

*REFERENCE 'G' SERIES FOR GENERAL NOTES AND ADDITIONAL INFORMATION.

GENERAL NOTES:

- INFORMATION SHOWN ON THE DRAWINGS IS INTENDED TO CONVEY SCOPE AND IS ARRANGED FOR DRAWING CLARITY. IT IS NOT TO BE TAKEN AS AN AS-BUILT CONDITION. THE SYSTEM INSTALLATION SHALL BE COORDINATED WITH STRUCTURE, CEILINGS, WALLS, AND ALL OTHER TRADES TO PROVIDE FOR A COMPLETE AND WORKING SYSTEM.
- COORDINATE ALL DUCT PENETRATIONS WITH STRUCTURAL PRIOR TO CUTTING FLOORS OR BEARING WALLS.
- PROVIDE ACOUSTICAL SEALANT AT PENETRATIONS OF ALL STC-RATED WALLS. REFER TO ARCHITECTURAL PLANS FOR LOCATIONS OF STC-RATED WALLS.
- PROVIDE FIRESTOPPING AT PENETRATIONS OF ALL RATED WALLS. REFER TO CODE PLANS FOR LOCATIONS OF RATED WALLS.
- WALL MOUNTED DEVICES SUCH AS THERMOSTATS, TEMPERATURE SENSORS, HUMIDITY SENSORS, AND PRESSURE SENSORS ARE SHOWN ON PLANS FOR CLAIRTY AND GENERAL REFERENCE OF LOCATIONS. LOCATIONS SHOW ARE NOT TO BE CONSIDERED THE EXACT MOUNTING LOCATION. COORDINATE THE INSTALLATION OF ALL WALL MOUNTED DEVICES WITH THE ARCHITECTURAL ELEVATIONS AND OTHER TRADES WALL MOUNTED DEVICES. GROUP THE INSTALLATION OF ALL THE DEVICES TO THE EXTENT POSSIBLE AND LOCATED DEVICES SUCH THAT THEY DO NOT CONFLICT WITH MILL WORK, TELEVISIONS, FURNITURE, TEACHING BOARDS, AND OTHER SIMILAR OBSTRUCTIONS.
- ALL DUCTWORK AND PIPING IS SHOWN DIAGRAMMATICALLY AND DOES NOT INCLUDE ALL OFFSETS, DROPS, AND RISES. CAREFULLY COORDINATE DUCT AND PIPE ROUTING WITH STRUCTURE AS WELL AS ALL OTHER TRADES TO MAINTAIN EQUIPMENT CLEARANCES, EQUIPMENT ACCESSIBILITY, DESIRED CEILING HEIGHTS, AND AESTHETICS. THE CONTRACTOR SHALL INCLUDE ANY NEEDED OFFSETS AND CHANGES OF DIRECTION IN THE BID PRICING.
- DUCT SIZES SHOWN ARE SHEET METAL DIMENSIONS. WHERE DUCT LINER IS REQUIRED, DUCT SIZES ARE NOT REQUIRED TO BE INCREASED TO ACCOUNT FOR LINER.
- FURNISH ALL EXPOSED DUCTWORK IN FINISHED SPACES WITH PAINTABLE FINISH. PROVIDE A TRIM FLANGE AT WALL PENETRATIONS OF EXPOSED DUCTWORK, FINISH BY ARCHITECT.
- AVOID ROUTING ANY PIPING THROUGH IT ROOMS OR ELECTRIC ROOMS. IN THE EVENT IT IS ABSOLUTELY NECESSARY, COORDINATE THE EXACT LOCATION SUCH THAT IT IS NOT DIRECTLY ABOVE ANY PANELS OR EQUIPMENT.

PLAN NOTES:

- 26"x20" SUPPLY DUCT UP TO ROOFTOP UNIT.
- 36"x24" RETURN DUCT UP TO ROOFTOP UNIT.
- 12"x12" EXHAUST DUCT UP TO EXHAUST FAN.
- 8"x8" EXHAUST DUCT UP TO EXHAUST FAN.

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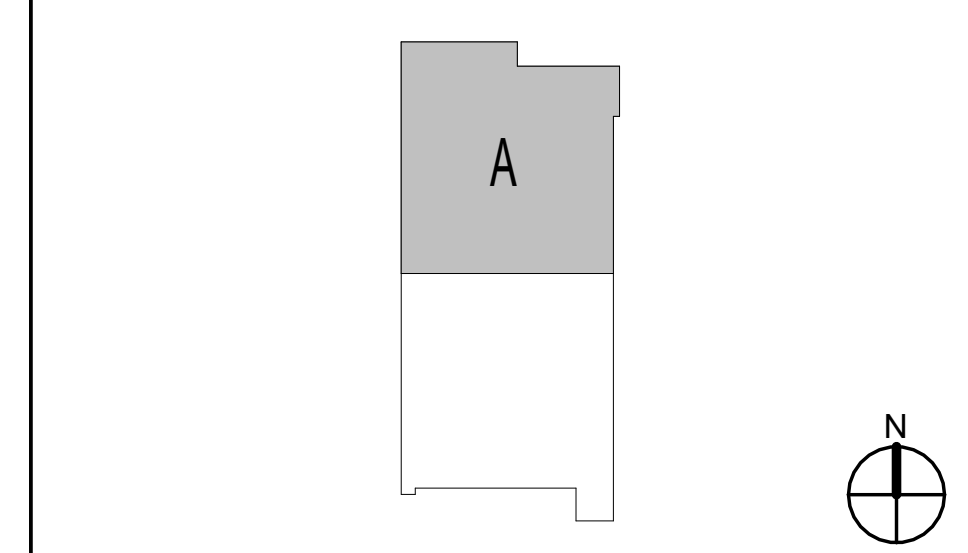
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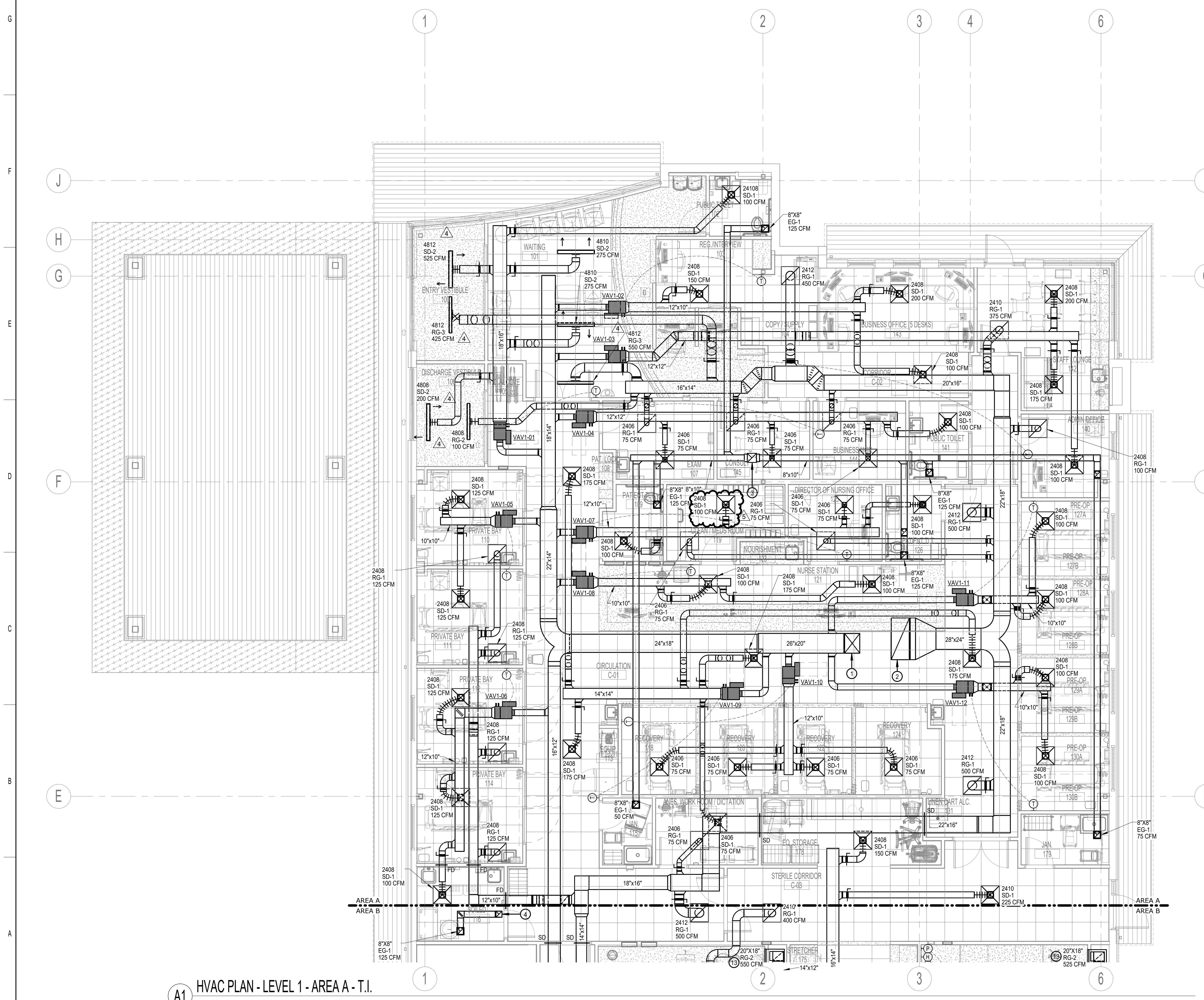
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PROJECT #:	24158
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4 ADDENDUM #4	04/04/25
5 DHSS COMMENTS	04/21/25

2M1-110
 HVAC PLAN - LEVEL 1 - AREA A

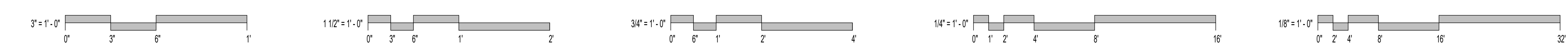
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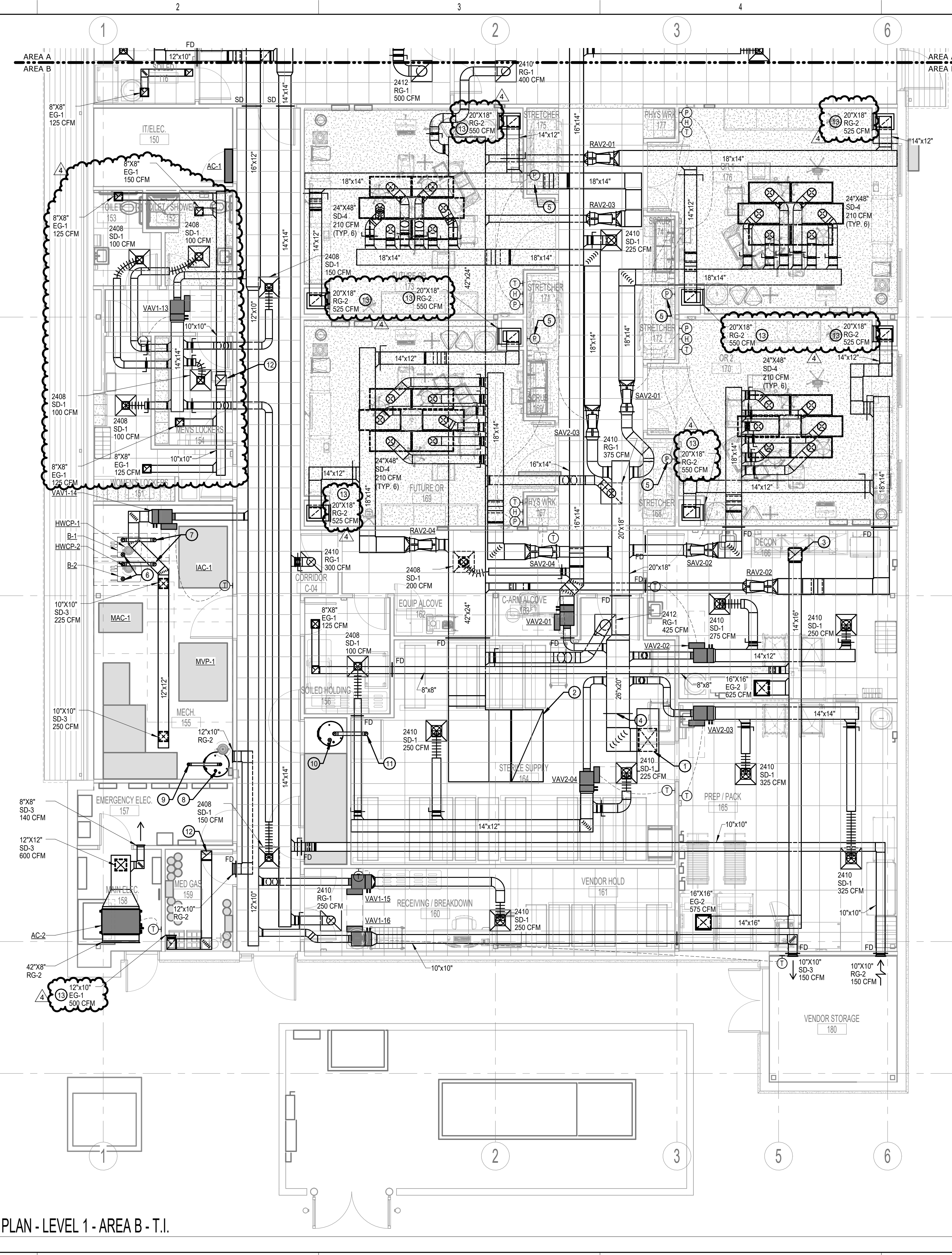


