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November 18, 2020

SOLICITATION ADDENDUM NO. 3
ITB 20-0008
Hiteon HVAC and Controls Upgrades

THE FOLLOWING CHANGES/ADDITIONS TO THE ABOVE CITED SOLICITATION ARE ANNOUNCED:

This Addendum modifies the Invitation to Bid (ITB) document(s) only to the extent indicated herein. All other areas not changed or otherwise modified by this Addendum shall remain in full force and effect. This Addendum is hereby made an integral part of the ITB document. Bidder must be responsive to any requirements of this Addendum as if the requirements were set forth in the ITB. Failure to do so may result in Bid rejection. See the ITB regarding requests for clarification or change and protests of this Addendum, and the deadlines for the foregoing.

This addendum is to be acknowledged in the space provided on the Bidder Certification form supplied in the solicitation document. Failure to acknowledge receipt of this addendum may be cause to reject your offer.

The closing date **REMAINS UNCHANGED: November 24, 2020 at 2:00 PM Pacific Time**

CHANGES:

1) **The version of Division 23 attached to this Addendum 3, hereby replaces the version of Division 23 included in Attachment K Specifications that that is included in Addendum 2. The Specifications Index included in this Addendum 3 replaces the Division 23 references on the Specifications Index that is included in Addendum 2.**
2) **The attached Supporting Documentation is hereby added to the Solicitation. The Supporting Documentation includes additional as-built drawings and is for Bidders' reference only.**

Attachment K – Specifications

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SPECIFICATIONS INDEX

BASIC HVAC REQUIREMENTS

PART 1 - GENERAL

1.1 OTHER REQUIREMENTS

A. The Bidding, General and Supplementary of this project manual and specific section as noted apply to the work specified in Mechanical Division 23 which encompasses Sections 23 00 00 through 23 36 00. This Section 23 00 00 applies to all sections of Mechanical Division 23.

1.2 SCOPE

A. It is the intent of these specifications and the accompanying drawings to describe complete mechanical systems installations for all building areas, new and renovation.

B. Furnish and install all material, labor and equipment in accordance with these documents.

C. Include all incidental items and work not specifically shown or specified but required by good practice in a complete system.

D. The drawings and specifications are complementary. What is called for in one shall be called for in both.

E. The drawings are diagrammatic but should be followed as closely as possible. Where required by jobsite conditions, relocate and provide fittings, etc., as required. Provide an allowance in the contract bid to furnish additional pipe and ductwork fittings required for coordination with structure and other construction trades.

F. Prepare and submit a utility coordination plan noting any disruptions of existing building services for approval by the school district, attaching any sketches, drawing excerpts, or step-by-step sequences / schedules required to fully-explain the proposed activities. Submit the coordination plan 2 weeks in advance of the planned activities.

G. Immediately notify the school district representative if existing mechanical elements are damaged or have been inadvertently damaged during the course of construction.

H. Coordinate cost accounting for the items identified in the plans and specifications as SB 1149 EEM measures. Provide separate discrete costs for all labor and materials associated with the installation of those items and appurtenances required for the proper operation as contained within the contract documents.

1. EEM #3 – Install VFD's on selected air handling systems in B-Wing and C-Wing: All labor and materials, including electrical wiring, DDC controls and systems programming directly required for the replacement of existing motors with VFD compliant, high efficiency motors and the addition of variable frequency drives (VFD's).
   - Supply air fans SF-1, SF-2 and SF-4.
   - Return fan RF-1.
2. EEM #4 – Replacement of existing pneumatic controls with direct digital controls (DDC) in A-Wing, B-Wing and C-Wing. All labor and materials required for the demolition of existing pneumatic controls and installation of new DDC controls including hardware, software, programming and training.
3. EEM #5 – Install VFD's on air handling systems ASU-1 and ASU-2 and upgrade system components, including rooftop heat pumps with DDC controls: All labor and materials, including electrical wiring, DDC controls and systems programming directly required for the installation of DDC controls and replacement of existing motors with VFD compliant, high efficiency motors and the addition of variable frequency drives (VFD's).

BASIC HVAC REQUIREMENTS

1.3 DEFINITIONS

A. Project Manager: The individual(s) designated by Beaverton School District as their authorized representative(s) for the project coordination, construction and closeout phases.

B. Or approved equal: Requires approval prior to bid date.

C. Indicated:
1. The term "indicated" is a cross reference to details, notes, or schedules on the drawings, other paragraphs or schedules in the specifications, and similar means of recording requirements in the Contract Documents.
2. Where terms such as "shown," "noted," "scheduled," and "specified" are used instead of "indicated," it is for the purpose of helping the reader locate the cross reference, and no limitation of location is intended except as specifically noted.

D. Directed, Requested, Etc.: Where not otherwise explained, terms such as "directed," "requested," "authorized," "selected," "approved," "required," "accepted," and "permitted" mean "directed by the Engineer," "requested by the Engineer," etc. However, no such implied meaning will be interpreted to extend the Engineer's responsibility into the Contractor's area of construction supervision.

E. Site or Project Site: The space available to the Contractor for the performance of the work, either exclusively or in conjunction with others performing the work as part of the project. The extent of the project site is shown on the project drawings and is not identical with the description of the land upon which the project is to be built.

F. Approved:
1. Where used in conjunction with the Project Manager's response to submittals, requests, applications, inquiries, reports and claims by the Contractor, the meaning of the term "approved" will be held to the limitations of the Project Manager's responsibilities and duties as specified in the General and Supplementary Conditions.
2. In no case will "approval" by the Project Manager be interpreted as a release of the Contractor from responsibilities to fulfill requirements of the Contract Documents.

G. Provide: The term "provide" means to furnish and install, complete and ready for the intended use.

1.4 STANDARDS AND CODES

A. Provide all equipment and material and perform all work in accordance with all local, state and national codes and regulations.

B. For work on this project, comply with the latest edition of the appropriate standards published by the following:

1.	Air Diffusion Council	ADC
2.	American Gas Association	AGA
3.	Air Movement and Control Association	AMCA
4.	American National Standards Institute	ANSI
5.	Air-Conditioning and Refrigeration Institute	ARI
6.	Acoustical Society of America	ASA
7.	American Society of Heating, Refrigerating and Air-Conditioning	ASHRAE
8.	American Society of Mechanical Engineers	ASME
9.	American Society for Testing and Materials	ASTM
10.	Washington County, Oregon.	

11.	National Environmental Balancing Bureau	NEBB
12.	National Electrical Manufacturers Association	NEMA
13.	National Fire Protection Association	NFPA
14.	Sheet Metal and Air Conditioning Contractors' National Association	SMACNA
15.	Underwriters' Laboratories	UL
16.	Oregon Structural Specialty Code	OSSC
17.	Oregon Mechanical Specialty Code	OMSC
18.	Oregon Plumbing Specialty Code	OPSC
19.	Oregon Energy Efficiency Specialty Code	OEESC

1.5 APPROVAL OF EQUIPMENT AND MATERIALS

A. Manufacturer's trade names, catalog numbers and material specifications used in this specification are intended to establish the quality of equipment or materials expected. Materials and manufacturers not listed require approval prior to the bid date.

B. Approval of substitute equipment or materials will be based upon performance, quality and other factors deemed important by the Project Manager. The Contractor will be responsible for making all changes in this and other associated work required as a result of the substitution. Additional or modified structural calculations and roof penetrations required to accommodate the substitution will be the responsibility of the contractor.

1.6 SUBMITTALS

A. Submit a digital copy of the submittals to the Project Manager for review

B. Furnish performance data and technical information on all materials and equipment to be used on the project.

C. Include shop drawings with the submittals where necessary to determine clearance, where the Contractor proposes alternate equipment or material arrangements, and when requested by the Project Manager.

D. Review of submittals or shop drawings by the Project Manager does not relieve the Contractor from the requirements of the Contract Documents unless specific approval has been requested for a given deviation.

1.7 QUALITY ASSURANCE

A. Maintain the highest standards of workmanship throughout the project.

B. Use the latest editions of applicable and specifically referenced standards.

C. Inspect all material and equipment upon arrival at the site and return any which is not in new condition.

PART 2 - PRODUCTS

Not Used

PART 3 - EXECUTION

3.1 COORDINATION

A. Cooperate with other trades to assure that construction proceeds in an orderly and timely manner. Contract cost increases due to improperly sequenced work with other trades will not be allowed.

B. Study the architectural, structural, electrical, shop and any specialty drawings as appropriate and specifications to determine required coordination.

C. Prepare detailed shop drawings where necessary to assure proper fit and necessary clearance.

D. Refer to electrical drawings to verify voltage and phase of mechanical equipment.

3.2 PERMITS, FEES AND INSPECTIONS

A. Obtain all required permits and pay for all fees and connection charges.

B. Schedule any required inspections.

3.3 MATERIALS AND WORKMANSHIP

A. Furnish all materials and equipment in new condition, free from defects and of size, make, type and quality specified. Installation shall be in a neat and workmanlike manner.

B. When two or more items of the same kind, type or class are required, use items of a single manufacturer.

3.4 MEASUREMENTS

A. Take all measurements from reference datums established by the mechanical contractor.

3.5 DELIVERY, HANDLING AND STORAGE

A. Receive all material and equipment at the jobsite or shop.

B. Use proper and sufficient equipment to handle all products employed in the project.

C. Where storage of material or equipment is necessary, it shall be a clean and weatherproof area. Seal any openings and cover the product to assure that there will be no corrosion or foreign matter introduced. Assure that it will be in new condition when placed in service.

3.6 EQUIPMENT INSTALLATION, BRACING AND SUPPORT

A. All serviceable equipment must be accessible without obstruction or removal of piping or accessories.

B. Install all equipment in strict accordance with the manufacturer's instructions unless otherwise indicated.

C. The drawings in general are based upon one of the specific manufacturers listed for a particular equipment item. The other specified manufacturers and additional approved manufacturers of equipment may require deviations from the drawings to properly install the particular equipment in accordance with the manufacturer's recommendations and to provide the system results required. Provide all work necessary in the base bid price to install this equipment.

D. Where the installation shown or specified is contrary to the manufacturer's instructions, advise the Project Manager in writing of the differences before proceeding with the installation.

E. Anchorage to Floors, Roofs, Etc., Sway Bracing and Seismic Restraints:

1. The contractor is responsible to determine the means and methods of equipment installation and support.
2. Provide supports for all apparatus as specified, detailed, as required by the manufacturers of specific equipment and the project governing code authorities. Anchor all roof and base/floor mounted equipment with size and spacing of anchor bolts or other attachment means as recommended by the respective equipment manufacturer.
3. Provide seismic restraints on all mechanical equipment in conformance with applicable OSSC sections. Costs for seismic calculations are to be included in the bid price.

4. Provide deferred submittals directly to the governing code jurisdiction for anchorage to floors, roofs, etc., sway bracing and seismic restraints. Submittals to show locations and sufficient support details as required by the governing code jurisdiction.
5. Provide supplementary drawings and calculations as required by governing code jurisdictions noting seismic support data/calculations as required for permit purposes.
6. Mechanical seismic criteria is as follows:
   a. Occupancy Classification III
   b. Seismic Design Category D
   c. Component Importance Factor (Ip)
      1) General building HVAC systems 1.5

F. Maintain a copy of the manufacturer's installation instructions at the jobsite for all equipment.

3.7 SLEEVES AND INSERTS

A. Provide sleeves at all locations where piping and ductwork passes through building construction.
1. Sleeves for interior walls and floors shall be 22 gauge galvanized or heavier as required.
2. Sleeves for exterior walls shall be cast iron, wall thickness as required.
3. Wall sleeves shall be installed in all exterior walls and all interior masonry or fire- rated walls in a manner that preserves the fire-rated or watertight integrity of the wall.
4. Interior wall sleeves for uninsulated pipe shall allow minimum 1/4-inch clearance all around pipe for pipe movement. Allow 1-inch clearance around pipe at building expansion joints.
5. Interior wall sleeves for insulated piping shall be selected to encompass the pipe and insulation and allow minimum 1/4-inch clearance around insulation for pipe movement. Allow 1-inch clearance around pipe and insulation at building expansion joints.

B. Seal space between pipe and sleeve with Dow Corning Fire Stop System, 3M Brand CP25 or approved equal where piping penetrates firewall or floors. Sealant must be between pipe and sleeve; sealant between insulation and sleeve is not acceptable. Install firestop materials in complete accordance with the manufacturer’s instructions and in compliance to applicable UL listings.

3.8 ACCESS DOORS AND PANELS

A. Manufacturers: Cesco, Milcor, Elmdor. Cesco used as basis of selection.

B. Non-rated panels: Style W, SR-1, SR-2, P, PX as required for wall or ceiling construction, 12 inch x 12 inch or larger as required for ease of access.

C. Fire-rated panels: Style FB, U.L. listed for 1-1/2 hr for fire rated stud and masonry wall systems.

D. Provide access panels where shown on the drawings or as required for proper access to mechanical appurtenances. Coordinate the installation of access panels is with the specific building construction penetrated. Coordinate access panel installation with manufacturer’s instructions.

E. Locate and size access doors to facilitate equipment service and optimize the safety of the maintenance personnel. Minimum access door size to be 18"x 18".

3.9 PROTECTION

A. Protect all work, material and equipment from loss or damage until the Owner accepts the project.

B. As the work progresses, keep all equipment covered and cap all ducts and piping that may temporarily be left unconnected.

C. Notify all other trades of any required precautions necessary to protect the work.

BASIC HVAC REQUIREMENTS

3.10 ACCESSIBILITY

A. Provide convenient access by location or access panel to all equipment requiring periodic service.

3.11 ELECTRICAL WORK

A. See Paragraph 3.20 for materials and work to be provided as a part of this Mechanical Division 23:

B. Wherever possible, provide all interconnect wiring within or on a piece of equipment with the equipment unless shown or specified otherwise. An electrician licensed to perform this type of work shall perform all field wiring.

3.12 RELATED WORK

A. The following work and materials are specified elsewhere:
1. Pipe chases, equipment pads and foundations, trenches, painting, air louvers, louvered penthouse and access panels except as otherwise specified in this division.
2. Framed openings, wood grounds and nailing strips, masonry, concrete and other architectural and structural elements.

3.13 CLEANING

A. Maintain premises and public properties free from accumulations of waste, debris and rubbish during construction.

B. Clean all mechanical equipment of dust, grease, iron cuttings, unnecessary stamps or shipping labels, etc.

C. Touch up factory-painted surfaces, as necessary, with paint of matching color.

3.14 RECORD DRAWINGS

A. Maintain one set of construction drawings at the jobsite for the sole purpose of recording work of the mechanical contract, as actually installed. Upon request, the Project Manager will make the original tracings available to the mechanical contractor for printing the drawings. The Contractor shall pay the reproduction costs.

B. Deliver record drawings to the Project Manager promptly upon completion of the project.

3.15 OPERATION AND MAINTENANCE MANUALS:

A. Submit a digital copy of the Operation and Maintenance Manuals to the Project Manager for approval before project completion. Include an index and tabs for major systems and equipment. Operation and Maintenance Manuals shall include the following:

B. Directories:
1. Supplier Directory: Alphabetical list of principal subcontractors and suppliers of equipment giving names, addresses and telephone numbers.
2. Equipment Directory: List of equipment installed such as fans, air supply units, pumps, heating and cooling equipment, plumbing fixtures, etc., giving drawing reference numbers, location, area served, manufacturer with model number and supplier.

C. Manufacturer's Literature:
1. Show name, address and phone number of the nearest service facility authorized by the manufacturer.

2. Include illustrations, diagrams, and instructions for installation, startup, operation, inspections, maintenance, parts list, data sheets and other necessary materials.
3. Include complete electrical, schematic and connection diagrams for each equipment item.
4. Include the name, address and phone number of contractor(s) who furnished and who installed equipment and systems.
5. Where the literature covers more than one model, check off neatly in ink correct model number and data for the model number including all specified options.
6. In those instances where the equipment, its mode of control, or both, is job assembled for special functions, then provide written operating and maintenance instructions prepared by the assembler on 8-1/2" x 11" sheets.

D Maintenance Instructions:

1. Where instructions for maintenance are not included in the manufacturer's literature, provide supplemental data to enable proper maintenance of the equipment installed.
2. Include specific lubrication methods and recommended frequencies along with procedures and precautions for inspection and routine service.

E Copy of Written Guarantee.

F. Recommended Spare Parts Stock.

3.16 HVAC SYSTEMS TRAINING

A. Training must be on fully operational system, or the training must be repeated when the system is fully operational at no additional cost to the Owner. Training must be scheduled through the Beaverton School District representative at a time that is convenient to district personnel. The Beaverton School District representative must be notified of any changes, re-scheduling or modifications to the training schedule.

1. Provide a written agenda to the attendees outlining the general scope of the training session and the building equipment involved. Submit the written training outline to the district representative prior to the training date.
2. Maintain a start-up log notebook in the job trailer containing signed copies of the manufacturer's start-up sheets for all equipment.
3. Training walk-throughs to be performed by a contractor field project manager or technician who is fully knowledgeable with the project specifics and has had continuous involvement during the course of the project. The individual is to be knowledgeable in the specific installation details and maintenance of the project equipment.
4. All training to be video recorded and provided to Owner.

B. Maintenance Training: Maintenance training will take place within 30 days after substantial completion. This session to include a detailed review of the HVAC system record drawings and equipment installation instructions. The instructor shall then walk through the building identifying the location of the equipment installed and specific function(s) related to the overall mechanical systems. The training shall include answering maintenance personnel questions, troubleshooting and diagnostics procedures, repair instructions and preventive maintenance. This training will include all maintenance staff per the Beaverton School District.

3.17 CUTTING AND PATCHING

A. Cut work as required for installation and patch to match original conditions as directed and approved by Project Manager. Do not cut structural portion without Project Manager's approval.

B. When masonry construction must be penetrated, provide a steel pipe sleeve in opening and grout in place in a neat manner. Leave grout surface to match existing finish.

C. Prior to cutting any existing work, locate all concealed utilities to eliminate any possible service interruption or damage.

D. Firestopping penetrations in fire-rated wall/floor assemblies.
1. Contractors shall provide proper sizing when providing sleeves or core-drilled holes to accommodate the through penetrating items.
2. All voids between sleeve or core-drilled hole and pipe passing through, shall be firestopped to meet the requirements of ASTM E-814 (Standard Test Method for Fire Tests of Penetration Firestop Systems).
3. Fire stop penetration systems to be installed in accordance with the U.L. listed assemblies provided by the manufacturers of the products used.

3.18 CHANGE ORDERS

A. All supplemental cost proposals by the Contractor shall be accompanied with a complete itemized breakdown of labor and materials cost without exception.

B. Contractor's estimating sheets for the supplemental cost proposals shall be made available to the Project Manager. Labor must be separated and allocated for each item of work.

3.19 VERIFICATION OF EXISTING CONDITIONS

A. Verify field conditions and measurements prior to the manufacture of shop fabricated materials and equipment.

B. Produce shop drawings with details as required verifying proper installation of materials & equipment in conformance with applicable codes and the manufacturer's requirements.

3.20 SYSTEMS WIRING AND RELATED DEVICES

	FURNISHED ITEM	BY	INSTALL BY	POWER WIRING	CONTROL WIRING
1.	Division 23 Equipment Motors	Div. 23	Div. 23	Div. 26	Div. 23
2.	Remote Motors Starters, Contactors and Overload Heaters – Integral	Div. 23	Div. 26	Div. 26	Div. 23
3.	Fused & Unfused Disconnect Switches	Div. 26	Div. 26	Div. 26	------
4.	Manual Operation Switches	Div. 26	Div. 26	Div. 26	Div. 26
5.	DDC Controls, Relays and Sensors	Div. 23	Div. 23	Div. 23	Div. 23

BASIC HVAC REQUIREMENTS

	FURNISHED ITEM	BY	INSTALL BY	POWER WIRING	CONTROL WIRING
6.	Smoke Duct Detectors	Div. 28	Div. 23	Div. 26	Div. 28

3.21 COMMISSIONING

A. The equipment and systems referenced in this section are to be commissioned.

B. The contractor has specific responsibilities for scheduling, coordination, startup, test development, testing and documentation. Coordinate all commissioning activities with the Commissioning Authority.

END OF SECTION

MOTOR REQUIREMENTS FOR HVAC EQUIPMENT

PART 1 - GENERAL

1.1 SUMMARY

A. Work included: Providing VFD compliant high efficiency motors and variable frequency drives (VFD's) as specified.

1.2 SUBMITTALS

A. Provide submittals in accordance with Section 23 00 00.

B. Submittals shall include manufacturer's catalog or technical data substantiating performance required.

1.3 OPERATION AND MAINTENANCE DATA

A. Provide O&M data in accordance with Section 23 00 00.

B. O&M data shall include:
1. Manufacturer's literature.
2. Maintenance instructions.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Motors: Premium efficiency, VFD compliant – Verify motor compatibility with specified VFD's prior to submittal.

B. Variable Frequency Drives: ABB AHC Series or owner approved equal.

2.2 DESCRIPTION

A. Motor Starters
1. Premium efficiency.
2. VFD compliant.

B. Variable Frequency Drives
1. The VFD package as specified herein shall be enclosed in a UL Listed Type 12 enclosure, completely assembled and tested by the manufacturer in an ISO9001 facility. The VFD tolerated voltage window shall allow the VFD to operate from a line of +30% nominal, and -35% nominal voltage as a minimum. UL Type 12 means the enclosure has been tested by UL Standards, not NEMA.
2. All VFD's shall have the following standard features:
   a. The VFD shall have integral 5% impedance line reactors to reduce the harmonics to the power line and to add protection from AC line transients. The 5% impedance may be from dual (positive and negative DC bus) reactors, or 5% AC line reactors. VFD's with only one DC reactor shall add AC line reactors. This increased impedance lower harmonic distortion (Vthd) meeting IEEE-519 guidelines.
   b. The VFD shall include a coordinated AC transient protection system consisting of 4-120 joule rated MOV's (phase to phase and phase to ground), a capacitor clamp, and 5% impedance reactors. MOV's protects against transients that would trip a VFD off line or cause serious damage.

3. All VFD's to have the following adjustments: Two (2) PID Setpoint controllers shall be standard in the drive, allowing pressure or flow signals to be connected to the VFD, using the microprocessor in the VFD for the closed loop control. The VFD shall have 250 ma of 24 VDC auxiliary power and be capable of loop powering a transmitter supplied by others. The PID setpoint shall be adjustable from the VFD keypad, analog inputs, or over the communications bus. There shall be two parameter sets for the first PID that allow the sets to be switched via a digital input, serial communications or from the keypad for night setback, summer/winter setpoints, etc. There shall be an independent, second PID loop that can utilize the second analog input and modulate one of the analog outputs to maintain setpoint of an independent process (i.e. valves, dampers, etc.). All setpoints, process variables, etc. to be accessible from the serial communication network. The setpoints shall be set in Engineering units and not require a percentage of the transducer input. Allows complete control of a system or process.
4. The VFD shall include a fireman's override input. Upon receipt of a contact closure from the fireman's control station, the VFD shall operate at an adjustable preset speed. The mode shall override all other inputs (analog/digital, serial communication, and all keypad commands) and force the motor to run at the adjustable, preset speed. "Override Mode" shall be displayed on the keypad. Upon removal of the override signal, the VFD shall resume normal operation.
5. Serial Communications
    a. The VFD shall have an RS-485 port as standard. The standard protocols shall be Modbus, Johnson Controls N2 bus, and Siemens Building Technologies FLN. Optional protocols for LonWorks, BACnet, Profibus, Ethernet, and DeviceNet shall be available. Each individual drive shall have the protocol in the base VFD. The use of third party gateways and multiplexers is not acceptable. All protocols shall be "certified" by the governing authority. Use of non-certified protocols is not allowed. If a gateway must be used, each drive must have its own gateway in order to prevent the entire drive system from dropping off line.
    b. Serial communication capabilities shall include, but not be limited to; run-stop control, speed set adjustment, proportional/integral/derivative PID control adjustments, current limit, accel/decel time adjustments, and lock and unlock the keypad. The drive shall have the capability of allowing the DDC to monitor feedback such as process variable feedback, output speed / frequency, current (in amps), % torque, power (kW), kilowatt hours (resettable), operating hours (resettable), and drive temperature. The DDC shall also be capable of monitoring the VFD relay output status, digital input status, and all analog input and analog output values. All diagnostic warning and fault information shall be transmitted over the serial communications bus. Remote VFD fault reset shall be possible. The following additional status indications and settings shall be transmitted over the serial communications bus – keypad "Hand" or "Auto" selected, bypass selected, the ability to change the PID setpoint, and the ability to force the unit to bypass (if bypass is specified). The DDC system shall also be able to monitor if the motor is running in the VFD mode or bypass mode (if bypass is specified) over serial communications. A minimum of 15 field parameters shall be capable of being monitored.
    c. The VFD shall allow the DDC to control the drive's digital and analog outputs via the serial interface. This control shall be independent of any VFD function. For example, the analog outputs may be used for modulating chilled water valves or cooling tower bypass valves. The drive's digital (relay) outputs may be used to actuate a damper, open a valve or control any other device that requires a maintained contact for operation. In addition, all of the drive's digital and analog inputs shall be capable of being monitored by the DDC system.

d. The VFD shall include an independent PID loop for customer use. The independent PID loop may be used for cooling tower bypass value control, chilled water value control, etc. Both the VFD control PID loop and the independent PID loop shall continue functioning even if the serial communications connection is lost. The VFD shall keep the last good set-point command and last good DO & AO commands in memory in the event the serial communications connection is lost.

6. EMI / RFI filters. All VFD's shall include EMI/RFI filters. The onboard filters shall allow the VFD assembly to be CE Marked and the VFD shall meet product standard EN 61800-3 for the First Environment restricted level. Complies with 1st Environment and exceeds FCC guidelines with motor cables less than 100 feet (30 meters)
7. All VFD's through 50HP shall be protected from input and output power mis-wiring. The VFD shall sense this condition and display an alarm on the keypad. Prevents damage to the VFD when the electrical contractor wires the input power to motor terminals.
8. OPTIONAL FEATURES – Optional features to be furnished and mounted by the drive manufacturer. All optional features shall be UL Listed by the drive manufacturer as a complete assembly and carry a UL508 label.
   a. Door interlocked, padlockable circuit breaker that will disconnect all input power from the drive and all internally mounted options.
   b. Fused VFD only disconnect (service switch). Fast acting fuses exclusive to the VFD – fast acting fuses allow the VFD to disconnect from the line prior to clearing upstream branch circuit protection, maintaining bypass capability. Bypass designs, which have no such fuses, or that incorporate fuses common to both the VFD and the bypass will not be accepted. Three contactor bypass schemes are not acceptable.
   c. The drive / bypass shall provide single-phase motor protection in both the VFD and bypass modes.
   d. The following operators shall be provided:
      1) Bypass Hand-Off-Auto
      2) Drive mode selector
      3) Bypass mode selector
      4) Bypass fault reset
   e. The following indicating lights (LED type) shall be provided. A test mode or push to test feature shall be provided.
      1) Power-on (Ready)
      2) Run enable (safeties) open
      3) Drive mode select damper opening
      4) Bypass mode selected
      5) Drive running
      6) Bypass running
      7) Drive fault and bypass fault
      8) Bypass H-O-A mode
      9) Automatic transfer to bypass selected
      10) Safety open
      11) Damper opening
      12) Damper end-switch made
   f. The following relay (form C) outputs from the bypass shall be provided:
      1) System started
      2) System running
      3) Bypass override enabled
      4) Drive fault
      5) Bypass fault (motor overload or underload (broken belt))
      6) Bypass H-O-A position
   g. The digital inputs for the system shall accept 24V or 115VAC (selectable). The bypass shall incorporate internally sourced power supply and not require an external control power source.

h. Customer Interlock Terminal Strip – provide a separate terminal strip for connection of freeze, fire, smoke contacts, and external start command. All external safety interlocks shall remain fully functional whether the system is in Hand, Auto, or Bypass modes (not functional in Fireman's Override 2). The remote start/stop contact shall operate in VFD and bypass modes.

i. Dedicated digital input that will transfer motor from VFD mode to bypass mode upon dry contact closure for fireman's override. Two modes of operation are required.
   1) One mode forces the motor to bypass operation and overrides both the VFD and bypass H-O-A switches and forces the motor to operate across the line (test mode). The system will only respond to the digital inputs and motor protections.
   2) The second fireman's override mode remains as above, but will also defeat the overload and single-phase protection for bypass and ignore all keypad and digital inputs to the system (run until destruction).

j. The VFD shall include a "run permissive circuit" that will provide a normally open contact whenever a run command is provided (local or remote start command in VFD or bypass mode). The VFD system (VFD or bypass) shall not operate the motor until it receives a dry contact closure from a damper or valve end-switch. When the VFD system safety interlock (fire detector, freezestat, high static pressure switch, etc) opens, the motor shall coast to a stop and the run permissive contact shall open, closing the damper or valve.

k. There shall be an internal switch to select manual or automatic bypass.

l. There shall be an adjustable current sensing circuit for the bypass to provide loss of load indication (broken belt) when in the bypass mode.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Motors: Remove and replace existing motors in the air handling fans listed in the Mechanical Equipment Schedule on drawing sheet M1.00 ready for service.

B. Variable Frequency Drives:
   1. Install the drive in accordance with the recommendations of the VFD manufacturer as outlined in the installation manual.
   2. Certified factory start-up shall be provided for each drive by a factory authorized service center. A certified start-up form shall be filled out for each drive with a copy provided to the owner, and a copy kept on file at the manufacturer.
   3. Perform harmonic measurements at the point where the utility feeds multiple loads (PCC) to verify compliance with the latest revision of IEEE519-1992. Provide a report of the voltage THD and current TDD for Engineer's review prior to substantial completion. Provide labor, materials, and protection as needed to access the test points. The readings shall be taken with all drives and other loads at full load, or as close to this as field conditions allow.

3.2 COMMISSIONING

A. The equipment and systems referenced in this section are to be commissioned.

B. The contractor has specific responsibilities for scheduling, coordination, startup, test development, testing and documentation. Coordinate all commissioning activities with the Commissioning Authority.

END OF SECTION

TESTING, ADJUSTING AND BALANCING FOR HVAC

PART 1 - GENERAL

1.1 SUMMARY

A Work Included: Providing system balance work as specified.

1.2 OPERATION AND MAINTENANCE DATA

A. Provide O&M data in accordance with Section 23 00 00.

B. O&M data shall include copies of system balance data.

1.3 QUALITY ASSURANCE

A. Contract with American Commissioning Consultants, Inc., Neudorfer Engineers Inc., Accurate Balancing Agency Inc., Air Balancing Specialty Inc., Precision Test and Balance Inc., Northwest Engineering Service, Inc., Smarttab, LLC or approved equal to perform the system balance work on this project.

B. Conduct the systems balance work in accordance with standard procedures and recognized practices outlined by ASHRAE and SMACNA.

C. Test and balance to be performed by an independent contractor specializing in HVAC systems test and balance.

D. Balance company to be certified by NEBB or AABC and have 3-years experience of work in the Portland Metro area.

PART 2 - PRODUCTS

Not Used

PART 3 - EXECUTION

3.1 GENERAL

A. Verify new or clean filter installation in filter assembly before the start of testing and balancing.

B. Record all actual equipment nameplate and operating data at the site.

C. Provide ladders, scaffolding, and access to each system for proper testing and balancing.

3.2 PRECONSTRUCTION SYSTEMS TESTING

A. Coordinate with the controls contractor to operate the systems as required during the systems preconstruction testing.

B. Air Handling Units – ASU-1, ASU-2, SF-1/RF-1, SF-2, SF-4.

1. Prior to demolition, measure the total existing supply and return (as applicable) air volumes in the fan / air handling unit systems noted in the Mechanical Equipment Schedule on drawing sheet M1.00.
2. Prior to demolition, measure the total existing minimum outside air volume and mark the minimum outside air damper locations adequately to return the outside air volumes to the same value after project completion.

C. Air Handling Unit SF-5/RF-3: Prior to demolition, measure the total existing minimum outside air volume and mark the minimum outside air damper locations adequately to return the outside air volumes to the same value after project completion.

D. Terminal Units.
   1. Prior to demolition, measure the existing maximum cooling and heating air volumes for the individual terminal units in the Terminal Unit Schedule on drawing sheet M1.00.

E. Furnish the air handling unit data and terminal unit data to the district project manager prior for review prior to the air handling systems revisions.

