLUMBIA, MO 65206</p>
<p>JOHNSON CONTROLS 2100 WISCONSIN ST ST LOUIS, MO 63104</p>	<p>DATE 07/27/71</p>
<p>CONTRACT NUMBER 87524-0002</p>	<p>DRAWING NUMBER</p>



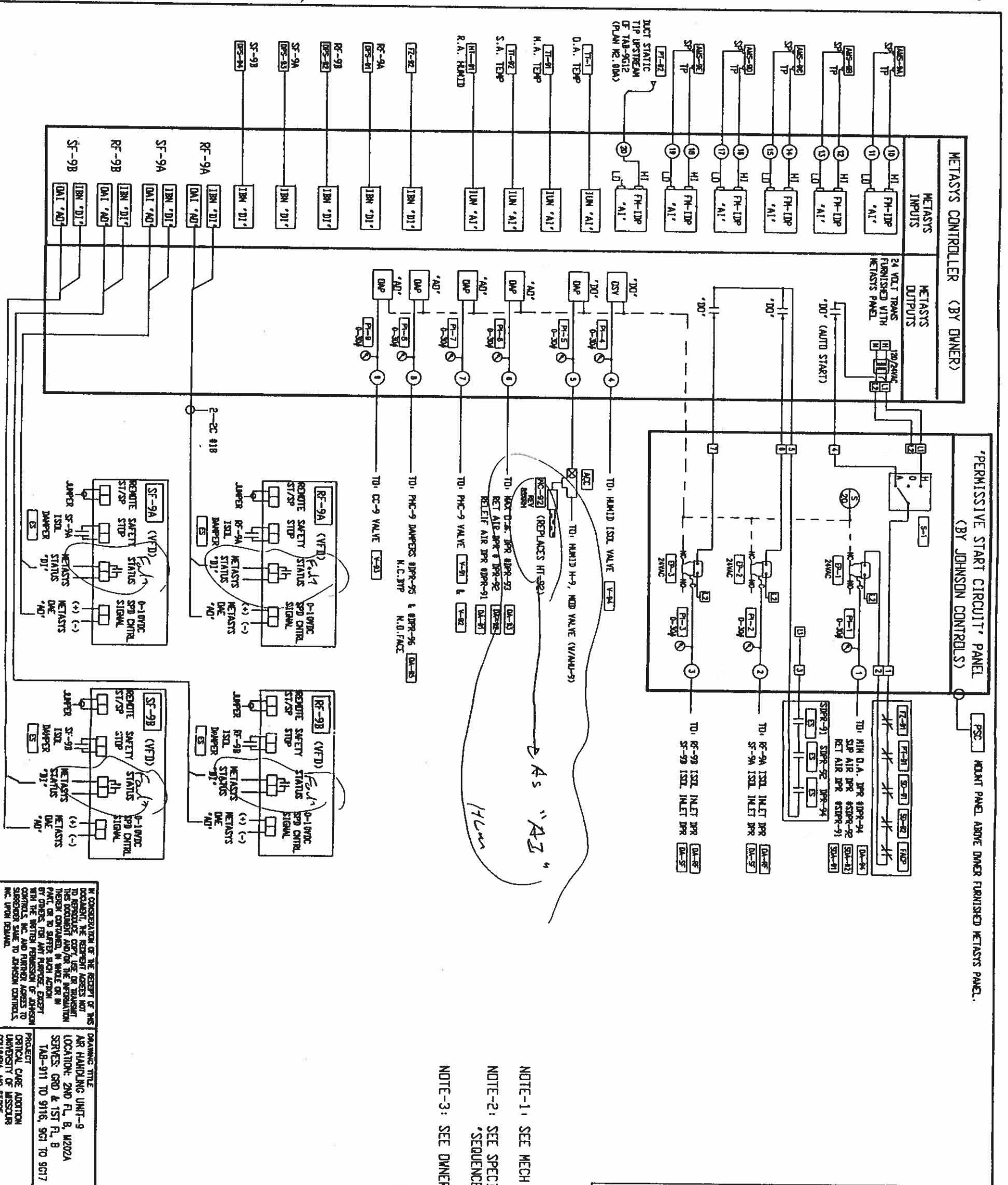
DEVICE TAG	QTY	CODE NUMBER	DESCRIPTION
DA-81-DA-83	3	D-3153-1	DPR ACT 8-13# V/PDS
DA-84	1	D-3153-1	DPR ACT 8-13# V/PDS
DA-86-DA-87	2	D-3153-2	DAMPER ACTUATOR 8-13#
DPS-81-DPS-82	3	P32AC-1C	SENSITIVE DIFF PRES CTL
PI-81	1	ZE-AU-2S	DPR END SWITCH-DRGRN
ES	1	BY E.C.	FIRE ALARM CONTROL PANEL
SD-81	1	BY E.C.	DUCT SMOKE DETECTOR
FZ-81	1	A11A-1C	LOW TEMP LIMIT NEMA 1
FZ-82	1	A170M-1C	TEMP CONTROL 4 VIRE, C-C
TI-81	1	TE-6316P-1	TEMP SENSOR, 1000 OHM, 5' DUCT
TI-82	1	TE-6311P-1	TEMP SENSOR, 1000 OHM, 5' DUCT
TI-83	1	TE-6314P-1	TEMP SENSOR, 1000 OHM, SPACE
V-81-V-83	3	SEE VL SCHED	