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A1 HVAC PLAN - LEVEL 1 - AREA A - T.I.
 3/16" = 1'-0"





A1 HVAC PLAN - LEVEL 1 - AREA B - T.I.
3/16" = 1'-0"



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- PLAN NOTES:**
- 26"x20" SUPPLY DUCT UP TO ROOFTOP UNIT.
 - 42"x24" RETURN DUCT UP TO ROOFTOP UNIT.
 - 16"x14" EXHAUST DUCT UP TO EXHAUST FAN.
 - HUMIDIFIER DISPERSION TUBE MOUNTED IN SUPPLY DUCT.
 - PROVIDE ROOM PRESSURE MONITOR (ANTEC PMT OR APPROVED EQUAL) TO MONITOR PRESSURE BETWEEN OPERATING ROOM AND CORRIDOR. MOUNT DISPLAY IN CORRIDOR AT 48" AFF. MAINTAIN OPERATING ROOM AT +0.02" TO CORRIDOR.
 - 4"ø BOILER COMBUSTION INTAKE UP THRU ROOF.
 - 4"ø BOILER FLUE UP THRU ROOF.
 - 3"ø DOMESTIC WATER HEATER COMBUSTION INTAKE UP THRU ROOF.
 - 3"ø DOMESTIC WATER HEATER FLUE UP THRU ROOF.
 - 4"ø DOMESTIC WATER HEATER COMBUSTION INTAKE UP THRU ROOF.
 - 4"ø DOMESTIC WATER HEATER FLUE UP THRU ROOF.
 - 12"x12" EXHAUST DUCT UP TO EXHAUST FAN.
 - LOCATE GRILLE WITH BOTTOM OF GRILLE AT 6" AFF.

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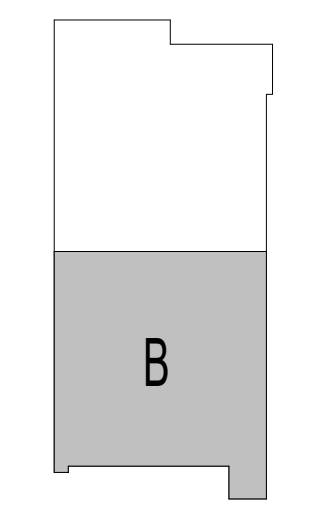
STATE OF MISSOURI
 RYAN JEROD DIEDER
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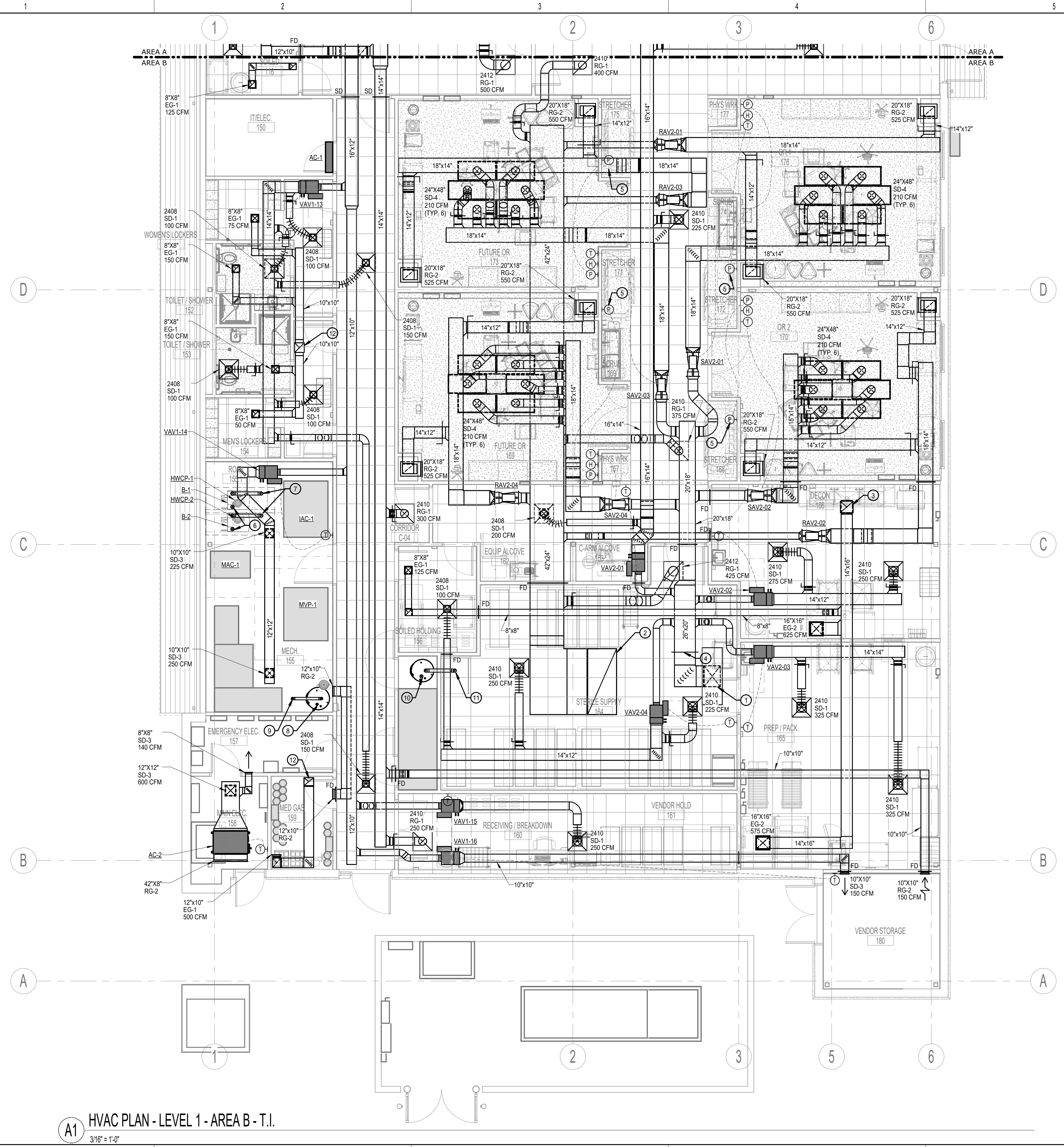
KEY PLAN



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2M1-120
 HVAC PLAN - LEVEL 1 - AREA B

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A1 HVAC PLAN - LEVEL 1 - AREA B - T.I.
3/16" = 1'-0"



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 - 12" x 12" EXHAUST DUCT UP TO EXHAUST FAN.

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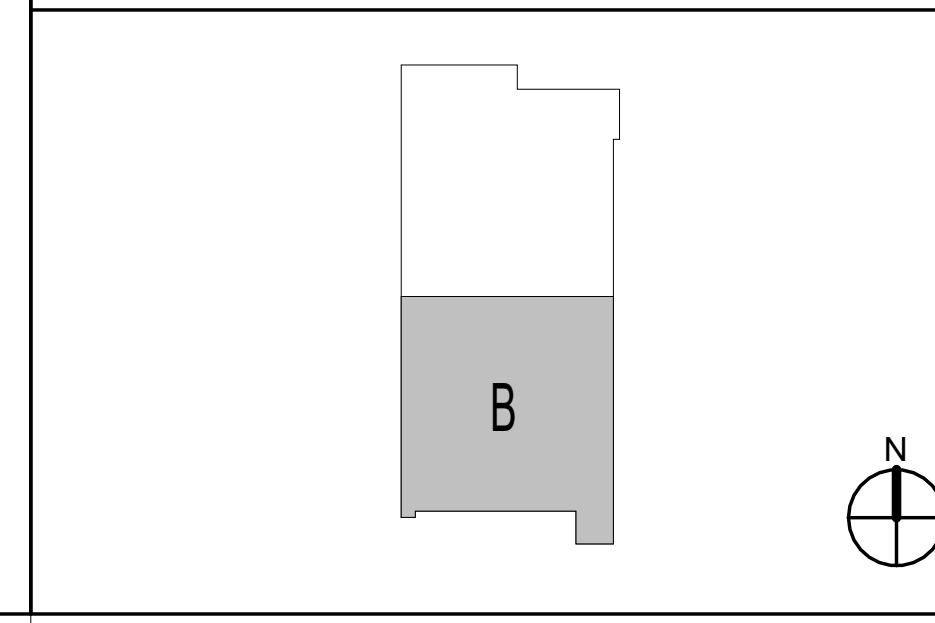
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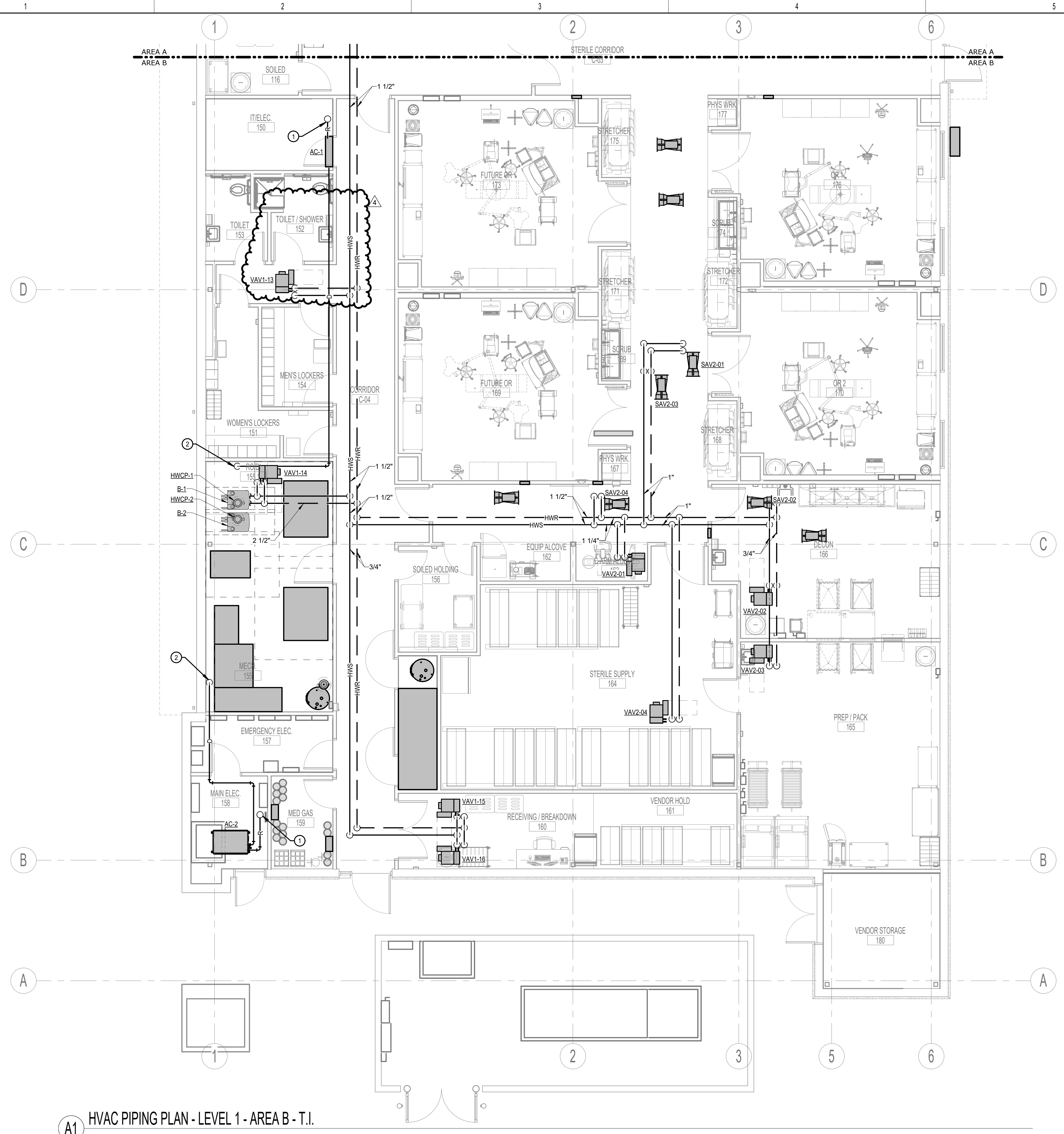
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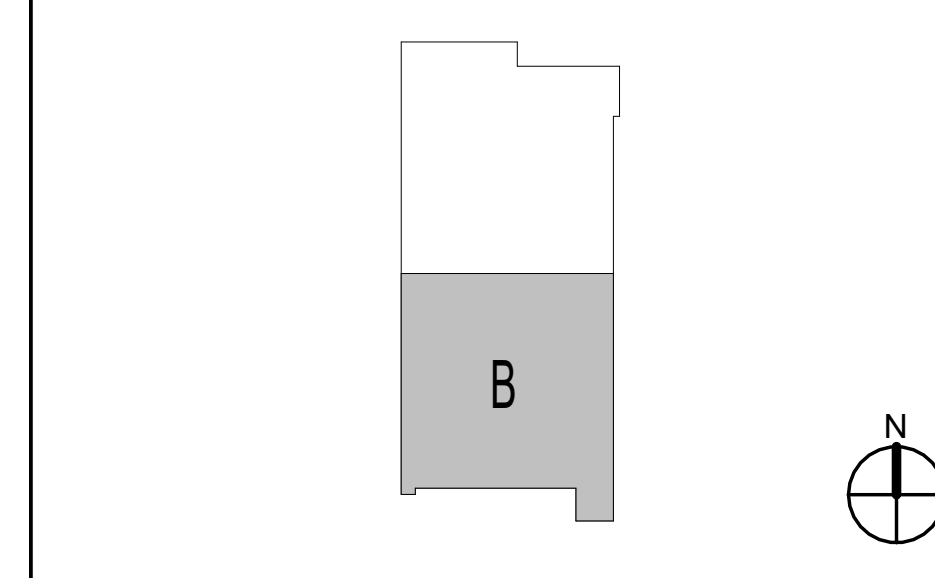
A1 HVAC PIPING PLAN - LEVEL 1 - AREA B - T.I.
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- REFRIGERANT PIPING UP THRU ROOF AND ROUTE TO INDOOR UNIT. SIZE AND ROUTE PER MANUFACTURERS INSTRUCTIONS.
 - TERMINATE 1" CONDENSATE DRAIN OVER FLOOR DRAIN.