3.3 FINAL SYSTEMS TESTING AND BALANCING

A. Coordinate with the controls contractor to operate the systems as required during the systems balancing.

B. Air Handling Units - ASU-1, ASU-2, SF-1/RF-1, SF-2, SF-4, SF-5/RF-3.
   1. Assure that air filters are clean, if not new, prior to beginning air balance work.
   2. Adjust fan speed as required for air volumes to match preconstruction volumes. Speed shall be set to the minimum to provide required air volume at furthest run without excessive static pressure.
   3. Adjust minimum outside air volume to the prebalance conditions.
   4. Include the following in the logs:
      a. Supply, return and outside air volumes.
      b. Supply air temperatures on full heating, cooling (as applicable) and full outside air.
      c. Static pressure drops across fan, filters and coil.
      d. Total pressure drops for supply and return system.
      e. Fan speed or RPM.
      f. Actual motor voltage, amperage, RPM and overload heater sizes.

C. Terminal Units:
   1. Calibrate the new terminal units per the manufacturer’s installation instructions and the direct digital controls system requirements.
   2. Adjust cooling (maximum) and heating (minimum) air volumes to values recorded during the preconstruction testing / Terminal Unit Schedule volumes.
   3. Include the heating / cooling air volumes and air pressure drops at scheduled maximum (cooling) volumes in the test and balance log.

3.4 COMMISSIONING

A. The equipment and systems referenced in this section are to be commissioned.

B. The contractor has specific responsibilities for scheduling, coordination, startup, test development, testing and documentation. Coordinate all commissioning activities with the Commissioning Authority.

END OF SECTION

HVAC INSULATION

PART 1 - GENERAL

1.1 SUMMARY

A Work included:
1. Providing of all required insulation for ductwork and piping.
2. Notify the district representative prior to covering completed piping and duct systems - All piping and ductwork to be reviewed by the district representative, engineer or authorized representative prior to installation of insulation.

1.2 SUBMITTALS

A. Provide submittals in accordance with Section 23 00 00.

B. Submittals shall include:
1. Data to show compliance with flame and smoke rating.
2. Manufacturer's catalog or technical data showing performance, dimensions, materials of construction and recommended methods of installation.

1.3 QUALITY ASSURANCE

A. Insulation materials and accessories such as adhesives, cement, etc. shall have composite fire and smoke hazard ratings, as tested by procedures indicated in NFPA 255 and U.L. 723, not to exceed a flame spread index of 25 and a smoke developed index of 50. Products or their shipping cartons shall have identification of the flame spread and smoke developed index.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manville, Knauf, Owens-Corning, Certain-teed, or approved equal. Schuller used as basis of selection.

B. Elastomeric Insulation Products: Armacell, Rubatex, K-Flex or approved equal.

2.2 DESCRIPTION

A. External Duct Insulation: Manville Microlite EQ FSK formaldehyde free, fiberglass duct insulation with FSKL jacket, 0.75 lb./cu. ft. Minimum installed R-value = 2.8 / inch.

B. Duct Lining: Manville Linacoustic 1.5-3.0 lb./cu. ft. made of glass fibers bonded with a thermosetting resin with a “Permacote” coating proving added durability and microbial growth protection. Minimum installed R-value = 4.2 / inch. No fibrous material is to be exposed to the airstream.

C. Minimum installed R-value (external insulation and lining):
1. General Service (within Building Envelope) - R = Minimum 5.
2. Unconditioned Spaces - R = Minimum 8.
3. Outside Building / Vented Attic Space - R = Minimum 8.

D. Hot Water Pipe Insulation:
1. Manville Micro-Lok HP rigid pre-formed fiberglass.
2. Maximum conductivity (k) = 0.27 Btu per inch/hour * ft2 * degree-F.
3. Pipe fittings: Zeston 2000 premolded PVC covers with fiberglass blanket insulation.
4. Foam filled elbows are not acceptable.

HVAC INSULATION

PART 3 - EXECUTION

3.1 INSTALLATION

A. Ductwork Insulation / Lining Application.
1. Rectangular supply and return air ductwork within 7 feet of a gas furnace – Internally lined.
2. Rectangular and round supply / return air ductwork except as noted above - Externally insulated or internally lined.
3. Outside air ductwork in mechanical rooms / mezzanines – Internally lined.

B. Ductwork Interior Lining Application.
1. General Requirements: Apply internal insulation in accordance with manufacturer's recommendations and SMACNA "Duct Liner Application Standard." Apply internal insulation to flat sheet metal with continuous coverage of adhesive.
2. Use adhesive on all butt edges. Install weld pins and clips on internal insulation 15" on center and no more than 2" maximum from any cut or exposed edge.
3. Coat all raw duct liner edges within the ductwork. No uncoated fiberglass is allowed within the ductwork.
4. Weld pins spaced maximum of 15 inch on center in both directions and within 2 inches of corners and joints. Weld pins flush with liner surface.
5. Complete duct surface coated with adhesive and insulation pressed tightly thereto.
6. Provide edges at terminal points with metal beading and heavily coated with adhesive.
7. Heavily coat joints and corners with adhesive.
8. Damaged areas replaced or heavily coated with adhesive.
9. Duct dimensions shown are net inside dimension.

C. Heating Hot Water Pipe Insulation.
1. 1-1/2 inch and smaller: Provide 1-1/2 inch pipe insulation on hot water supply and return piping.
2. Larger than 1-1/2 inch: Provide 2-inch pipe insulation on hot water supply and return piping.
3. Insulate fittings on piping utilizing preformed pipe covering.
4. Insulate all valve bodies, fittings, unions, flanges and equipment with insulation equal to the attached service piping.
5. Seal all insulation to maintain a vapor barrier.

3.2 COMMISSIONING

A. The equipment and systems referenced in this section are to be commissioned.

B. The contractor has specific responsibilities for scheduling, coordination, startup, test development, testing and documentation. Coordinate all commissioning activities with the Commissioning Authority.

END OF SECTION

INSTRUMENTATION AND CONTROL FOR HVAC

PART 1 - GENERAL

1.1 SCOPE DESCRIPTION

A. The controls portion of this project is design build based on the project drawings and specifications.
   1. Coordinate with the school district project manager to visit the site to become familiar with the existing building conditions and project requirements.
   2. Design conduit / cable routing to minimize exposed portions of the systems. Coordinate all exposed conduit / cabling with the district project manager prior to installation.
   3. Retain sub-contractors as required to restore exposed building elements – Walls, ceilings, floors to preconstruction condition after project alterations.

B. Governmental funding sources (SB 1149) requiring cost tracking / documentation will be used to fund portions of this project Coordinate and document project construction costs as noted in specification section 23 00 00, H.

C. Furnish and install all control hardware and software necessary for a complete DDC control system revision as specified and noted on the drawings.
   1. All pneumatic devices are to be removed and replaced as required with DDC control devices.
   2. All pneumatically controlled equipment will be converted to DDC control during this project.
   3. No pneumatic devices with the exception of control tubing located behind walls or inaccessible ceiling areas are to remain after construction.
   4. Cap all pneumatic tubing entering walls and inaccessible ceiling areas behind the architectural element and patch to match the existing wall / ceiling.

D. Furnish all modules, temperature sensors, flow sensors, control valves, control valve actuators, damper actuators and any other items necessary for a complete system and sequence of control.
   1. Coordinate the installation of temperature sensors, dampers and actuators to assure all work required for a complete system is included in the base bid.
   2. Add additional control devices not specifically noted in the contract documents required to perform the written sequence of operations. Include the price of these additional components in the base bid.

E. The final installation will allow all school control components to be monitored / controlled at a single point by district personnel through the existing district interface.

F. Establish communication to the new equipment through BACnet IP protocol via the MSTP controllers. Bring the system DDC points into the district server and integrate the system graphics to match Beaverton School District (BSD) standards.

G. Provide cut and patch work as required to restore school architectural elements to existing conditions prior to project start. Include all wall / ceiling repair and paint.

1.2 QUALITY ASSURANCE

A. Provide control work by a single company with licensed journeymen specialists in the type of work required, so that only one supplier is responsible for all control work for the project.

B. Provide coordination with other contractors and subcontractors for work required by other trades for control work accomplishment.

1.3 SUBMITTALS

A. In diagrams, show complete piping or ductwork system schematics with DDC, electrical and pneumatic control devices, tubing and wiring superimposed.

B. Completely identify all control devices with manufacturer's type, number, and functional description.

C. Uniquely identify all control tubing, wire and conduit on the drawings with a logical numbering system.

D. Show all electric and hydronic connections of the control system to equipment furnished by others, complete to terminal points specifically identified with manufacturer's terminal designation.

E. In booklet form, provide a bill of material and catalog data on all control device types, including control operation description, technical parameters and connection identifications. Describe the complete sequence of operation containing all information necessary for clarity and understanding of device function and system sequence of operation.

F. Furnish a list of connected data points, including connected control unit and input device.

G. In booklet form, provide catalog data on all description, technical parameters and connection identifications. Describe the complete sequence of operation containing all information necessary for clarity and understanding of device function and system sequence of operation.

1.4 OPERATING AND MAINTENANCE DATA:

A. O&M Manuals in PDF format.

B. Include a complete set of control Shop Drawings indicating as built and operating changes.

C. Include operating and maintenance data on all equipment requiring periodic or incidental services or adjustment. Include a summary schedule for all maintenance tasks. Describe troubleshooting procedures for anticipated problems.

D. Controls Systems Commissioning:
1. Submit a complete, dated, and initialed record of all system adjustment for components of the control system.
2. Indicate deviations from the specified temperatures, pressures, flows, setpoints, etc.
3. Include a copy of the completed commissioning worksheets in each copy of the Operating and Maintenance Data.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS AND SYSTEMS

A. Johnson controls by the local factory branch, Northwest Controls Company (NCC), or Automated Controls (Kirkland / Redmond, Washington).

2.2 CONTROL WIRING / COORDINATION WITH LINE VOLTAGE CONTROL

A. Provide control wiring to all control modules, sensors and actuators required to provide the project sequences of operation.

B. Provide control interface air handling units, unit ventilators and accessory equipment as required.

C. All control wiring exposed in occupied areas to be in conduit. Coordinate exposed control wiring in normally occupied spaces with the school district project manager

D. Provide all control system related conduit within mechanical room or at equipment locations unless specifically shown to be in other divisions work.

E. Control wiring in non-accessible ceilings, walls or floors shall be in conduit.

F. All wiring not in conduit or control cabinets shall be rated for plenum installation.

G. Provide conduit where required between the zone temperature sensor locations and the zone equipment. Provide all wiring / conduit in the base bid necessary for a complete operating control system.

2.3 AUTOMATION SYSTEM / DDC CONTROL DEVICES

A. All control devices to be standard products of the specified control system and accessory devices utilized by the controls installer consistent with Beaverton School District standards.

B. All sensors located in hallways, corridors, toilet rooms and other common spaces to have metal protective plates.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Single source responsibility of supplier shall be the complete installation and proper operation of the building automation system and control system and shall include debugging and proper calibration of each component in the entire system.

B. Provide all controllers to accomplish the control sequences specified herein.

C. Provide / coordinate the installation of; sensors, pipe wells, relays and any other devices and materials required to accomplish the functions described herein.

D. Establish communication to the new equipment through BACnet IP protocol via the MSTP controllers. Bring the system DDC points into the district server and integrate the system graphics to match Beaverton School District (BSD) standards.

E. Furnish all software, device installation, programming, technical assistance to the school district and product licenses required for complete operating control systems throughout the entire facility.

F. All control identification points and HVAC systems graphics to conform to Beaverton School district naming standards – Verify with BSD project manager prior to initiation of programming and graphics development.

G. Provide all temperature sensors, flow sensors, humidity sensors, IAQ sensors, control valves, control valve actuators, dampers, damper actuators, programming and other items necessary for a complete system and sequence of control for new equipment as identified in the contract drawings.

H. All new equipment to have points as noted on Contract Drawings M1.00, M1.01 and M1.02.

I. Program all control diagrams and sequences of operation into the system graphics to allow visual review of diagrams / sequence when viewing system programming.

J. Furnishing and installing all control hardware and software necessary for a complete DDC control system as specified.

K. Final installation will allow all school control components to be monitored / controlled at a single point by district personnel through a single user interface.

L. Coordinate the installation of automatic control valves, dry wells for fluid temperature sensors, dampers and actuators with the mechanical contractor to assure all work required for a complete system is included in the base bid.

M. The Controls Contractor shall be responsible for field verification of site conditions and for gathering all necessary field data for all items to be provided under this contract prior to submitting his or her bid.

N. Where work specified under other Sections of this Specification connects to equipment or systems that are listed and described in this Section, the Controls Contractor shall coordinate with other trades to provide proper connection(s) to such equipment.

O. Identification - Provide nameplates identifying all switches, lights and starters, and each control device where the control function is not readily apparent.

3.2 SEQUENCES OF OPERATION

A. Energy Management System Point Schedule: Provide monitoring and control functions as listed herein for each piece of equipment listed below. Provide a point list that includes each hard wired, calculated and/or resettable point.

B. Distributed Control – The control system shall observe the concept of distributed control. Modules shall be located at each operating equipment location such that individual systems or zones shall remain functional without communication to other systems on the network.

C. Energy Compliance:
1. Provide 365 day, 24 hour occupancy scheduling.
2. When controlling both heating and cooling (mechanical), provide a 5-degree deadband in which the heating energy provided to the zone is reduced to a minimum.
3. Provide optimum start controls to enable a morning warm-up cycle capable of varying the unit start time to meet occupied setpoint at scheduled time of occupancy.
4. Close outside air dampers as appropriate to the equipment when the units are off and during the warm-up period.

D. General: Allow the setpoints referred to in the following sequences to be adjusted at the operator workstation (OWS) or at the local digital controller (DDC). If communication is lost to the DDC, default setpoints in the DDC are used for stand-alone control.

E. ASU-1, ASU-2, Rooftop Heat Pump (EEM#5).
1. Unoccupied:
   a. Fans off, outside air, return air and exhaust air dampers (as applicable) indexed to full recirculation.
   b. Heat Pump not enabled.
   c. Electric convectors / wall heaters off.
   d. Unoccupied Low Limit: When the space temperature drops below the night low limit set point (district standard), start the supply fan and enable the heat pump to full heating. Unit to heat until the space is 5-degrees above night low limit set point.
   e. Roof relief vent damper is closed.
2. Morning Warm-up.
   a. The zone temperature is used to determine the amount of time needed to preheat the space to the occupied setpoint minus 1 degree F no more than 20 minutes prior to or 10 minutes after the scheduled occupied time.
   b. The supply fan starts and runs continuously. The outside air damper closes and the return air damper opens. Reversing valve is positioned for heating. Stage on the heating.

c. The unit is indexed to occupied control at the scheduled start time. Disable the morning warm-up when the 3-hour rolling average outdoor air temperature, during unoccupied mode, is greater than setpoint (55 degrees F). If the morning warm-up is disabled, switch air handler to occupied mode 10 minutes prior to scheduled occupied time.
d. Index terminal units to heating volume.
e. Electric convectors / wall heaters enabled.
f. Based on the space temperature, the optimum start/stop function starts the air handling system and enables the convectors / wall heaters in warm-up mode so that the space temperature will reach set point at the scheduled occupancy time.
g. During warm-up the dampers will remain in full circulation and will cycle to appropriate ventilation mode control at occupancy time regardless of average zone temperature.
h. Roof relief vent damper is closed.

3. Occupied Mode.
   a. The supply fan starts and runs continuously.
   b. Open the roof relief vent damper.
   c. The occupied sequence of operations for the units shall consist of four separate control modes: heat pump heating, economizer cooling, heat pump cooling and ventilation.
   d. The supply and return fans run continuously.
   e. Heating Mode (Heat Pump):
      1) Modulate the supply fan VFD to the preset heating speed.
      2) Modulate the mixed air to the minimum position allowed by outside air setting and CO2 level, the heat pump shall operate according to the integral controls until the heating setpoint is attained.
      3) Modulate the terminal units to the preset heating position.
      4) On a continued call for heat enable the electric convectors / wall heaters to meet the heating setpoint.
   f. Cooling Mode (Economizer cycle) - When the outdoor air is 4 degrees F (adjustable) less than the return air temperature, modulate the outside air damper between the minimum and full open position to maintain the space temperature setpoint.
      1) Modulate the supply fan VFD to the preset cooling speed.
      2) Modulate the terminal units to the preset cooling position.
      3) Actuators shall operate outside air and return dampers in accordance with system operating status, supply air, zone air temperatures, and outside air temperatures.
      4) Occupied: Modulate between minimum outside air position and 100% open to meet the cooling requirements of the zone being served.
   g. Cooling Mode (Heat Pump): On a continued call for cooling, mixed air shall modulate to the minimum position allowed by outside air setting and CO2 level, the heat pump shall operate according to the integral controls until the cooling setpoint is attained.

4. Demand Control Ventilation Mode: The mixed air control shall modulate to control the following in the priority listed:
   a. Mixed air low limit set point (45 deg F)
   b. CO2 high limit set point: Reset the outside air according to the following adjustable setpoints -
      1) 800-ppm CO2 and below - OSA at 5% maximum supply air volume.
      2) 1200-ppm CO2 maximum - OSA at 50% maximum supply air volume.
   c. The mixed air set point shall be reset from (55) deg F at (70) deg F outside air to (65) deg F at (50) deg F based on an outside air temperature reset. If the outside air temperature is above the return air temperature the mixed air should be at minimum position as allowed by the minimum outside air setting and CO2 level.

5. Occupancy Sensor Control: When space served by unit with occupancy sensor control is sensed as occupied, unit is in occupied mode. If space is occupied for more than 10 minutes (adjustable), close outside air damper and cycle unit to meet occupied space temperature setpoint.
6. Safeties: The supply and return fan shall stop, the outside and exhaust air dampers shall close and control valves shall go to their normal position and an alarm shall be generated if any of the listed events occur:
    a. Duct Smoke detector/fire alarm.
    b. Low temperature alarm (freeze protection).
    c. High temperature alarm.
    d. Airflow Interlock Logic - Airflow must be proven in order to operate the compressor(s) and supplemental heat. Anytime flow is lost for more than 5-seconds, the controller will send the compressor and supplemental heat commands to 0.0 percent.
7. Defrost Mode: Close outside air damper when unit is in defrost mode.

F. SF-1, RF-1, Hot Water Convectors (EEM#3).
1. Unoccupied:
    a. Fans off, outside air, return air and exhaust air dampers (as applicable) indexed to full recirculation.
    b. Convectors hydronic valves closed,
    c. Unoccupied Low Limit: When the space temperature drops below the night low limit set point (district standard), enable boiler operation and open the convector valves to full heating. Units to heat until the space is 5-degrees above night low limit set point.
    d. Terminal units remain closed.
    e. Subject to the boiler outside air lockout temperature (65), when there is a call for night low limit heating, the boiler system will be enabled.
2. Morning Warm-up.
    a. The zone temperature is used to determine the amount of time needed to preheat the space to the occupied setpoint minus 1 degree F no more than 20 minutes prior to or 10 minutes after the scheduled occupied time.
    b. The supply fan starts and runs continuously. The outside air damper closes and the return air damper opens. Reversing valve is positioned for heating. Stage on the heating.
    c. The unit is indexed to occupied control at the scheduled start time. Disable the morning warm-up when the 3-hour rolling average outdoor air temperature, during unoccupied mode, is greater than setpoint (55 degrees F). If the morning warm-up is disabled, switch air handler to occupied mode 10 minutes prior to scheduled occupied time.
    d. Index terminal units to heating volume.
    e. Hot water convectors enabled.
    f. Based on the space temperature, the optimum start/stop function starts the air handling system and enables the convectors in warm-up mode so that the space temperature will reach set point at the scheduled occupancy time.
    g. During warm-up the dampers will remain in full circulation and will cycle to appropriate ventilation mode control at occupancy time regardless of average zone temperature.
3. Occupied Mode.
    a. The supply and return fans start and run continuously.
    b. The occupied sequence of operations for the units shall consist of four separate control modes: heating, economizer cooling, chilled water cooling and ventilation.
    c. The supply and return fans run continuously.

d. Heating Mode (Hot Water):
   1) Modulate the supply fan VFD to the preset heating speed.
   2) Modulate the mixed air to the minimum position allowed by outside air setting and CO2 level, the heat pump shall operate according to the integral controls until the heating setpoint is attained.
   3) Modulate the terminal units to the preset heating position.
   4) On a continued call for heat enable the hot water convectors to meet the heating setpoint.

e. Cooling Mode (Economizer cycle) - When the outdoor air is 4 degrees F (adjustable) less than the return air temperature, modulate the outside air damper between the minimum and full open position to maintain the space temperature setpoint.
   1) Modulate the supply and return fan VFD's to the preset cooling speeds.
   2) Modulate the terminal units to the preset cooling position.
   3) Actuators shall operate outside air and return dampers in accordance with system operating status, supply air, zone air temperatures, and outside air temperatures.
   4) Occupied: Modulate between minimum outside air position and 100% open to meet the cooling requirements of the zone being served.

f. Cooling Mode (Chilled Water): The mixed air shall modulate to the minimum position allowed by outside air setting and CO2 level, the chiller will enable and the cooling coil valve shall modulate to meet the cooling setpoint.

4. Demand Control Ventilation Mode: The mixed air control shall modulate to control the following in the priority listed:
   a. Mixed air low limit set point (45 deg F)
   b. CO2 high limit set point: Reset the outside air according to the following adjustable setpoints -
      1) 800-ppm CO2 and below - OSA at 5% maximum supply air volume.
      2) 1200-ppm CO2 maximum - OSA at 50% maximum supply air volume.
   c. The mixed air set point shall be reset from (55) deg F at (70) deg F outside air to (65) deg F at (50) deg F based on an outside air temperature reset. If the outside air temperature is above the return air temperature the mixed air should be at minimum position as allowed by the minimum outside air setting and CO2 level.
5. Occupancy Sensor Control: When space served by unit with occupancy sensor control is sensed as occupied, unit is in occupied mode. If space is occupied for more than 10 minutes (adjustable), close outside air damper and cycle unit to meet occupied space temperature setpoint.
6. Safeties: The supply and return fan shall stop, the outside and exhaust air dampers shall close and control valves shall go to their normal position and an alarm shall be generated if any of the listed events occur:
   a. Duct Smoke detector/fire alarm.
   b. Low temperature alarm (freeze protection).
   c. High temperature alarm.

G. SF-5, RF-3 (Music Room).
1. Unoccupied:
   a. Fans off, outside air, return air and exhaust air dampers (as applicable) indexed to full recirculation.
   b. Unoccupied Low Limit: When the space temperature drops below the night low limit set point (district standard), enable boiler operation and open the unit heating valve to full heating. Unit to heat until the space is 5-degrees above night low limit set point.
   c. Terminal units remain closed.
   d. Subject to the boiler outside air lockout temperature (65), when there is a call for night low limit heating, the boiler system will be enabled.

2. Warm-up:
   a. At optimum warm up start period, start fans to run continuously. Index outside air, return air and exhaust air dampers (as applicable) to full recirculation. Open the heating coil valve to full heating.
   b. Based on the space temperature, the optimum start/stop function starts the air handling system and opens the convector valves in warm-up mode so that the space temperature will reach set point at the scheduled occupancy time.
   c. During warm-up the air handling unit dampers will remain in full circulation and will cycle to appropriate ventilation mode control at occupancy time regardless of average zone temperature.
3. Occupied:
   a. The occupied sequence of operations for the units shall consist of four separate control modes: heating, economizer cooling, chilled water cooling and ventilation.
   b. The Fans run continuously.
   c. Heating Mode:
      1) Modulate the mixed air to the minimum position allowed by outside air setting and CO2 level, the air handling unit heating valve will modulate to maintain the heating setpoint.
   d. Cooling Mode (Economizer cycle):
      1) Actuators shall operate outside air and return dampers in accordance with system operating status, supply air, zone air temperatures, and outside air temperatures.
      2) Occupied: Modulate between minimum outside air position and 100% open to meet the cooling requirements of the zone being served.
      3) Air handling unit coil valves are closed.
   e. Cooling Mode (Chilled Water): The mixed air shall modulate to the minimum position allowed by outside air setting and CO2 level, the chiller will enable and the cooling coil valve shall modulate to meet the cooling setpoint.
4. Demand Control Ventilation Mode: The mixed air control shall modulate to control the following in the priority listed:
   a. Mixed air low limit set point (45 deg F)
   b. CO2 high limit set point: Reset the outside air according to the following adjustable setpoints -
      1) 800-ppm CO2 and below - OSA at 5% maximum supply air volume.
      2) 1200-ppm CO2 maximum - OSA at 50% maximum supply air volume.
   c. The mixed air set point shall be reset from (55) deg F at (70) deg F outside air to (65) deg F at (50) deg F based on an outside air temperature reset. If the outside air temperature is above the return air temperature the mixed air should be at minimum position as allowed by the minimum outside air setting and CO2 level.
5. Safeties: The supply and return fan shall stop, the outside and exhaust air dampers shall close and control valves shall go to their normal position and an alarm shall be generated if any of the listed events occur:
   a. Duct Smoke detector/fire alarm.
   b. Low temperature alarm (freeze protection).
   c. High temperature alarm.

H. SF-2 (Gymnasium), SF-4 (Cafeteria) (EEM#3).
1. Unoccupied:
   a. Fans off, outside air and return air dampers indexed to full recirculation. Roofcap relief air dampers closed.
   b. Unoccupied Low Limit: When the space temperature drops below the night low limit set point (district standard), enable boiler operation and open the unit heating valve to full heating. Unit to heat until the space is 5-degrees above night low limit set point.

c. Subject to the boiler outside air lockout temperature (65), when there is a call for night low limit heating, the boiler system will be enabled.

2. Warm-up:
   a. At optimum warm up start period, start fans to run continuously. Index outside air and return air dampers to full recirculation – Relief air damper remains closed. Open the heating coil valve to full heating.
   b. Based on the space temperature, the optimum start/stop function starts the air handling system and opens the convector valves in warm-up mode so that the space temperature will reach set point at the scheduled occupancy time.
   c. During warm-up the air handling unit dampers will remain in full circulation and will cycle to appropriate ventilation mode control at occupancy time regardless of average zone temperature.
3. Occupied:
   a. The occupied sequence of operations for the units shall consist of four separate control modes: heating, economizer cooling, DX cooling and ventilation.
   b. The Fans run continuously.
   c. Relief air dampers open.
   d. Heating Mode:
      1) Modulate the mixed air to the minimum position allowed by outside air setting and CO2 level, the air handling unit heating valve will modulate to maintain the heating setpoint.
   e. Cooling Mode (Economizer cycle):
      1) Actuators shall operate outside air and return dampers in accordance with system operating status, supply air, zone air temperatures, and outside air temperatures.
      2) Occupied: Modulate between minimum outside air position and 100% open to meet the cooling requirements of the zone being served.
      3) Air handling unit coil valves are closed.
   f. Cooling Mode (Chilled Water): The mixed air shall modulate to the minimum position allowed by outside air setting and CO2 level, the chiller will enable and the cooling coil valve shall modulate to meet the cooling setpoint.
4. Demand Control Ventilation Mode: The mixed air control shall modulate to control the following in the priority listed:
   a. Mixed air low limit set point (45 deg F)
   b. CO2 high limit set point: Reset the outside air according to the following adjustable setpoints -
      1) 800-ppm CO2 and below - OSA at 5% maximum supply air volume.
      2) 1200-ppm CO2 maximum - OSA at 50% maximum supply air volume.
   c. The mixed air set point shall be reset from (55) deg F at (70) deg F outside air to (65) deg F at (50) deg F based on an outside air temperature reset. If the outside air temperature is above the return air temperature the mixed air should be at minimum position as allowed by the minimum outside air setting and CO2 level.
5. Safeties: The supply and return fan shall stop, the outside and exhaust air dampers shall close and control valves shall go to their normal position and an alarm shall be generated if any of the listed events occur:
   a. Duct Smoke detector/fire alarm.
   b. Low temperature alarm (freeze protection).
   c. High temperature alarm.

INSTRUMENTATION AND CONTROL FOR HVAC

I. SF-6 (Kitchen):
   1. Unoccupied:
      a. Fan off, outside air closed.
      b. Unoccupied Low Limit: When the space temperature drops below the night low limit set point (district standard), enable boiler operation, start the unit and open the unit heating valve to full heating. Unit to heat until the space is 5-degrees above night low limit set point.
      c. Subject to the boiler outside air lockout temperature (65), when there is a call for night low limit heating, the boiler system will be enabled.
   2. Warm-up:
      a. At optimum warm up start period, start fan to run continuously. Open the hot water heating coil valve to full heating.
      b. Start EF-13.
      c. Based on the space temperature, the optimum start/stop function starts the air handling system and operates the unit in warm-up mode so that the space temperature will reach set point at the scheduled occupancy time.
   3. Occupied:
      a. The Fans run continuously.
      b. Heating Mode: Modulate the air handling unit heating valve to maintain the heating setpoint.
   4. Safeties: The supply and return fan shall stop, the outside and exhaust air dampers shall close and control valves shall go to their normal position and an alarm shall be generated if any of the listed events occur:
      a. Duct Smoke detector/fire alarm.
      b. Low temperature alarm (freeze protection).
      c. High temperature alarm.

J. SF-7 (Boys 2), SF-8 (Girls 2):
   1. Unoccupied:
      a. Fan off, outside air closed.
      b. Unoccupied Low Limit: When the space temperature drops below the night low limit set point (district standard), enable boiler operation, start the unit and open the unit heating valve to full heating. Unit to heat until the space is 5-degrees above night low limit set point.
      c. Subject to the boiler outside air lockout temperature (65), when there is a call for night low limit heating, the boiler system will be enabled.
   2. Warm-up:
      a. At optimum warm up start period, start fan to run continuously. Open the heating coil valve to full heating.
      b. Start EF-9.
      c. Based on the space temperature, the optimum start/stop function starts the air handling system and operates the unit in warm-up mode so that the space temperature will reach set point at the scheduled occupancy time.
   3. Occupied:
      a. The Fans run continuously.
      b. Heating Mode: Modulate the air handling unit heating valve to maintain the heating setpoint.
      c. Cooling Mode (Chilled Water): The mixed air shall modulate to the minimum position allowed by outside air setting and CO2 level, the chiller will enable and the cooling coil valve shall modulate to meet the cooling setpoint.

4. Safeties: The supply and return fan shall stop, the outside and exhaust air dampers shall close and control valves shall go to their normal position and an alarm shall be generated if any of the listed events occur:
    a. Low temperature alarm (freeze protection).
    b. High temperature alarm.

K. Exhaust Fan (Time Schedule): Fan to run during occupancy hours on its own start-stop time schedule.

L. Exhaust Fan (Temperature Control): Fan to run on a space temperature sensor to maintain sensor setpoint.

M. Independent Wall Heaters.
1. Unoccupied:
    a. Heater off.
    b. Unoccupied Low Limit: When the space temperature drops below the night low limit set point (district standard), enable heater operation and allow unit to heat until the space is 5-degrees above night low limit set point.
2. Warm-up - At optimum warm up start period, e
3. Occupied- enable heater to maintain the heating setpoint.
4. Safeties:
    a. Low temperature alarm (freeze protection).
    b. High temperature alarm.

N. Chiller (CH):

1. General: Setpoints referred to in the following sequences can be adjusted at the operator workstation (OWS) or at the local digital controller (DOC). If communication is lost to the DOC, default setpoints in the DOC are used for stand-alone control.
Chiller Control: When the outside air temperature is above 70 degrees F, the DOC starts the chilled water pump and enables the chiller. When chilled water flow is proven, the chiller will be allowed to start. The chiller will operate under manufacturer controls and safeties to maintain leaving chilled water temperature. If the outside air temperature decreases below 70 degrees F, disable the chiller.

3.3 FIELD QUALITY CONTROL

A. Startup: Implement a logical step-by-step startup and checkout of the control system. In addition, startup assistance and coordination shall be provided during startup of the mechanical equipment. Startup shall be considered complete after the entire system is operating properly.

B. Self-commission all hardware and software provided for the project.

C. Completed field commissioning sheets shall be included with the final “as-built” O&M manuals. These sheets shall include validation check fields for all physical and LAN inputs and outputs and graphics for each operating unit or system within the facility. Each system and point shall be listed, using logical names for future reference by the owner.

D. Commissioning shall include calibration and verification of operation of each I/O and graphic field. Functional commissioning of software programming to meet sequences of operation as submitted and approved shall be verified on the field commissioning sheets.

E. At the completion of the job, in the presence of an Owner's representative, thoroughly check out the entire control system by simulating each control function and determine that the system performs in accordance with the Contract Specifications.

3.4 INSTRUCTION OF OWNER PERSONNEL

A. Provide complete list of system generated messages for system operation, including alarm messages.

B. Modify error message wording as required by the Owner's personnel.

C. Locate all control components for Operating Engineer.

3.5 RECORD DRAWINGS

A. Provide complete and accurate record drawings noting all deviations from the information furnished in the original submittals.

3.6 COMMISSIONING

A. The equipment and systems referenced in this section are to be commissioned.

B. The contractor has specific responsibilities for scheduling, coordination, startup, test development, testing and documentation. Coordinate all commissioning activities with the Commissioning Authority.