ALL DAMPER ACTUATORS WITH PILOTS AND VALVE ACTUATORS WITH PILOTS TO BE SET FOR 3-15# RANGE.

NOTE-1: SEE MECH PLAN M5.000A FOR CONTROL SCHEMATIC OF AHU-8.
 NOTE-2: SEE SPECIFICATION PAGES 15954-6 THRU 8 FOR AHU-X 'SEQUENCE OF CONTROL' DESCRIPTION.
 NOTE-3: SEE OWNERS DRAWINGS FOR METASYS CONTROLLER TERMINATIONS.

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PROJECT	CRITICAL CARE ADDITION UNIVERSITY OF MISSOURI
DRAWING TITLE	FILE: AHU-8
LOC: (GROUND FLOOR, PLAN M5.00A)	
SERVICES: SWITCHGEAR ROOM AND GENERATOR ROOM, PLAN M5.00A	
DATE	
BY	
CHECKED	
APPROVED	
CONTRACT NUMBER	87524-0002
DRAWING NUMBER	



DEVICE TAG	QTY	CODE NUMBER	DESCRIPTION	FIELD MATERIAL
ACC	1	R-3710-3007	BARBED Tee 1/4", .007	
AMS-9A, B, D, E	6	SEE AMS SCHED	AIR NON STATION-AIR NON	
DA-91, 92, 93, 95	4	DA-3153-1	DR ACTUATOR V/PILLOT, SET 3-15#	
	4	D-3153-2	DAMPER ACTUATOR B-13#	
DA-94, DA-9F,	7	D-3153-2	DAMPER ACTUATOR B-13#	
DA-9F,	7	D-3153-2	DAMPER ACTUATOR B-13#	
SDA-91, SDA-92	4	P32AC-1C	DIFF PRESS SWITCH, 0.15 TO 12"	
DPS-91-DPS-94	7	ZE-4L-23	DR END SWITCH-DWDM	
ES	1	BY E.C.	FIRE ALM CTRL PANEL	
FADP	2	BY E.C.	DUCT SMK DETECTOR	
SD-91, SD-92	1	A11B-1C	LOW TEMP LIMIT, AUTO RESET	
FZ-91	1	A11A-1C	LOW TEMP LIMIT, MANUAL RESET	
FZ-92	1	H-3610-1001	HUMIDITY CONTR KEY (85Z)	
HE-92	1	HE-6310-2	TRANS RH/TEMP/DUCT 0/100K	
HI-91	1	HE-6310-1	DIFF PRESS SWITCH, 0.15 TO 12"	
PT-91	1	FTG19A-600R	REMOTE RND STATIC DUCT TTP	
TT-1	1	TE-6310-2	TEMP SENSOR, 1000 OHM, 0. A.	
TT-91	1	TE-6310-1	TEMP SENSOR, 1000 OHM, 6" DUCT	
TT-92	1	TE-6310-1	TEMP SENSOR, 1000 OHM, 6" DUCT	
V-91-V-94	4	SEE VI SCHED	AUTO CONTR VLS V/PILLOTS	

NOTE-1: SEE MECH PLAN MS.04A FOR CONTROL SCHEMATIC OF AHU-9.

NOTE-2: SEE SPECIFICATION PAGES 15954-8 THRU 11 FOR AHU-9 'SEQUENCE OF CONTROL' DESCRIPTION.

NOTE-3: SEE OWNERS DRAWINGS FOR METASYS CONTROLLER TERMINATIONS.