KEY PLAN



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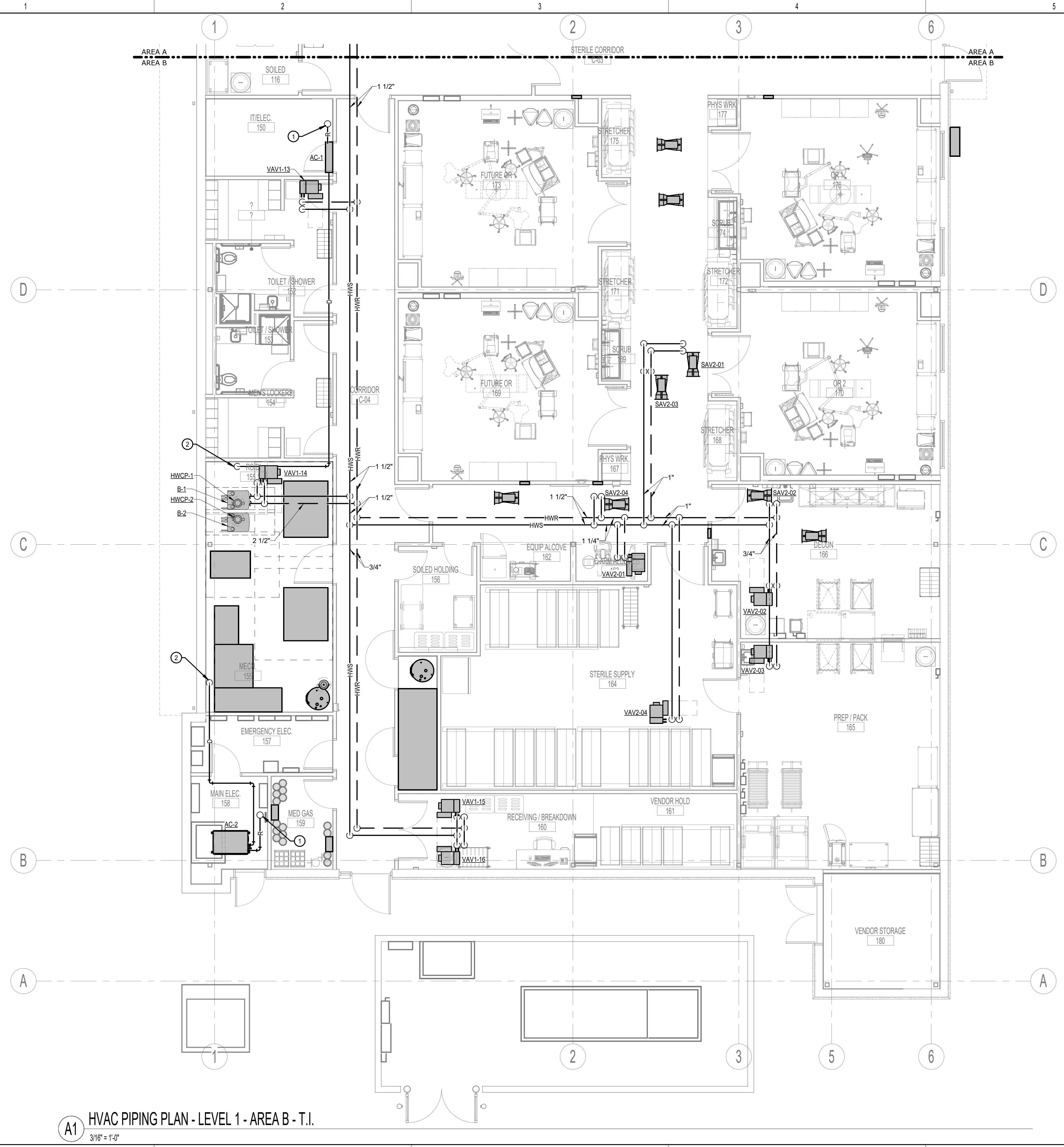
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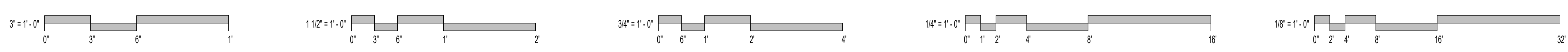
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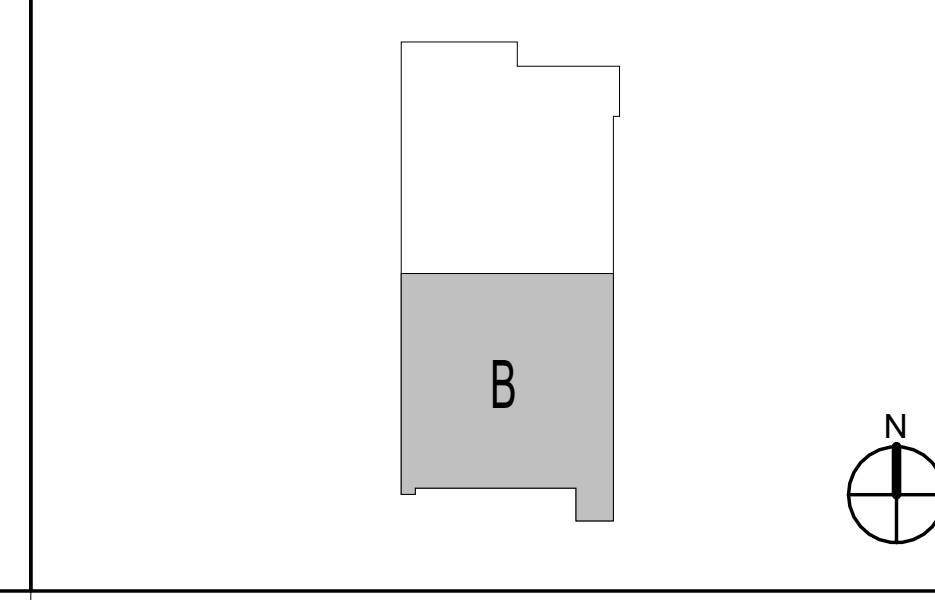
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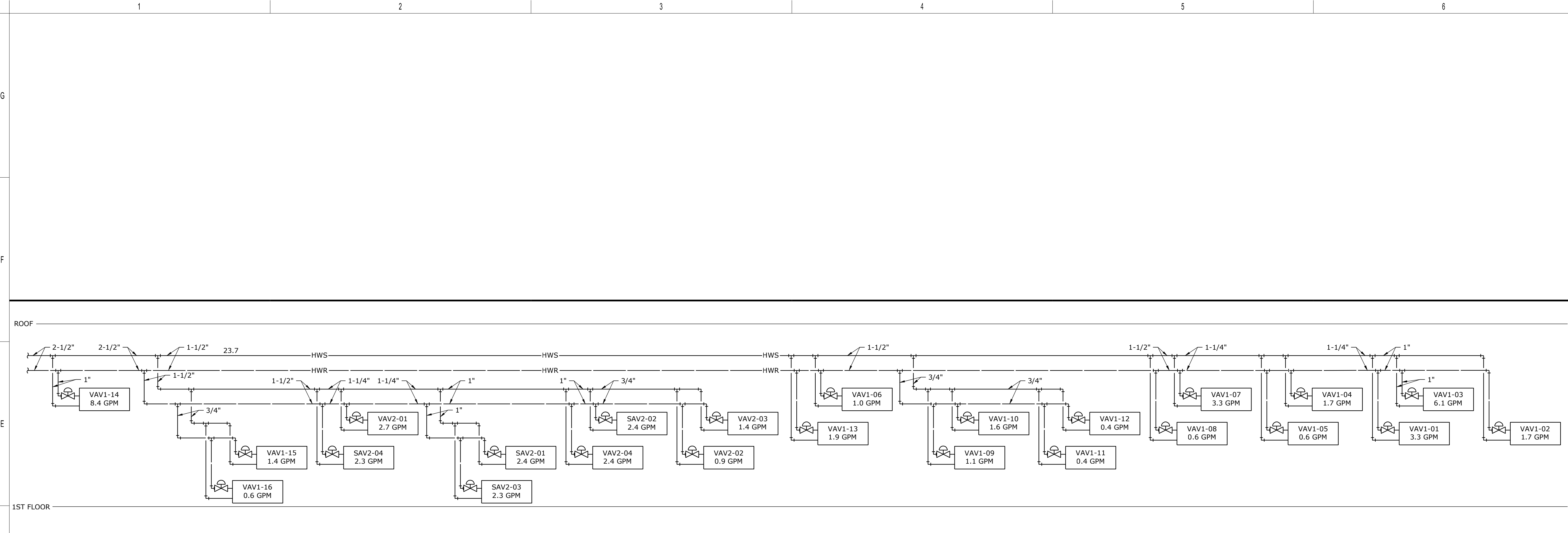
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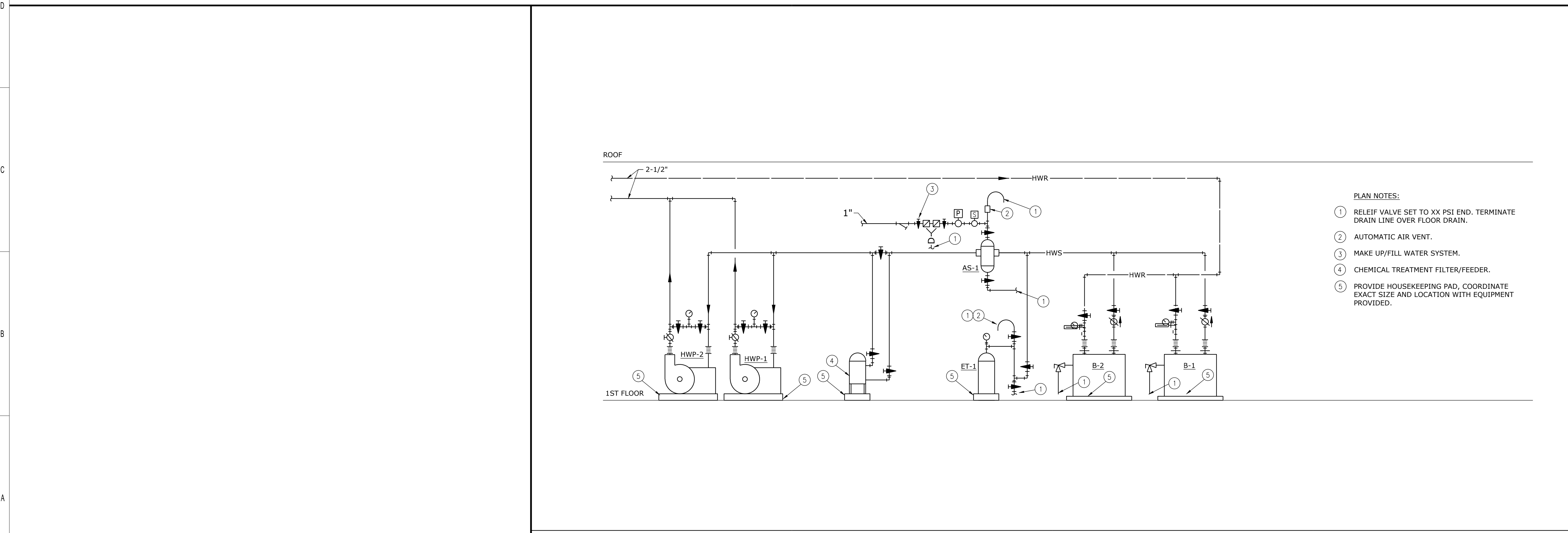
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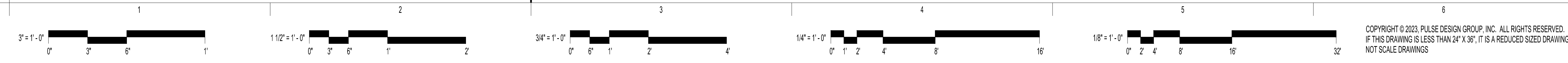
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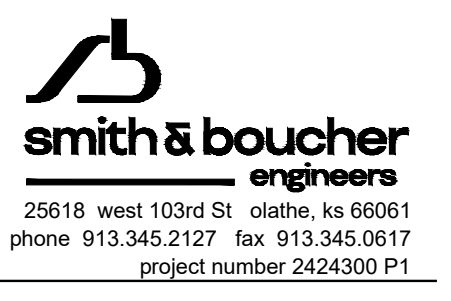
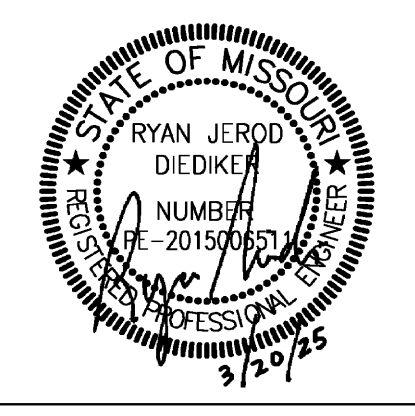
HEATING HOT WATER PIPING SCHEMATIC
NO SCALE