END OF SECTION

HVAC PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 SUMMARY

A. Work included:
1. Remove existing control valves and installing controls contractor furnished control valves.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Black Steel Pipe:
1. Pipe: Schedule 40 black steel pipe conforming to ASTM A120-82 or A53-93A.
2. Fittings: 150 psi screwed malleable iron for 2 1/2" and smaller, Schedule 40 weld fittings conforming to ASTM A234 for 3" and larger.
3. Standard product of manufacturer.

B. Unions: Standard product of manufacturer.

2.2 DESCRIPTION

A. Heating Water Piping:
1. Black steel – Provide screwed, welded or flanged fittings as required.

B. Unions: 150 malleable iron, brass to iron seat, ground joint, black or galvanized to match pipe. 200-psi wog bronze, ground joint, solder type for copper tubing. Where dissimilar metals join, dielectric unions, couplings or flanges shall be installed.

PART 3 - EXECUTION

3.1 PREPARATION - MEASUREMENTS, LINES AND LEVELS

A. Check dimension at the building site for the work specified in this Division.

3.2 INSTALLATION

A. Hydronic Piping.
1. Grade mains and runouts to drain.
2. Provide miscellaneous valves and appurtenances as noted on the drawings.
3. Provide shutoff valves at equipment and coil connections.
4. Provide unions in piping at control valves, pressure reducing valves, pumps, coils, etc. if equipment is furnished without flanges for pipe connections.
5. Provide manual air vents at all high points and drain valves at all low points in the piping system.
6. Provide fittings and install automatic temperature control wells provided and located by the automatic temperature control contractor and where shown on the drawings.
7. Provide reducers as required for changes in pipe size, equipment connections and control valves.

B. Miscellaneous Condensate and Drain Systems:
1. Install condensate system sized in conformance with the drawings.
2. Slope lines in direction of flow.
3. Install indirect waste fittings as shown on the Drawings, providing access as required by code
4. Test piping system per this Section.

C. Pressure testing of piping:
   1. Piping: Test prior to concealment, insulation being applied, and connection to equipment, fixtures, or specialties. Conduct tests with all valves but those used to isolate the test section 10% closed.
   2. Leaks: Repair all leaks or replace defective pipe or fittings and retest until stipulated results are achieved.
   3. Notification: Advise the Project Manager 48 hours in advance of each test. Failure to so notify will require test to be rescheduled.
   4. Testing Equipment: Provide all necessary pumps, gauges, connections similar items required to perform the tests.

D. Maintain service clearances for all equipment, valves, etc. per the respective manufacturer's requirements and as required for adequate service.

E. Provide flexible pipe connections at all piping penetrations through building expansion joints.

F. Provide shutoff valves at equipment connections.

G. Install unions in all non-flanged piping connections to apparatus and adjacent to all screwed control valves, traps, and appurtenances requiring removal for servicing, so located that piping may be disconnected without disturbing the general system.

H. Coils:
   1. Install coils where noted on the drawings in accordance with the manufacturer's recommendations.
   2. Connect the ductwork when required to the coil casing providing transitions and fittings.
   3. Pipe 3/4-inch condensate lines to existing floor drains in the boiler room

I. Support all piping independently at apparatus so that the equipment shall not carry its weight.

J. Screwed Joints: Ream pipe ends. Apply dope or tape to male threads only. Brass joints shall be made with Teflon tape only. Make up fitting with not over two threads showing beyond the fitting end.

K. Provide reducers as required for changes in pipe size, equipment connections and valves

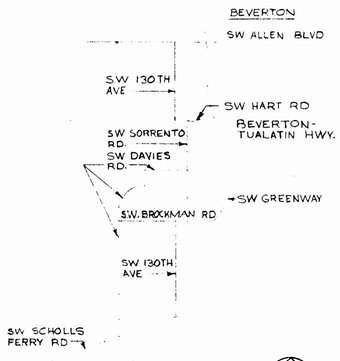
3.3 COMMISSIONING

A. The equipment and systems referenced in this section are to be commissioned.

B. The contractor has specific responsibilities for scheduling, coordination, startup, test development, testing and documentation. Coordinate all commissioning activities with the Commissioning Authority.

END OF SECTION

Supporting Documentation



VICINITY MAP

SITE PLAN
SCALE: 1"=50'

REVISIONS	
DRWN	PP
CHKD	
DATE	1-30-14
COMM	13-07

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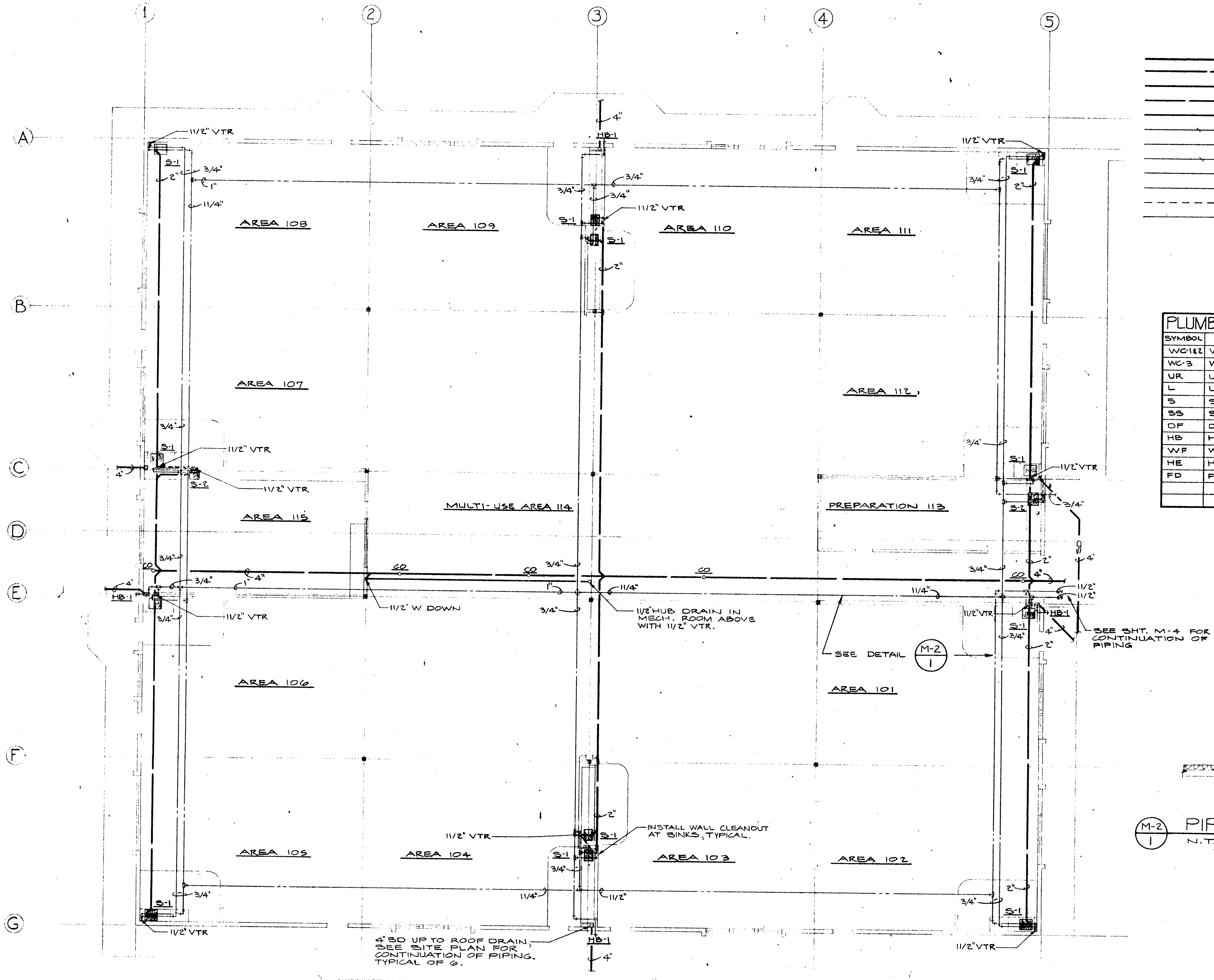
SITE PLAN
S.W. BROCKMAN ROAD AND S.W. DAVIES ROAD
BEAVERTON, OREGON
WASHINGTON COUNTY

SHEET M1
OF 11



M-2 / A BUILDING 100 FLOOR PLAN — PLUMBING

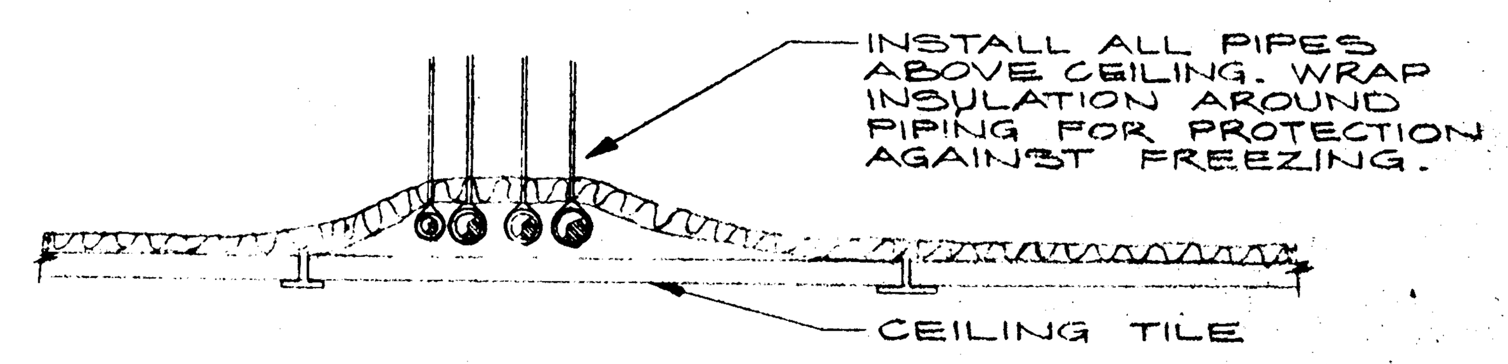
SCALE: 1/8" = 1'-0"

PIPING LEGEND

- WASTE BELOW GRADE
- WASTE ABOVE GRADE
- SD — STORM DRAIN BELOW GRADE
- SD — STORM DRAIN ABOVE GRADE
- COLD WATER BELOW GRADE
- COLD WATER ABOVE GRADE
- HOT WATER BELOW GRADE
- HOT WATER ABOVE GRADE
- HOT WATER RETURN
- VENT
- G — GAS
- CB — CATCH BASIN
- CO — CLEAN-OUT
- FH — FIRE HYDRANT
- VTR — VENT THRU ROOF

PLUMBING FIXTURE CONNECTION SCHEDULE

SYMBOL	FIXTURE	W	V	CW	HW	REMARKS
WC-1&2	WATER CLOSET	4"	2"	11/2"	---	
WC-3	WATER CLOSET	4	2	3/4	---	
UR	URINAL	2	2	3/4	---	
L	LAVATORY	11/2	11/4	3/4	3/4"	
S	SINK	2	11/2	3/4	3/4	
SS	SERVICE SINK	3	2	3/4	3/4	
DF	DRINKING FOUNTAIN	11/4	11/4	3/4	---	
HB	HOSE BIBB	---	---	3/4	---	
WF	WASH FOUNTAIN	2	11/2	3/4	3/4	
HE	HEAT EXCHANGER	---	---	2	2	
FD	FLOOR DRAIN	---	---	---	---	PRIME



M-2 / 1 PIPE INSTALLATION DETAIL

N.T.S.

PLUMBING PLAN - BUILDING 100

S.W. BROCKMAN ROAD AND S.W. DAVIES ROAD
BEAVERTON OREGON

ELEMENTARY SCHOOL - SCHOOL DISTRICT 48
BEAVERTON WASHINGTON COUNTY OREGON

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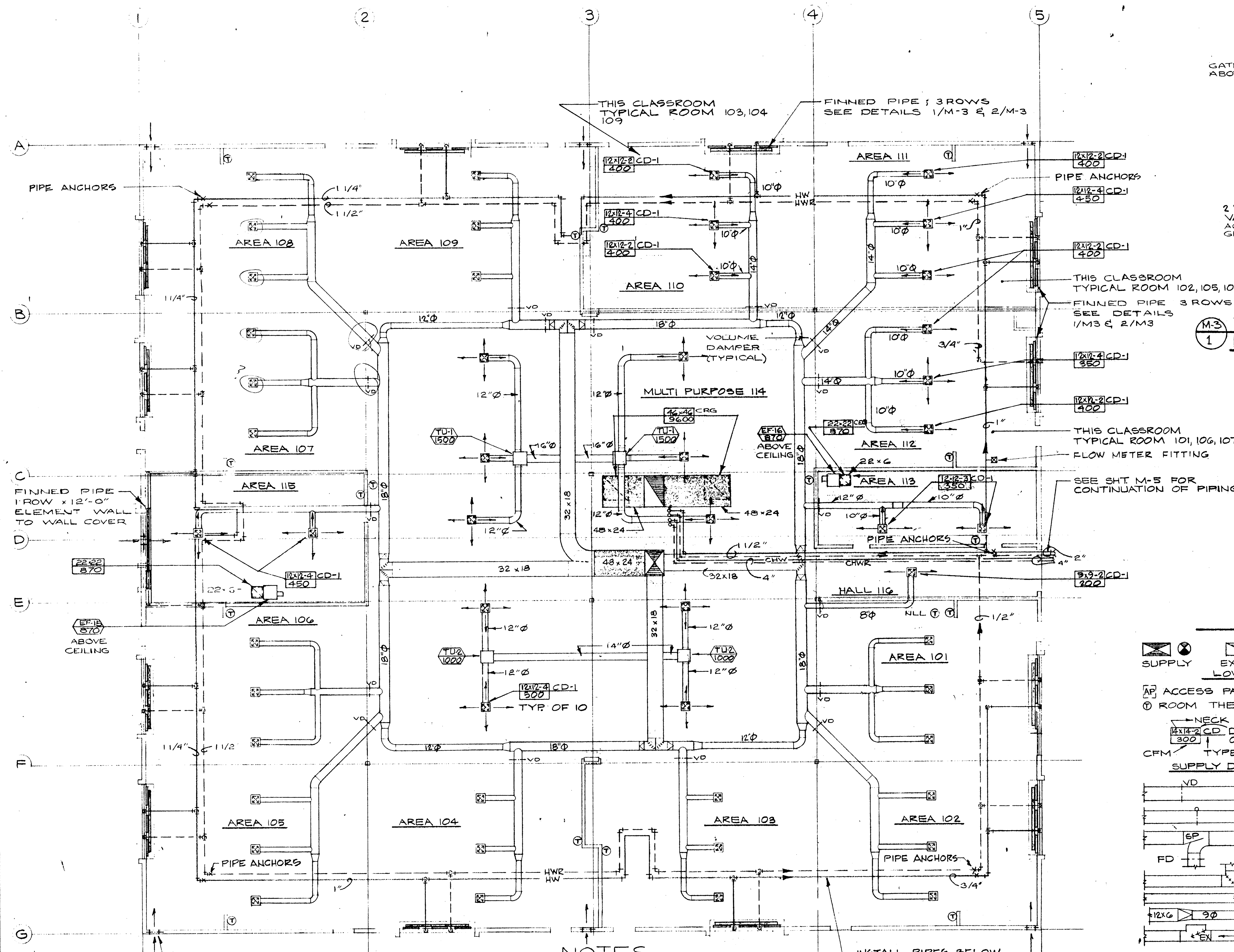
REVISIONS
DRWN JP
CHKD
DATE 1-20-74
COMM 73-07
FILE

SHEET 1
M 2

REGISTERED PROFESSIONAL ENGINEER 6436 OREGON May 7, 1969 LARRY R. McGINNIS

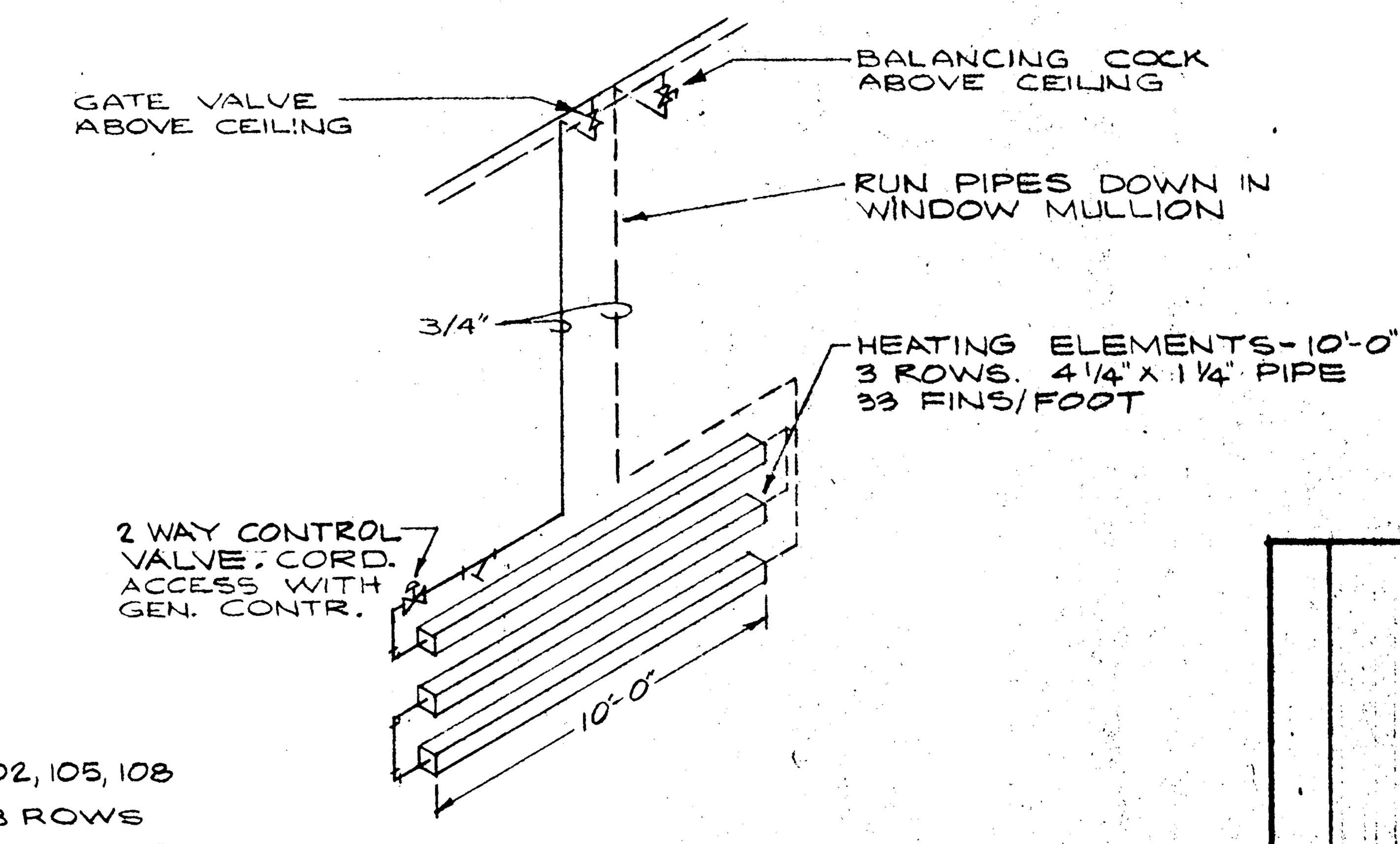


NOTES

1. COORDINATE LOCATION OF ALL CEILING DIFFUSERS & GRILLS WITH LIGHT FIXTURES & T-BAR
2. INSTALL FIRE DAMPERS IN ALL CEILING PENETRATIONS
3. INSTALL VOLUME DAMPERS IN ALL BRANCH DUCTS

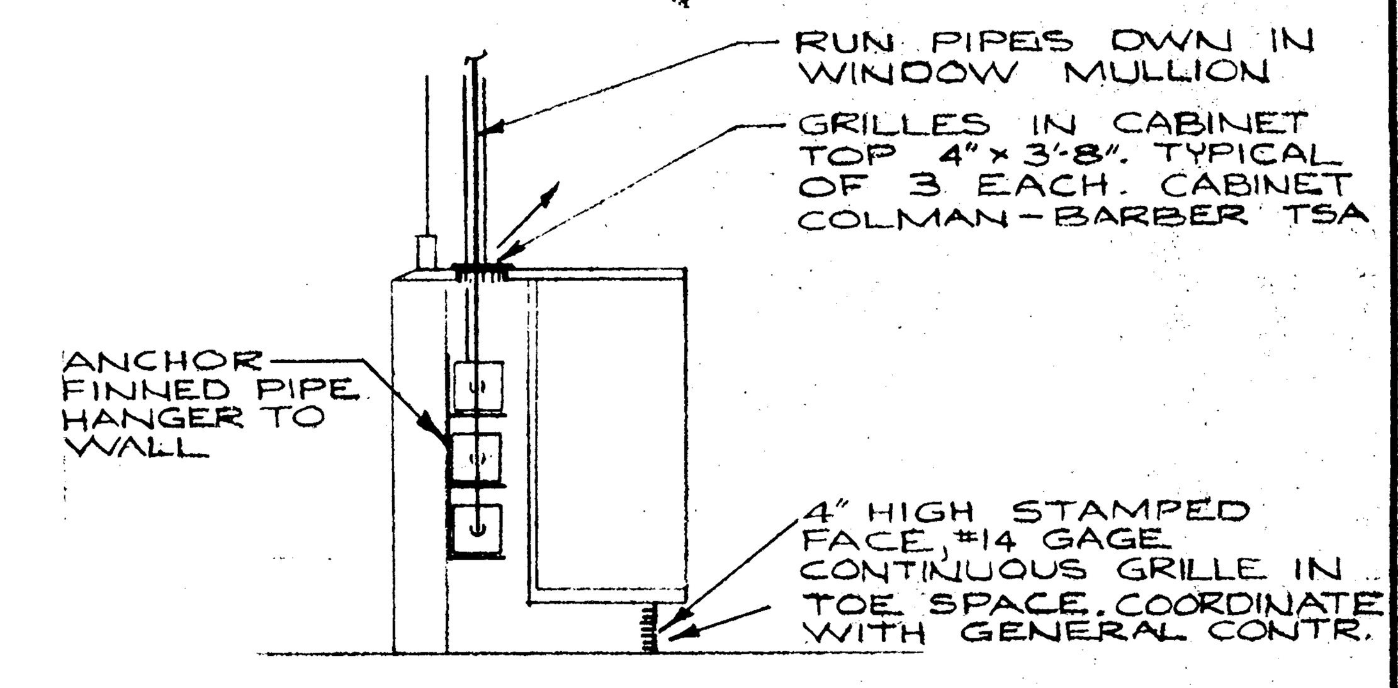
M-3 A BUILDING 100 FLOOR PLAN - AIR CONDITIONING

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



M-3 1 TYPICAL CLASSROOM FINNED PIPE PIPING DIAGRAM

SCALE: 1/4" = 1'-0"



M-3 2 TYPICAL CLASSROOM FINNED PIPE DETAIL

SCALE: 3/4" = 1'-0"

DUCT LEGEND

SUPPLY — EXHAUST — OUTSIDE AIR — RETURN

LOW VELOCITY DUCTS

AP ACCESS PANEL — FLEXIBLE DUCT

T ROOM THERMOSTAT

NECK SIZE — DIRECTION OF THROW — CFM — TYPE (SEE SPECS) — SUPPLY DIFFUSER

GRILLE SIZE — TYPE (SEE SPECS) — CFM — EXHAUST OR RETURN AIR GRILLES

VOLUME DAMPER

MOTORIZED DAMPER

SPLITTER DAMPER

FIRE DAMPER

TURNING VANES

ACOUSTICALLY LINED DUCT (SIZES SHOWN ARE NET INSIDE)

TRANSITION FROM RECT. TO ROUND

ADJUSTABLE EXTRACTOR

FLEX CONNECTION

EQUIP. NO. — CAPACITY

PIPING LEGEND

HW	HEATING WATER SUPPLY
HWR	HEATING WATER RETURN
CHW	CHILLED WATER
CHWR	CHILLED WATER RETURN
C	CONDENSER WATER
CR	CONDENSER WATER RETURN
FOS	FUEL OIL SUCTION
FOR	FUEL OIL RETURN
D	DRAIN

AIR CONDITIONING PLAN - BUILDING 100

SW. BROCKMAN ROAD AND SW. DAVIES ROAD BEAVERTON, OREGON

ELEMENTARY SCHOOL - SCHOOL DISTRICT 48

WASHINGTON COUNTY BEAVERTON OREGON

WILLIAMS & EHMANN AIA
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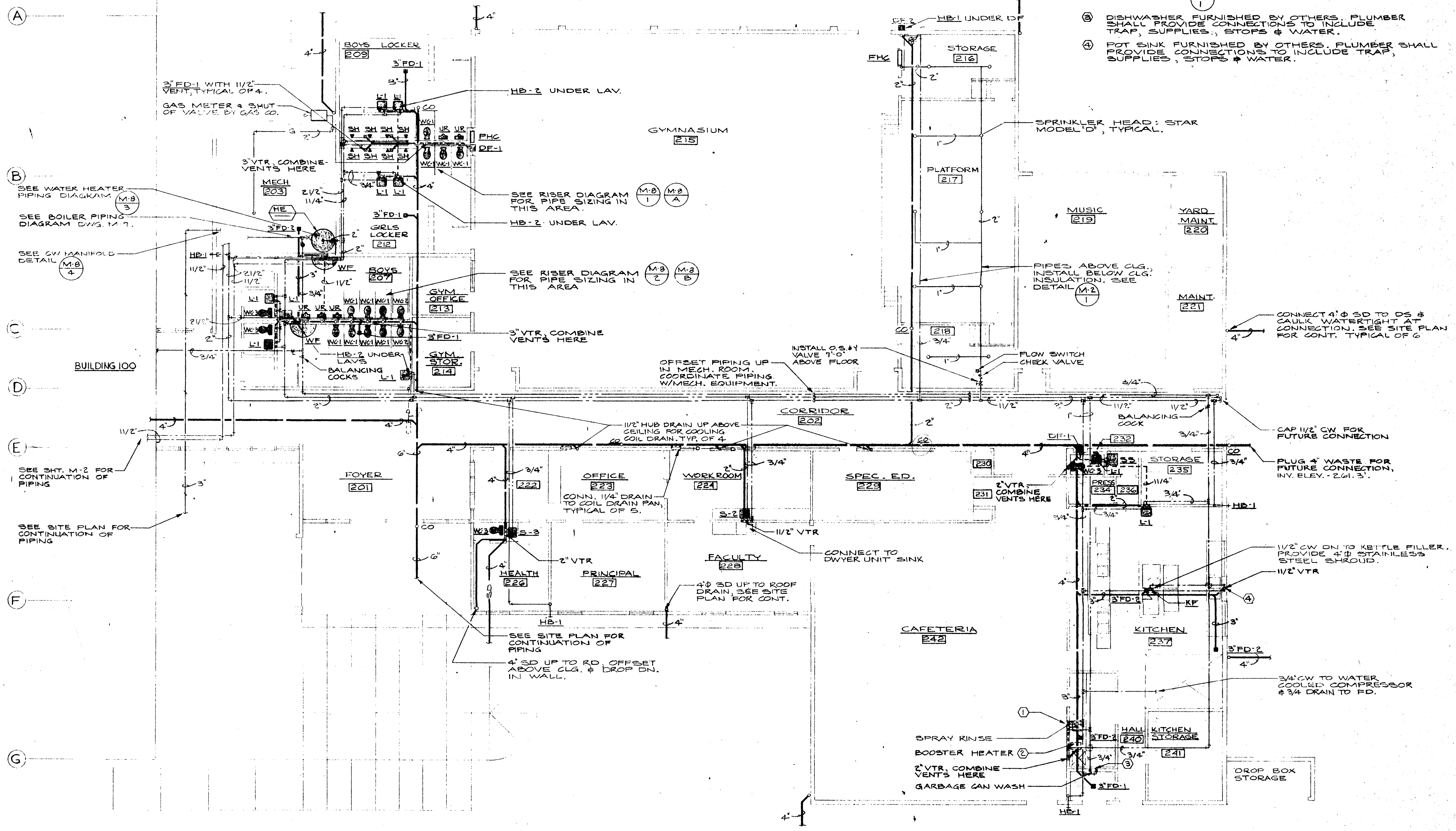
SHEET M 3 of 11



BOYS LOCKER 209
3" FD-1
HB-2 UNDER LAV.
3" FD-1 WITH 1 1/2" VENT, TYPICAL OF 4.
GAS METER & SHUT OFF VALVE BY GAS CO.
GYMNASIUM 215
3" VTR, COMBINE VENTS HERE
MECH 203
SEE WATER HEATER PIPING DIAGRAM M-8 3
SEE BOILER PIPING DIAGRAM DWG. M-7.
SEE RISER DIAGRAM M-8 1 M-8 A FOR PIPE SIZING IN THIS AREA.
HB-2 UNDER LAV.
GIRLS LOCKER 212
SEE CW MANIFOLD DETAIL M-8 4
BOYS 207
SEE RISER DIAGRAM M-8 2 M-8 B FOR PIPE SIZING IN THIS AREA
GYM OFFICE 213
3" VTR, COMBINE VENTS HERE
GYM STOR. 214
HB-2 UNDER LAVS
BALANCING COCKS
BUILDING 100
OFFSET PIPING UP IN MECH. ROOM. COORDINATE PIPING W/MECH. EQUIPMENT.
INSTALL O.S.&Y VALVE 7'-0" ABOVE FLOOR
CORRIDOR 202
1 1/2" HUB DRAIN UP ABOVE CEILING FOR COOLING COIL DRAIN. TYP. OF 4
SEE SHT. M-2 FOR CONTINUATION OF PIPING
FOYER 201
OFFICE 223
CONN. 1 1/4" DRAIN TO COIL DRAIN PAN, TYPICAL OF 5.
WORKROOM 224
SPEC. ED. 229
SEE SITE PLAN FOR CONTINUATION OF PIPING
HEALTH 226
PRINCIPAL 227
2" VTR
FACULTY 228
1 1/2" VTR
CONNECT TO DWYER UNIT SINK
4" SD UP TO ROOF DRAIN, SEE SITE PLAN FOR CONT.
SEE SITE PLAN FOR CONTINUATION OF PIPING
4" SD UP TO RD. OFFSET ABOVE CLG. & DROP DN. IN WALL.
CAFETERIA 242
HB-1 UNDER DF
STORAGE 216
FHC
SPRINKLER HEAD: STAR MODEL 'D', TYPICAL.
PLATFORM 217
MUSIC 219
YARD MAINT. 220
PIPES ABOVE CLG. INSTALL BELOW CLG. INSULATION. SEE DETAIL M-2 1
MAINT. 221
CONNECT 4" Ø SD TO DS & CAULK WATERTIGHT AT CONNECTION. SEE SITE PLAN FOR CONT. TYPICAL OF 6
FLOW SWITCH
CHECK VALVE
BALANCING COCK
CAP 1 1/2" CW FOR FUTURE CONNECTION
STORAGE 235
PLUG 4" WASTE FOR FUTURE CONNECTION, INV. ELEV. - 261.3'.
2" VTR - COMBINE VENTS HERE
1 1/2" CW ON TO KETTLE FILLER. PROVIDE 4" Ø STAINLESS STEEL SHROUD.
1 1/2" VTR
KITCHEN 237
3/4" CW TO WATER COOLED COMPRESSOR & 3/4 DRAIN TO FD.
SPRAY RINSE
BOOSTER HEATER 2
2" VTR, COMBINE VENTS HERE
GARBAGE CAN WASH
HALL 240
KITCHEN STORAGE 241
DROP BOX STORAGE

NOTES

1. BOILED DISH SINK & DISPOSAL FURNISHED BY OTHERS. PLUMBER SHALL PROVIDE CONNECTIONS TO INCLUDE TRAP, SUPPLIES, STOPS & WATER.
2. BOOSTER HEATER FURNISHED BY OTHERS. SEE DETAIL M-2 1 FOR CONNECTIONS.
3. DISHWASHER FURNISHED BY OTHERS. PLUMBER SHALL PROVIDE CONNECTIONS TO INCLUDE TRAP, SUPPLIES, STOPS & WATER.
4. POT SINK FURNISHED BY OTHERS. PLUMBER SHALL PROVIDE CONNECTIONS TO INCLUDE TRAP, SUPPLIES, STOPS & WATER.

