

K. Firestop Pipe and Duct insulation:

1. Provide firestopping insulation at fire and smoke barriers through penetrations. Fire stopping insulation shall be UL listed as defines in Section 07 84 00, FIRESTOPPING.
2. Pipe and duct penetrations requiring fire stop insulation including, but not limited to the following:
  - a. Pipe risers through floors.
  - b. Pipe or duct chase walls and floors.
  - c. Smoke partitions.
  - d. Fire partitions.

that is located in mechanical equipment rooms or in locations where it can reasonably be expected that insulation will be damaged.

L. Provide vapor barrier jackets over insulation as follows:

1. All piping and ductwork exposed to outdoor weather.
2. All interior piping and ducts conveying fluids exposed to outdoor air (i.e. in attics, crawl spaces, ventilated (not air conditioned) spaces, etc.).

M. Provide metal jackets over insulation as follows:

1. All piping and ducts exposed to outdoor weather.
2. Piping exposed in building, within 1800 mm (6 feet) of the floor, that ~~connects to sterilizers, kitchen and laundry equipment.~~ Jackets may be applied with pop rivets. Provide aluminum angle ring escutcheons at wall, ceiling or floor penetrations.
3. A 50 mm (2 inch) overlap is required at longitudinal and circumferential joints.

### 3.2 INSULATION INSTALLATION

A. Mineral Fiber Board:

1. Faced board: Apply board on pins spaced not more than 300 mm (12 inches) on center each way, and not less than 75 mm (3 inches) from each edge of board. In addition to pins, apply insulation bonding adhesive to entire underside of horizontal metal surfaces. Butt insulation edges tightly and seal all joints with laps and butt strips. After applying speed clips cut pins off flush and apply vapor seal patches over clips.
2. Plain board:
  - a. Insulation shall be scored, beveled or mitered to provide tight joints and be secured to equipment with bands spaced 225 mm (9 inches) on center for irregular surfaces or with pins and clips on flat surfaces. Use corner beads to protect edges of insulation.

- b. For hot equipment: Stretch 25 mm (1 inch) mesh wire, with edges wire laced together, over insulation and finish with insulating and finishing cement applied in one coat, 6 mm (1/4 inch) thick, trowel led to a smooth finish.
  3. Exposed, unlined ductwork and equipment in unfinished areas, mechanical and electrical equipment rooms and attics, and duct work exposed to outdoor weather:
    - a. 50 mm (2 inch thick insulation faced with ASJ (white all service jacket): Supply air duct.
    - b. 50 mm (2 inch) thick insulation faced with ASJ: Return air duct, mixed air plenums and prefilter housing.
    - c. Outside air intake and exhaust ducts: 25 mm (one inch) thick insulation faced with ASJ.
  4. Hot equipment: 65 mm (2-1/2 inch) thick insulation faced with ASJ.
    - a. Convertors.
  5. Hot equipment: 40 mm (2 inch) thick insulation faced with ASJ.
    - a. Air separators.
- B. Flexible Mineral Fiber Blanket:
1. Adhere insulation to metal with 75 mm (3 inch) wide strips of insulation bonding adhesive at 200 mm (8 inches) on center all around duct. Additionally secure insulation to bottom of ducts exceeding 600 mm (24 inches) in width with pins welded or adhered on 450 mm (18 inch) centers. Secure washers on pins. Butt insulation edges and seal joints with laps and butt strips. Staples may be used to assist in securing insulation. Seal all vapor retarder penetrations with mastic. Sagging duct insulation will not be acceptable. Install firestop duct insulation where required.
  2. Supply air ductwork to be insulated includes main and branch ducts from AHU discharge to room supply outlets, and the bodies of ceiling outlets to prevent condensation. Insulate sound attenuator units, coil casings and damper frames. To prevent condensation insulate trapeze type supports and angle iron hangers for flat oval ducts that are in direct contact with metal duct.
  3. Concealed supply air ductwork.
    - a. Above ceilings at a roof level, in attics, and duct work exposed to outdoor weather: 50 mm (2 inch) thick insulation faced with FSK.