MECHANICAL ROOM HOT WATER PIPING SCHEMATIC
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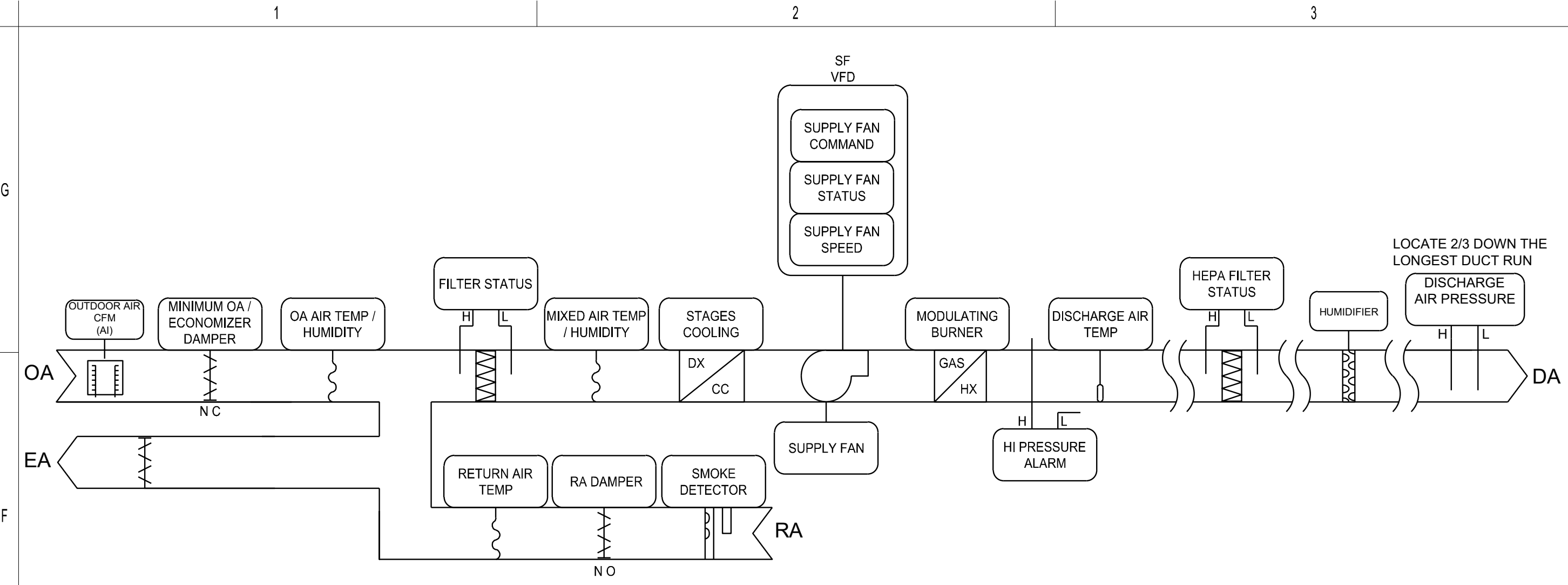
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LAST CORRECTION BY: Jlangenfeld Thursday, March 20, 2025 1:05:42 PM
PLOTTED BY: B. Charley Thursday, March 20, 2025 4:25:54 PM



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 PROJECT #: 24158

REVISION DATE



VAV AIR ROOFTOP HANDLING UNIT SEQUENCE

THE ROOFTOP UNITS SHALL BE FURNISHED WITH OEM CONTROLS AND A COMMUNICATION INTERFACE TO CONNECT TO THE BMS SYSTEM.

THE BMS SHALL PICK UP AVAILABLE UNIT MONITORING AND ADJUSTABLE POINTS AND PROVIDE THEM ON THE GRAPHIC DISPLAY. THESE INCLUDE BUT ARE NOT LIMITED TO DISCHARGE AIR TEMPERATURE, OUTSIDE AIR TEMPERATURE, RETURN AIR TEMPERATURE, MIXED AIR TEMPERATURE, FILTER DIFFERENTIAL PRESSURE, AND HIGH DUCT STATIC PRESSURE.

SUPPLY FAN:

THE SUPPLY FAN SHALL BE STARTED ACCORDING TO THE BUILDING OCCUPANCY SCHEDULE. IF THE SUPPLY FAN STATUS DOES NOT MATCH THE COMMANDED VALUE, AN ALARM SHALL BE GENERATED. WHEN THE SUPPLY FAN STATUS INDICATES THE FAN STARTED, THE CONTROL SEQUENCE SHALL BE ENABLED. THE SUPPLY FAN SHALL MODULATE TO MAINTAIN THE DISCHARGE STATIC PRESSURE AT SET POINT (ADJ.)

STATIC PRESSURE SET POINT OPTIMIZATION:

THE BUILDING AUTOMATION SYSTEM SHALL CONTINUOUSLY MONITOR THE DAMPER POSITION OF ALL TERMINAL UNITS. WHEN ANY DAMPER IS MORE THAN 95% (ADJ.) OPEN, THE STATIC PRESSURE SET POINT SHALL BE RESET UPWARD BY 5% (ADJ.) OF THE MAXIMUM SYSTEM PRESSURE SET POINT AT A FREQUENCY OF 10 MINUTES (ADJ.) UNTIL NO DAMPER IS MORE THAN 95% OPEN OR THE PRESSURE SET POINT HAS RESET UPWARD TO THE SYSTEM MAXIMUM SETTING OR VARIABLE FREQUENCY DRIVE IS AT MAXIMUM SETTING. WHEN ALL DAMPERS ARE LESS THAN 85% (ADJ.) OPEN, THE STATIC PRESSURE SET POINT SHALL BE RESET DOWNWARD BY 5% (ADJ.) OF THE MAXIMUM SYSTEM PRESSURE SET POINT AT A FREQUENCY OF 10 MINUTES (ADJ.) UNTIL AT LEAST ONE DAMPER IS MORE THAN 85% OPEN OR THE PRESSURE SET POINT HAS RESET DOWNWARD TO THE SYSTEM MINIMUM SETTING OR VARIABLE FREQUENCY DRIVE IS AT MINIMUM SETTING. THE CONTROL BANDS, SET POINT INCREMENT VALUES, SET POINT DECREMENT VALUES AND ADJUSTMENT FREQUENCIES SHALL BE ADJUSTED TO MAINTAIN MAXIMUM PRESSURE OPTIMIZATION WITH STABLE SYSTEM CONTROL AND MAXIMUM COMFORT CONTROL.

DISCHARGE AIR CONTROL:

THE UNIT DISCHARGE AIR TEMPERATURE SET POINT SHALL BE 45°F (ADJ.). ON A CALL FOR COOLING, THE DX COOLING SHALL STAGE ON AS NEEDED TO MAINTAIN THE DISCHARGE AIR TEMPERATURE AT COOLING SET POINT. ON A CALL FOR HEATING, THE GAS HEAT EXCHANGER SHALL MODULATE TO MAINTAIN DISCHARGE AIR TEMPERATURE AT HEATING SET POINT.

GAS HEAT EXCHANGER:

THE GAS HEAT EXCHANGER WILL MODULATE TO MAINTAIN THE DISCHARGE TEMPERATURE SET POINT. WHEN THE UNIT IS SHUTDOWN, THE GAS HEAT EXCHANGER WILL BE OFF.

COOLING COIL:

THE DX COOLING COIL WILL BE STAGED IN SEQUENCE TO MAINTAIN THE DISCHARGE TEMPERATURE SET POINT. THE COOLING COIL WILL BE LOCKED OUT ON A DROP IN OUTDOOR AIR TEMPERATURE BELOW THE LOCKOUT SET POINT.

HUMIDIFIER CONTROL:

MAINTAIN A MINIMUM SPACE RELATIVE HUMIDITY SETPOINT OF 40% (ADJ.). IN THE EVENT SPACE HUMIDITY REDUCES BELOW THE MINIMUM SET POINT, ENABLE THE HUMIDIFIER TO MAINTAIN SPACE HUMIDITY. HUMIDIFIERS SHALL BE PROVIDED WITH A BACNET INTEGRATION CARD AND 0-10 V CONTROL. START THE STEAM HUMIDIFIER AT LOWEST SETTING, THEN MODULATE AS NEEDED TO MAINTAIN THE SPACE RH SET POINT. LIMIT STEAM HUMIDIFIER CAPACITY TO A MAXIMUM OF 90% RH WITHIN SUPPLY DUCTWORK. GENERATE ALARM IN THE EVENT HUMIDITY IN THE DUCTWORK EXCEEDS 95% RH (ADJ.).

ECONOMIZER MODE:

WHEN THE OUTSIDE AIR ENTHALPY IS LOWER THAN THE RETURN AIR ENTHALPY THE UNIT SHALL BE IN ECONOMIZER MODE. THE ECONOMIZER SHALL ACT AS THE INITIAL STAGE OF COOLING, WORKING IN SEQUENCE WITH THE COOLING COIL. ONCE ACTIVE COOLING IS NO LONGER NEEDED, MODULATE THE RETURN AIR AND OUTSIDE AIR DAMPERS TO PROVIDE THE SUPPLY AIR DISCHARGE TEMPERATURE SET POINT. WHEN THE OUTSIDE AIR DRY BULB TEMPERATURE FALLS BELOW 45°F, ECONOMIZER SHALL BE DISABLED.