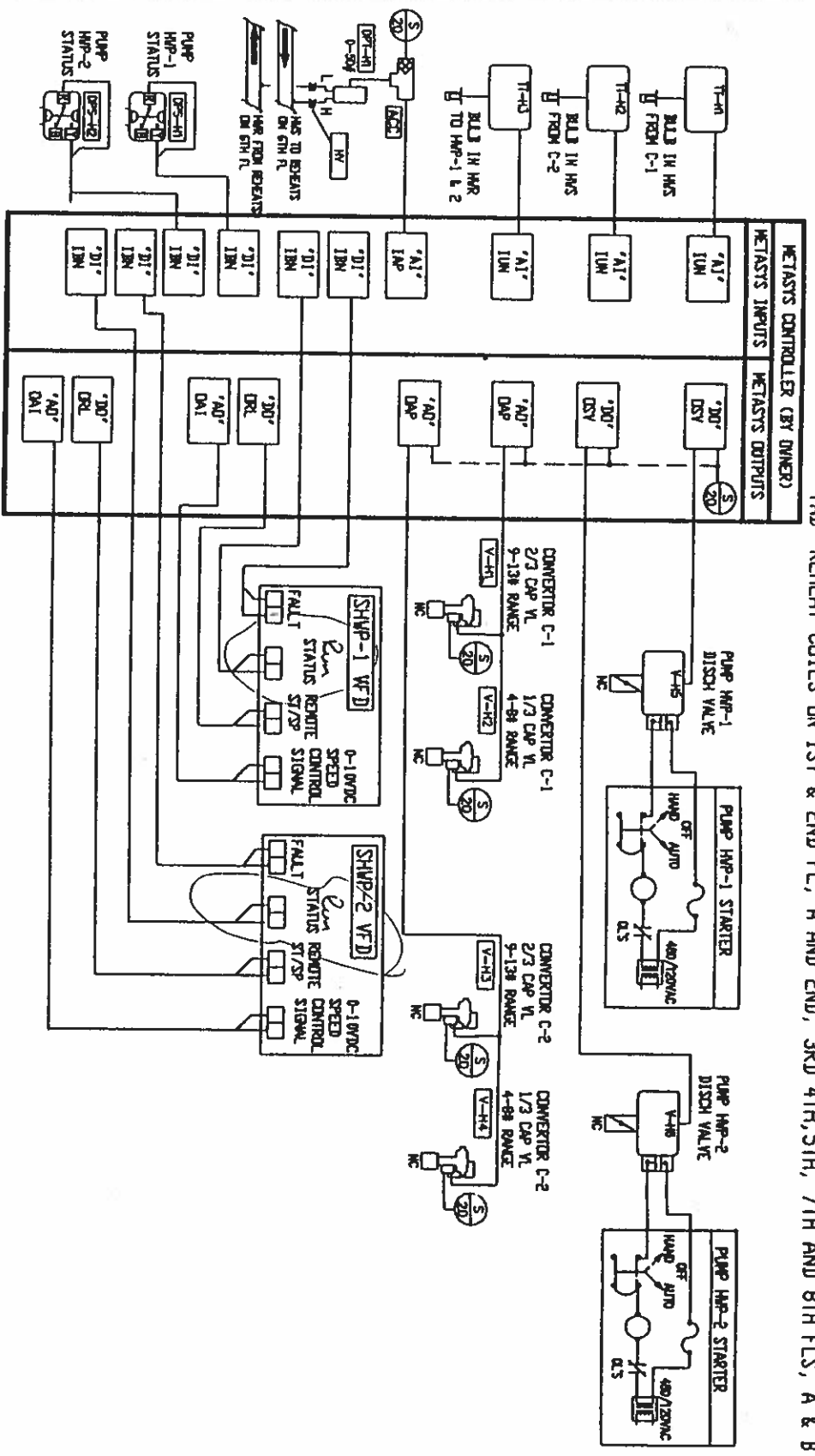
ALL DAMPER ACTUATORS WITH PILOTS AND VALVE ACTUATORS WITH PILOTS TO BE SET FOR 3-15# RANGE.

IN CONNECTION OF THE REPLY OF THIS DOCUMENT, THE REQUEST AGENTS NOT TO REPRODUCE COPY, USE OR TRANSMIT THIS DOCUMENT AND/OR THE INFORMATION THEREIN CONTAINED, IN WHOLE OR IN PART, OR TO SUFFER SUCH ACTION BY OTHERS, FOR ANY PURPOSE, EXCEPT WITH THE WRITTEN PERMISSION OF JOHNSON CONTROLS, INC. AND FURTHER AGES TO SURRENDER SAME TO JOHNSON CONTROLS, INC. UPON DEMAND.