MP Steam > 4" = 3 1/2"

Hot Water > 4" = 2 1/2"

Aluminum since within 6' of floor

- b. Above ceilings for other than roof level: 40 mm (1 ½ inch) thick insulation faced with FSK.
- 4. Concealed return air duct:
  - a. Above ceilings at a roof level, 40 mm (1-1/2 inch) thick, insulation faced with FSK.
  - b. Concealed return air ductwork in other locations need not be insulated.
- 5. Concealed outside air duct: 40 mm (1-1/2 inch) thick insulation faced with FSK.

#### C. Molded Mineral Fiber Pipe and Tubing Covering:

1. Fit insulation to pipe or duct, aligning longitudinal joints. Seal longitudinal joint laps and circumferential butt strips by rubbing hard with a nylon sealing tool to assure a positive seal. Staples may be used to assist in securing insulation. Seal all vapor retarder penetrations on cold piping with a generous application of vapor barrier mastic. Provide inserts and install with metal insulation shields at outside pipe supports. Install freeze protection insulation over heating cable.
2. Contractor's options for fitting, flange and valve insulation:
  - a. Insulating and finishing cement for sizes less than 100 mm (4 inches) operating at surface temperature of 16 degrees C (61 degrees F) or more.
  - b. Factory premolded one piece PVC covers with mineral fiber, (Form B), inserts. Provide two insert layers for pipe temperatures below 4 degrees C (40 degrees F), or above 121 degrees C (250 degrees F). Secure first layer of insulation with twine. Seal seam edges with vapor barrier mastic and secure with fitting tape.
  - c. Factory molded, ASTM C547 or field mitered sections, joined with adhesive or wired in place. For hot piping finish with a smoothing coat of finishing cement. For cold fittings, 16 degrees C (60 degrees F) or less, vapor seal with a layer of glass fitting tape imbedded between two 2 mm (1/16 inch) coats of vapor barrier mastic.
  - d. Fitting tape shall extend over the adjacent pipe insulation and overlap on itself at least 50 mm (2 inches).
3. Nominal thickness in millimeters and inches specified in the schedule at the end of this section.

### 3.3 PIPE INSULATION SCHEDULE

A. Provide insulation for piping systems as scheduled below:

Nominal Pipe Size (in)	Domestic (Service) Hot Water	Chilled Water	Heating Hot & Glycol Water	Low Pressure Steam / Condensate (<15 psi)	Medium Pressure Steam / Condensate (15 - 75 psi)	High Pressure Steam / Condensate (>75 psi)
n<=1"	1"	1.5"	1.5"	2"	2.5"	2.5"
1"<n<=2"	1.5"	1.5"	2"	2"	2.5"	2.5"
2"<n<=4"	1.5"	2"	2"	2"	2.5"	3"
4"<n	2"	2.5"	2.5"	3"	3.5"	3.5"