UNOCCUPIED MODE:

WHEN THE UNIT IS IN UNOCCUPIED MODE ACCORDING TO THE SCHEDULE, THE OUTSIDE AIR DAMPER IS CLOSED, THE RELIEF AIR DAMPER IS CLOSED, THE RETURN AIR DAMPER IS OPEN AND THE UNIT IS OFF. UPON A REQUEST FOR COOLING BY A MINIMUM OF FIVE ZONES NEEDING TO MAINTAIN THEIR UNOCCUPIED COOLING TEMPERATURE SET POINT, ACTIVATE THE UNIT SUPPLY FAN, THE OUTSIDE AIR AND RELIEF AIR DAMPERS SHALL REMAIN CLOSED.

BUILDING PRESSURE CONTROL:

BUILDING PRESSURE CONTROL IS MANAGED VIA THE RETURN/RELIEF FAN AND PREDEFINED OFFSETS OF THE OUTSIDE AIR AND RELIEF AIR QUANTITIES. PROVIDE SPACE PRESSURE SENSORS TO MONITOR SPACE PRESSURE.

MORNING WARM-UP MODE AND COOL-DOWN MODES:

PROVIDE OPTIMAL START LOGIC TO DETERMINE WHEN TO BEGIN THE MORNING WARM-UP OR COOL-DOWN SEQUENCE. WHEN THE UNIT TRANSITIONS FROM THE UNOCCUPIED MODE TO OCCUPIED MODE, MORNING WARM-UP OR COOL-DOWN SHALL BE ACTIVATED. DURING MORNING WARM-UP/COOLDOWN, THE RTU SUPPLY AND RETURN FANS SHALL OPERATE AT 100% FLOW, THE OUTSIDE AIR SHALL REMAIN AT 25% OF NORMALLY SCHEDULED AIRFLOW, AND THE DX COOLING / GAS HEAT EXCHANGER SHALL MODULATE TO MAINTAIN THE OCCUPIED DISCHARGE AIR TEMPERATURE SET POINT. WHEN THE ZONE TEMPERATURE IS WITHIN 1°F OF SET POINT, THE RTU SHALL TRANSITION TO THE OCCUPIED SEQUENCE.

FILTER STATUS:

THE DIFFERENTIAL PRESSURE ACROSS THE FILTERS WITHIN THE UNIT AND THE HEPA FILTERS WITHIN THE ROOF CURB SHALL BE MONITORED AND AN ALARM GENERATED IF THE DIFFERENTIAL PRESSURE RISES ABOVE SET POINT.

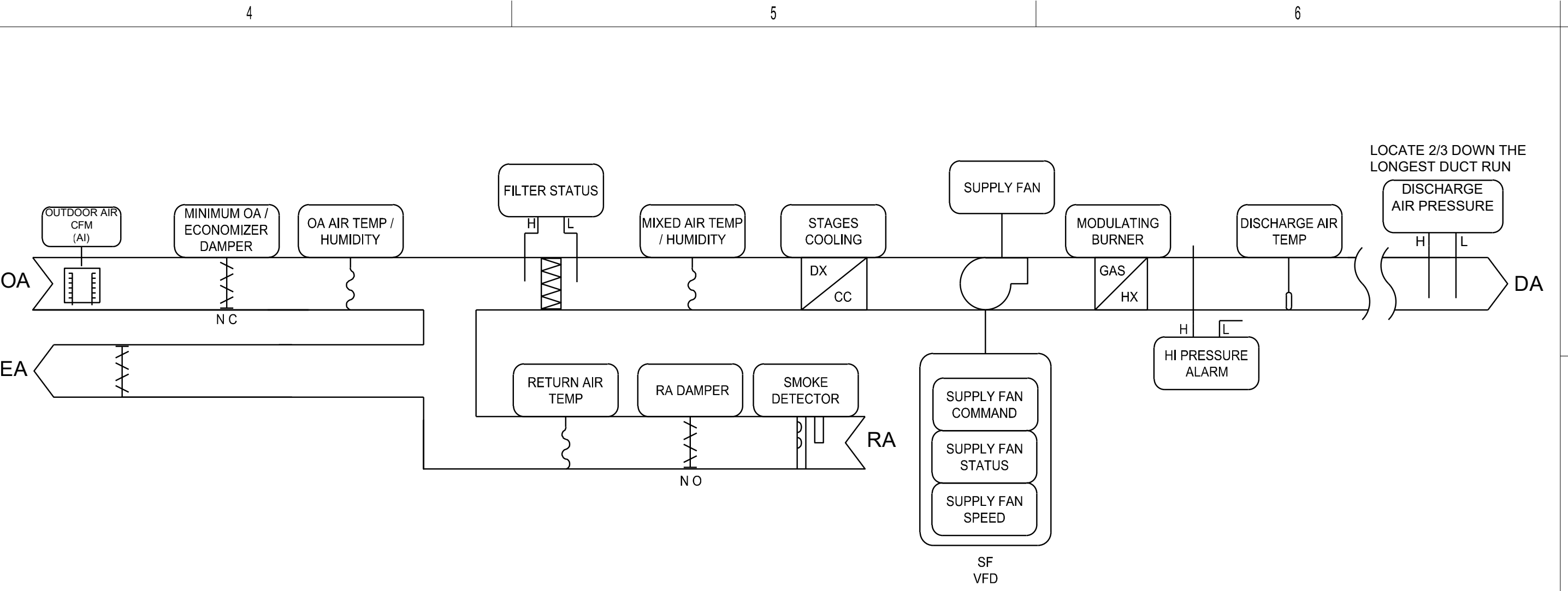
SMOKE DETECTOR ALARM:

NOTIFY BMS AND SHUTDOWN UNIT IN THE EVENT THE SMOKE DETECTOR GOES INTO ALARM.

SAFETIES:

IF A FIRE ALARM SHUTDOWN CONTACT IS MADE, THE SUPPLY FAN AND RETURN FAN SHALL BE SHUTDOWN WHEN TRIGGERED.

IF A HIGH STATIC PRESSURE SWITCH LOCATED AFTER THE SUPPLY FAN SENSES A DISCHARGE PRESSURE THAT IS GREATER THAN SET POINT, THE SUPPLY FAN AND RETURN FAN SHALL BE SHUTDOWN.



VAV AIR ROOFTOP HANDLING UNIT SEQUENCE

THE ROOFTOP UNITS SHALL BE FURNISHED WITH OEM CONTROLS AND A COMMUNICATION INTERFACE TO CONNECT TO THE BMS SYSTEM.

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STATIC PRESSURE SET POINT OPTIMIZATION:

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DISCHARGE AIR CONTROL:

THE UNIT DISCHARGE AIR TEMPERATURE SET POINT SHALL BE 55°F (ADJ.). THE DISCHARGE AIR TEMPERATURE SHALL BE RESET UPWARDS BASED UPON THE MOST CRITICAL ZONE TO A MAXIMUM OF 60°F (ADJ.). WHEN ALL ZONES ARE CALLING FOR HEATING, THE DISCHARGE AIR TEMPERATURE SET POINT SHALL BE RESET TO 70°F (ADJ.). ON A CALL FOR COOLING, THE DX COOLING SHALL STAGE ON AS NEEDED TO MAINTAIN THE DISCHARGE AIR TEMPERATURE AT COOLING SET POINT. ON A CALL FOR HEATING, THE GAS HEAT EXCHANGER SHALL MODULATE TO MAINTAIN DISCHARGE AIR TEMPERATURE AT HEATING SET POINT.

GAS HEAT EXCHANGER:

THE GAS HEAT EXCHANGER WILL MODULATE TO MAINTAIN THE DISCHARGE TEMPERATURE SET POINT. WHEN THE UNIT IS SHUTDOWN, THE GAS HEAT EXCHANGER WILL BE OFF.

COOLING COIL:

THE DX COOLING COIL WILL BE STAGED IN SEQUENCE TO MAINTAIN THE DISCHARGE TEMPERATURE SET POINT. THE COOLING COIL WILL BE LOCKED OUT ON A DROP IN OUTDOOR AIR TEMPERATURE BELOW THE LOCKOUT SET POINT.

ECONOMIZER MODE:

WHEN THE OUTSIDE AIR ENTHALPY IS LOWER THAN THE RETURN AIR ENTHALPY THE UNIT SHALL BE IN ECONOMIZER MODE. THE ECONOMIZER SHALL ACT AS THE INITIAL STAGE OF COOLING, WORKING IN SEQUENCE WITH THE COOLING COIL. ONCE ACTIVE COOLING IS NO LONGER NEEDED, MODULATE THE RETURN AIR AND OUTSIDE AIR DAMPERS TO PROVIDE THE SUPPLY AIR DISCHARGE TEMPERATURE SET POINT. WHEN THE OUTSIDE AIR DRY BULB TEMPERATURE FALLS BELOW 45°F, ECONOMIZER SHALL BE DISABLED.

UNOCCUPIED MODE:

WHEN THE UNIT IS IN UNOCCUPIED MODE ACCORDING TO THE SCHEDULE, THE OUTSIDE AIR DAMPER IS CLOSED, THE RELIEF AIR DAMPER IS CLOSED, THE RETURN AIR DAMPER IS OPEN AND THE UNIT IS OFF. UPON A REQUEST FOR COOLING BY A MINIMUM OF FIVE ZONES NEEDING TO MAINTAIN THEIR UNOCCUPIED COOLING TEMPERATURE SET POINT, ACTIVATE THE UNIT SUPPLY FAN, THE OUTSIDE AIR AND RELIEF AIR DAMPERS SHALL REMAIN CLOSED.

BUILDING PRESSURE CONTROL:

BUILDING PRESSURE CONTROL IS MANAGED VIA THE RETURN/RELIEF FAN AND PREDEFINED OFFSETS OF THE OUTSIDE AIR AND RELIEF AIR QUANTITIES. PROVIDE SPACE PRESSURE SENSORS TO MONITOR SPACE PRESSURE.

MORNING WARM-UP MODE AND COOL-DOWN MODES:

PROVIDE OPTIMAL START LOGIC TO DETERMINE WHEN TO BEGIN THE MORNING WARM-UP OR COOL-DOWN SEQUENCE. WHEN THE UNIT TRANSITIONS FROM THE UNOCCUPIED MODE TO OCCUPIED MODE, MORNING WARM-UP OR COOL-DOWN SHALL BE ACTIVATED. DURING MORNING WARM-UP/COOLDOWN, THE RTU SUPPLY AND RETURN FANS SHALL OPERATE AT 100% FLOW, THE OUTSIDE AIR SHALL REMAIN AT 25% OF NORMALLY SCHEDULED AIRFLOW, AND THE DX COOLING / GAS HEAT EXCHANGER SHALL MODULATE TO MAINTAIN THE OCCUPIED DISCHARGE AIR TEMPERATURE SET POINT. WHEN THE ZONE TEMPERATURE IS WITHIN 1°F OF SET POINT, THE RTU SHALL TRANSITION TO THE OCCUPIED SEQUENCE.

FILTER STATUS:

THE DIFFERENTIAL PRESSURE ACROSS THE FILTERS SHALL BE MONITORED AND AN ALARM GENERATED IF THE DIFFERENTIAL PRESSURE RISES ABOVE SET POINT.