M-4 A BUILDING 200 FLOOR PLAN - PLUMBING

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

PLUMBING PLAN - BUILDING 200

SW. BROCKMAN ROAD AND SW. DAVIES ROAD BEAVERTON OREGON

ELEMENTARY SCHOOL - SCHOOL DISTRICT 48

WASHINGTON COUNTY OREGON

BEAVERTON

WILLIAMS & EHMANN AIA
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PORTLAND, ORE. 97202

SHEET M-4

NOTES THIS SHEET

1. COMBINE EXH. DUCTS TO 16"ϕ. RUN UP EF ON ROOF
2. COORDINATE CEILING DIFFUSER LAYOUT W/ LIGHTS & T-BAR GRID
3. RAISE SA DUCT TO RUN ABOVE RA DUCT
4. INSTALL FIRE DAMPERS IN ALL GRILLES + DIFFUSERS PENETRATING CEILINGS.
6. INSTALL GRAVITY ROOF VENTILATOR, 24x24 NECK SIZE. PACE SKY-CAP WITH BIRD SCREEN.
7. INSTALL VOLUME DAMPERS IN ALL BRANCH DUCTS.
8. INSTALL 24x24 ACCESS PANEL TO EQUIP. ABOVE CEIL. COORDINATE WITH CEIL. PATTERN + LIGHT FIXTURES AND FOR CLEAR ACCESS.
9. INSTALL GALVANIZED STEEL DRAIN PANS UNDER COILS WITH 1¼" DRAIN CONNECTIONS
10. PROVIDE 2-SPEED SWITCH FOR EXHAUST FANS FOR ELECTRICAL CONTRACTOR TO INSTALL

(M-5 A) BUILDING 200 FLOOR PLAN - AIR CONDITIONING
SCALE 1/8"=1'-0"

AIR CONDITIONING PLAN - BUILDING 200
SW. BROCKMAN ROAD AND SW. PAYNE ROAD
BEAVERTON OREGON

ELEMENTARY SCHOOL - SCHOOL DISTRICT 48
BEAVERTON WASHINGTON COUNTY OREGON

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CORRN 7-8-74
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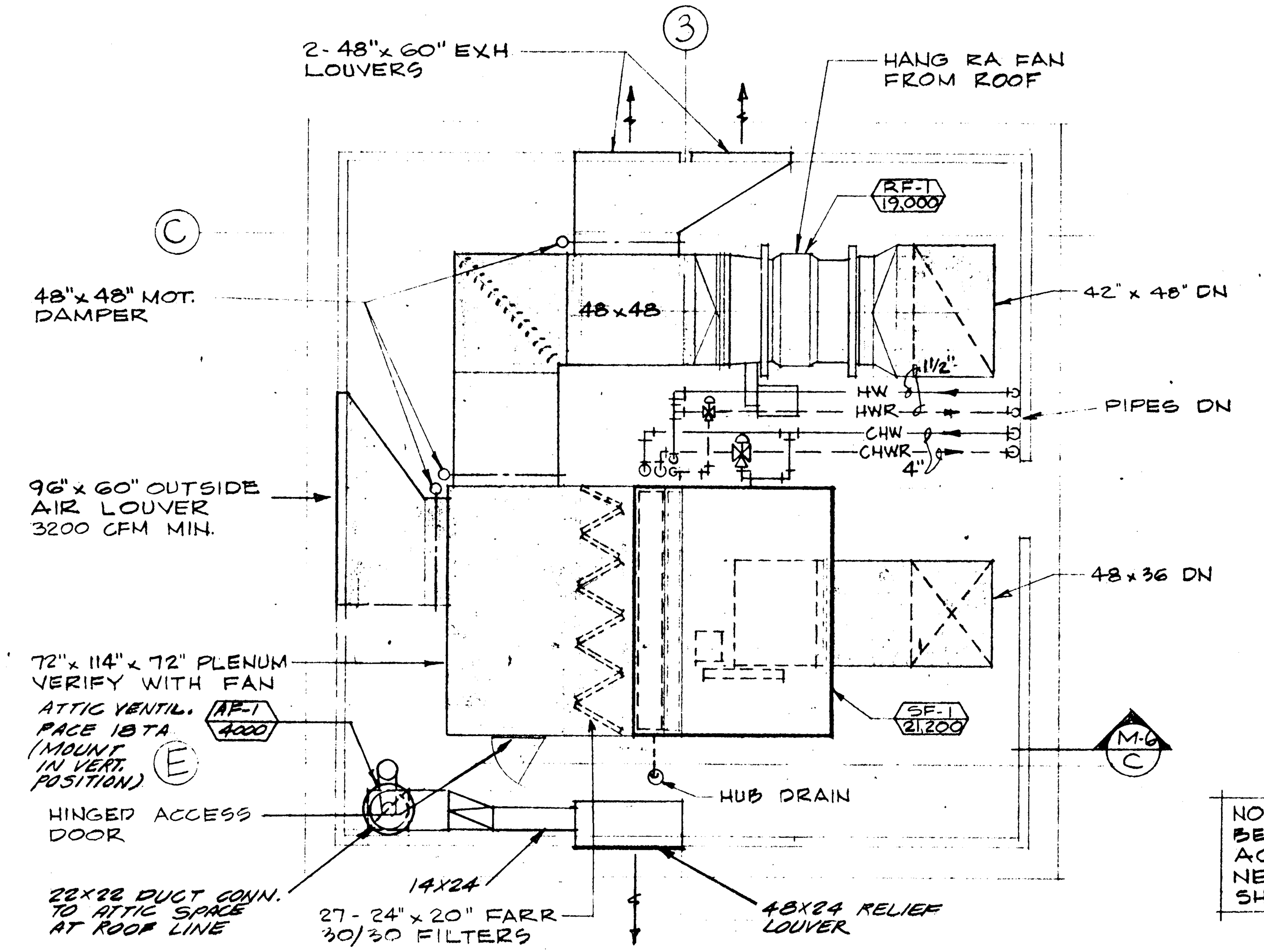
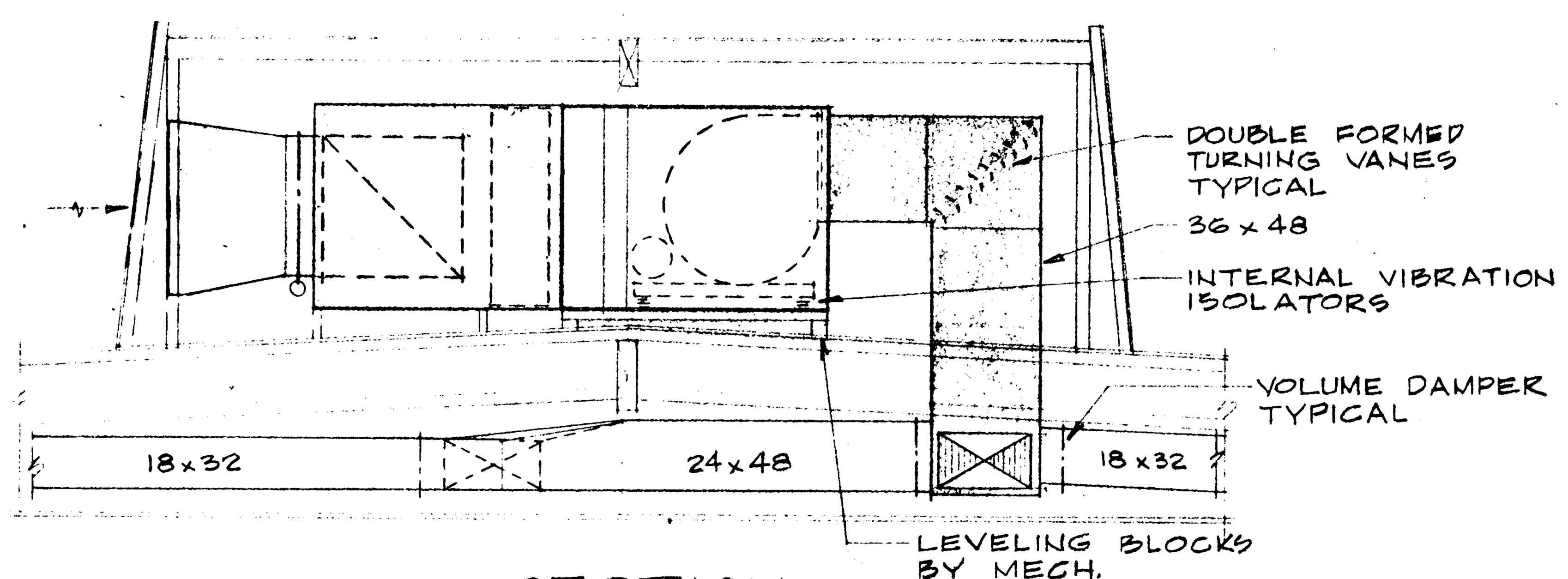
REGISTERED PROFESSIONAL ENGINEER 6436 OREGON JAMES R. McGINNIS MAY 7, 1969

SHEET M 5 OF 11

DATAPRINT STOCKDRAFTING FORM NO. 101-84

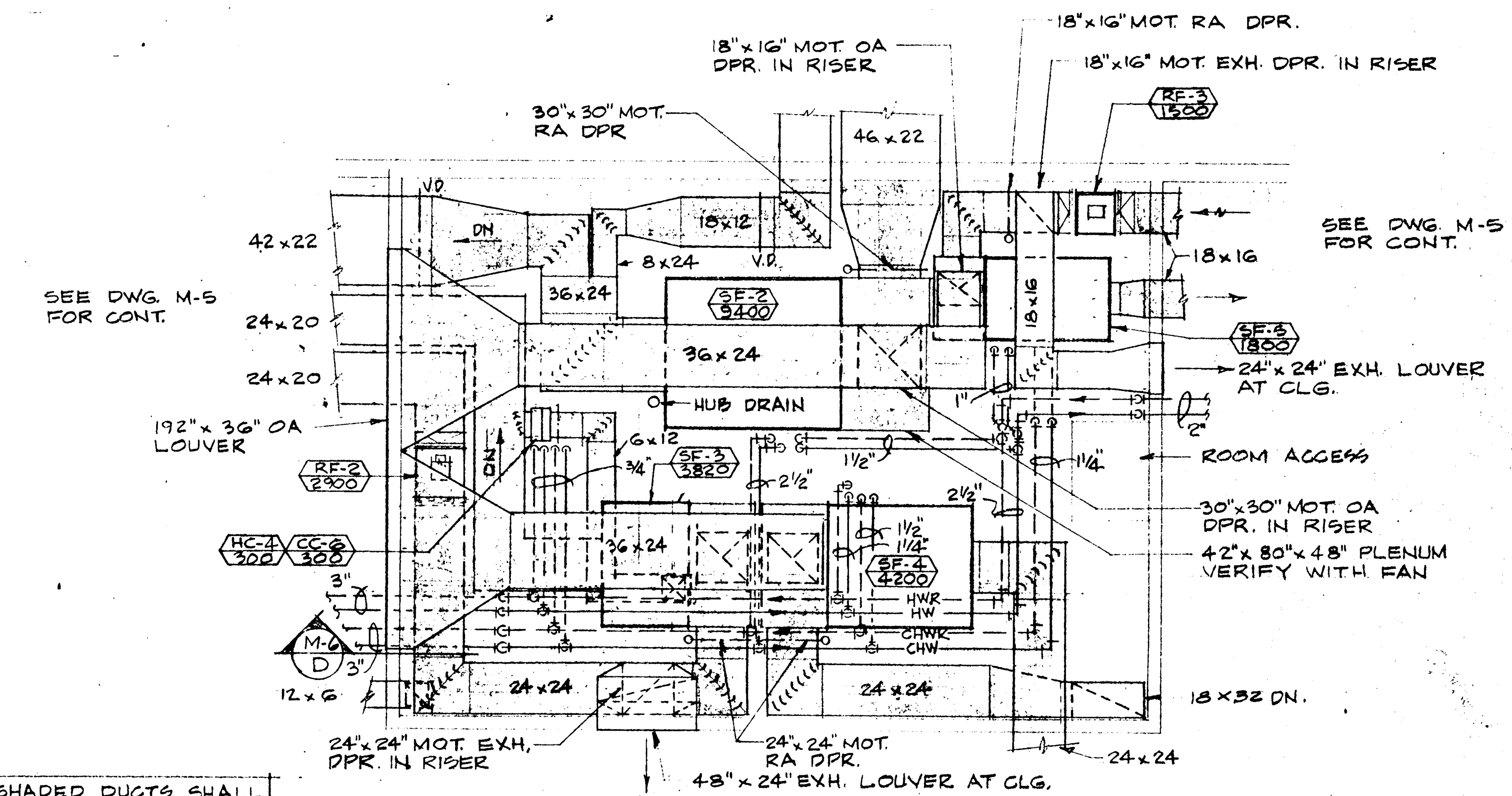


M-6 A BUILDING 100 MECH. ROOM PLAN
SCALE 1/4" = 1'-0"

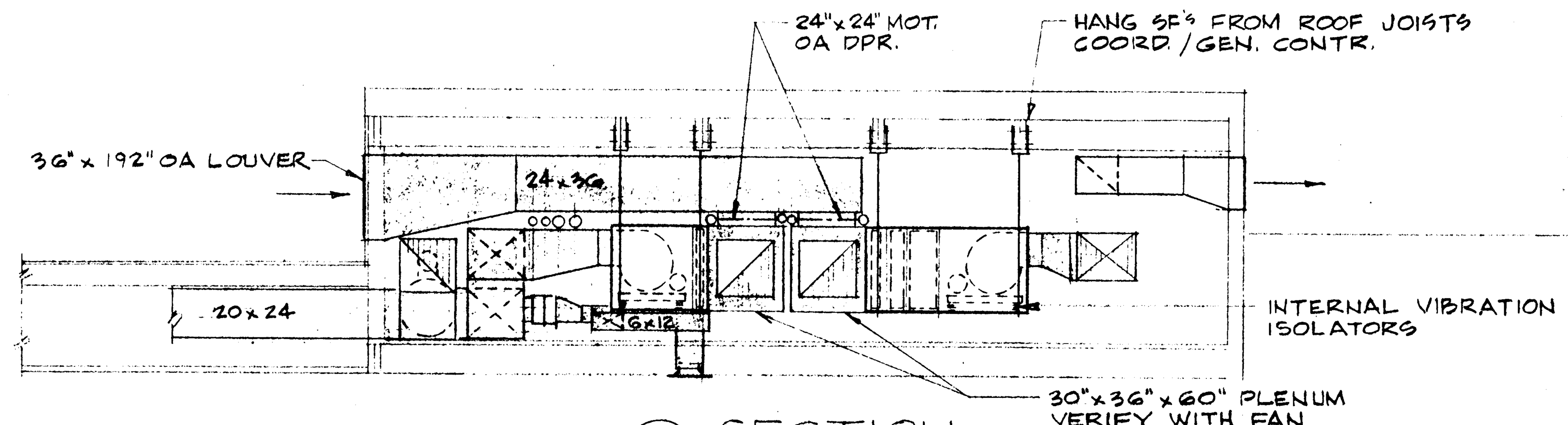


M-6 A SECTION
SCALE 1/4" = 1'-0"

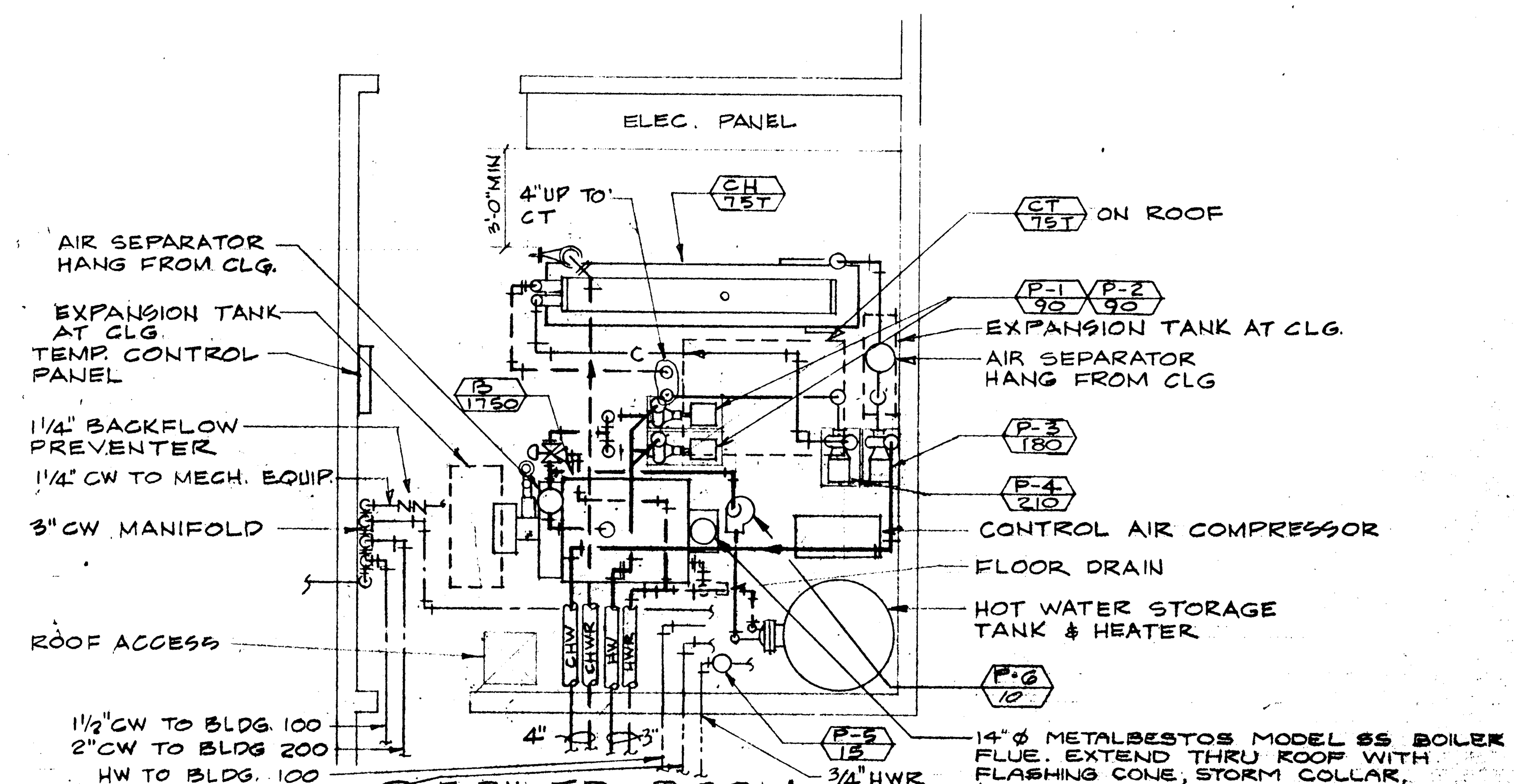
NOTE: ALL SHADED DUCTS SHALL BE LINED WITH 1" THICK ACOUSTICAL DUCT LINING NET AIR PASSAGE SIZES SHOWN



M-6 B BUILDING 200 MECH. ROOM PLAN
SCALE 1/4" = 1'-0"



M-6 D SECTION
SCALE 1/4" = 1'-0"



M-6 E BOILER ROOM
SCALE 1/4" = 1'-0"

MECHANICAL ROOM PLANS

SW. BROCKMAN ROAD AND SW. DAVIES ROAD
BEAVERTON OREGON

ELEMENTARY SCHOOL - SCHOOL DISTRICT 48
BEAVERTON WASHINGTON COUNTY OREGON

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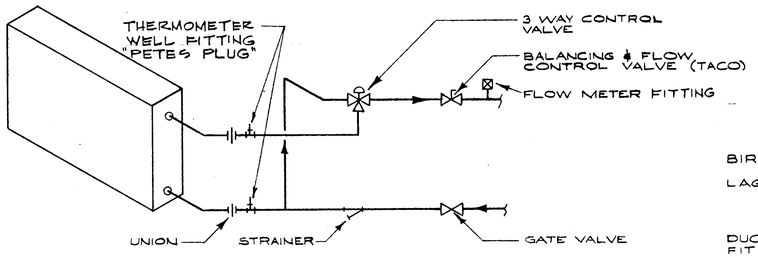
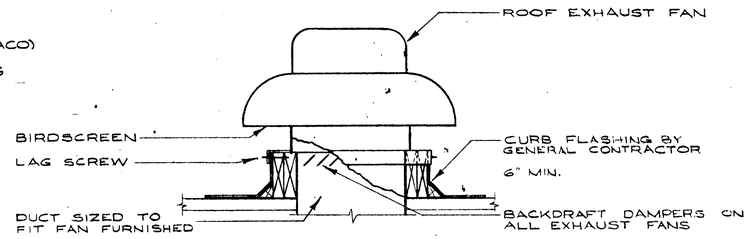
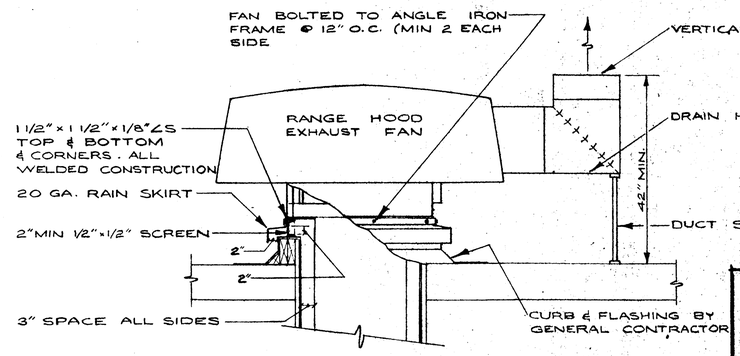
SHEET M 6
of 11



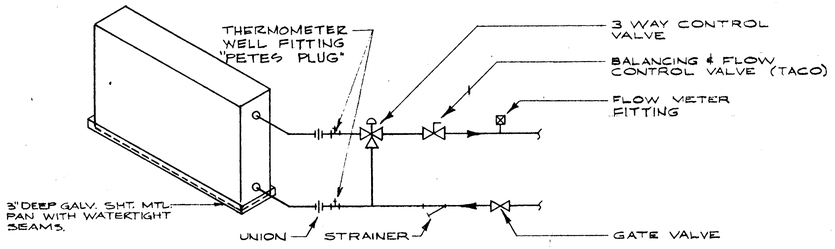
M-7/1 HEATING COIL DIAGRAM



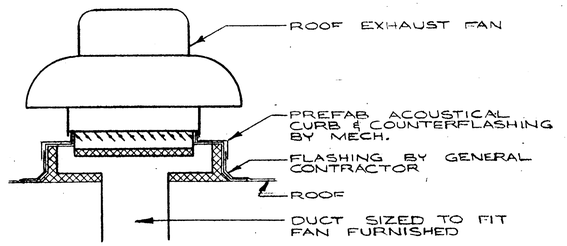
M-7/3 ROOF EXHAUST FAN DETAIL
NTS.



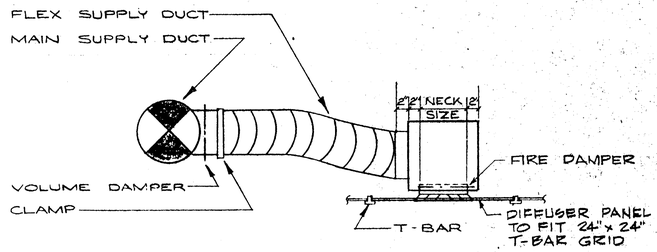
M-7/5 RANGE HOOD EXHAUST FAN DETAIL SCALE: 3/4"=1'-0"



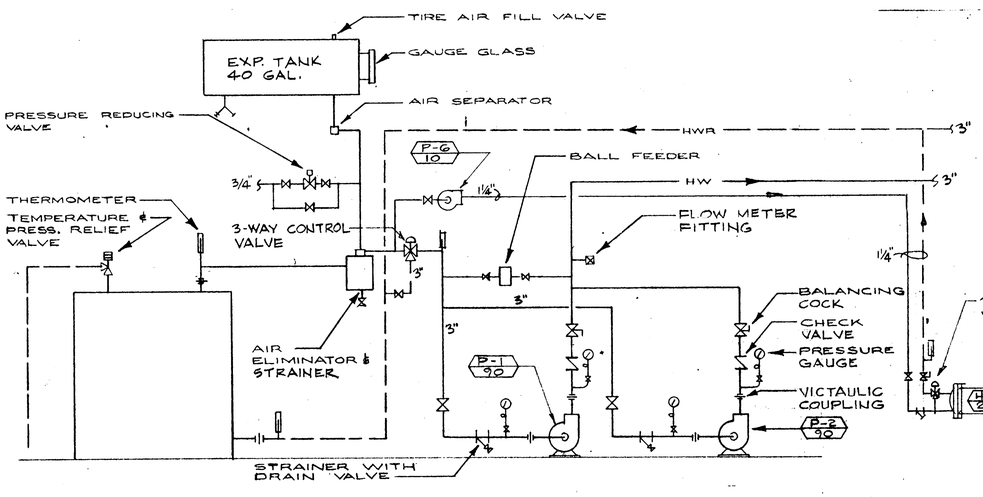
M-7/2 CHILLED WATER COIL DIAGRAM



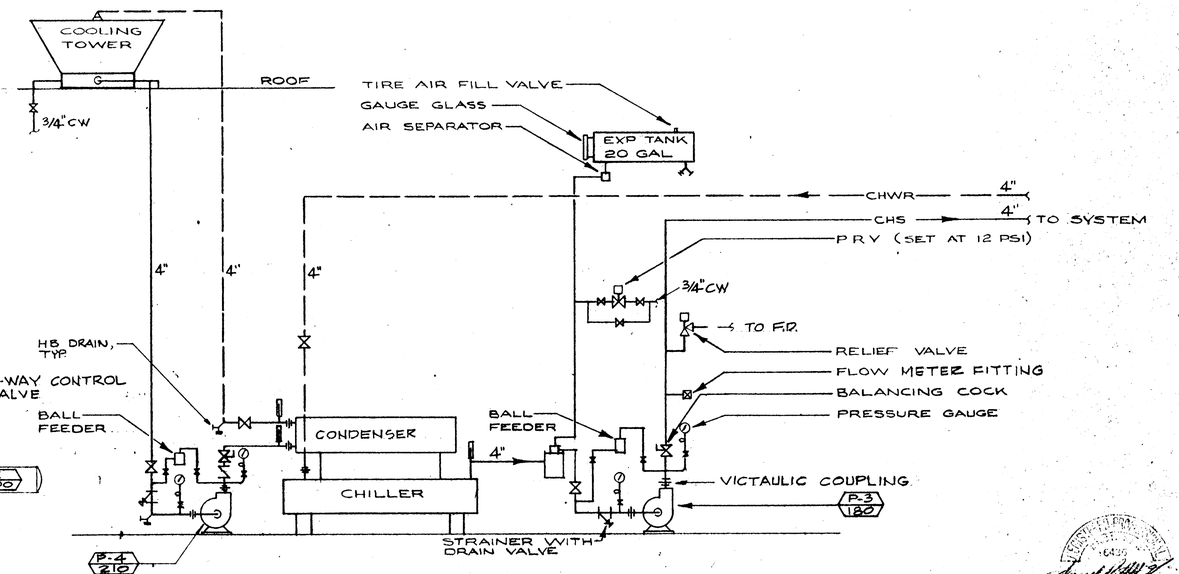
M-7/4 EXHAUST FAN DETAIL SOUND CURB N.T.S.



M-7/6 DIFFUSER NO. 1
N.T.S.