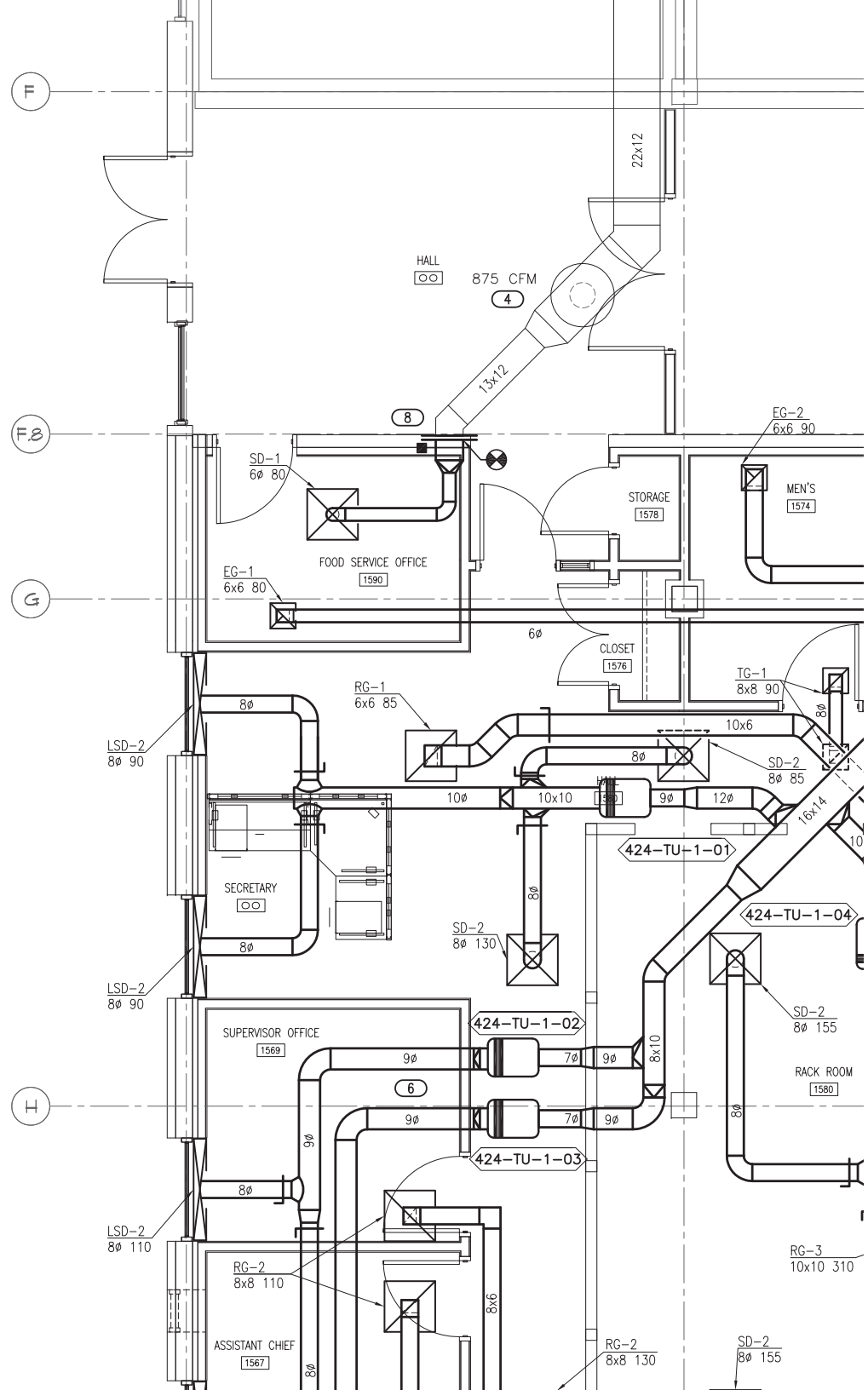
Insulation Thickness Millimeters (Inches)					
		Nominal Pipe Size Millimeters (Inches)			
Operating Temperature Range/Service	Insulation Material	Less than 25 (1)	25 - 32 (1 - 1¼)	38 - 75 (1½ - 3)	100 (4) and Above