SMOKE DETECTOR ALARM:

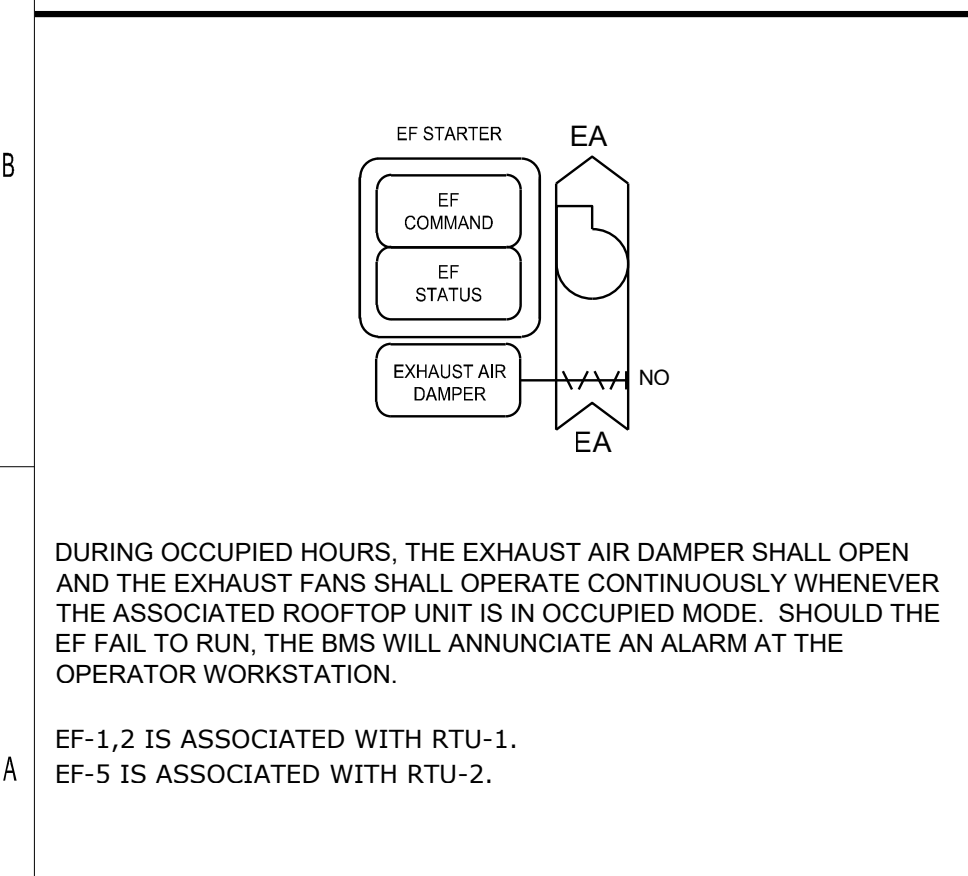
NOTIFY BMS AND SHUTDOWN UNIT IN THE EVENT THE SMOKE DETECTOR GOES INTO ALARM.

SAFETIES:

IF A FIRE ALARM SHUTDOWN CONTACT IS MADE, THE SUPPLY FAN AND RETURN FAN SHALL BE SHUTDOWN WHEN TRIGGERED.

IF A HIGH STATIC PRESSURE SWITCH LOCATED AFTER THE SUPPLY FAN SENSES A DISCHARGE PRESSURE THAT IS GREATER THAN SET POINT, THE SUPPLY FAN AND RETURN FAN SHALL BE SHUTDOWN.

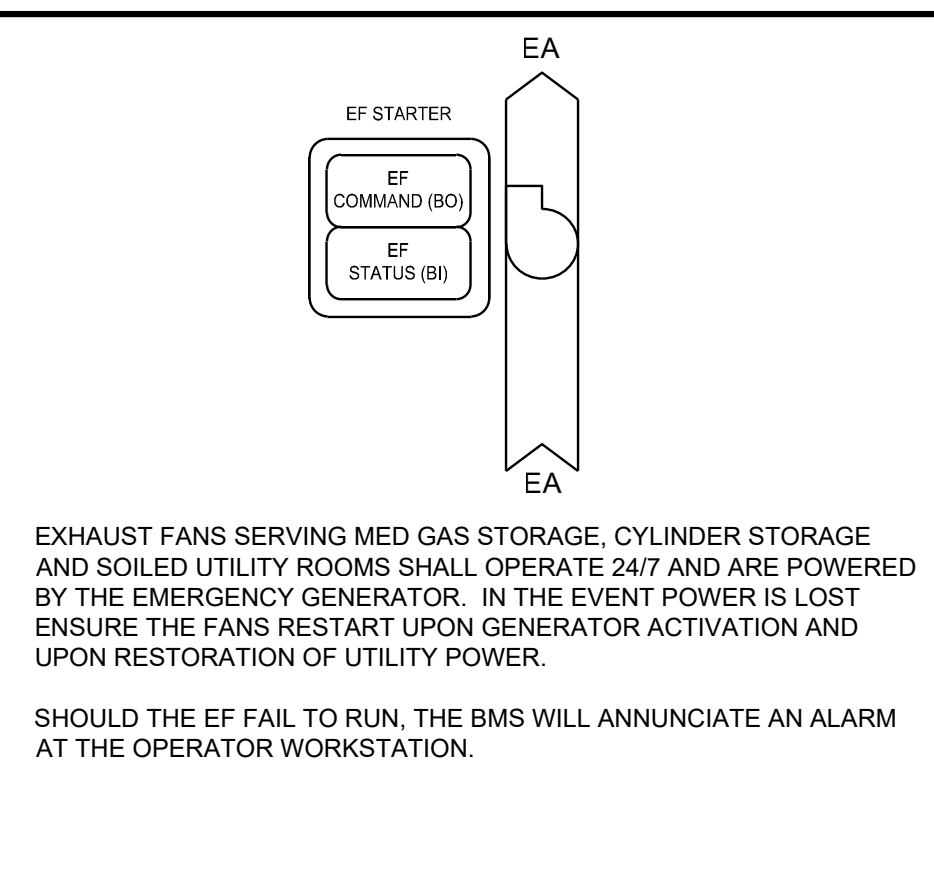
STERILE PACKAGED VAV ROOFTOP CONTROL DIAGRAM (RTU-2)
 NO SCALE



EXHAUST FANS (EF-1,2,5)
 NO SCALE

DURING OCCUPIED HOURS, THE EXHAUST AIR DAMPER SHALL OPEN AND THE EXHAUST FANS SHALL OPERATE CONTINUOUSLY WHENEVER THE ASSOCIATED ROOFTOP UNIT IS IN OCCUPIED MODE. SHOULD THE EF FAIL TO RUN, THE BMS WILL ANNUNCIATE AN ALARM AT THE OPERATOR WORKSTATION.

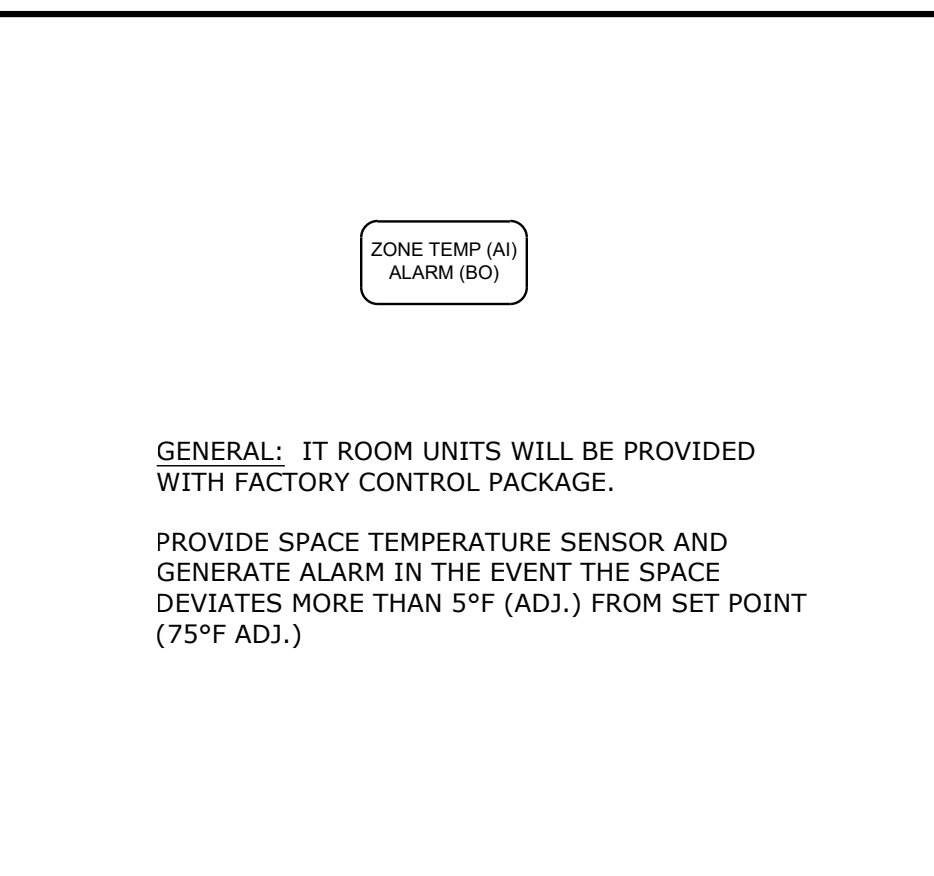
EF-1,2 IS ASSOCIATED WITH RTU-1.
 EF-5 IS ASSOCIATED WITH RTU-2.



EXHAUST FANS (EF-3,4)
 NO SCALE

EXHAUST FANS SERVING MED GAS STORAGE, CYLINDER STORAGE AND SOILED UTILITY ROOMS SHALL OPERATE 24/7 AND ARE POWERED BY THE EMERGENCY GENERATOR. IN THE EVENT POWER IS LOST ENSURE THE FANS RESTART UPON GENERATOR ACTIVATION AND UPON RESTORATION OF UTILITY POWER.

SHOULD THE EF FAIL TO RUN, THE BMS WILL ANNUNCIATE AN ALARM AT THE OPERATOR WORKSTATION.

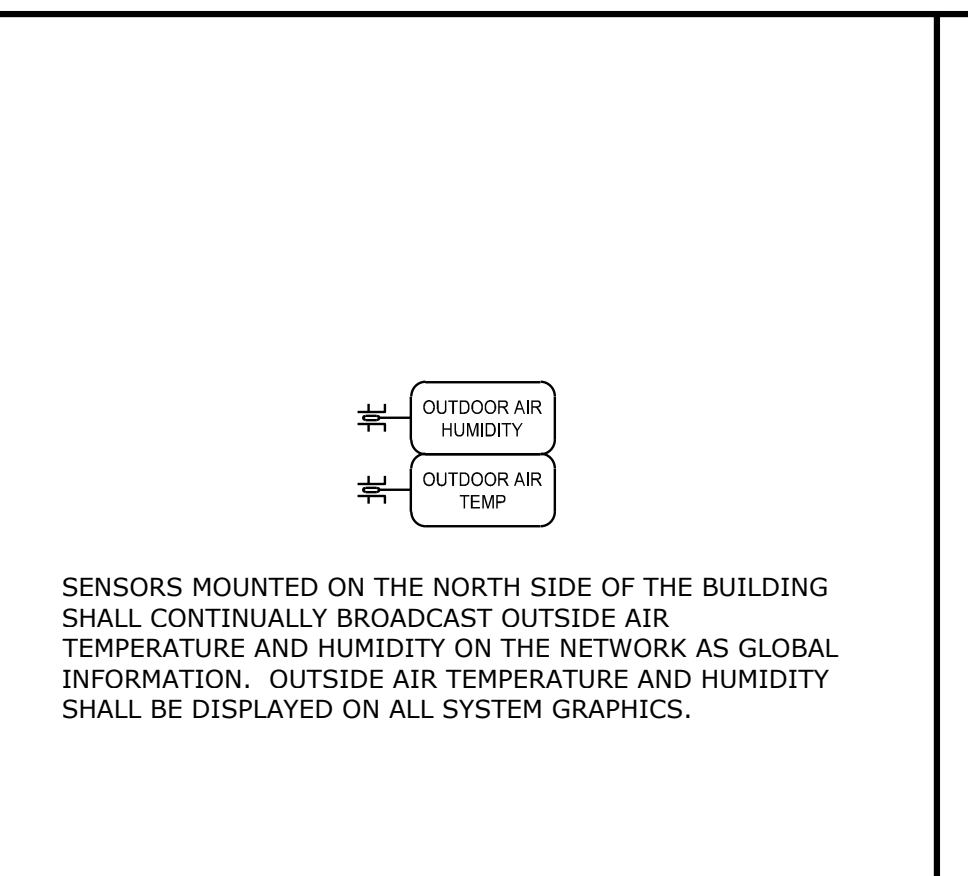


IT ROOM UNIT SEQUENCE
 NO SCALE

GENERAL: IT ROOM UNITS WILL BE PROVIDED WITH FACTORY CONTROL PACKAGE.