M-7/7 BOILER PIPING DIAGRAM



M-7/8 CHILLER PIPING DIAGRAM

DETAILS & FLOW DIAGRAMS

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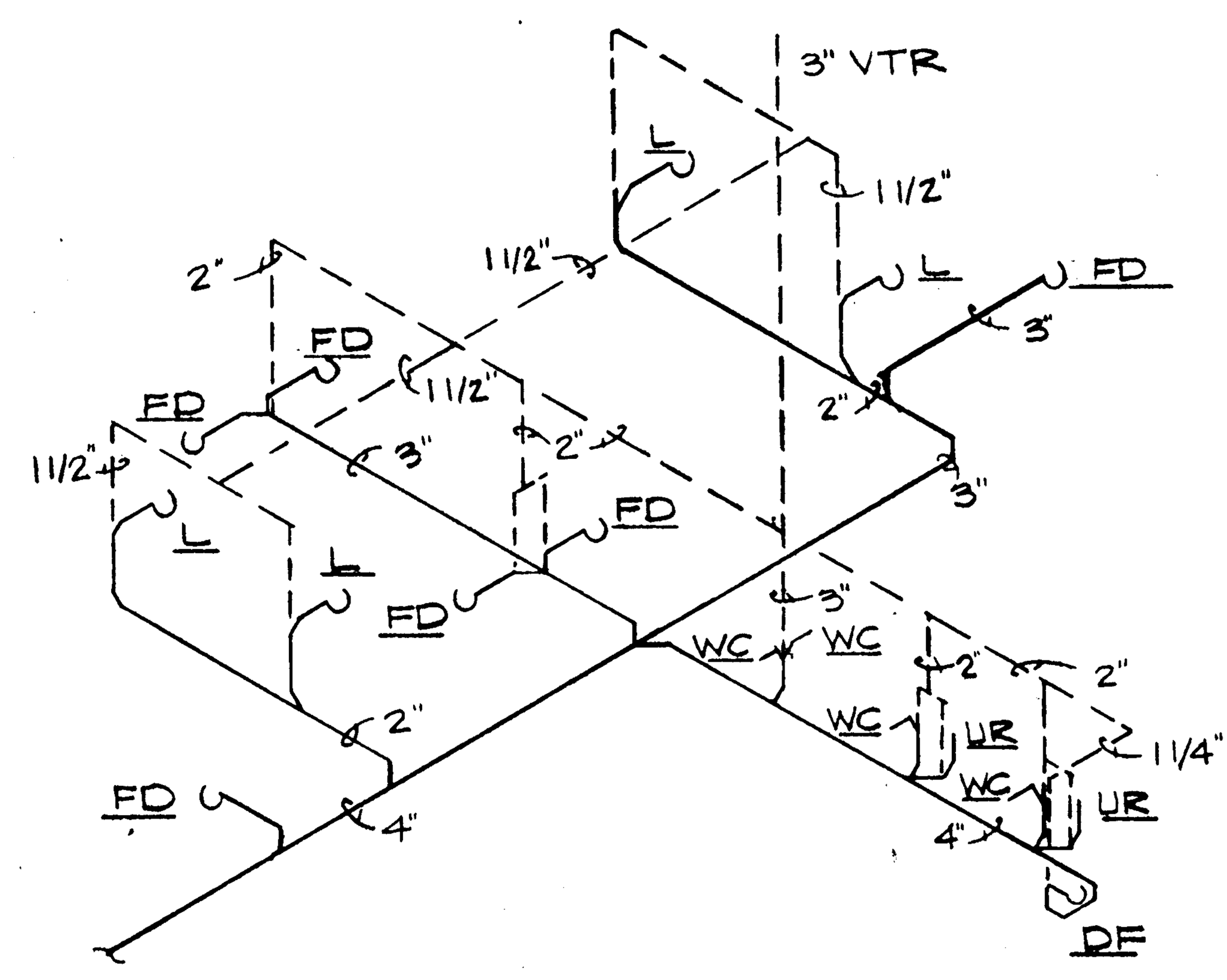
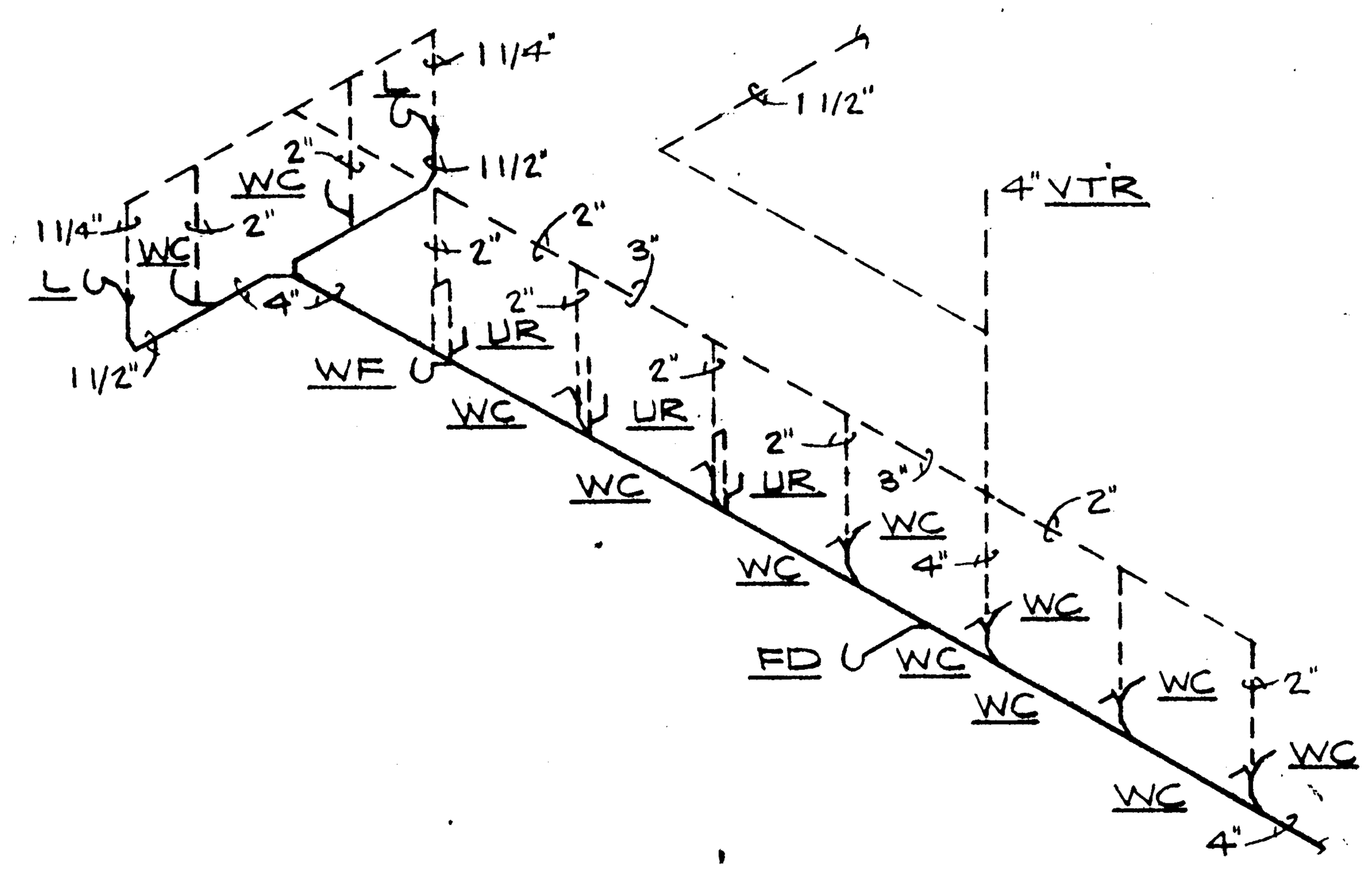
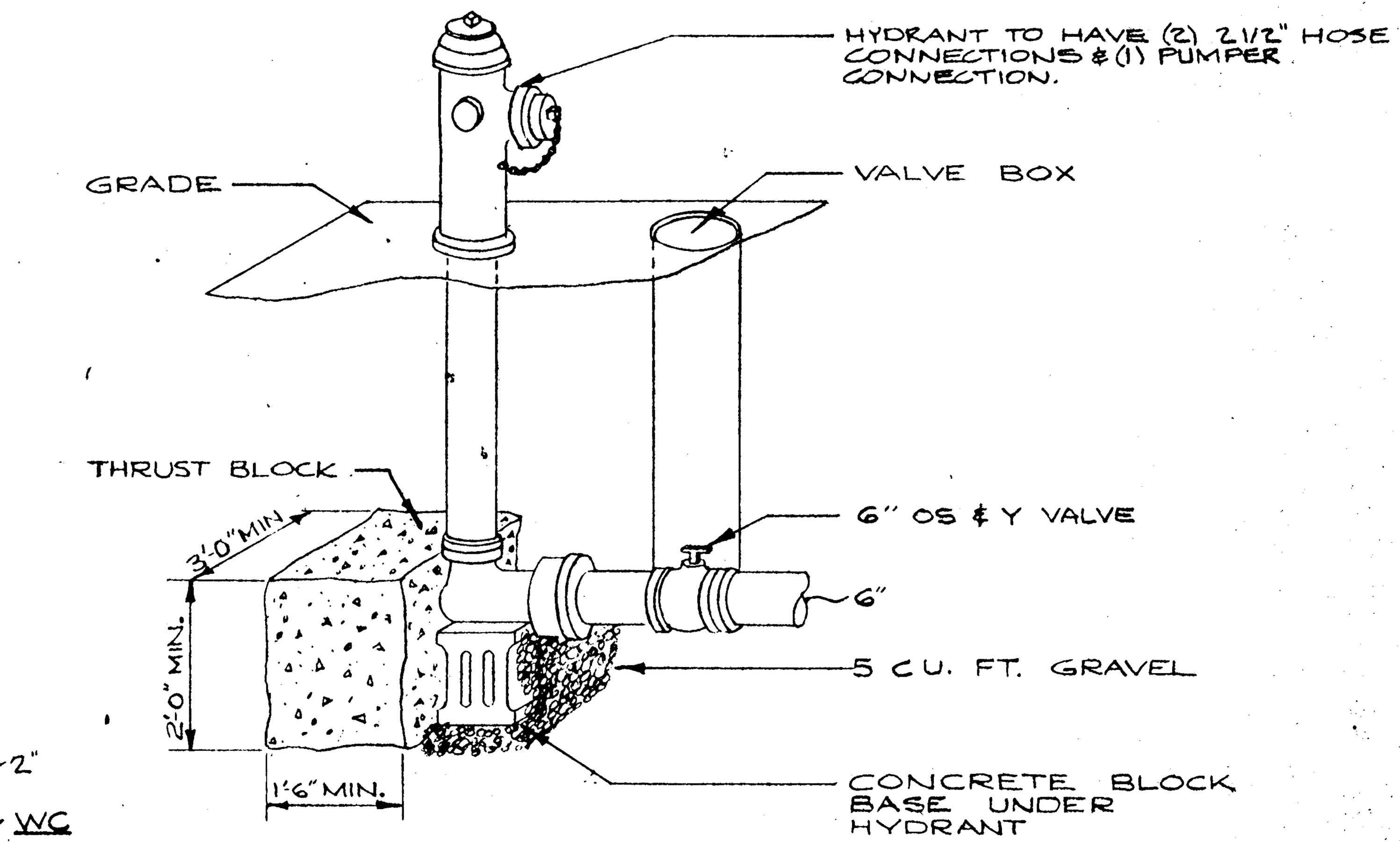


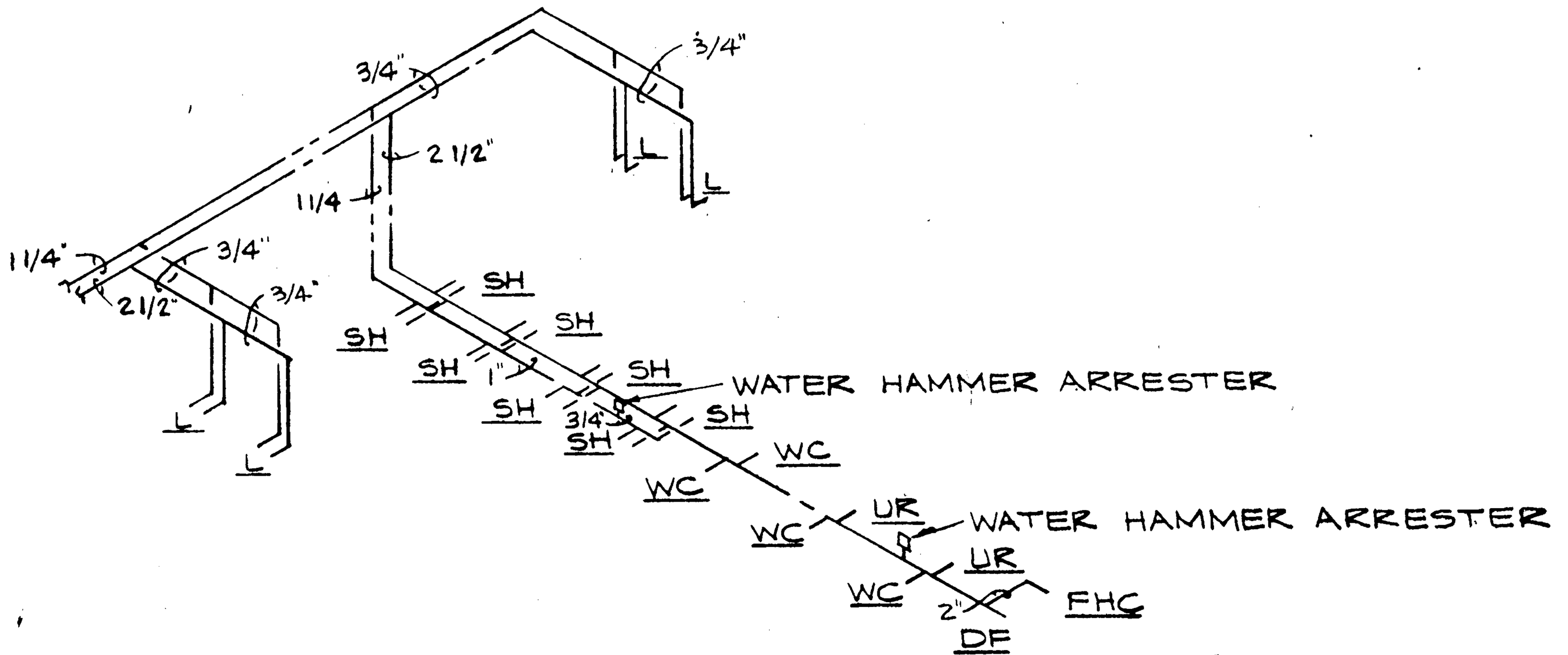
M-8 1 WASTE & VENT RISER



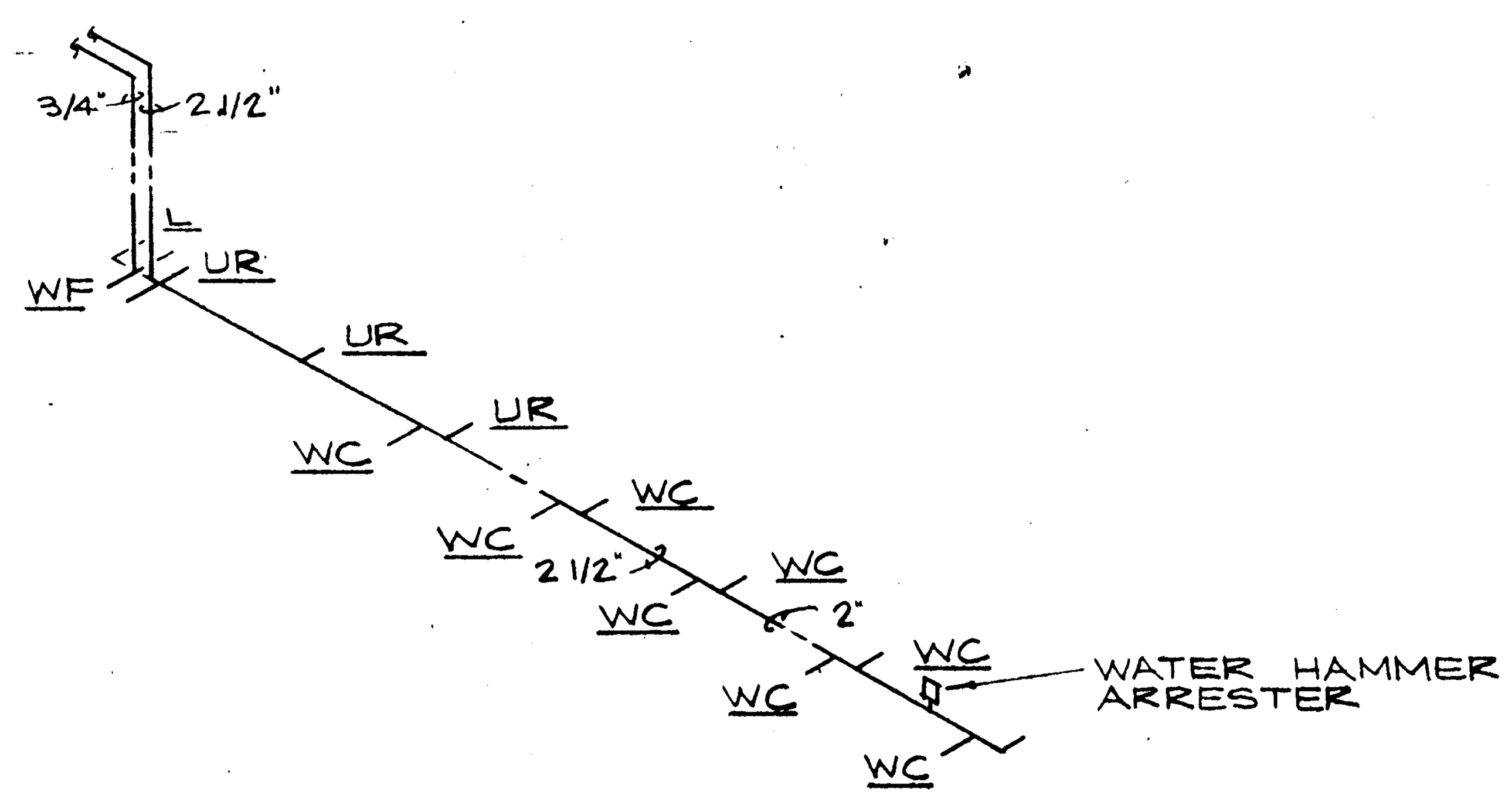
M-8 2 WASTE & VENT RISER



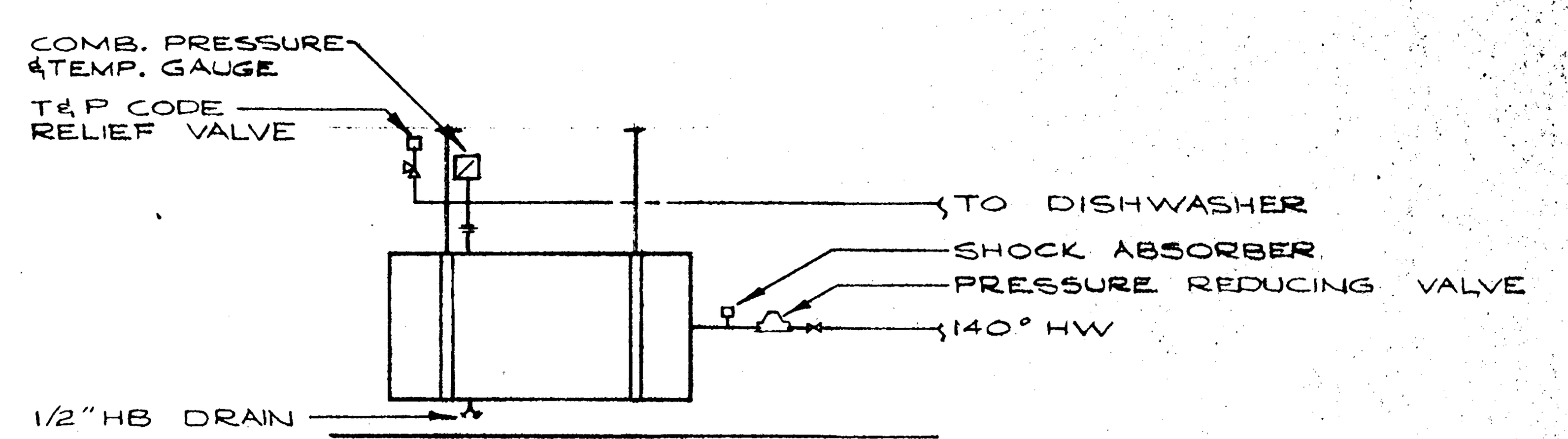
M-8 6 FIRE HYDRANT DETAIL



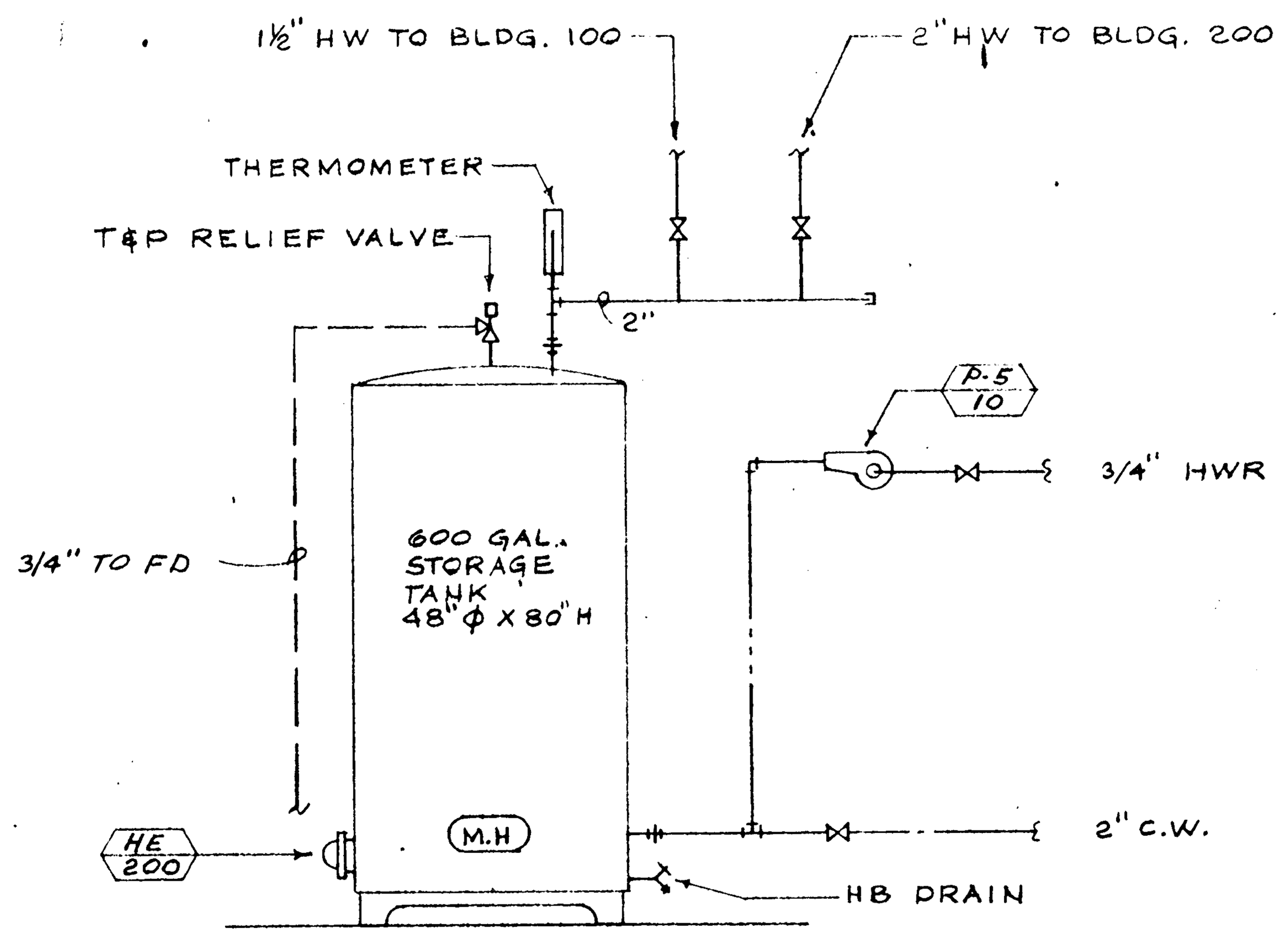
M-8 A HOT & COLD WATER RISER



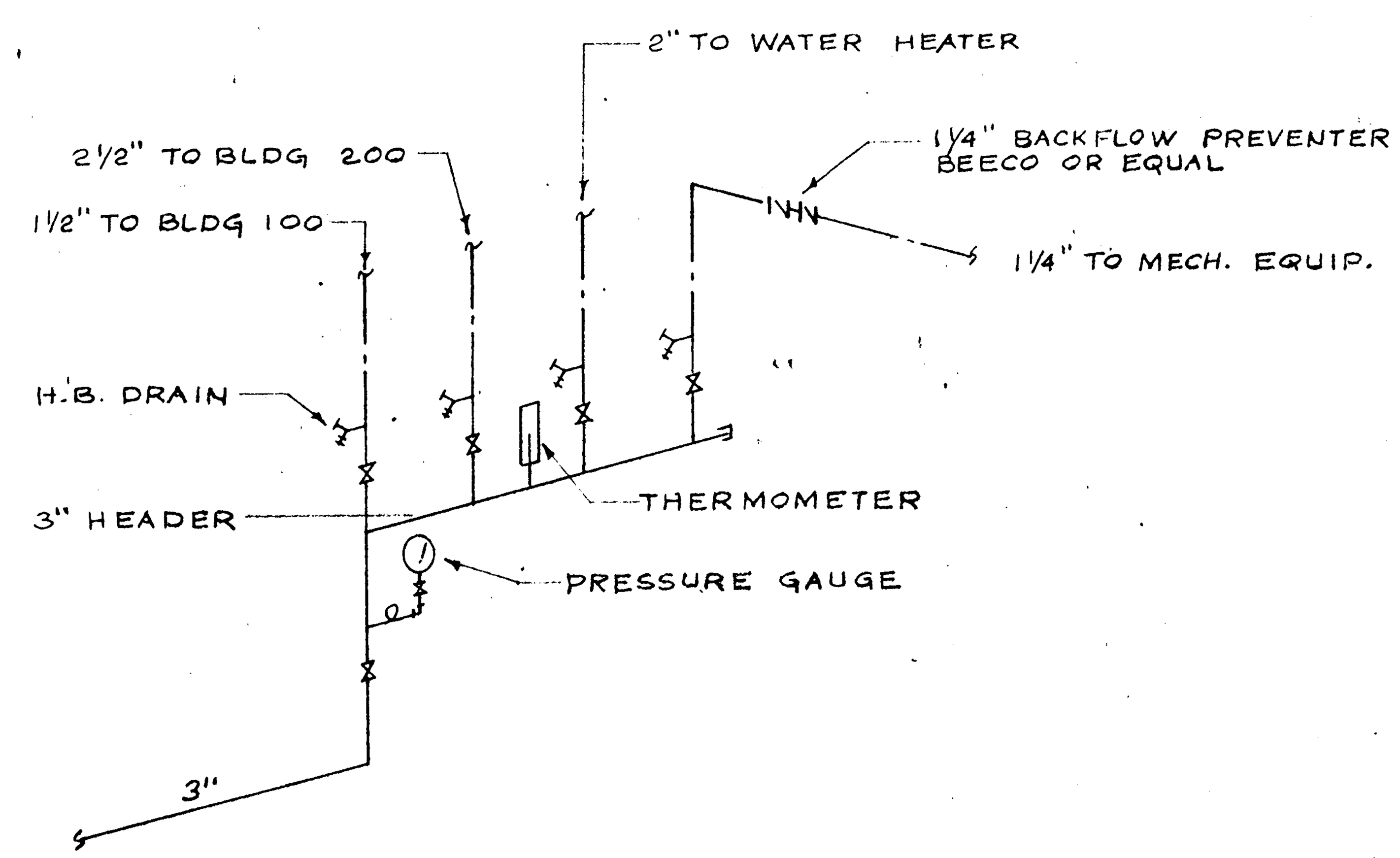
M-8 B HOT & COLD WATER RISER



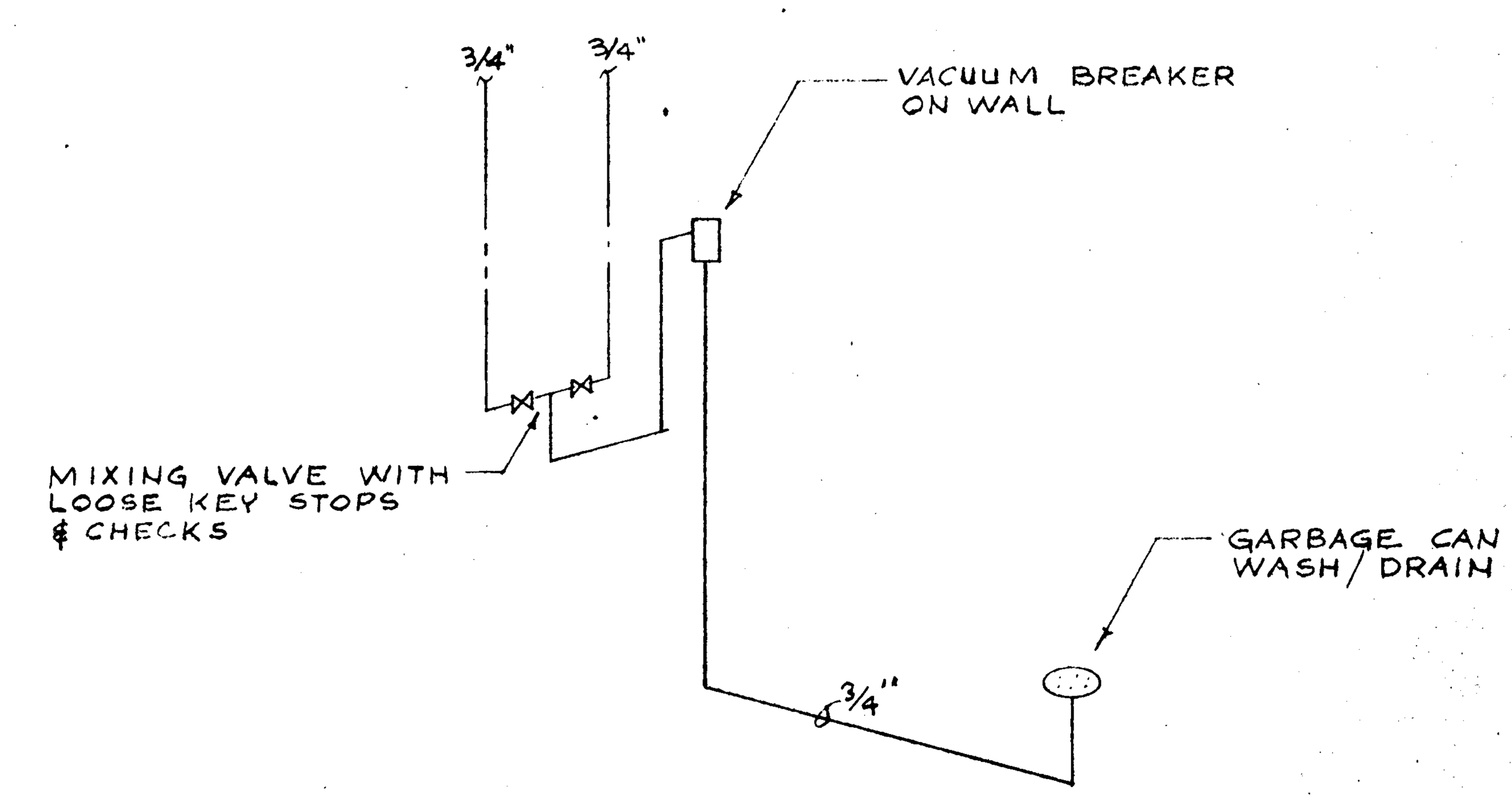
M-8 7 DISHWASHER BOOSTER HEATER DETAIL



M-8 3 WATER HEATER PIPING DIAGRAM



M-8 4 CW MANIFOLD



M-8 5 GARBAGE CAN WASH PIPING DIAGRAM

PLUMBING DETAILS

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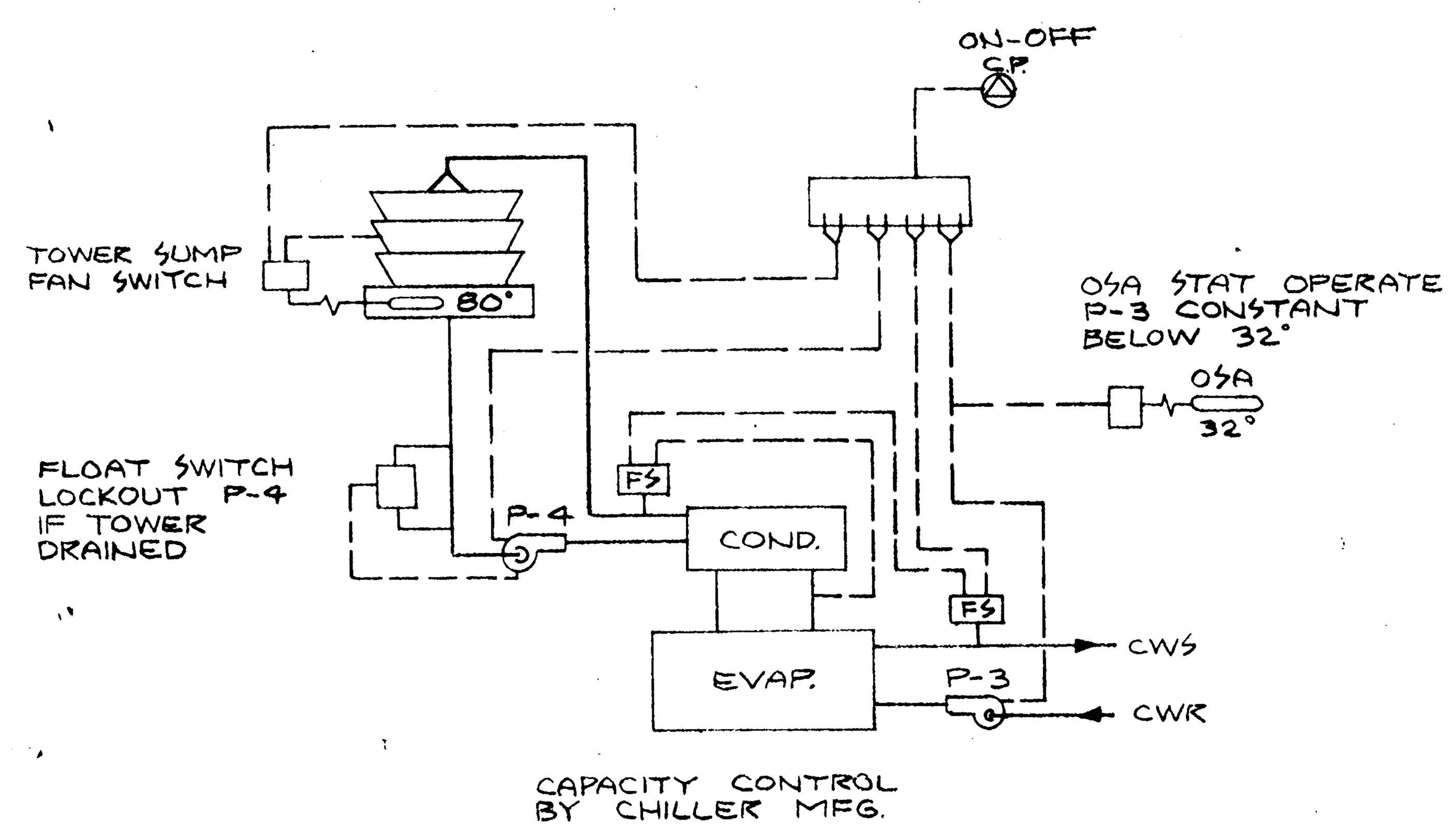
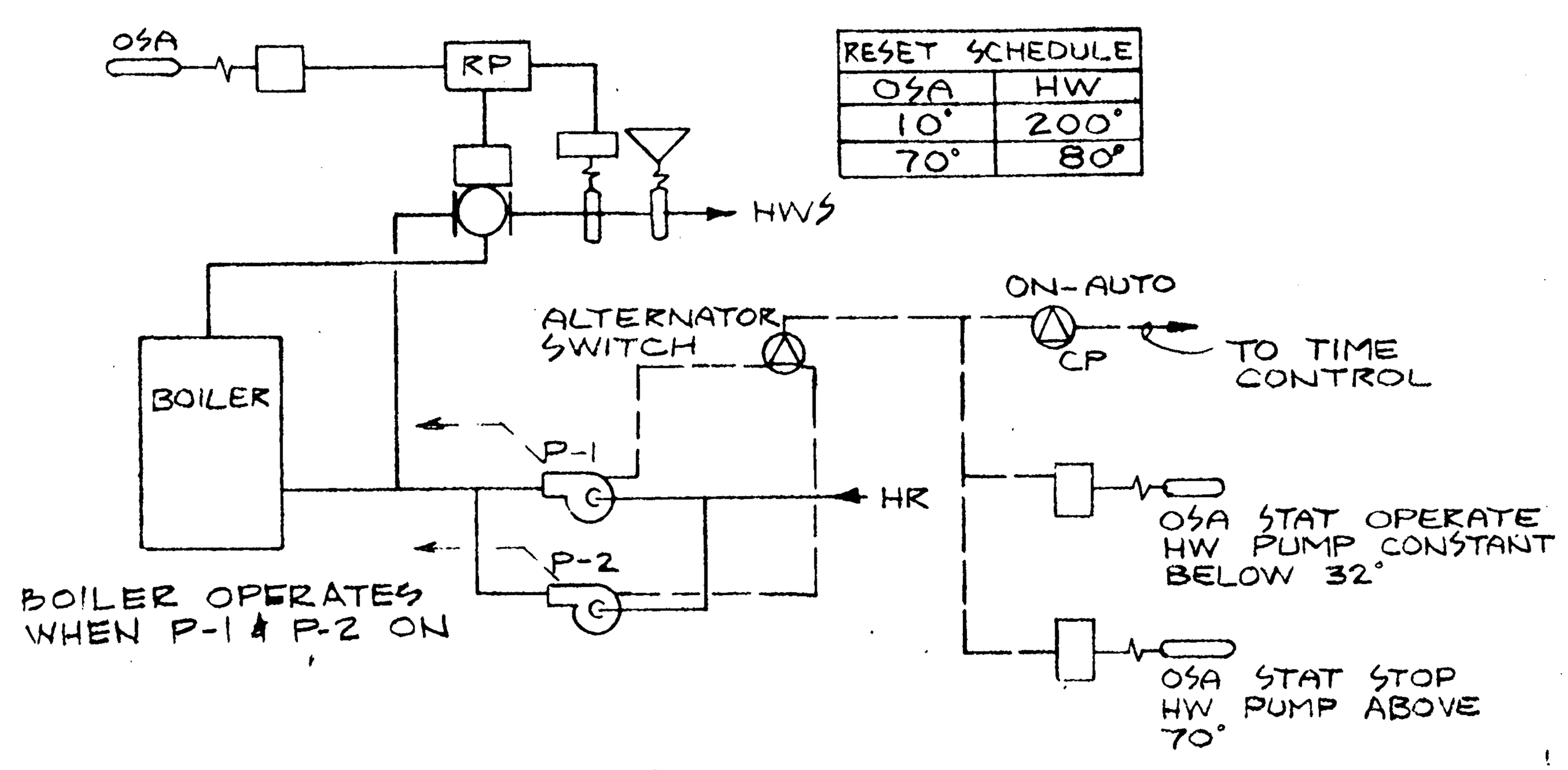
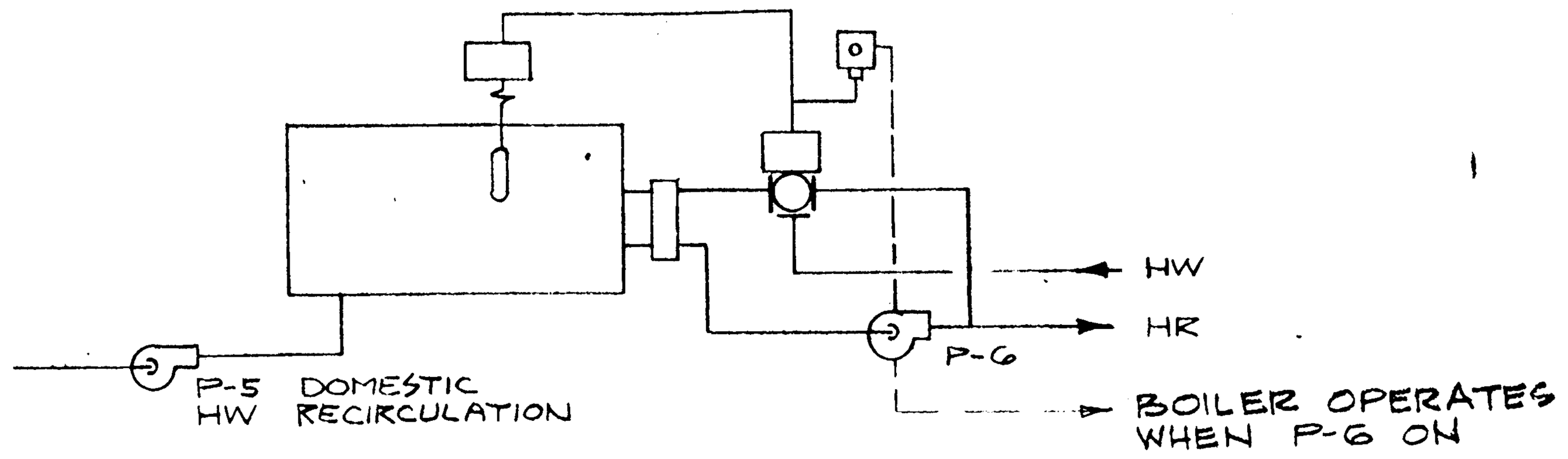