- - - E N D - - -

# NEW WORK KEYED NOTES

- 1 PROVIDE DUCT CAP.
- 2 CLEARLY MARK DUCT "ABANDONNED DUCT", MINIMUM TEXT SIZE 2" TALL, BOTH SIDES.
- 3 MEASURE AND DOCUMENT DUCT AIRFLOW AND STATIC PRESSURE AT COMPLETION OF CONSTRUCTION PROJECT, AIRFLOW AND STATIC PRESSURE TO BE VERIFIED TO BE AT PRECONSTRUCTION VALUES DURING AND AFTER CONSTRUCTION, REBALANCE AS REQUIRED ASSURING NO AFFECT ON EXISTING SYSTEM WHICH REMAINS IN OPERATION DURING AND AFTER CONSTRUCTION. PROVIDE DOCUMENTATION OF FINDINGS AND SETTINGS TO OWNER AND HVAC SYSTEM ENGINEER.
- 4 MEASURE AND DOCUMENT GRILLE OR DIFFUSER AIRFLOW AT COMPLETION OF CONSTRUCTION PROJECT, GRILLE OR DIFFUSER AIRFLOW TO BE VERIFIED TO BE MAINTAINED AT PRECONSTRUCTION VALUES DURING AND AFTER CONSTRUCTION, REBALANCE AS REQUIRED ASSURING NO AFFECT ON EXISTING SYSTEM WHICH REMAINS IN OPERATION DURING AND AFTER CONSTRUCTION. PROVIDE DOCUMENTATION OF FINDINGS AND SETTINGS TO OWNER AND HVAC SYSTEM ENGINEER
- 5 REBALANCE 424-AHU-1 (LOCATED IN MECHANICAL PENHOUSE) DETERMINE REQUIRED AIRFLOW REDUCTION AS FROM PRECONSTRUCTION MEASUREMENT OF AIRFLOWS BEING ELIMINATED. ADJUST FAN SPEED AS REQUIRED TO ADDRESS REDUCED AIRFLOW REQUIREMENT. AS PART OF HVAC BALANCING, MEASURE AND DOCUMENT 424-AHU-1 PERFORMANCE:
  - WORK WITH OWNER TO HAVE CLEAN AIR FILTERS INSTALLED
  - MEASURE SUPPLY, OUTDOOR, RETURN, AND EXHAUST AIRFLOWS
  - MEASURE FILTER PRESSURE LOSS(ES)
  - MEASURE ALL COIL PRESSURE LOSSES
  - MEASURE SUPPLY AND RETURN STATIC PRESSURE
  - MEASURE SUPPLY AND RETURN AIR TEMPERATURE
  - MEASURE SUPPLY AND EXHAUST AIRFLOW WHEN OPERATING AT FULL ECONOMIZER
  - MEASURE FAN AND FAN MOTOR OPERATING DATA AT OPERATING CONDITION OF GREATEST LOAD (SUPPLY AND EXHAUST FANS) – AMPS VOLTS, RPM
  - RECORD FAN MOTOR NAMEPLATE AMPS, VOLTS, RPM, VFD SETTINGS
  - WORK WITH CONTROLS CONTRACTOR TO ADJUST STATIC PRESSURE SENSORS
  - PROVIDE WRITTEN REPORT DOCUMENTING AS LEFT CONDITION OF 424-AHU-1 TO HVAC ENGINEER AND VA COR.
- 6 INSULATE SUPPLY DUCT; PROVIDE R6 DUCT INSULATION WITH VAPOR BARRIER FROM ROOFTOP UNIT TO TERMINAL DEVICES (GRILLES/DIFFUSERS).
- 7 JOHNSON CONTROLS ENCLOSURE; RELOCATED TO AVOID INTERFERENCE WITH NEW DUCTWORK.
- 8 PROVIDE 1 1/2 HOUR RATED FIRE DAMPER.

M-424-2.1



A

three inches = one foot  
6"

B

one and one half inches = one foot  
6"

C

one inch = one foot  
6"one foot  
2

1

2

3

## KEYED NOTES

- 1 PROVIDE PIPE CAP. ASSURE NO LOW POINTS THAT COULD ACCUMULATE CONDESATE.
- 2 PIPE STEAM AND CONDENSATE TO FEED EXISTING CONVECTOR ABOVE.
- 3 INSULATE AND JACKET STEAM AND CONDENSATE PIPING (1-1/2", 0.27<K<0.30), PVC JACKET.