PROJECT	CRITICAL CARE ADDITION UNIVERSITY OF MISSOURI COLUMBIA, MO 65204
DRAWING TITLE	AIR HANDLING UNIT-9
LOCATION	2ND FL. B. M202A
SERVICES	GRD & 1ST FL. B
TAB-911 TO 9116, 901 TO 9017	
DATE	07/20/97
DESIGNED BY	RAW
CHECKED BY	RAW
APPROVED BY	RAW
DATE	
FILE	AHU-9

JOHNSON CONTROLS, INC.
2700 WELSH RD. ST. LOUIS, MO 63144
CONTRACT NUMBER 87524-0002
DRAWING NUMBER

HEATING HOT WATER SYSTEM #1 -- LOCATION: GROUND FLOOR, WEST (MECH PLAN MS.00)
SERVES: 'RHC' REHEAT COILS ON GRD FL, A AND 'TAB' REHEAT COILS ON 1ST & 2ND FL, A AND 2ND, 3RD 4TH, 5TH, 7TH AND 8TH FLS, A & B



DEVICE TAG	QTY	CODE NUMBER	DESCRIPTION	FIELD MATERIAL
DPS-H1, H2, H3	4	P74F-A-SC	DIFFERENTIAL PRESS CONTROL	
DPI-H1, H2, H3	2	P-3275-1	TRANSMITTER, DIFFERENTIAL	
ACC	4	F-1000-218	PIE COCK VALVE 1/8" FPT	
	2	R-371B-3005	BARBED TEE 1/4", .005	
TI-H1, H2, H3	6	TE-6000-1	SENSOR, 1000 OHM +/- 1%	
TT-H21, 22, 23	6	TE-6001-3	PACKING NUT & FITS S	
	6	VZ-1000-5	WELL, BRASS, .299 I.D.	
V-H1, H2, H3, H4, H5, H6	13		SEE VALVE SCHEDULE	
V-H21, V-H22, V-H23, V-H24, V-H25, V-H26, V-H27				

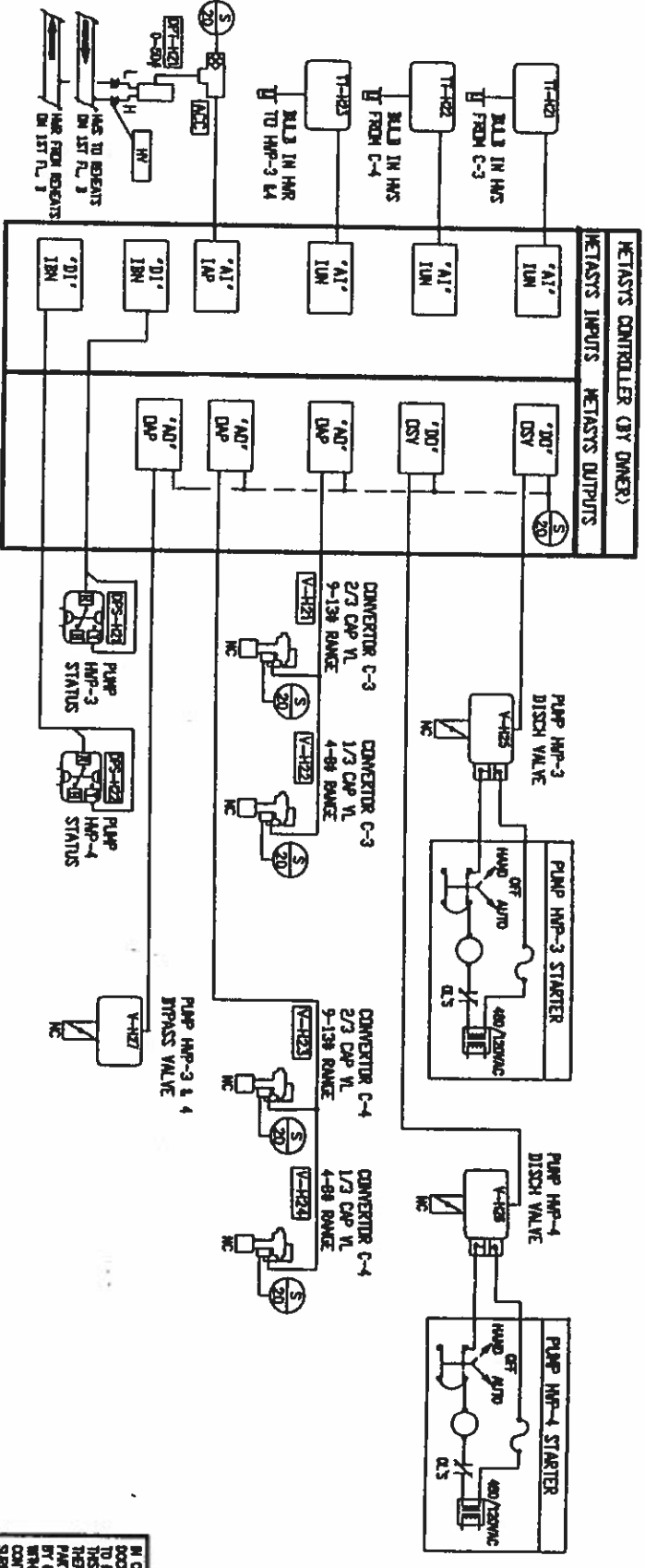
NOTE-1: SEE MECH PLAN MS. 04 FOR CONTROL SCHEMATIC OF HEATING SYSTEM #1
SEE MECH PLAN MS. 04A FOR CONTROL SCHEMATIC OF HEATING SYSTEM #2.