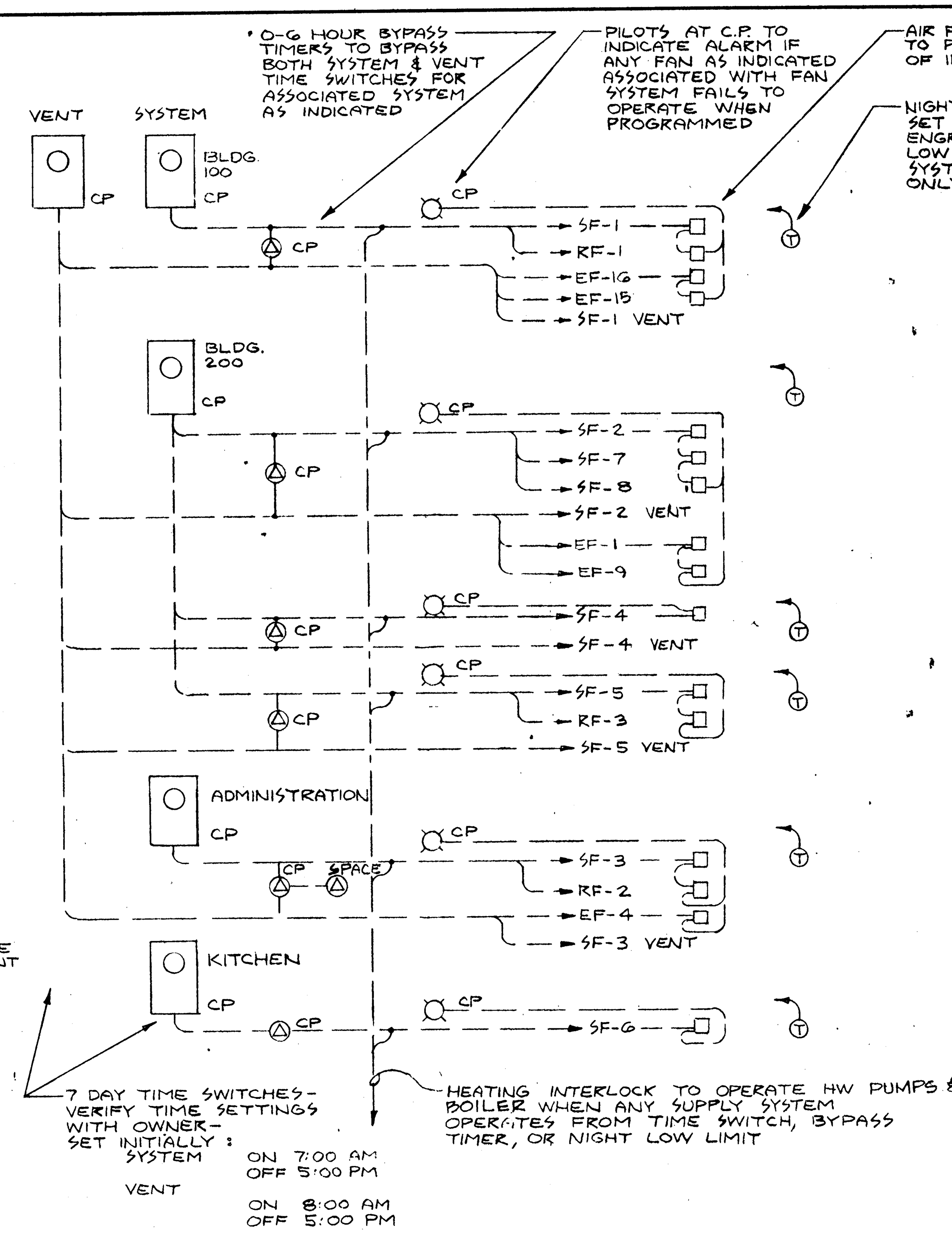
M-9 1 CHILLER



BOILER



M-9 2 DOMESTIC HOT WATER



M-9 3 TIME CONTROL

TEMPERATURE CONTROL LEGEND

CP CENTRAL PANEL
EA EXHAUST AIR
RA RETURN AIR
OSA OUTSIDE AIR
WIRING
CONTROL TUBING
PNEUMATIC RELAY
EP (ELECTRIC OPERATED)
KP RESET PANEL (SUBMASTER INSTRUMENT)
PILOT LIGHT
ON-OFF SWITCH (ELECTRIC)
ANY RELAY OR MISCELLANEOUS DEVICE AS NOTED
DP DIFFERENTIAL PRESSURE INDICATOR OR CONTROLLER

NC NORMALLY CLOSED
FU NON-FREEZE
LSFS CONNECT TO LOAD SIDE OF FAN STARTER
DAMPER MOTOR
2-WAY CONTROL VALVE
3-WAY CONTROL VALVE
FS FLOW SWITCH
NO NORMALLY OPEN
DUCT THERMOSTAT - 15" AVERAGING TYPE SENSING ELEMENT
R CONTROL POINT W/ MANUAL REMOTE READJUSTMENT

THERMOSTAT * HC: HEATING COOLING TYPE; HG: HEAVY DUTY GUARD; DN: 2 TEMPERATURE DAY-NIGHT TYPE; G: GUARD; NLL: NIGHT LOW LIMIT; AS: ACCESSIBLE SETTING W/LIMIT STOPS

IMMERSION THERMOSTAT * R = AUTOMATIC RESET W/RESET CUT-OUT; RC: RECORDING CONTROLLER

INDICATION POINT ELEMENTS AS SHOWN FOR THERMOSTAT + T: TEMPERATURE; P: PRESSURE; D: DEW POINT; H: HUMIDITY — CP, LP, PM INDICATES LOCATION OF READ-OUT(S)

PNEUMATIC SWITCH * G: GRADUAL; T: 2 POSITION

CONTROL DIAGRAMS
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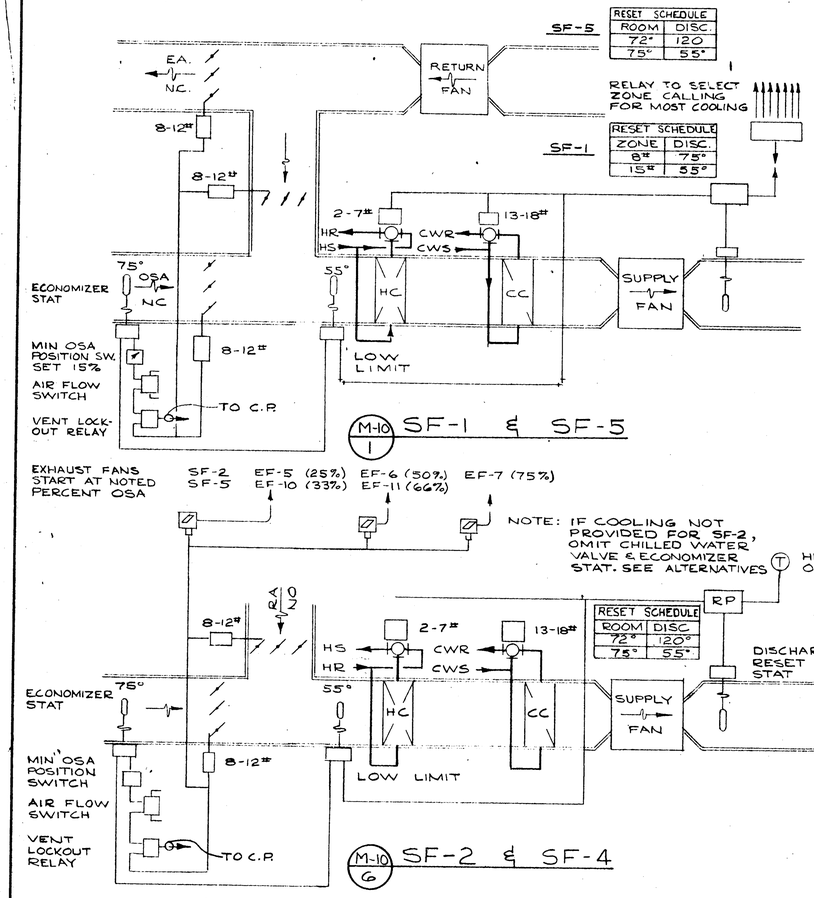

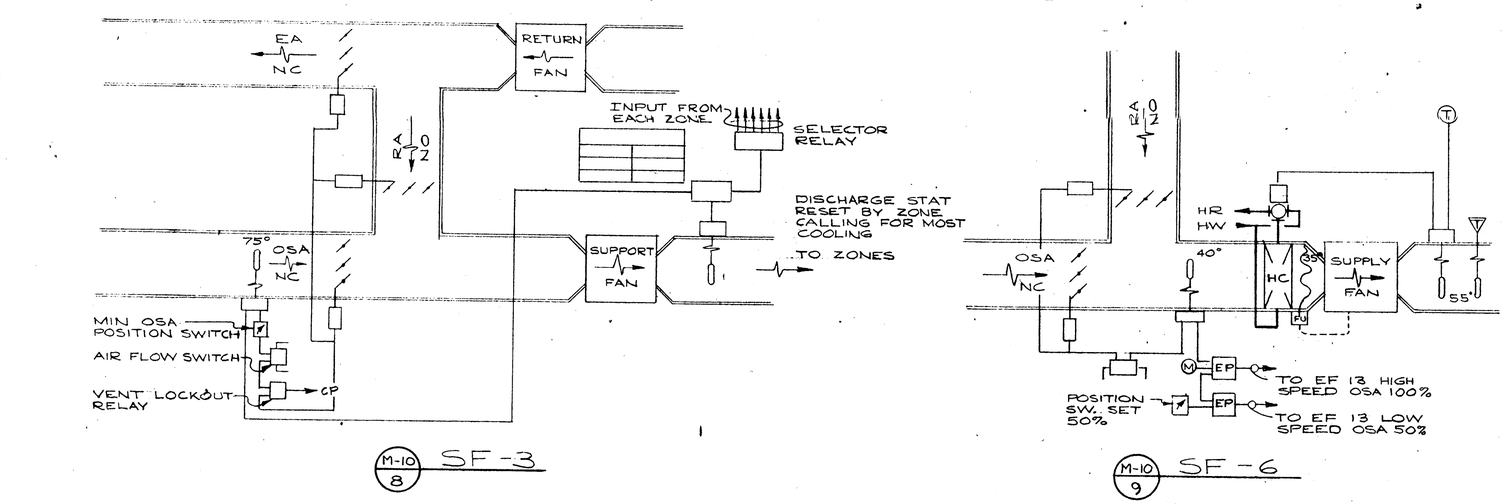

CONTROL SEQUENCE

SF-1: SUPPLY RETURN FANS START FROM CENTRAL TIME CONTROL SYSTEM. ROOM STAT OPERATES VARIABLE VOLUME BOX OR RADIATION CONTROL VALVE THROUGH LOWER HALF OF CONTROL RANGE. UPPER HALF OF CONTROL RANGE OF STAT CALLING FOR MOST COOLING RESETS UNIT DISCHARGE STAT. DISCHARGE STAT OPERATES UNIT HEATING VALE, DAMPERS, & UNIT COOLING VALVE IN SEQUENCE. OUTSIDE AIR CLOSES TO MINIMUM ABOVE 75° OUTSIDE. OUTSIDE AIR CLOSED ON FAN STOP & UNIT VENTILATION ALLOWED BY CENTRAL TIME CONTROL SYSTEM.

SF-2: SUPPLY FAN STARTS FROM CENTRAL TIME CONTROL SYSTEM. ROOM STAT RESETS CONTROL POINT OF DISCHARGE STAT. DISCHARGE STAT OPERATES UNIT HEATING VALVE, DAMPERS, & UNIT COOLING VALVE IN SEQUENCE, OUTSIDE AIR CLOSES TO MINIMUM ABOVE 75° OUTSIDE. OUTSIDE AIR CLOSED ON FAN STOP & UNTIL VENTILATION ALLOWED BY CENTRAL TIME CONTROL SYSTEM. SF-5,6,&7 INTERLOCKED TO OPERATED WHEN OSA DAMPER 25%, 50% & 75% OPEN RESPECTIVELY.

SF-3: SUPPLY AND RETURN FANS START FROM CENTRAL TIME CONTROL SYSTEM. PERIMETER ZONE ROOM STATS OPERATE RADIATION VALVES THROUGH LOWER THIRD OF RANGE, RESET UNIT THROUGH MIDDLE THIRD OF RANGE, & OPERATE ZONE COOLING COIL THROUGH UPPER THIRD OF RANGE. INTERIOR ZONE ROOM STATS OPERATE ZONE HEATING COIL THROUGH LOWER THIRD OF RANGE, RESET UNIT THROUGH MIDDLE THIRD OF RANGE, & OPERATE ZONE COOLING COIL THROUGH UPPER THIRD OF RANGE. RELAX SELECTS ZONE CALLING FOR GREATEST COOLING WHICH RESETS UNIT DISCHARGE STAT THROUGH MIDDLE THIRD OF RANGE. DISCHARGE STAT OPERATES DAMPERS. OUTSIDE AIR CLOSES TO MINIMUM ABOVE 75° OUTSIDE. OUTSIDE AIR CLOSES ON FAN STOP & UNTIL VENTILATION ALLOWED BY CENTRAL TIME CONTROL SYSTEM.

SF-4: OPERATES AS NOTED FOR SF-2 EXCEPT EF-10 AT 33% & EF-11 AT 66% ARE INTERLOCKED EXHAUST FANS.

SF-5: OPERATES AS NOTED FOR SF-1 EXCEPT DISCHARGE STAT RESET BY SINGLE UNIT ROOM STAT.

SF-6: SUPPLY FAN STARTS FROM CENTRAL TIME CONTROL SYSTEM ROOM STAT & DISCHARGE, LOW LIMIT OPERATE UNIT HEATING VALVE. ANTIFREEZE STAT STOPS FAN. OUTSIDE AIR OPEN 50% IF EF-13 ON LOW SPEED & TO 100% IF EF-13 ON HIGH SPEED. OUTSIDE AIR SUBJECT TO MIXED AIR LOW LIMIT. OUTSIDE AIR CLOSED ON FAN STOP.

SF-7: SUPPLY FAN STARTS FROM CENTRAL TIME CONTROL SYSTEM. ROOM STAT OPERATES HEATING COIL VALVE.

SF-8: OPERATES AS NOTED FOR SF-7.

CUH: RETURN AIR THERMOSTAT CYCLES FAN SUBJECT TO AQUASTAT WHICH KEEPS FAN OFF UNLESS HEATING AVAILABLE.

AF: ATTIC STAT CYCLES FAN WITH OPERATION ABOVE 50°.

DOMESTIC HOT WATER: TANK STAT OPERATES HEATING VALVE. P-6 ON IF VALVE OPEN. RETURN LINE AQUASTAT CYCLES RECIRCULATION PUMP P-5.

BOILER: P-1 OR P-2 OPERATE FROM CENTRAL TIME CONTROL SYSTEM SUBJECT TO ON-AUTO SWITCH. PROVIDE ALTERNATOR SWITCH. SELECTED PUMP OFF ABOVE 75° OUTSIDE & OPERATES CONSTANT BELOW 32° OUTSIDE REGARDLESS OF OTHER CONTROL. MAIN HEATING 3-WAY VALVES CONTROLLED BY DISCHARGE STAT RESET BY OUTSIDE STAT. BOILER OPERATES WHEN P-1, P-2 OR P-6 ON

CHILLER: SYSTEM OPERATES FROM CENTRAL TIME CONTROL SYSTEM SUBJECT TO AUTO-OFF SWITCH. IF OPERATION PROGRAMMED & OSA ABOVE 60°; P-3 STARTS: P-4 STARTS IF TOWER FILLED AS SENSED BY FLOAT SWITCH: COOLING TOWER FAN ALLOWED TO OPERATE: & CHILLER ALLOWED TO OPERATE IF FLOW IS PROVEN IN CONDENSER & CHILLER CIRCUITS. COOLING TOWER FAN CYCLED BY SUMP STAT. P-3 OPERATES CONSTANT BELOW 32° OUTSIDE.

CENTRAL TIME CONTROL SYSTEM: SYSTEM TIME SWITCHED (3REG'D) START ASSOCIATED SUPPLY SYSTEMS. VENTILATION TIME SWITCH STARTS ASSOCIATED EXHAUST FANS & ALLOWS OUTSIDE DAMPERS TO OPEN. BY PASS TIMERS RESTORE INDIVIDUAL SUPPLY SYSTEM OPERATIONS & BY PASS BOTH VENTILATION & SYSTEM TIME SWITCHES. NIGHT LOW LIMIT STATS BY PASS SYSTEM TIME SWITCH FOR ASSOCIATED SYSTEM ONLY. PILOTS AT CENTRAL PANEL SHALL INDICATE IF ASSOCIATED SYSTEM FANS FAIL TO OPERATE. SEE DRAWINGS FOR FANS ASSIGNED TO EACH TIME SWITCH, BY PASS TIMER ALARM PILOT, & NIGHT LOW LIMIT STAT.

BOILER INTERLOCK PROVIDED TO START P-1 OR P-2 IF ANY SUPPLY SYSTEM OPERATES FROM TIME SWITCH, BY PASS, OR NIGHT LOW LIMIT STAT.

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SHEET M10 OF 11

DATAPRINT CORP. 800 LITTLEFIELD AVE. SO. SAN FRANCISCO CA 94080

DATAPRINT STOCKDRAFTING FORM NO. 101-84

SUPPLY FAN SCHEDULE

SYMBOL	SERVING	TOTAL CFM	WHEEL SIZE INCH	SP IN	MOTOR HP	MOTOR VOLT	MOTOR PHASE	CLASS	MAX COIL FACE FPM	HEATING COIL EWT 190° EAT °F	LAT °F	MBH	MAX GPM	LWT 150° MAX AIR PD IN H2O	MAX H2O PD FT H2O	COOLING COIL AIR TEMP °F ENT DB	ENT WB	LVG DB	LVG WB	MBH	SEC. TEMP	AIR P.D. IN H2O	MIN NO. ROWS	GPM	FINS PER INCH	REMARKS
SF-1	CLASSROOMS	21,200	33"	2 1/4"	15	208	3	1	500	63.8°	73.8°	228	11.5	.25	5.0	77	63.5	55	54.5	575	45°	.75	6	115	9	PACE "SI" A 33-AF
SF-2	GYM	9,400	22 1/4"	1 1/4"	5	208	3	1	500	61°	95°	313	1.6	.25	5.0	77	63.5	55	54.5	225	45°	.75	6	51	9	PACE "SI" A 22
SF-3	ADMINISTRATION	3,820	13 1/2"	1 3/4"	3	208	3	1	—	62.7°	85.0°	92	4.6	—	—	—	—	—	—	—	—	—	—	20.8	—	PACE "SI" A 22
SF-4	CAFETERIA	4,200	15"	2"	3	208	3	1	500	55°	85°	136	8.1	.25	5.0	77	63.5	55	54.5	114	45°	.75	6	22.8	9	PACE "SI" A 14
SF-5	MUSIC ROOM	1,800	9 3/4"	1 3/4"	1 1/2	208	3	1	500	62.7°	85.0°	43	2.2	.25	5.0	77	63.5	55	54.5	49	45°	.75	6	9.8	9	PACE "SI" A 9
SF-6	KITCHEN	3,750	15"	1"	1 1/2	208	3	1	500	40°	100°	202	10.	.25	5.0	—	—	—	—	—	—	—	—	—	—	PACE "SI" A 15
SF-7&8	LOCKER ROOMS	600	6 1/2"	3/4"	1/12	120	1	1	500	62.7°	82.7°	13	.65	.25	5.0	—	—	—	—	—	—	—	—	—	—	PACE CUH 61-1

COOLING COIL SCHEDULE

SYMBOL	SERVING	CFM	SIZE NO	SIZE HDR	SIZE TUBES	MAX FACE VEL FPM	AIR TEMP ENT DB	ENT WB	LVG DB	LVG WB	ENT H2O TEMP	MAX GPM	MAX AIR P.D. IN H2O	MAX H2O P.D. IN H2O	MAX FINS/ INCH	MBH	REMARKS
CC-1	FOYER	1250	1	18	24"	415	77.4	64	55	54.5	45	7	.75"	5'	8	36	
CC-2	GYM OFFICE	620	1	12	18	415	77.4	64	55	54.5	45	3.5	.75"	5'	8	18.0	
CC-3	PRINCIPAL	600	1	12	18	400	77.4	64	55	54.5	45	3.5	.75"	5'	8	18.0	
CC-4	OFFICE	550	1	12	18'	366	77.4	64	55	54.5	45	3.2	.75"	5'	8	16	
CC-5	FACULTY	500	1	12	12	500	77.4	64	55	54.5	45	2.9	.75"	5'	8	14	
CC-6	SPECIAL ED	300	1	9	12	400	77.4	64	55	54.5	45	1.7	.75"	5'	8	9	

HEATING COIL SCHEDULE

SYMBOL	SERVING	CFM	SIZE NO.	SIZE HDR	SIZE TUBE	MAX FACE VEL FPM	MAX AIR PD IN H2O	AIR TEMP ENT	AIR TEMP LVG	WTR. TEMP ENT	WTR. TEMP LVG	MAX GPM	MAX FINS INCH	MBH	MAX WTR PD.	PIPE SIZE
HC-1	FOYER	1250		18	24	416	.75"	62.7	82.7	180	140	1.4	8	27	5'	1/2"
HC-2	GYM OFFICE	620		12	18	413	.75"	62.7	82.7	180	140	.7	8	14	5'	1/2"
HC-3	OFFICE	550		12	18	366	.75"	62.7	82.7	180	140	.6	8	12	5'	1/2"
HC-4	SPECIAL ED.	300		4	12	400	.75"	62.7	82.7	180	140	.4	8	7	5'	1/2"

EXHAUST & RETURN FAN SCHEDULE

SYMBOL	SERVING	CFM	TOTAL S.P. WATER	MOTOR HP	MOTOR VOLT	MOTOR PHASE	MAX SONES AT 5 FT	TYPE	REMARKS
EF-1	BOYS & GIRLS LAV	1200	3/8"	1/3	120	1	5.0	ROOF	PACE CRE-11
EF-2&3	TOILET	100	1/4	—	120	1	5.0	ROOF	PACE DD-200 R
EF-4	FACULTY	500	3/8	1/8	120	1	3.0	ROOF	PACE DD-650 R, SOUND CURB
EF-5,6,7,8	GYM	1800	3/8	1/2	208	3	3.0	ROOF	PACE CRE-15, SOUND CURB
EF-9	LOCKER ROOMS	1500	3/8	1/3	120	1	5.0	ROOF	PACE CRE-15,
EF-10,11	CAFETERIA	2000	3/8	1/2	208	3	3.0	ROOF	PACE CRE-16, SOUND CURB
EF-12	MAINTENENCE	200	1/4	—	120	1	5.0	ROOF	PACE DD-350 R
EF-13	RANGE HOOD	3800	1	1 1/2	208	3	7.5	ROOF	PACE CRE-20, 2 SPEED
EF-14	DISHWASHER HOOD	1200	1/2	1/2	208	3	7.5	ROOF	PACE CRE-11, 2 SPEED
EF-15,16	BLDG. 100	870	1/4	1/6	120	1	5.0	CEILING	PACE DD 850
RF-1	BLDG. 100	19,000	1/2	5	208	3	—	AXIAL	TRANE MODEL Q SIZE 44
RF-2	ADMINISTRATION	2800	3/4	3/4	208	3	—	AXIAL	TRANE MODEL Q SIZE 19
RF-3	MUSIC ROOM	1500	5/8	1/2	208	3	—	AXIAL	TRANE MODEL Q SIZE 16

PUMP SCHEDULE

SYMBOL	SERVING	GPM	HEAD WATER	WATER TEMP °F	MOTOR HP	MOTOR VOLT	MOTOR PHASE	TYPE PUMP	RPM	REMARKS
P-1&2	HEATING PUMPS	90	105	210	7 1/2	208	3	BASE MOUNT	1750	B&G NO U2-G
P-3	CHILLED WATER PUMP	180	52	45	5	208	3	CLOSE CPLD	1750	B&G NO 1531 2 1/2" B
P-4	CONDENSER WTR PUMP	210	40	95	5	208	3	CLOSE CPLD	1750	B&G NO 1531 4" AB
P-5	DOMESTIC WTR RECIRC. PUMP	10	15	140	1/6	120	1	IN LINE	1750	B&G 1" PR ALL BRONZE
P-6	HEAT EXCHANGER	10	15	210	1/6	120	1	IN LINE	1750	B&G 1" PR

MISCELLANEOUS EQUIPMENT

SYMBOL	DESCRIPTION	ELECTRICAL
B	BOILER: GAS FIRED, 1750 MBH, 52.3 HP, 2,188 MBH INPUT, 239 SQ FT. TOTAL HEATING SURFACE. KEWANEE M-175.	3/4 HP BOILER MOTOR 230V, 1 Ø
CH	CHILLER: 70 TONS, 45° L.W.T., 179 GPM COND. WATER, 85° ENT, 95° L.W.T., 10 FT. HD. COND. P.D., 15 FT. HD. CHILLER P.D. MAX. TRANE CG 75D	224 FLA 208 V 3 Ø
CT	COOLING TOWER: CAPACITY TO 210 GPM AT 70° WB, 95° EWT / 85° LWT. BAC-VNT 50 B	7 1/2 HP FAN MOTOR
FP	FINNED PIPE: 4 1/4" x 1 1/4", 850 BTUH/FT., 33 FINS/FOOT, 180° AVERAGE WATER TEMP	
HE	HEAT EXCHANGER: (WATER HEATER) CAPACITY TO HEAT 4.2 GPM FROM 45° TO 140° WITH 10 GPM, 200° E.W.T., .0005 FOULING FACTOR	
CUH	CABINET UNIT HEATER: 600 CFM, 24 MBH, 190° E.W.T., PACE #61-2	1/12 HP 120V, 1Ø
AF	ATTIC FAN: 4,000 CFM AT 1/4" S.P., 18" S.P., BELT DRIVE, TUBE AXIAL FAN, PACE TYPE TA	3/4 HP 208V, 3Ø

SCHEDULES

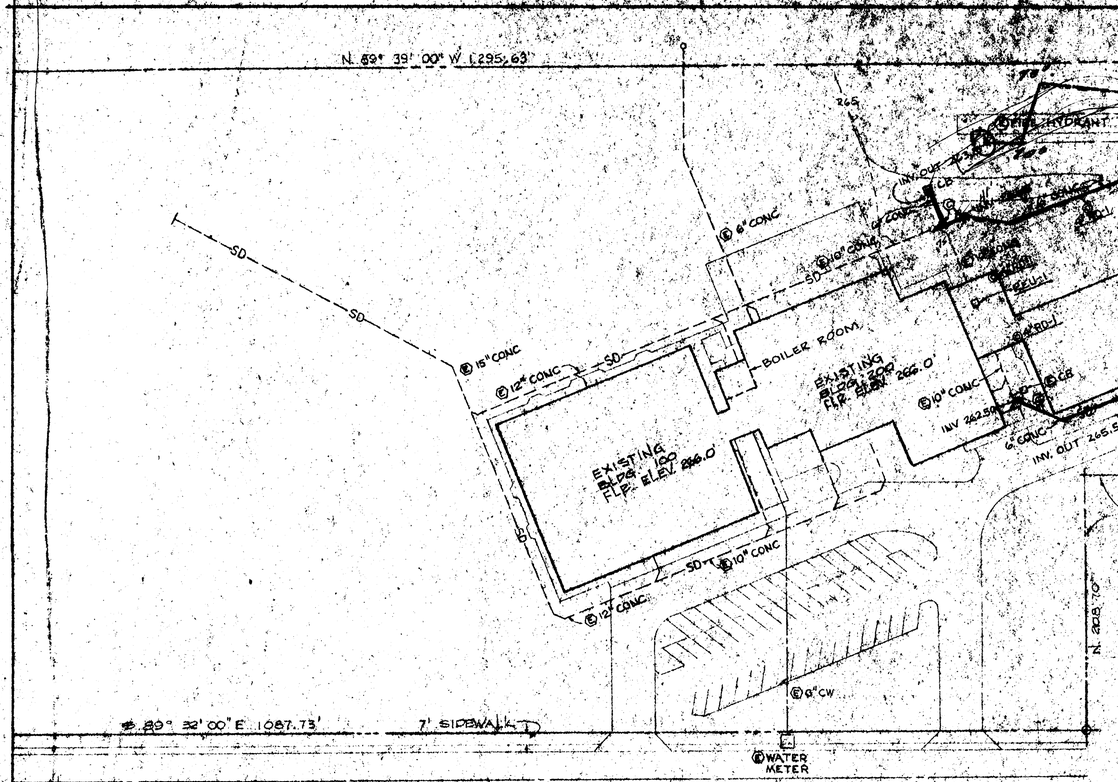
SW. BROCKMAN ROAD AND SW. DAVIES ROAD
BEAVERTON OREGON

ELEMENTARY SCHOOL - SCHOOL DISTRICT 48
BEAVERTON WASHINGTON COUNTY OREGON

WILLIAMS & EHMANN AIA
ARCHITECTS - PLANNERS
3777 S.E. MILWAUKIE AVENUE
PORTLAND, ORE. 97202 503-232-1186

REVISIONS
DRWN. DP
CHKD
DATE 1-30-74
COMM 70-61
FILE

SHEET M 11 OF 11



SITE PLAN

(1/M-1)

SCALE: 1" = 50'-0"

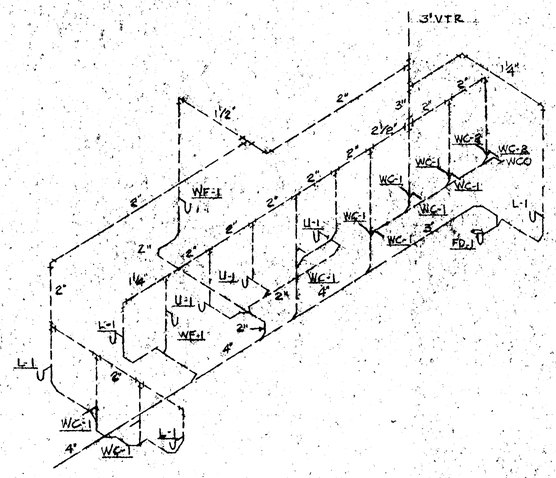
NOTE:
1. FOR ADDITIONAL GRADES SEE ARCHITECTURAL SITE PLAN.