M-424-2.2

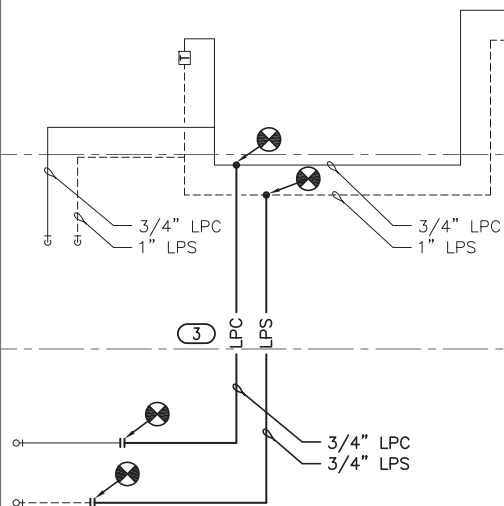
F

F.8

G

2

1



A

three inches = one foot  
6"

B

one and one half inches = one foot  
6"

C

one inch = one foot  
6"one foot  
2

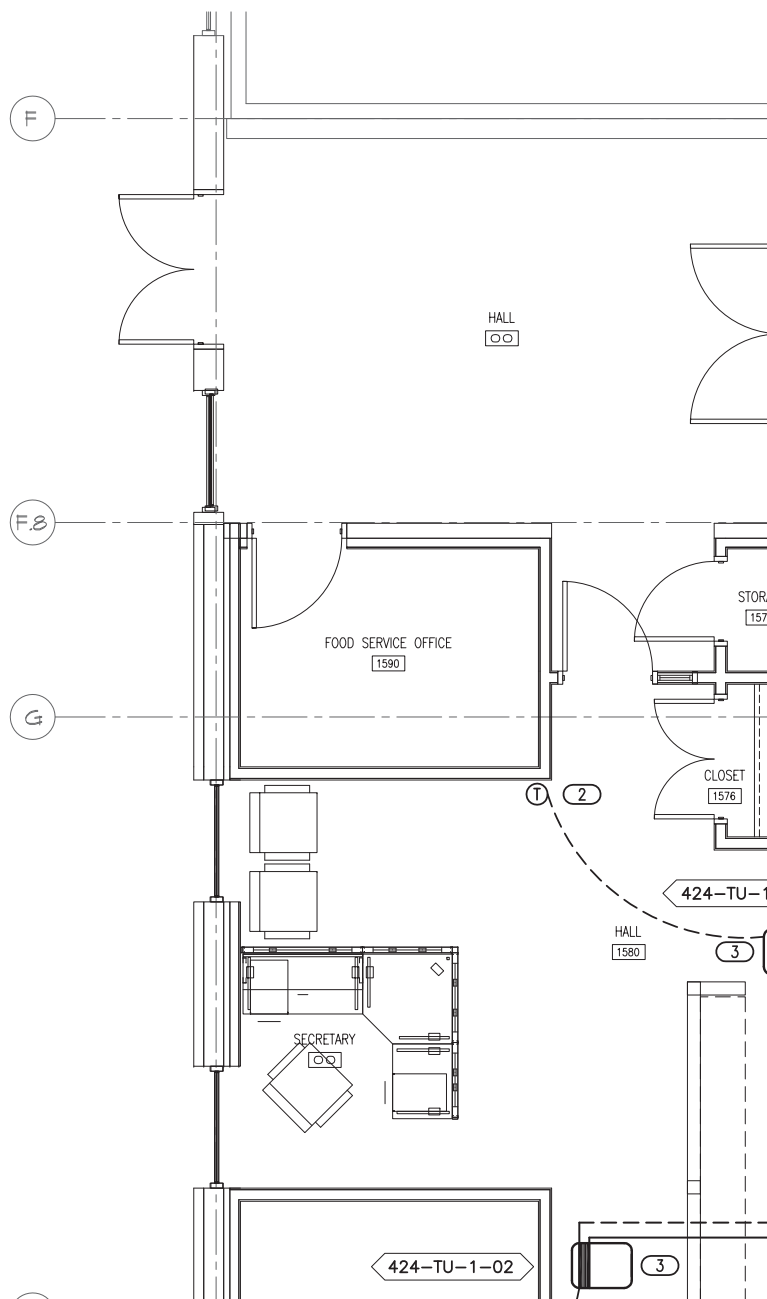
## KEYED NOTES

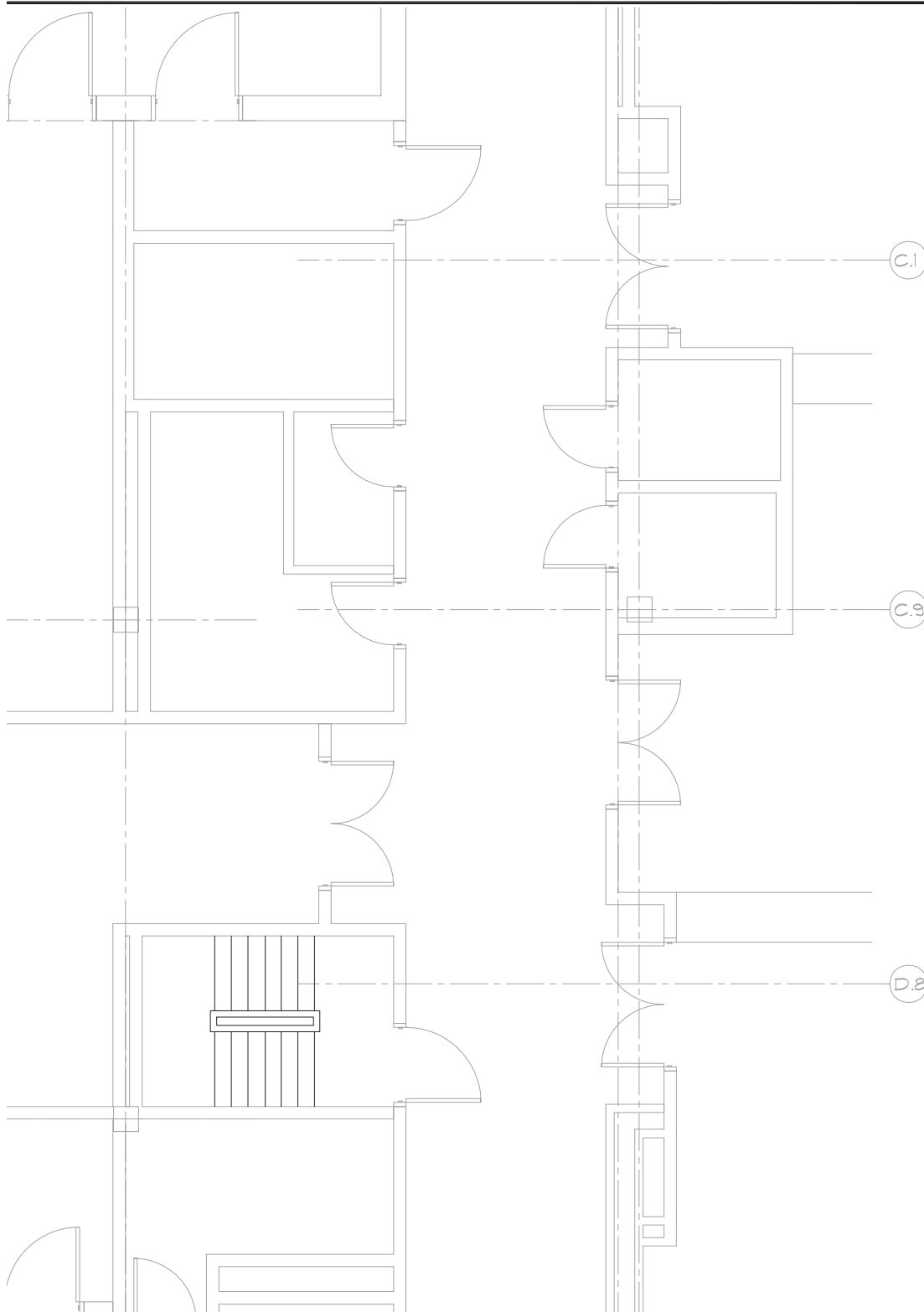
- 1 PROVIDE DUCT MOUNTED HOT WATER COIL.
- 2 PROVIDE THERMOSTAT.
- 3 PROVIDE VARIABLE AIRFLOW TERMINAL UNIT WITH HOT WATER COIL.
- 4 EMERGENCY POWER SHUT OFF SWITCH FOR ROOFTOP UNIT SERVING SPACE (424-RTU-1). PROVIDE CONTROLS INTERFACE. MANUAL RESTART THROUGH BUILDING AUTOMATION SYSTEM. SWITCH BY ELECTRICAL CONTRACTOR, CONTROLS CONTRACTOR TO COORDINATE WITH ELECTRICAL FOR CONTROLS REQUIREMENTS.
- 5 INSULATE AND JACKET HOT WATER SUPPLY AND RETURN PIPING (1-1/2", 0.27<K<0.30), PVC JACKET.
- 6 PROVIDE HWS/HWR DIFFERENTIAL PRESSURE STATION.