NOTE-2: SEE SPECIFICATION PAGES 15954-16 AND 17 FOR 'SEQUENCE OF CONTROL' DESCRIPTION.

ADDED SEQUENCE NOT SPECIFIED:
HEATING SYSTEM #2, BYPASS VALVE V-H27, SHALL BE MODULATED TO PREVENT SYSTEM DIFFERENTIAL PRESSURE, SENSED BY DPI-H21, FROM RISING ABOVE 10 PSIG.

NOTE-3: SEE OWNERS DRAWINGS FOR METASYS CONTROLLER TERMINATIONS.

HEATING HOT WATER SYSTEM #2 -- LOCATION: GROUND FLOOR, EAST (MECH PLAN MS.05)
SERVES: 'TAB' REHEAT COILS ON GRD FL, B AND 1ST FL, B

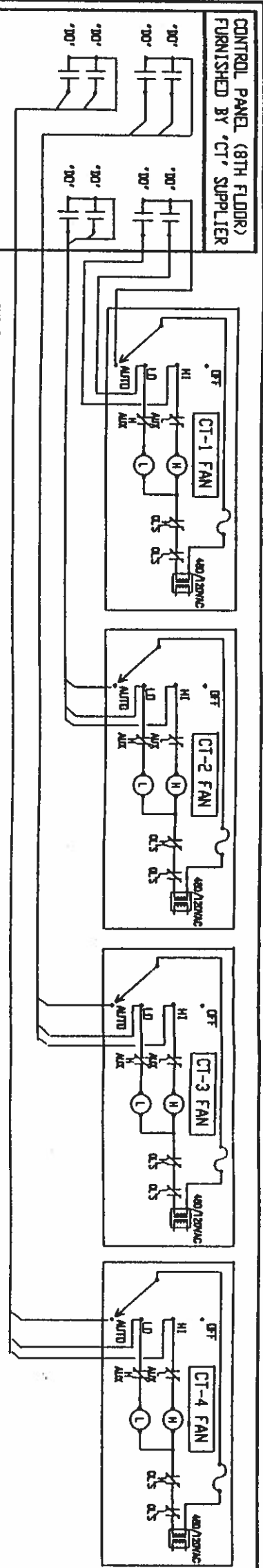


- DRAINING TITLE
1. HEAT EXCHANGERS C-1 & C-2
 2. HEAT EXCHANGERS C-3 & C-4

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PROJECT	JOHNSON CONTROLS
DRAWING NO.	87524-0002
DATE	07/27/97
BY	DAVID L. BROWN
CHECKED	DAVID L. BROWN
APPROVED	DAVID L. BROWN
DATE	07/27/97
FILE	HR-ALL