PLUMBING FIXTURE SCHEDULE

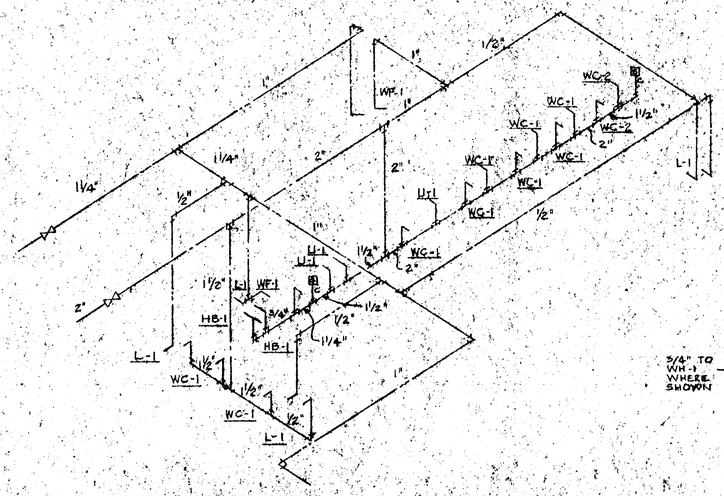
SYMBOL	DESCRIPTION	ROUGH-IN W	ROUGH-IN V	SIZE-INCHES CW	SIZE-INCHES HW	REMARKS
WC-1	WATER CLOSET	4'	2'	1 1/4	—	WALL HUNG
WC-2	WATER CLOSET	4'	2'	1 1/4	—	HANDICAPPED HEIGHT
L-1	LAVATORY	1 1/2	1 1/4	1/2	1/2	HANDICAPPED TYPE
U-1	URINAL	2	2	1	—	
WF-1	WASH FOUNTAIN	2'	4	1	1	SEMI-CIRCULAR
S-1	SINK	2	1 1/2	1/2	1/2	CLASSROOM SINK

LEGEND

CD	CD	CONDENSATE DRAIN.
W	W	SANITARY WASTE ABOVE GRADE.
W	W	SANITARY WASTE BELOW GRADE.
SD	SD	STORM DRAIN ABOVE GRADE.
SD	SD	STORM DRAIN BELOW GRADE.
V	V	VENT.
CW	CW	COLD WATER.
HW	HW	HOT WATER.
RHW	RHW	RECIRCULATED HOT WATER.
		GATE VALVE.
		GLOBE VALVE.
		CHECK VALVE.
		BUTTERFLY VALVE.
		BALANCING FITTING.
WH	WH	WALL HYDRANT.
DV	DV	HOSE END DRAIN VALVE.
SA		SHOCK ABSORBER, SIZE C (R.D.I. STANDARD 201)
		PITCHED DOWN.
		AIR FLOW DIRECTION.
		SUPPLY-OSA DUCT SECTION, ROUND, RECTANGULAR.
		RETURN-EXHAUST DUCT SECTION ROUND, RECTANGULAR.
		LINED, INSULATED DUCT DOUBLE LINE, SINGLE LINE.
		FLEXIBLE DUCT CONNECTION.
FLD	FLD	FUSIBLE LINK DAMPER DOUBLE LINE, SINGLE LINE.
		BUTTERFLY VOLUME DAMPER DOUBLE LINE, SINGLE LINE.
①		ROOM THERMOSTAT, WALL MOUNTED
T		ROOM THERMOSTAT, SURFACE MOUNTED
⌀10		ROUND DUCT DIAMETER, INCHES
32x14		RECTANGULAR DUCT, INCHES
ASU		AIR SUPPLY UNIT.
SF		SUPPLY FAN.
REU		ROOF EXHAUST UNIT
UH		UNIT HEATER.
CC		COOLING COIL.
OSA		OUTSIDE AIR.
AUD		AUTOMATIC DAMPER.
OAD		OUTSIDE AIR DAMPER.
RAD		RETURN AIR DAMPER.
EAD		EXHAUST AIR DAMPER.
CS		CEILING SUPPLY DIFFUSER.
CE		CEILING EXHAUST GRILLE.
LCS		LINEAR CEILING SUPPLY.
FD		FLOOR DRAIN.
RD		ROOF DRAIN.
VTR		VENT THROUGH ROOF.
CTG		CLEANOUT TO GRADE.
FCO		FLOOR CLEANOUT.
WCO		WALL CLEANOUT.
CO		CLEANOUT.
INV		INVERT ELEVATION.
CI		CAST IRON PIPE.
CONC		CONCRETE PIPE.
NIM		NOT IN MECHANICAL - FURNISHED UNDER ANOTHER DIVISION.
EH		ELECTRIC HEATER, NIM
EBB		ELECTRIC BASEBOARD, NIM.
Ⓐ		ACCESS DOOR.
Ⓒ		CONNECT TO EXISTING.
Ⓔ		EXISTING TO REMAIN.
Ⓕ		BELOW FLOOR.
Ⓚ		CAP
Ⓡ		RELOCATE EXISTING.
Ⓧ		REMOVE EXISTING.



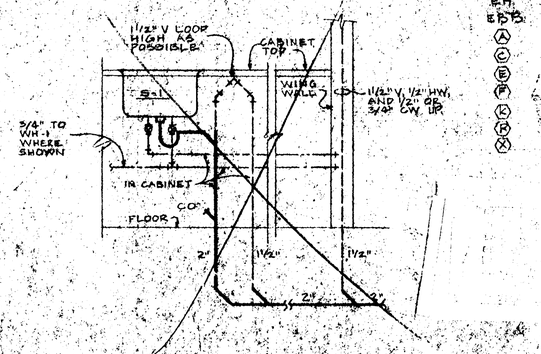
WASTE AND VENT



HOT AND COLD WATER

TOILET ROOM PLUMBING PIPING DIAGRAM

(2/M-1) NO SCALE



SINK WASTE AND VENT DIAGRAM

(3/M-1) NO SCALE

SIX CLASSROOM ADDITION
HITEON ELEMENTARY SCHOOL
SCHOOL DISTRICT No 48
3800 S.W. BROCKMAN RD. - BEAVERTON, OREGON

59712

1 FLOOR PLAN

1/8"=1'-0"

NOTES:

① ALL FLEXIBLE CONNECTORS AND RIGID ROUND DUCTS ARE 8Φ, EXCEPT AS SCHEDULED FOR THE TERMINAL UNITS.

② 12×18 FLD AT GYPSUM BOARD ON BOTTOM OF T.J.S. FURNISHED AND INSTALLED BY MECHANICAL CONTRACTOR.

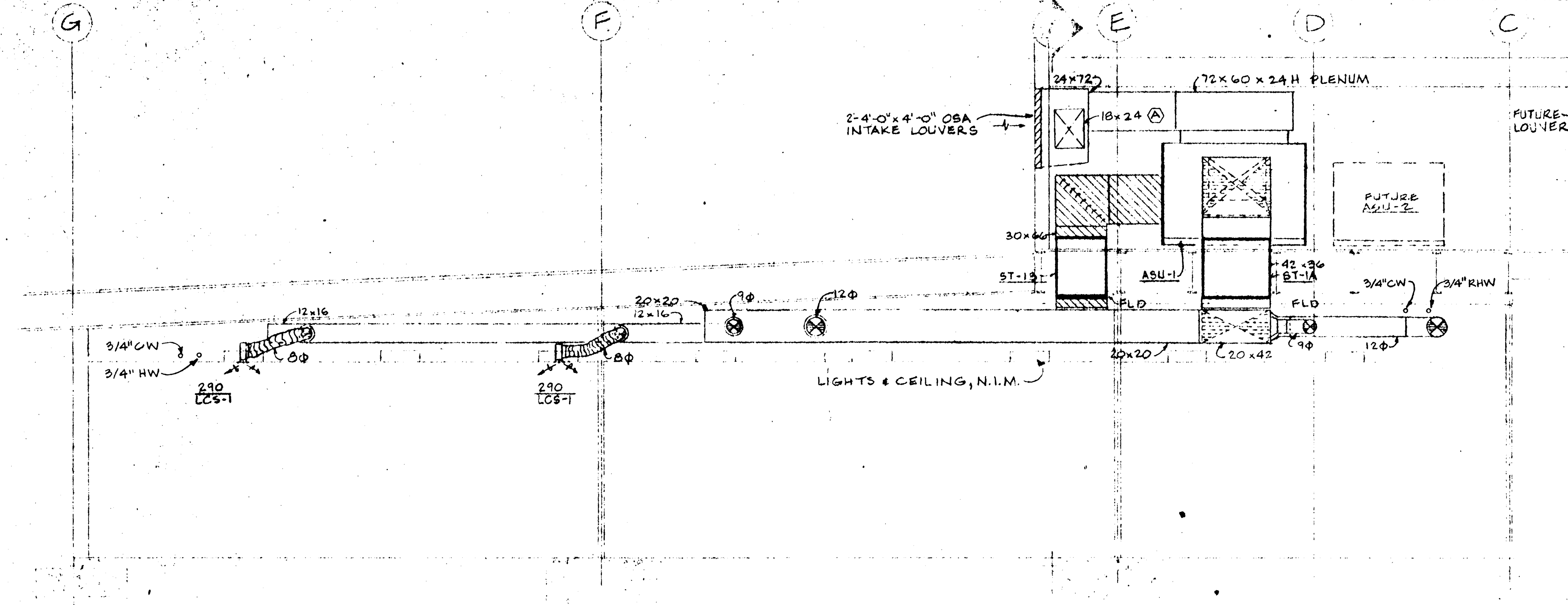
2 PARTIAL PLAN

1/8"=1'-0"

NOTE: SAME AS NOTE 1 FOR 1/M-2.

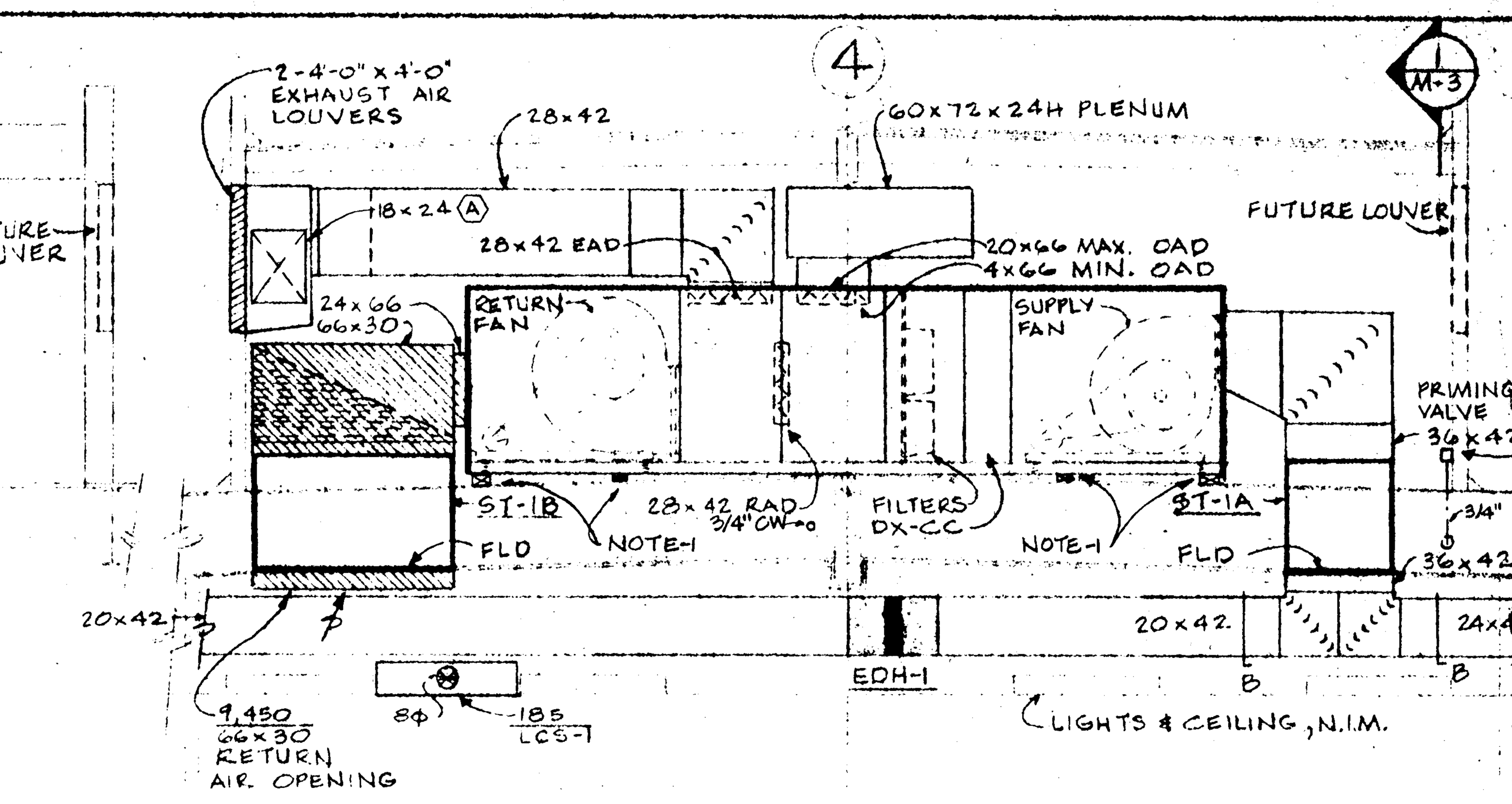
SIX CLASSROOM ADDITION
HILTON ELEMENTARY SCHOOL
SCHOOL DISTRICT NO 48
3500 S.W. BROCKMAN RD - BEAVERTON, OREGON

59713



(1/M-3) SECTION

1/4" = 1'-0"



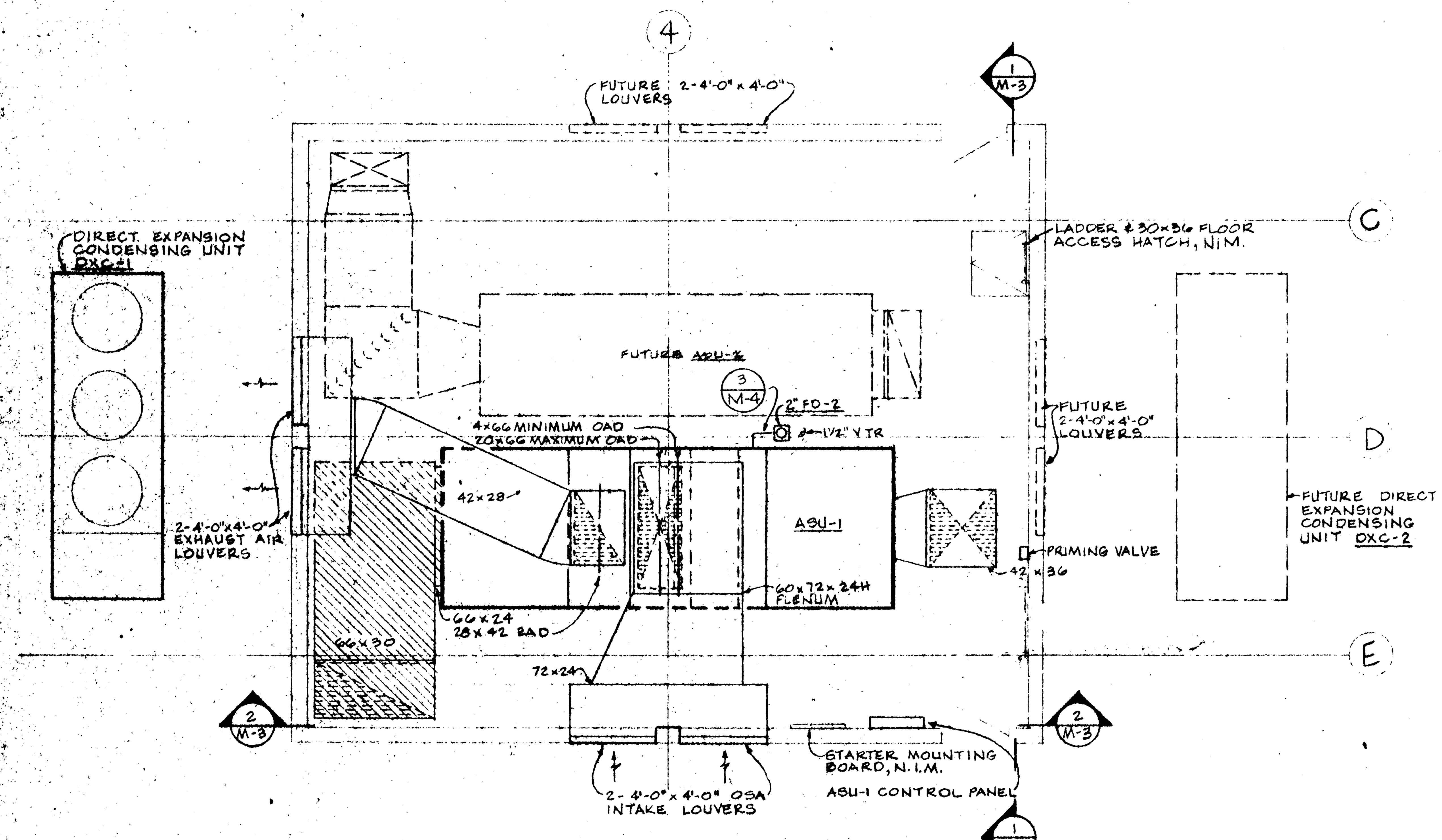
(2/M-3) SECTION

1/4" = 1'-0"

NOTE:

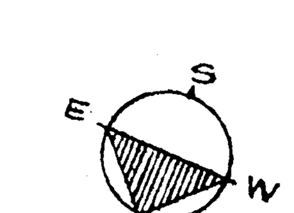
~~SHIM UNDER ... TO PROVIDE LEVEL SUPPORT~~

1. Provide Treated wood Supports to give a level ASU installation,



(3/M-3) PLAN - MECHANICAL ROOM

1/4" = 1'-0"



PARTIAL MECH. PLAN & SECTIONS

WILLIAMS & GILHAM
ARCHITECTS - PLANNERS

REGISTERED ARCHITECT — MAX P. WILLIAMS — PORTLAND, OREGON — STATE OF OREGON

REGISTERED PROFESSIONAL ENGINEER 4916 OREGON — ROBERT G. MANFULL — JULY 9, 1962

SIX CLASSROOM ADDITION

HITEON ELEMENTARY SCHOOL

SCHOOL DISTRICT No 48

13800 S.W. BROCKMAN RD. - BEAVERTON, OREGON

REVISION	
DRAWN	
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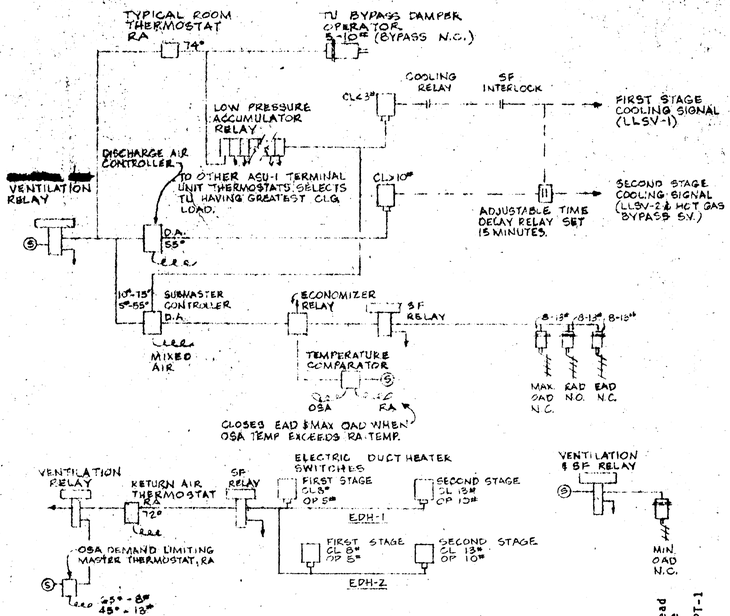
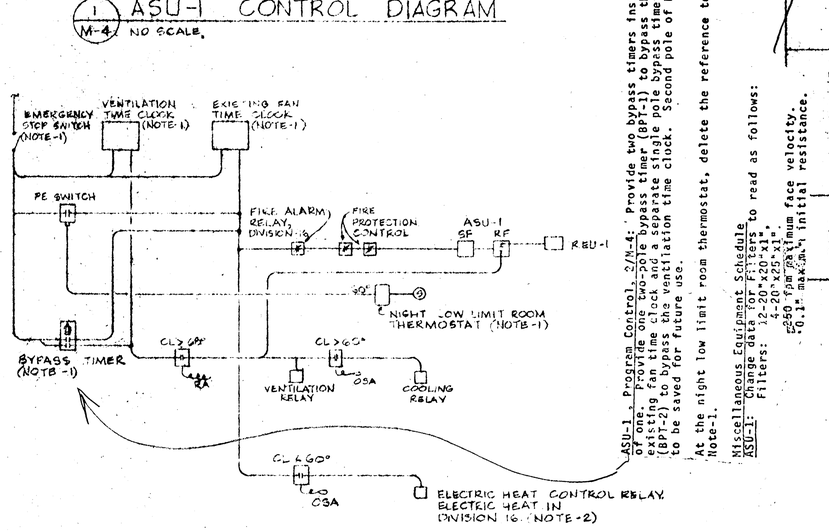
COMM	7743
FILE	27
DATE	
SHEET NO.	M-3

59714



1/M-4 ASU-1 CONTROL DIAGRAM
NO SCALE.



2/M-4 ASU-1 PROGRAM CONTROL
NO SCALE
NOTES:
1. LOCATED IN EXISTING BOILER ROOM.
2. LOCATED IN FAN CONTROL PANEL.

ASU-1 - Program Control, 2/M-4: Provide two bypass timers instead of existing fan time clock and a separate single pole bypass timer (BPT-2) to bypass the ventilation time clock. Second pole of BPT-1 to be saved for future use.

At the night low limit room thermostat, delete the reference to Note-1.

Miscellaneous Equipment Schedule
ASU-1: Change data to read as follows:
Filters: 2-20"x20"x2".
4-20"x25"x2".
≤250 fpm maximum face velocity.
0.1" maximum initial resistance.

SOUND TRAP SCHEDULE

SYMBOL	APPLICATION	AIR VOLUME CFM	DYN INSERT LOSS ① OCT BAND CENTER FREQ 250	500	BASIS OF SELECTION	MAX PRESS LOSS IN. WG	OVERALL SIZE W X H
ST-1A	SUPPLY AIR	10,650	14	33	IAC-3S	0.35	36"X42"
ST-1B	RETURN AIR	9,450	14	20	IAC-3MS	.2	30"X66"

① D.I.L. IN DB. RE 10^-12 WATTS.
② MAX FACE VELOCITY 1018 FPM.

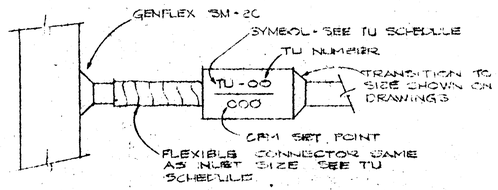
MISCELLANEOUS EQUIPMENT SCHEDULE

ITEM	DESCRIPTION
ASU-1 Air Supply Unit (Approx. total operating weight, 5,000 lbs.)	Supply Fan: Single-zone 10,650 cfm @ 2-1/2" static pressure, approximately 1190 rpm, 24-1/2" air foil wheel, 7-1/2 HP, 208 volt, 3 phase motor. Vibration isolation: type B, 1-1/2" deflection. Design basis: Pace A-24 fan in A-27 casing; internal spring isolated. D-X Cooling Coil: 10,650 cfm, 350 MBH total at 80.5°F EDB, 64.5°F. EWB, 55°F LDB and approximately 54°F LWB. Maximum face velocity 500 FPM. Performance based on 40°F saturated suction temperature. Maximum air P = 0.4". Filters: (4) 20"x25"x9", (4) 16"x25"x9". 500 fpm maximum face velocity. Design basis: Cambridge Hi-Cap. Outside Air Dampers: Maximum - 20"x66" at 9,450 cfm. Minimum - 4"x66" at 1,200 cfm. Return Air Damper: 28"x42" at 9,450 cfm. Exhaust Air Damper: 28"x42" at 9,450 cfm. Return Fan: 9,450 cfm 9 3/4" static pressure, approximately 640 rpm, 27" air foil wheel, 3 HP, 208 volt, 3 phase motor. Vibration isolation: type B, 1-1/2" deflection. Design Basis: Pace A-27 in A-27 casing; internal spring isolated.
DXC-1 DIRECT EXPANSION CONDENSING UNIT	Nominal 30 ton compressor-condensing unit; refrigerant 22, 1750 rpm reciprocating, hermetic compressor with 208 volt, 3 phase motor, 133 FLA, 551 LRA 35.6 KW input. 350 Mbh total load at 90°F outside with 39°F saturated suction temperature. Condensing fans, 4 - 1 HP motors, 0.90 KW input, 208 volt, 3 phase; approximate operating weight 2,750 lbs. Vibration isolation; type B, 1-1/2" deflection for compressor. Design Basis: Trane RAUA 300.
REU-1 Roof Exhaust UNIT	700 cfm at 3/8" static pressure, approximately 775 rpm, 1/4 HP, 120 volt, single phase motor. Vibration isolation: type B, 1" deflection. Design Basis: Pace CRE-9F.

TERMINAL UNIT SCHEDULE

SYMBOL	CFM RANGE	INLET SIZE	DESIGN BASIS ①
TU-A	240 - 360	6Ø	MODEL 300
TU-B	400 - 600	9Ø	MODEL 500
TU-C	601 - 900	10 OVAL	MODEL 750
TU-D	901 - 1200	12 OVAL	MODEL 1000
TU-E	1201 - 1800	14 OVAL	MODEL 1500

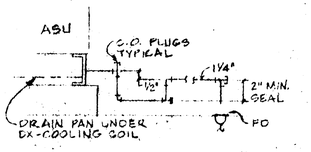
①TEMPMASTER TYPE MSR.



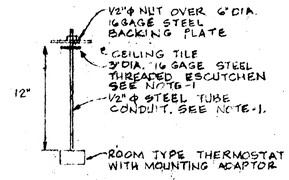
5/M-4 DETAIL - TERMINAL UNIT
NO SCALE

ELECTRIC DUCT HEATER SCHEDULE

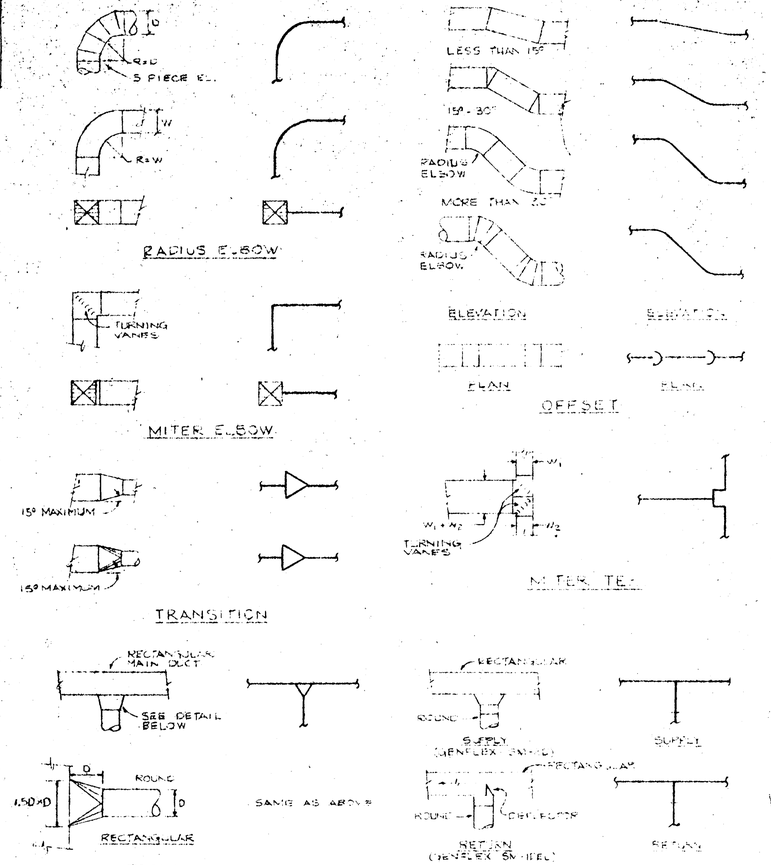
SYMBOL	MAX. CFM	DUCT SIZE	KW	STEPS
EDH-1	6000	42 X 20	17.5	2
EDH-2	6000	42 X 20	17.5	2



3/M-4 DETAIL-CONDENSATE TRAP
NO SCALE

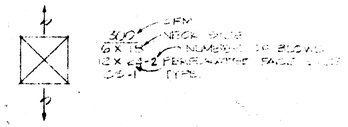


4/M-4 DETAIL-SUSPENDED THERMOSTAT
NO SCALE
NOTE:
1. PAINT WITH 2 COATS OF ENAMEL; COLOR AS APPROVED.

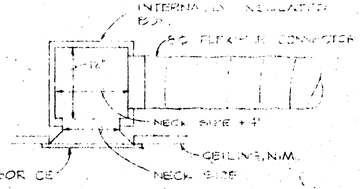


6/M-4 DETAILS - DUCT FITTINGS
NO SCALE

NOTES:
1. FITTING USED ON LOW PRESSURE SYSTEMS ONLY.
2. 32 x 14 FIRST DIMENSION IS THE SIDE SEEN IN ONE THE FIRST DIMENSION IS THE HORIZONTAL SIDE.
3. THE SUPPLY FITTING TO BE USED DOWN STREAM OF TERMINAL UNIT ONLY.



7/M-4 DETAIL - CEILING OUTLET SYMBOL
NO SCALE
NOTE:
1 SUPPLY SYMBOL SHOWN, EXHAUST SIMILAR.