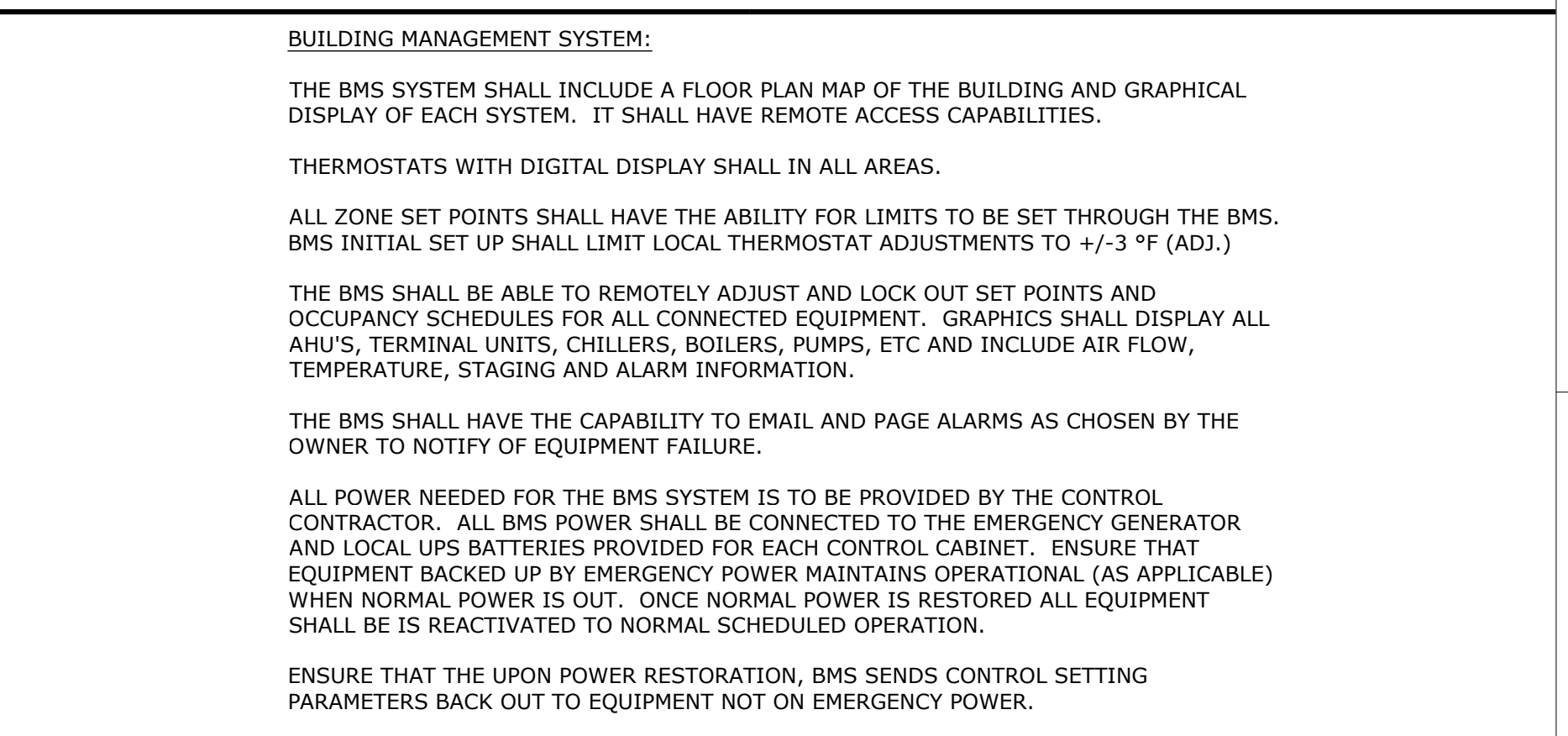
PROVIDE SPACE TEMPERATURE SENSOR AND GENERATE ALARM IN THE EVENT THE SPACE DEVIATES MORE THAN 5°F (ADJ.) FROM SET POINT (75°F ADJ.)

PACKAGED VAV ROOFTOP CONTROL DIAGRAM (RTU-1)
 NO SCALE



OUTSIDE AIR CONDITIONS
 NO SCALE

SENSORS MOUNTED ON THE NORTH SIDE OF THE BUILDING SHALL CONTINUALLY BROADCAST OUTSIDE AIR TEMPERATURE AND HUMIDITY ON THE NETWORK AS GLOBAL INFORMATION. OUTSIDE AIR TEMPERATURE AND HUMIDITY SHALL BE DISPLAYED ON ALL SYSTEM GRAPHICS.



GENERAL BMS REQUIREMENTS
 NO SCALE

BUILDING MANAGEMENT SYSTEM:

THE BMS SYSTEM SHALL INCLUDE A FLOOR PLAN MAP OF THE BUILDING AND GRAPHICAL DISPLAY OF EACH SYSTEM. IT SHALL HAVE REMOTE ACCESS CAPABILITIES.

THERMOSTATS WITH DIGITAL DISPLAY SHALL IN ALL AREAS.

ALL ZONE SET POINTS SHALL HAVE THE ABILITY FOR LIMITS TO BE SET THROUGH THE BMS. BMS INITIAL SET UP SHALL LIMIT LOCAL THERMOSTAT ADJUSTMENTS TO +/- 3 °F (ADJ.)

THE BMS SHALL BE ABLE TO REMOTELY ADJUST AND LOCK OUT SET POINTS AND OCCUPANCY SCHEDULES FOR ALL CONNECTED EQUIPMENT. GRAPHICS SHALL DISPLAY ALL AHU'S, TERMINAL UNITS, CHILLERS, BOILERS, PUMPS, ETC AND INCLUDE AIR FLOW, TEMPERATURE, STAGING AND ALARM INFORMATION.

THE BMS SHALL HAVE THE CAPABILITY TO EMAIL AND PAGE ALARMS AS CHOSEN BY THE OWNER TO NOTIFY OF EQUIPMENT FAILURE.

ALL POWER NEEDED FOR THE BMS SYSTEM IS TO BE PROVIDED BY THE CONTROL CONTRACTOR. ALL BMS POWER SHALL BE CONNECTED TO THE EMERGENCY GENERATOR AND LOCAL UPS BATTERIES PROVIDED FOR EACH CONTROL CABINET. ENSURE THAT EQUIPMENT BACKED UP BY EMERGENCY POWER MAINTAINS OPERATIONAL (AS APPLICABLE) WHEN NORMAL POWER IS OUT. ONCE NORMAL POWER IS RESTORED ALL EQUIPMENT SHALL BE IS REACTIVATED TO NORMAL SCHEDULED OPERATION.

ENSURE THAT THE UPON POWER RESTORATION, BMS SENDS CONTROL SETTING PARAMETERS BACK OUT TO EQUIPMENT NOT ON EMERGENCY POWER.

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 Thursday, March 20, 2025 11:45:39 AM
 Jlangenfeld
 Thursday, March 20, 2025 4:26:01 PM
 Booty Charles
 PLOTTED BY: DATE: TIME:

VAV TERMINAL UNIT SEQUENCE

OCCUPIED MODE:
ON A RISE IN ZONE TEMPERATURE ABOVE THE SET POINT (74°F, ADJ.), THE PRIMARY AIR DAMPER SHALL INCREASE THE CFM AND THE REHEAT VALVE REMAINS FULLY CLOSED. ON A DROP IN ZONE TEMPERATURE BELOW THE HEATING SET POINT (68°F, ADJ.) THE PRIMARY DAMPER SHALL DECREASE TO THE MINIMUM CFM. ONCE HEATING IS NEEDED, THE AIRFLOW SHALL INCREASE TO THE HEATING CFM OR REMAIN AT THE MINIMUM POSITION AS APPLICABLE (REFER TO EQUIPMENT SCHEDULES) AND THE REHEAT VALVE SHALL MODULATE TO MAINTAIN SPACE SET POINT.

NIGHT SETBACK MODE:
DURING NIGHT SETBACK, TERMINAL BOX CONTROLLERS ARE INDEXED TO UNOCCUPIED MODE. WHEN THE ZONE TEMPERATURE IS BETWEEN THE UNOCCUPIED HEATING (60°F, ADJ.) AND COOLING (80°F, ADJ.) SET POINTS, THE PRIMARY AIR DAMPER SHALL BE CLOSED AND THE REHEAT VALVE SHALL BE CLOSED. ON A RISE IN ZONE TEMPERATURE ABOVE THE UNOCCUPIED COOLING SET POINT, A REQUEST FOR COOLING SHALL BE SENT TO THE BMS. ONCE FIVE UNITS HAVE REQUESTED FOR COOLING, OR A SINGLE SPACE IS MORE THAN 5°F, (ADJ.) OUT OF RANGE, THE AIR HANDLING UNIT SHALL START, THE PRIMARY AIR DAMPER SHALL MODULATE OPEN, AND THE REHEAT VALVE REMAINS FULLY CLOSED. ON A DROP IN ZONE TEMPERATURE BELOW THE UNOCCUPIED HEATING SET POINT, A REQUEST FOR HEATING SHALL BE SENT TO THE BMS. ONCE FIVE UNITS HAVE REQUESTED FOR HEATING, OR A SINGLE SPACE IS MORE THAN 5°F, (ADJ.) OUT OF RANGE, THE AIR HANDLING UNIT SHALL START, THE PRIMARY AIR DAMPER SHALL MODULATE OPEN, AND THE REHEAT VALVE MODULATES OPEN. WHEN THE AHU ACTIVATES, ALL ZONES SHALL BE ENABLED TO BRING SPACES TO 5°F (ADJ) PAST THE MINIMUM SET POINT THRESHOLD.

OPTIMAL START MODE:
WHEN THE SPACE TEMPERATURE IS BELOW SET POINT MORNING WARM UP SHALL BE PROVIDED. THE SPACE SETPOINT SHALL INCREASE FROM UNOCCUPIED SETPOINT TO OCCUPIED SETPOINT OVER A 2 HOUR PERIOD (ADJ.). ONCE THE SPACE SETPOINT IS NOT MET, A REQUEST FOR HEATING SHALL BE SENT TO THE BMS. ONCE FIVE UNITS HAVE REQUESTED FOR HEATING, OR A SINGLE SPACE IS MORE THAN 5°F, (ADJ.) OUT OF RANGE, THE AIR HANDLING UNIT SHALL START, THE PRIMARY AIR DAMPER SHALL MODULATE OPEN, AND THE REHEAT VALVE MODULATES OPEN.

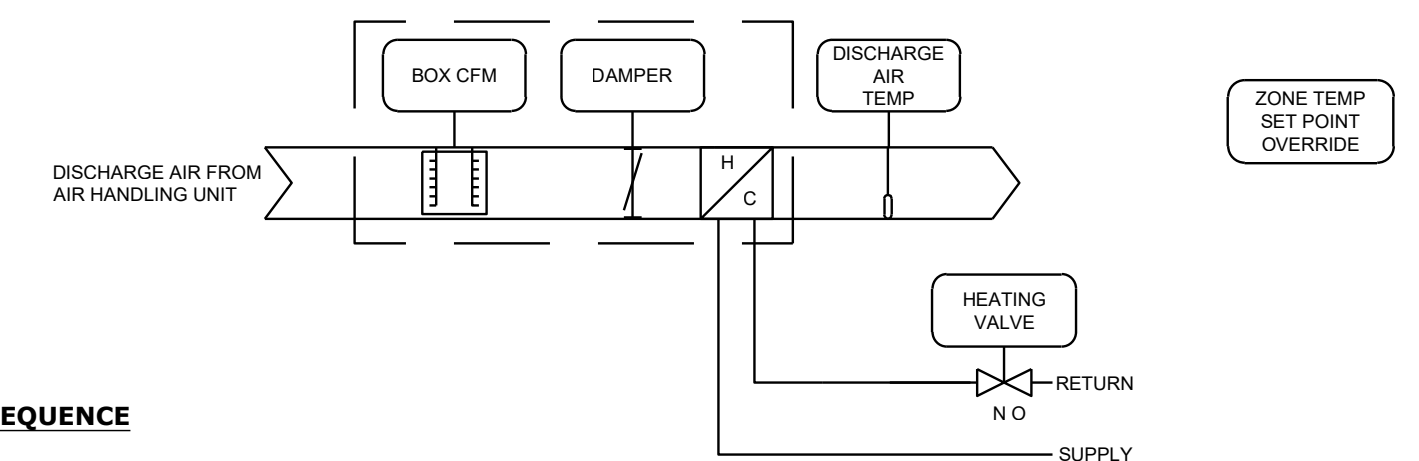
WHEN THE SPACE TEMPERATURE IS ABOVE SET POINT, MORNING COOL DOWN SHALL BE PROVIDED. THE SPACE SETPOINT SHALL DECREASE FROM UNOCCUPIED SETPOINT TO OCCUPIED SETPOINT OVER A 2 HOUR PERIOD (ADJ.). ONCE THE SPACE SETPOINT IS NOT MET, A REQUEST FOR COOLING SHALL BE SENT TO THE BMS. ONCE FIVE UNITS HAVE REQUESTED FOR COOLING, OR A SINGLE SPACE IS MORE THAN 5°F, (ADJ.) OUT OF RANGE, THE AIR HANDLING UNIT SHALL START AND THE PRIMARY AIR DAMPER SHALL MODULATE OPEN.

SET POINT LIMIT RANGE:
LIMIT SET POINT ADJUSTMENTS FROM THE SPACE THERMOSTAT TO +/- 3°F (ADJ.).