## GENERAL NOTES

1. ALL BRANCH RUNOUTS TO TERMINAL UNITS OVER 5' IN LENGTH MINIMUM 3/4" DIAMETER.

M-424-2.3





## KEYED NOTES

- 1 PROVIDE NEW STEAM TO HOT WATER CONVERTER. SEE 5/5.3
- 2 PROVIDE NEW PUMP.
- 3 PROVIDE NEW EXPANSION TANK.
- 4 PROVIDE NEW AIR SEPARATOR.
- 5 PROVIDE NEW STEAM TRAP.
- 6 EXISTING HVAC CONTROL PANEL TO BE USED FOR NEW CONTROLS - 424-RTU-1, TERMINAL UNITS, AND HYDRONIC SYSTEM.
- 7 BALANCE HYDRONIC SYSTEM. SET BRANCH FLOWS TO EXISTING AREAS TO FLOWS MEASURED PRIOR TO CONSTRUCTION. SET FLOWS TO REMODELED AREA IN ACCORDANCE WITH EQUIPMENT FLOW REQUIREMENTS:
  - DOCUMENT TOTAL SYSTEM FLOW
  - DOCUMENT BRANCH FLOWS TO EXISTING AREAS AND REMODELED AREA
  - MEASURE PUMP PRESSURE RISE AND STRAINER PRESSURE LOSS
  - MEASURE PUMP MOTOR OPERATING DATA - AMPS, VOLTS, RPM
  - PROVIDE WRITTEN REPORT DOCUMENTING AS FOUND CONDITION OF HYDRONIC SYSTEM TO HVAC ENGINEER AND VA COR.
- 8 INSULATE AND JACKET STEAM AND CONDENSATE PIPING, PVC JACKET, SEE SPEC.
- 9 INSULATE AND JACKET HOT WATER SUPPLY AND RETURN PIPING, PVC JACKET, SEE SPEC.
- 10 PROVIDE NEW STRAINER, MANUAL ISOLATION VALVES, SUCTION DIFFUSERS, CHECK VALVES, PRESSURE GAUGES, FLEX CONNECTORS, AND THERMOMETERS, SEE INLINE PUMP DETAIL.
- 11 PROVIDE BRANCH LINE CIRCUIT SETTER.
- 12 CAP PIPE.
- 13 INSULATE AND JACKET STEAM TO HOT WATER CONVERTER AND AIR SEPARATOR, SEE SPECS.
- 14 PROVIDE NEW HEATING WATER RELIEF VALVE, PIPE DISCHARGE TO FLOOR DRAIN.
- 15 PROVIDE FULL LINE SIZE DIRT LEG WITH TRAP CONNECTION, REUSE EXISTING TRAP FROM END OF MAIN.
- 16 REINSTALL CHEMICAL POT FEEDER.
- 17 TEST CONCENTRATION OF PROPYLENE GLYCOL IN EXISTING SYSTEM, IF FOUND TO BE LESS THAN 40%, PROVIDE GLYCOL AS REQUIRED TO RAISE GLYCOL TO 40% AFTER SYSTEM REFILL.
- 18 FABRICATE ANGLE IRON FRAME WITH SUPPORT SADDLES FOR STEAM TO HOT WATER HEAT EXCHANGERS. SUPPORT AT HEIGHT REQUIRED FOR CONDENSATE REMOVAL BY GRAVITY PER DETAIL 5/5.3.

M-424-2.4