8/M-4 DETAIL - CEILING CONNECTION SYMBOL
NO SCALE

WILLIAMS & GILHAM
ARCHITECTS - PLANNERS
3777 S.E. MILWAUKIE AVE. 238-1196
PORTLAND, OREGON 97202

REGISTERED ARCHITECT MAX P. WILLIAMS PORTLAND, OREGON STATE OF OREGON

REGISTERED PROFESSIONAL ENGINEER ROBERT G. MANN OREGON JULY 9, 1971

C.W. Tramer Associates Inc. Consulting Engineers

DETAILS & SCHEDULES

SIX CLASSROOM ADDITION
HITEON ELEMENTARY SCHOOL
SCHOOL DISTRICT Nº 48
13800 S.W. BROCKMAN RD. - BEAVERTON, OREGON

REVISION
DRAWN
CH'K'D
COMM 77-17
FILE 27
DATE 8-15-77
SHEET NO. M4
OF 4

59715

PLUMBING FIXTURE SCHEDULE

MARK	FIXTURE	CONNECTION SIZES IN INCHES				REMARKS
		W	V	CW	HW	
WC-1	WATER CLOSET	3	2	3/4	–	
S-1	CLASSROOM SINK	2	2	1/2	1/2	FAUCET LEDGE ON RIGHT SIDE
S-2	SINK	2	2	1/2	1/2	DOUBLE COMPARTMENT
SS-1	SERVICE SUMP	3	2	1/2	1/2	
HB-1	HOSE BIBB	–	–	3/4	–	NON-FREEZE

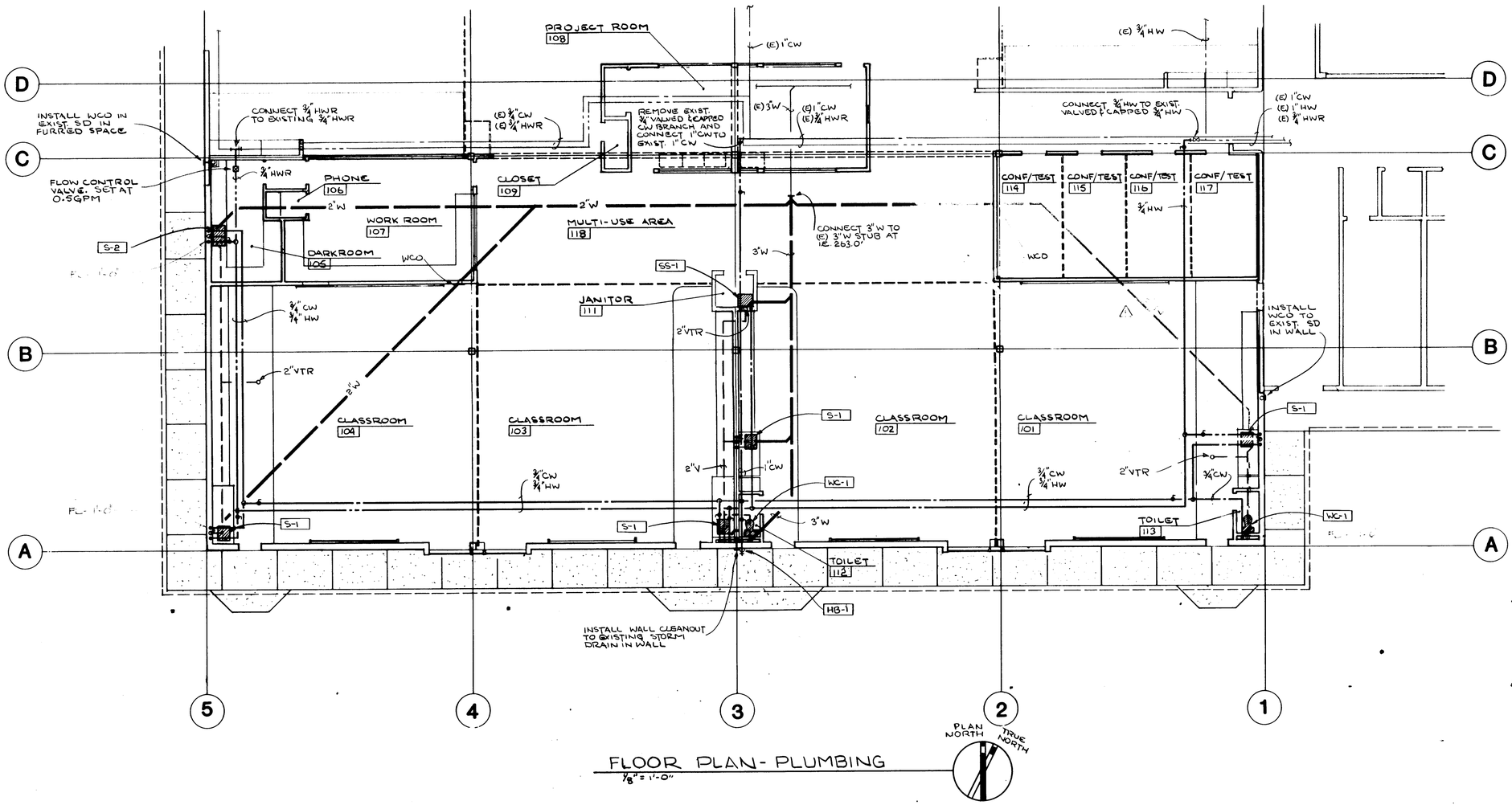
GENERAL NOTES

1. PIPE SIZES SHOWN ON CONNECTION SCHEDULES ARE INDIVIDUAL FIXTURE REQUIREMENTS. SIZE BRANCH WASTE & VENT PIPING ON ACCUMULATED FIXTURE WEIGHTS PER APPLICABLE PLUMBING CODE.
2. PLUMBING DRAWINGS ARE GENERALLY DIAGRAMMATIC. VERIFY FIXTURE LOCATIONS & MOUNTING HEIGHTS W/ARCHITECTURAL DRAWINGS. VERIFY ROUGH-IN REQUIREMENTS PRIOR TO INSTALLING ANY FIXTURE OR EQUIPMENT FURNISHED BY OWNER.
3. EXISTING UNDERGROUND PIPING LOCATIONS & FLOW LINES, GRADES, & DATUM ELEVATIONS ARE TAKEN FROM AVAILABLE RECORDS. CONTRACTOR TO VERIFY ALL CONDITIONS FOR CONNECTING TO EXISTING PIPING PRIOR TO CONSTRUCTION.

PLUMBING LEGEND

(E)W	EXISTING WASTE
(E)CW	EXISTING COLD WATER
(E)HW	EXISTING HOT WATER
(E)HWR	EXISTING HOT WATER RETURN
W	WASTE
V	VENT
CW	COLD WATER
HW	HOT WATER
HWR	HOT WATER RETURN
	POINT OF CONNECTION, NEW TO EXISTING
	BALL VALVE

(E) EXISTING
I.E. INVERT ELEVATION
SD STORM DRAIN
VTR VENT THROUGH ROOF
WCO WALL CLEAN OUT



PLAN NORTH / TRUE NORTH

FLOOR PLAN - PLUMBING

1/8" = 1'-0"

FLOOR PLAN - PLUMBING

HITEON ELEMENTARY SCHOOL
• CLASSROOM ADDITION •

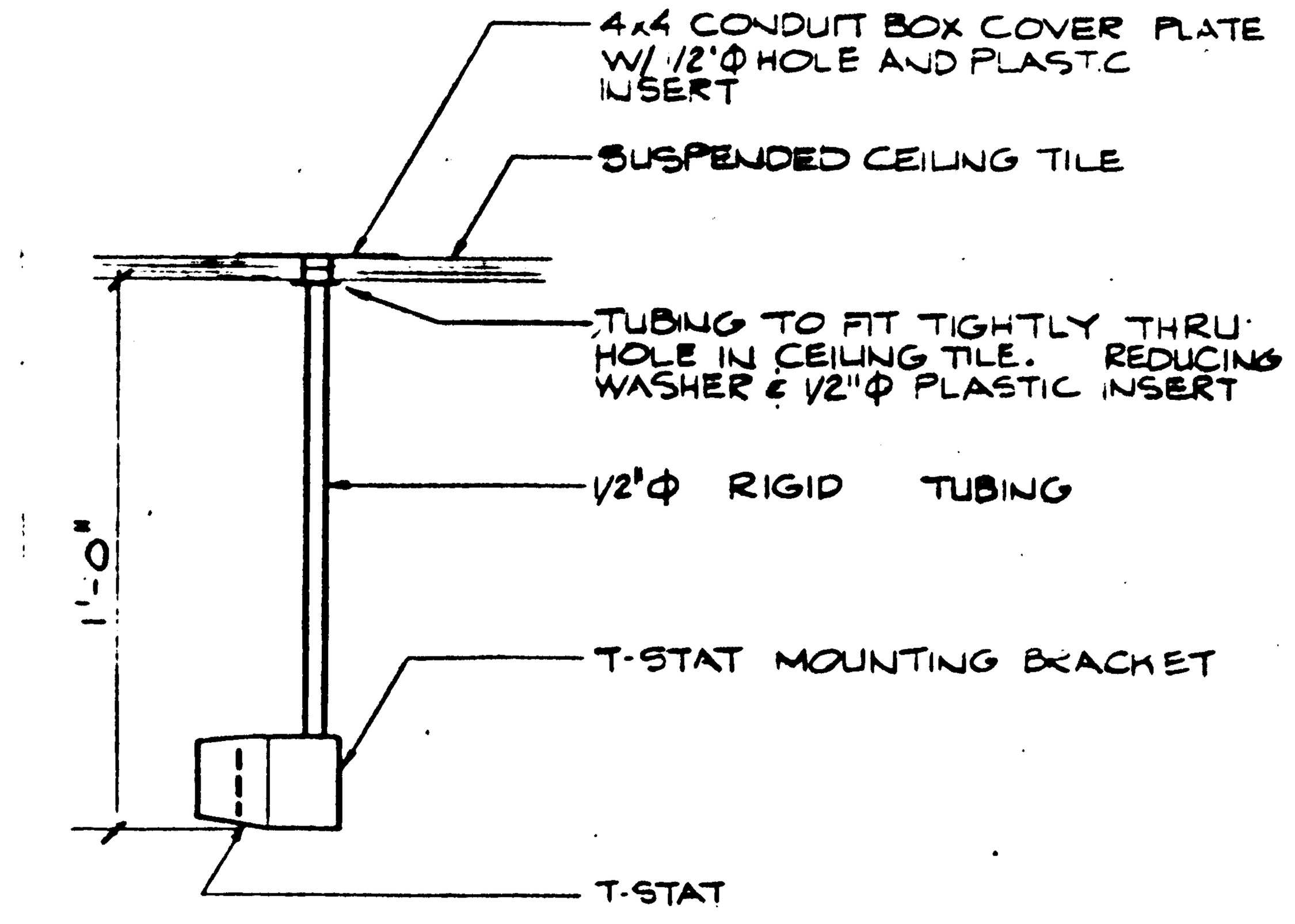
REGISTERED PROFESSIONAL ENGINEER 12276 OREGON TIMOTHY W. SMITH

12 MAY 1989 date
revised 86-14-12. job no.

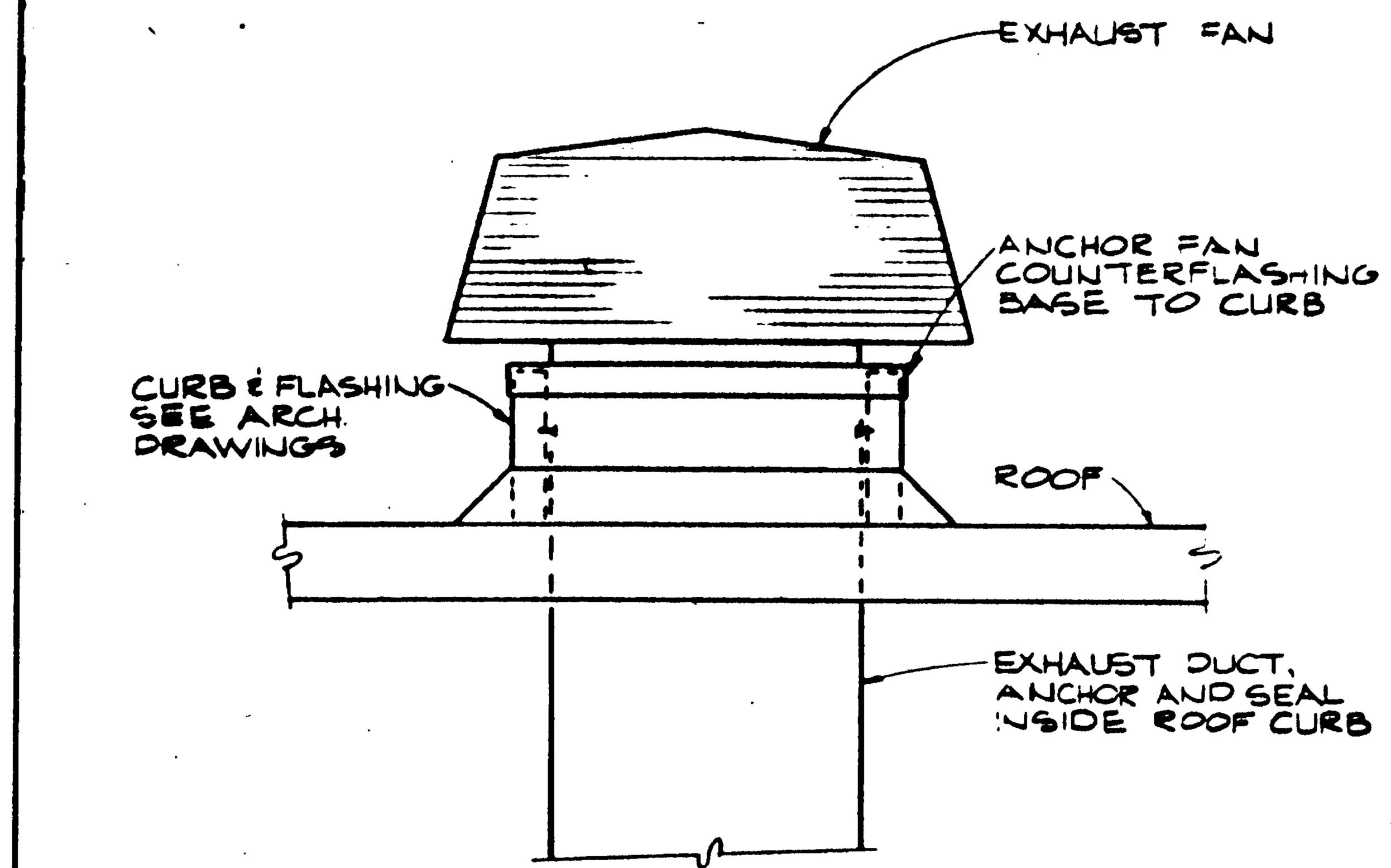
smith/dull partnership architects
20915 S.W. 105th AVENUE, TUALATIN, OREGON 97062 503/692-6065

M1

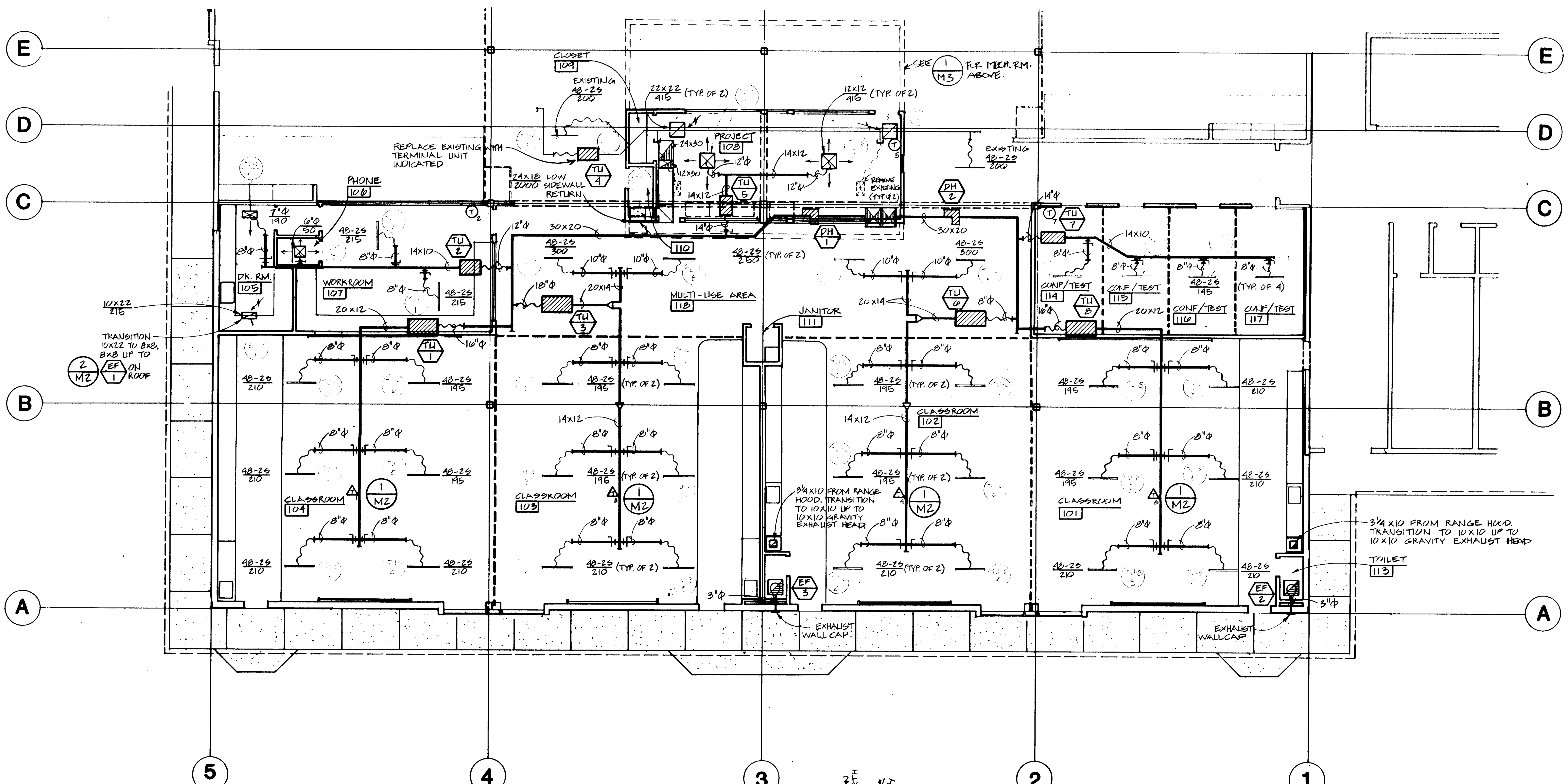
Carson, Bekooy, Gulick & Associates, Inc.
Consulting Engineers
3220 S.W. First Avenue, Portland, Oregon 97201
(503) 227-4405



1 / M2 SUSPENDED THERMOSTAT
SCALE: NONE



2 / M2 ROOF EXHAUST FAN
SCALE: NONE



FLOOR PLAN – HVAC
SCALE: 1/8"=1'-0"

FLOOR PLAN – HVAC

HITEON ELEMENTARY SCHOOL
• CLASSROOM ADDITION •

REGISTERED PROFESSIONAL ENGINEER 12276 OREGON TIMOTHY

12 MAY 1986
date
revised
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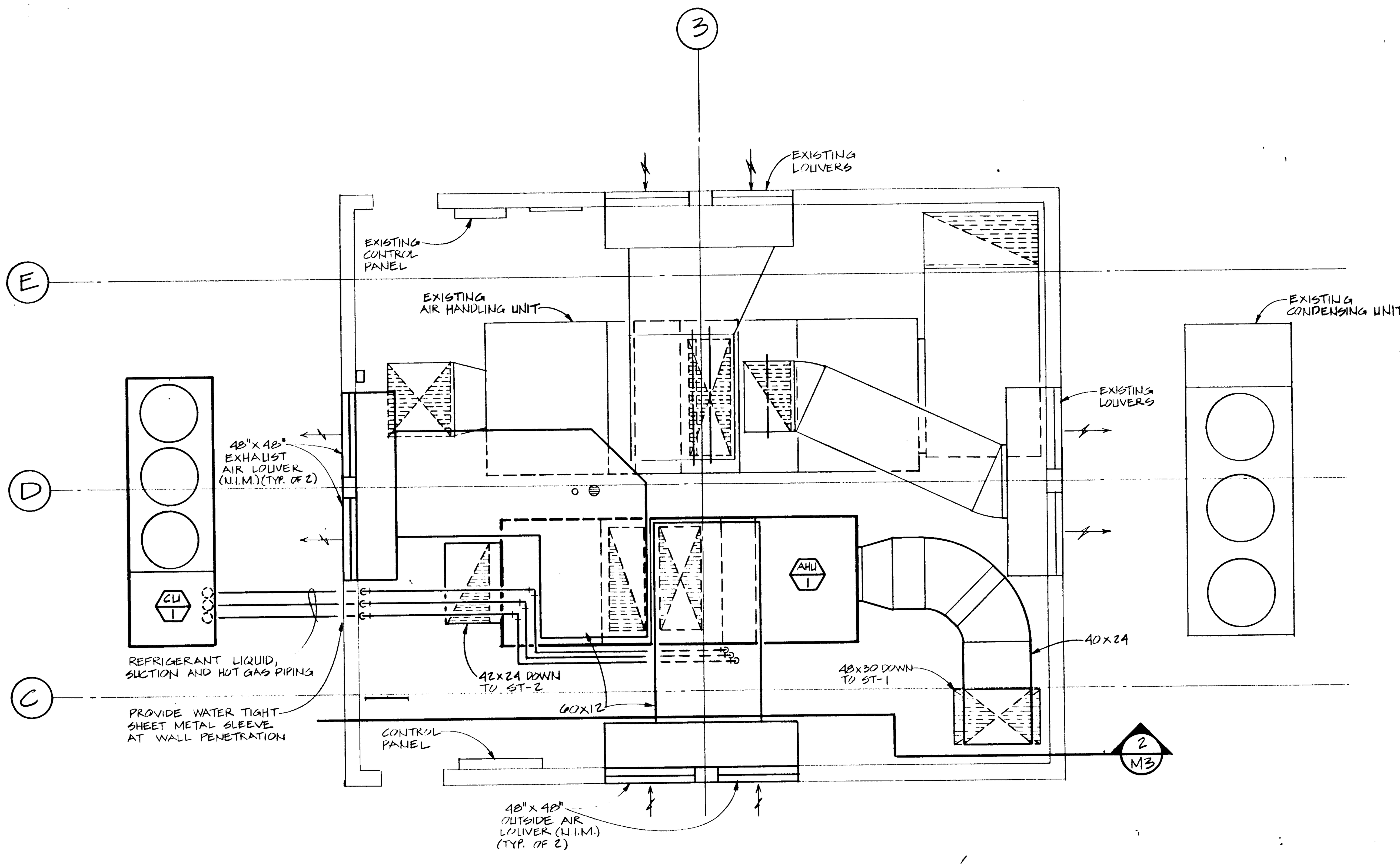
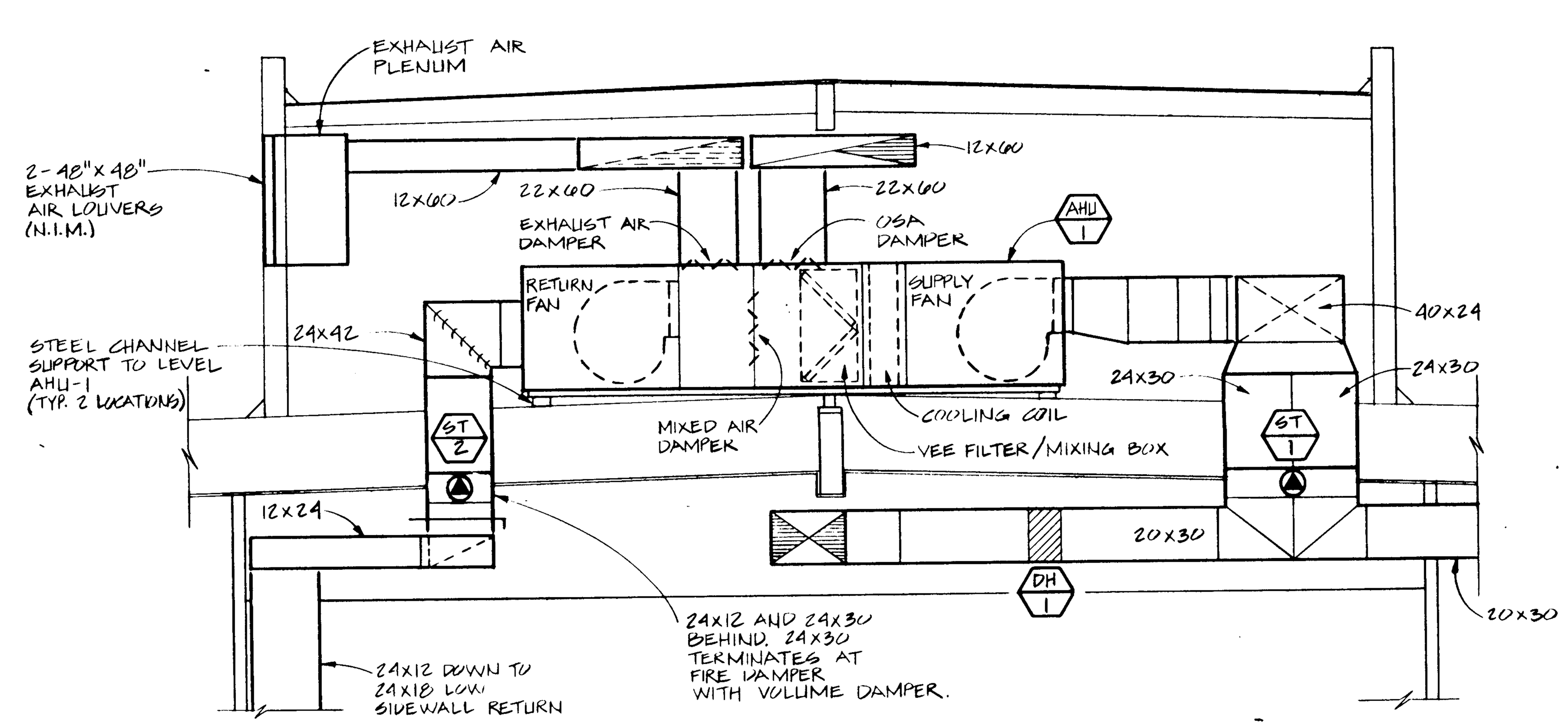
Consulting Engineers
3220 S.W. First Avenue, Portland, Oregon 97201
(503) 227-4406

M2



FLOOR PLAN – MECHANICAL ROOM (1/M3)
SCALE: 1/4"=1'-0"

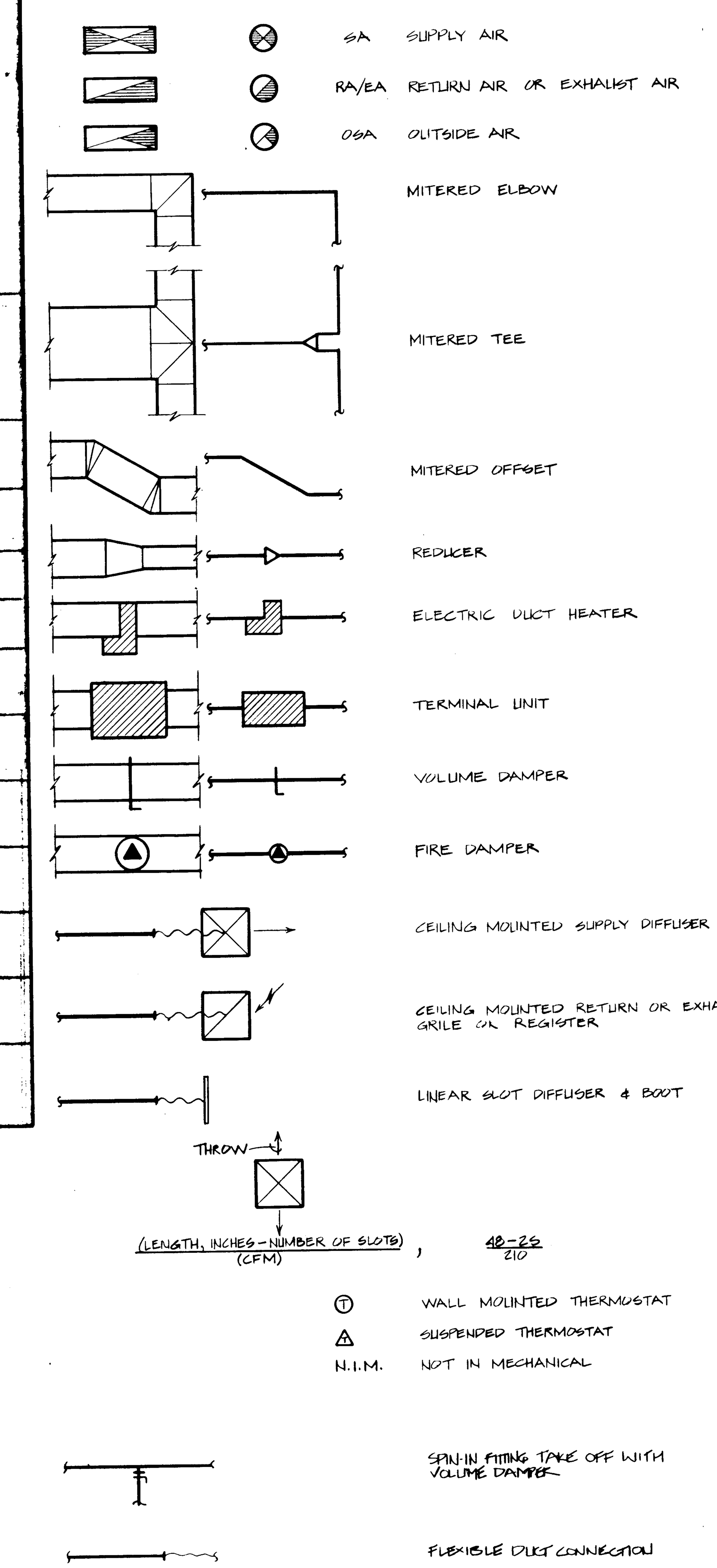


SECTION – MECHANICAL ROOM (2/M3)
SCALE: 1/4"=1'-0"

EQUIPMENT SCHEDULE

MARK	DESCRIPTION
AHU 1	SUPPLY FAN: 8,030 CFM @ 2.25" STATIC PRESSURE, 1440 RPM, 20" DIAM. BACKWARD INCLINED AIR FOIL FAN WHEEL, 5 MOTOR H.P. RETURN FAN: 7,830 CFM @ .75" STATIC PRESSURE, 494 RPM, 20" DIAM. FORWARD CURVED FAN WHEEL, 3 MOTOR H.P. COOLING COIL: 8,030 CFM, 222 MBH TOTAL COOLING CAPACITY, 187 MBH SENSIBLE COOLING CAPACITY @ 76.2 DEGREE F. DB, 61.5 DEGREE F. WB EAT. 55 DEGREE F. DB, 52 DEGREE F. WB LAT. 40 DEGREE F. SAT SUC. TEMP. 4 ROW, 8 FPI. AIR PRESS. DROP = .55" S.P. COOLING COIL TO OPERATE IN CONJUNCTION WITH CU-1. FILTERS: 4 - 20" x 25", 8 - 20" x 20" FILTERS. TOTAL 36.1 SQ. FT. FACE AREA. (PRE-PURCHASED BY OWNER)
CU 1	AIR-COOLED CONDENSING UNIT: MINIMUM 222 MBH COOLING CAPACITY @ 40 DEGREE F. SATURATED SUCTION TEMPERATURE AND 100 DEGREE F. CONDENSER ENTERING AIR TEMPERATURE. CU-1 TO OPERATE IN CONJUNCTION WITH AHU-1 COOLING COIL WITH TWO STAGE COOLING OPERATION.
EF 1	ROOF MOUNTED EXHAUST FAN: 210 CFM @ .375" ESP. 6 3/4" FORWARD CURVED FAN WHEEL, 1111 RPM, 1/4 MOTOR H.P.
EF 2,3	CEILING MOUNTED EXHAUST FAN: 70 CFM. BROAN 671. PROVIDE BROAN 640 WALL CAP.
DH 1	ELECTRIC DUCT HEATER: 15.0 KW, 30" x 20", FOUR STAGE.
DH 2	ELECTRIC DUCT HEATER: 12.5 KW, 30" x 20", FOUR STAGE.
ST 1	SOUND TRAP: 2 - 24" x 30" MODULES, 8030 CFM, 803 FPM, .15" STATIC PRESSURE DROP. IAC 3ES.
ST 2	SOUND TRAP: 1 - 42" x 24" MODULE, 1 - 42" x 12" MODULE, 7820 CFM, 745 FPM, .125" STATIC PRESSURE DROP. IAC 3ES.
TU 1,8	TERMINAL UNIT, VAV RELIEF TYPE: 1230 CFM, 1200 CFM MIN - 1800 CFM MAX, 14"0 INLET.
TU 2	TERMINAL UNIT, VAV RELIEF TYPE: 620 CFM, 600 CFM MIN - 900 CFM MAX, 10"0 INLET.
TU 3,6	TERMINAL UNIT, VAV RELIEF TYPE: 1750 CFM, 1600 CFM MIN - 2400 CFM MAX, 16"0 INLET
TU 4,7	TERMINAL UNIT, VAV RELIEF TYPE: 580 CFM, 400 CFM MIN - 600 CFM MAX, 9"0 INLET.
TU 5	TERMINAL UNIT, VAV RELIEF TYPE: 830 CFM, 800 CFM MIN - 1200 CFM MAX, 12"0 INLET.

HVAC LEGEND



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REGISTERED PROFESSIONAL ENGINEER 12276 OREGON TIMOTHY W. YOUNG

MECHANICAL ROOM PLAN & SECTION SCHEDULE

HITEON ELEMENTARY SCHOOL
• CLASSROOM ADDITION •

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