JOHNSON CONTROLS
2100 W. BISHOP BLVD. CT
ST. LOUIS, MO. 63146
PHONE: 314.992.1300

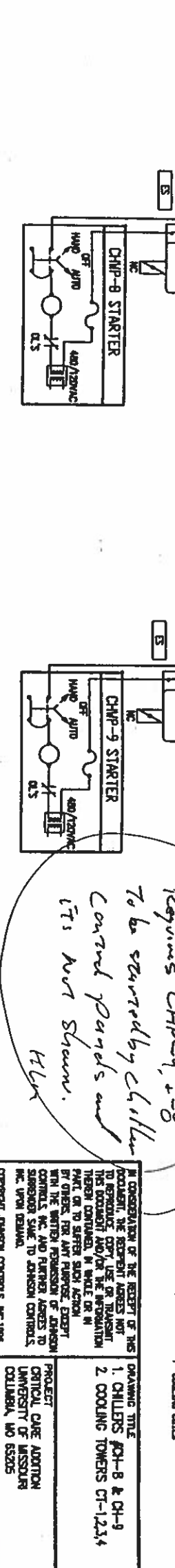
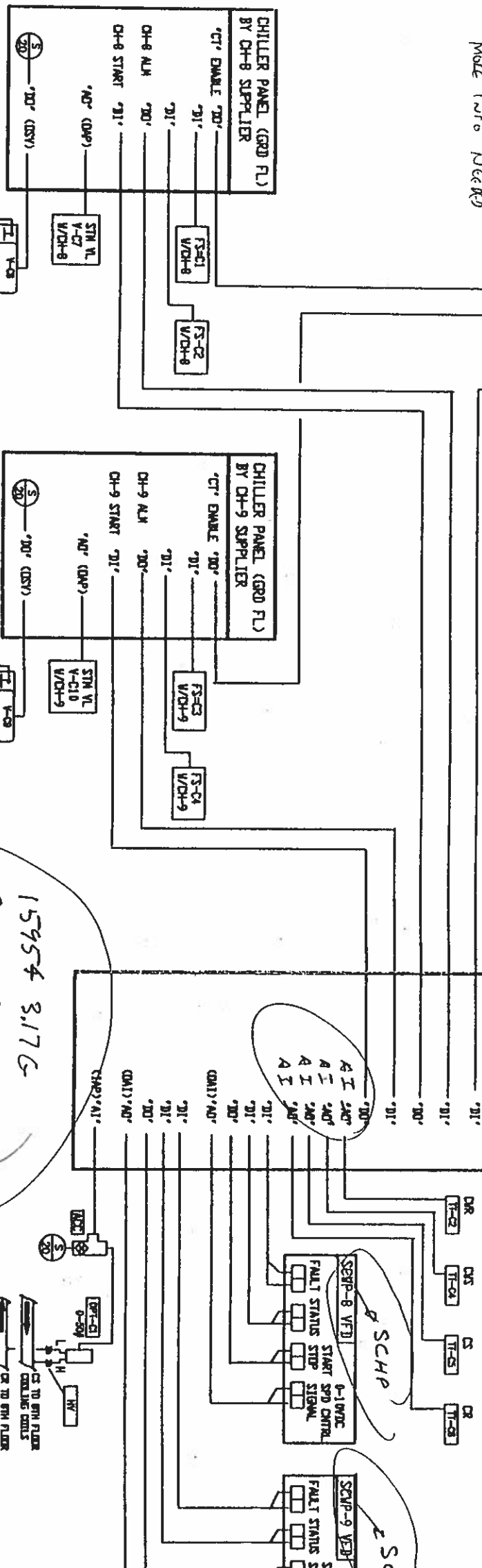
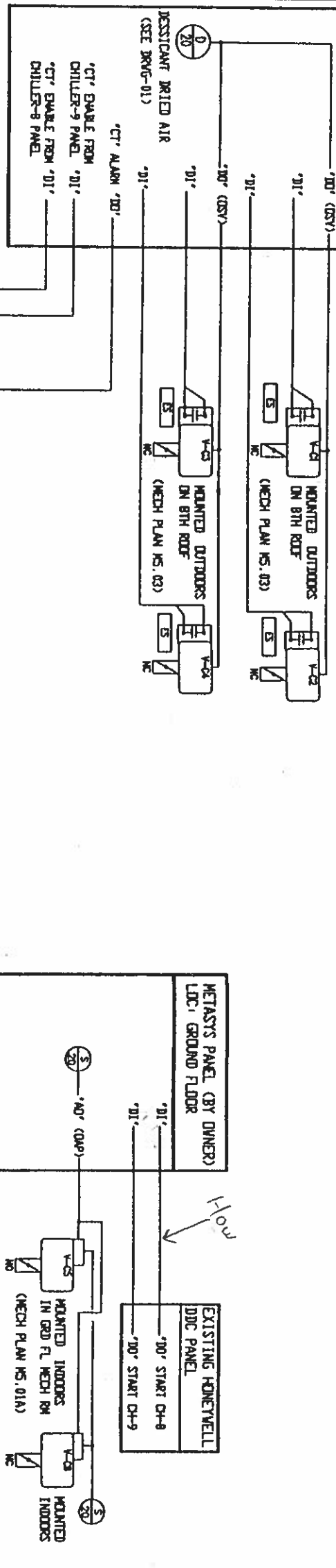


DEVICE TAG	QTY	CODE NUMBER	DESCRIPTION
DP-1	1	P-SZS-1	TRANSMITTER, DIFFERENTIAL
ACC	1	R-3710-3005	BARBED TEE 1/4" .005
HV	2	F-1100-218	RET COX VALVE 1/8" FPT
TI-1	4	TE-631AP-1	TE-631AP-1
TI-2, TI-3	4	VZ-1000-5	VELL. BRASS, .299 I.D.
Y-C1, Y-C2, Y-C3, Y-C4, Y-C5, Y-C6, Y-C8	8		SEE VALVE SCHEDULE
ES	6	ZE-NU-25	VALVE END SWITCH-DWGN

NOTE-1: SEE MECH PLAN HS. 04 FOR CONTROL SCHEMATIC.

NOTE-2: SEE SPECIFICATIONS PAGES 15954-15 AND 16 FOR 'SEQUENCE OF CONTROL' DESCRIPTION.

NOTE-3: SEE OWNERS DRAWINGS FOR METASTS TERMINATIONS.



15954 3.17 G
Requires CHP-9, +8
To be started by Chiller
Control Panels and
it's not shown.
Hlx

IN CONSIDERATION OF THE BEST OF HIS
KNOWLEDGE AND BELIEF, THE ENGINEER
HEREBY CERTIFIES THAT THE DRAWING
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PURPOSE OTHER THAN THAT FOR WHICH
IT WAS PREPARED.

DRIVING TITLE
1. CHILLERS CH-8 & CH-9
2. COOLING TOWERS CT-1, 2, 3, 4

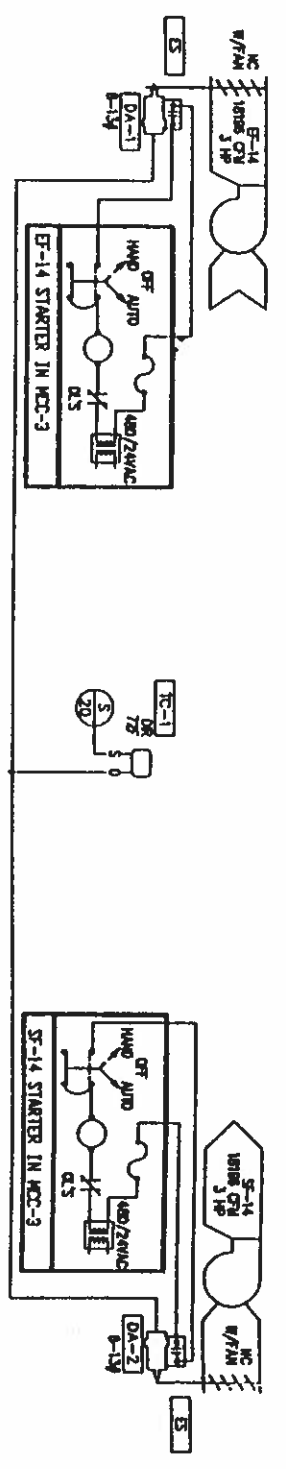
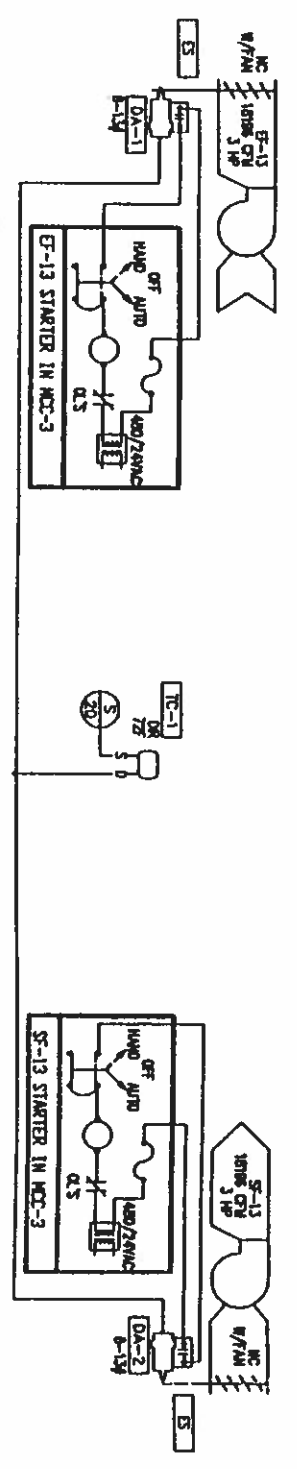
NO.	REVISION/LOCATION	DATE	BY	CHKD.
1				
2				

PROJECT: CRITICAL CARE ADDITION
UNIVERSITY OF MISSOURI
COLUMBIA, MO 65205

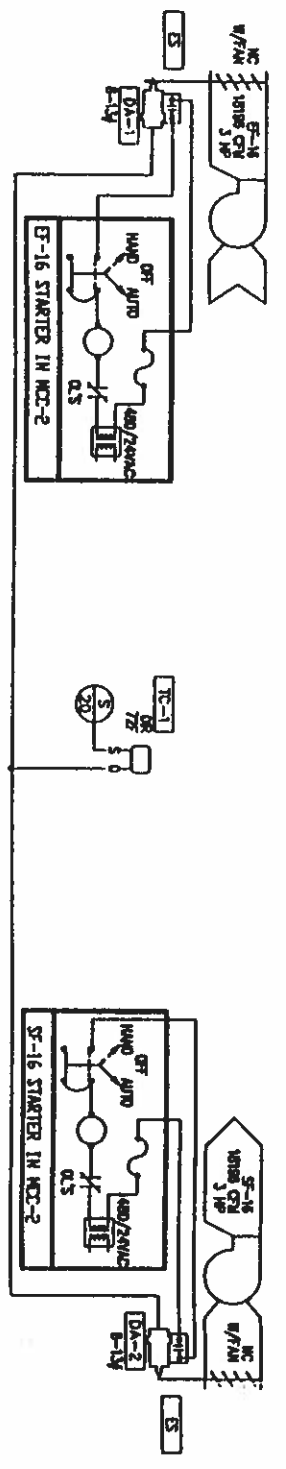
CONTRACT NUMBER: 87524-0002
DRAWING NUMBER: 11

FILE: CR-11W

SF-13 AND EF-13 ----- SF-14 AND EF-14 ----- 8TH FLOOR VENTILATION SYSTEMS
 LOCATION: 8TH FLOOR (MECH PLAN M5.02, ELEC PLAN E2.07)



SF-16 AND EF-16 ----- GROUND FLOOR MECH ROOM VENTILATION SYSTEM
 LOCATION: GRD FLOOR (MECH PLAN M5.00, ELEC PLAN E2.00)



DEVICE TAG	QTY	CODE NUMBER	DESCRIPTION
DA-1-DA-2	6	D-31S3-2	DAMPER ACTUATOR 8-13#
ES	6	ZE-NJ-25	DAMPER END SWITCH-ORON
TC-1	3	T-4002-201	THERMOSTAT, DIR HORIZ F
	3	T-4000-3142	COVER, WHITE PLASTIC, HRZ
	3	T-4002-124	MTG. BRACKET, THEOM.

CONTROL SEQUENCE:
 ON A RISE IN SPACE TEMPERATURE, ROOM THERMOSTAT TC-1 MODULATES THE EXHAUST AIR DAMPER DA-1 AND SUPPLY AIR DAMPER DA-2 TOWARD AN OPEN POSITION.
 WHEN THE DAMPERS APPROACH FULL OPEN POSITION, DAMPER END SWITCHES ES ENERGIZE THEIR RESPECTIVE EXHAUST OR SUPPLY FAN.
 WHEN THE DAMPERS START TO CLOSE, THE DAMPER END SWITCHES DE-ENERGIZE THEIR RESPECTIVE EXHAUST AIR OR SUPPLY AIR FAN.

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DRAWING TITLE
 1. 8TH FL MECH RM VENT SYSTEMS
 2. SF-13/EF-13 & SF-14/EF-14
 3. GRD FL MECH RM VENT SYSTEMS
 4. SF-16/EF-16

NO.	REVISION/LOCATION	DATE	BY
1	ISSUED	07/27/77	JAH
2	REVISED		
3	REVISED		
4	REVISED		

PROJECT: CRITICAL CARE ADDITION UNIVERSITY OF MISSOURI COLUMBA, MO 65205

DESIGNER: JOHNSON CONTROLS, INC. 7000 W. 15TH AVENUE, BLDG. 1700, DENVER, CO 80202

DATE: 07/27/77

CONTRACT NUMBER: 87524-0002

DRAWING NUMBER: 1