OCCUPANCY OVERRIDE:
ALL SPACE THERMOSTATS WILL HAVE OCCUPANCY OVERRIDE BUTTONS AS PART OF THIS CONTRACT. PROVIDE SELECTABLE OPTION THROUGH THE BMS TO DISABLE OCCUPANCY OVERRIDE FOR EACH TERMINAL UNIT.

NOTE THAT SPACE OCCUPANCY SENSORS CANNOT OVERRIDE NORMALLY SCHEDULED UNOCCUPIED MODE. ONLY THE MANUAL OVERRIDE DESCRIBED ABOVE HAS THAT CAPABILITY.

REFER TO THE ASSOCIATED AHU FOR TIMED OCCUPANCY OVERRIDE SEQUENCE.



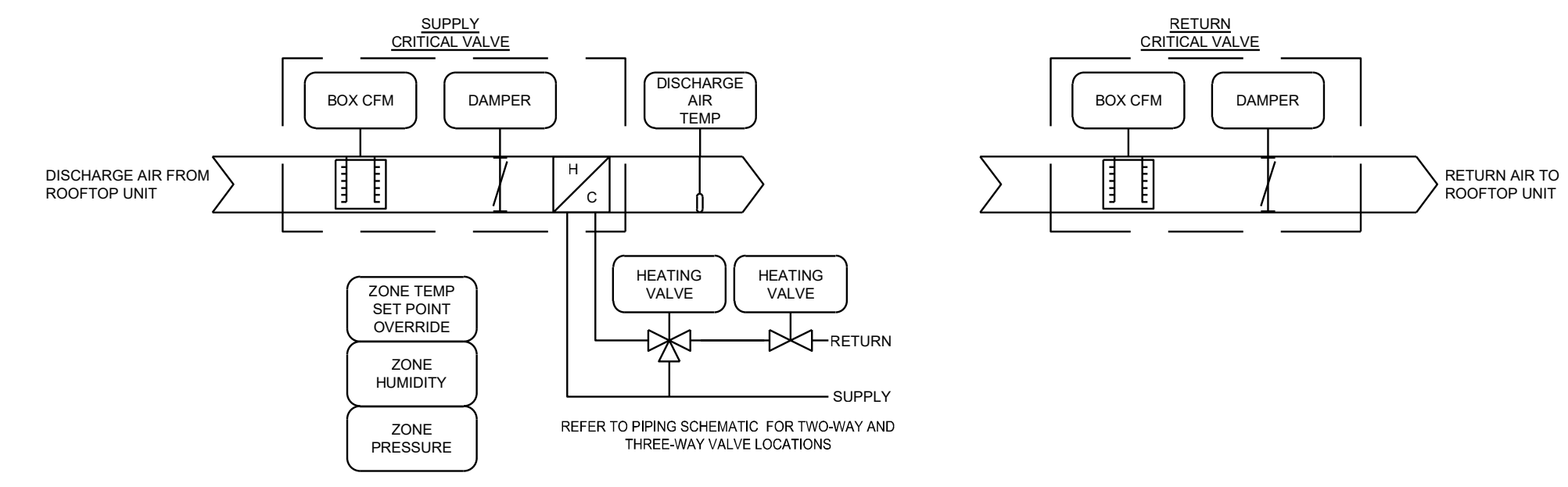
VAV TERMINAL (HOT WATER)
NO SCALE

CRITICAL VALVE SEQUENCE

OCCUPIED MODE:
THE SUPPLY CRITICAL VALVE PRIMARY AIR DAMPER SHALL MODULATE TO PROVIDE CONSTANT AIRFLOW TO THE OPERATING ROOM. THE RETURN CRITICAL VALVE SHALL BE CONTROLLED BY THE SPACE PRESSURE SENSOR TO MAINTAIN THE PRESSURIZATION SET POINT. THE PRESSURE ALGORITHM WILL PAUSE WHEN THE OPERATING ROOM DOOR IS OPEN. THE REHEAT VALVE SHALL MODULATE FROM FULLY CLOSED TO FULLY OPEN TO MAINTAIN SPACE TEMPERATURE SET POINT 65°F (ADJ)

NIGHT SETBACK MODE:
INDEX TERMINAL UNITS TO UNOCCUPIED MODE AND REDUCE AIRFLOW SET POINTS TO 30% (ADJ.) OF MAXIMUM AIRFLOW. UNOCCUPIED ZONE TEMPERATURE SET POINTS ARE AS FOLLOWS: UNOCCUPIED HEATING 65°F (ADJ.) UNOCCUPIED COOLING 85°F (ADJ.) SPACE PRESSURE CONTROLS SHALL BE RESET SIMILARLY AND MAINTAIN THE SAME PRESSURIZATION REQUIREMENTS AS OCCUPIED MODE.

ON A RISE IN ZONE TEMPERATURE ABOVE THE UNOCCUPIED COOLING SET POINT, A REQUEST FOR COOLING SHALL BE SENT TO THE BMS. ONCE FIVE UNITS HAVE REQUESTED FOR COOLING OR A SINGLE ZONE IS MORE THAN 5°F (ADJ) OUT OF RANGE, THE AIR HANDLING UNIT SHALL START, ALL VAV PRIMARY AIR DAMPERS SHALL INCREASE THE CFM TO 100% OF THE SCHEDULED VALUE AND THE REHEAT VALVE REMAINS FULLY CLOSED. ON A DROP IN ZONE TEMPERATURE BELOW THE UNOCCUPIED HEATING SET POINT, A REQUEST FOR HEATING SHALL BE SENT TO THE BMS. ONCE FIVE UNITS HAVE REQUESTED FOR HEATING OR A SINGLE ZONE IS MORE THAN 5°F (ADJ), THE AIR HANDLING UNIT SHALL START, ALL VAV PRIMARY AIR DAMPERS SHALL INCREASE THE CFM TO 100% OF THE SCHEDULED VALUE, AND THE REHEAT VALVE MODULATES OPEN.



MORNING WARM UP/COOL DOWN:
WHEN THE SPACE TEMPERATURE IS BELOW SET POINT MORNING WARM UP SHALL BE PROVIDED. WHEN THE SPACE TEMPERATURE IS ABOVE SET POINT, MORNING COOL DOWN SHALL BE PROVIDED. VAV BOXES SHALL PROVIDE CONSTANT DESIGN AIRFLOW IN BOTH MODES. DURING MORNING WARM UP, THE PRIMARY AIR DAMPER IS OPEN AND THE HEATING VALVE OPENS. DURING MORNING COOL DOWN THE PRIMARY AIR DAMPER IS OPEN. ONCE THE SPACE IS WITHIN 1°F (ADJ) OF SET POINT, SIGNAL THE BMS AND TRANSITION TO THE OCCUPIED SEQUENCE OF CONTROL

SPACE PRESSURE CONTROLS SHALL REMAIN UNDER NORMAL CONTROL DURING MORNING WARM UP/COOL DOWN MODES.

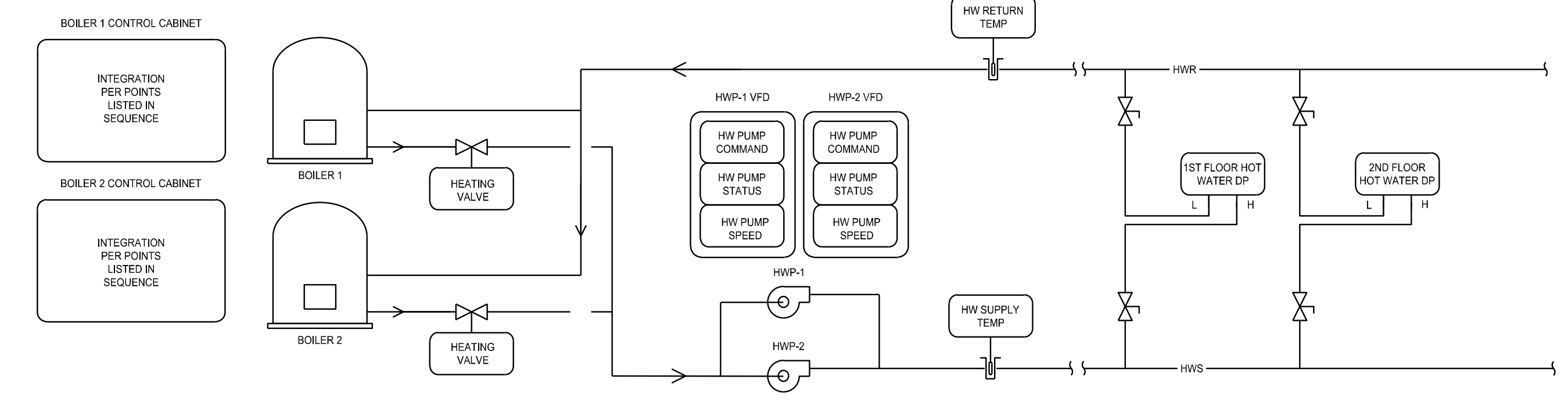
SET POINT LIMIT RANGE:
LIMIT SET POINT ADJUSTMENTS FROM THE SPACE THERMOSTAT TO +/- 3°F (ADJ.).

OCCUPANCY OVERRIDE:
ALL SPACE THERMOSTATS WILL HAVE OCCUPANCY OVERRIDE BUTTONS AS PART OF THIS CONTRACT. REFER TO THE ASSOCIATED AHU FOR TIMED OCCUPANCY OVERRIDE SEQUENCE.

FILTER STATUS:
THE DIFFERENTIAL PRESSURE ACROSS THE HEPA FILTER SHALL BE MONITORED AND AN ALARM GENERATED IF THE DIFFERENTIAL PRESSURE RISES ABOVE SET POINT.

TAB:
TAB CONTRACTOR TO PROVIDE TEST AND BALANCE IN ALL MODES OF OPERATION TO VERIFY PRESSURIZATION SETTINGS ARE MAINTAINED AND ADJUST SYSTEM AS NECESSARY.

CRITICAL VALVE (HOT WATER) SCHEMATIC
NO SCALE



HOT WATER SYSTEM - SEQUENCE OF OPERATION

THE BAS CONTROLLER SHALL ENABLE AND DISABLE THE BOILER MANUFACTURER'S SEQUENCING PANEL. THE BOILER MANUFACTURER'S SEQUENCING PANEL SHALL SEQUENCE THE BOILERS, AND SHALL INTEGRATE TO THE BMS SYSTEM VIA BACNET COMMUNICATION PROTOCOL. AS A MINIMUM THE FOLLOWING INPUT/OUTPUT POINTS SHALL BE PASSED VIA THE BOILER CONTROL PANEL COMMUNICATION LINK:

BOILER CONTROL INTERFACE:

- HW SYSTEM ENABLE
- HWS SET POINT
- HWS TEMPERATURE
- HWR TEMPERATURE
- BURNER FIRING RATE
- BOILER ALARM
- BOILER SET POINT
- BOILER STATUS

THE HOT WATER SUPPLY TEMPERATURE SHALL BE BY BMS RESET BASED ON OUTSIDE AIR TEMPERATURE SUCH THAT AT 60°F AND ABOVE OUTSIDE, THE SUPPLY TEMPERATURE SHALL BE 120°F AND AT 20°F AND BELOW OUTSIDE, THE SUPPLY TEMPERATURE SHALL BE 150°F. THE TEMPERATURE SHALL VARY LINEARLY BETWEEN THOSE CONDITIONS.

ADDITIONALLY, THE HOT WATER SUPPLY TEMPERATURE SHALL BE RESET BASED ON LOAD CONDITIONS SUCH THAT IF ALL ZONES HEATING DEMANDS ARE SATISFIED, THE HOT WATER SUPPLY TEMPERATURE SHALL BE RESET DOWNWARDS IN 5°F (ADJ.) INCREMENTS TO A MINIMUM OF 100 °F (ADJ)

HOT WATER PUMP START/STOP: THE BAS CONTROLLER STARTS THE LEAD HOT WATER PUMP THROUGH A CONTACT CLOSURE OF THE PUMP'S VARIABLE FREQUENCY (VFD) DRIVE RUN-ENABLE CONTACTS.

HOT WATER PUMP STATUS: THE BAS CONTROLLER DETECTS HOT WATER PUMP RUN STATUS BY A VARIABLE FREQUENCY DRIVE CURRENT SWITCH.

HOT WATER PUMP SPEED: THE BAS CONTROLLER MONITORS THE HOT WATER SYSTEM DIFFERENTIAL PRESSURE SENSOR. WHEN THE PUMP VARIABLE FREQUENCY DRIVE IS ENABLED, THE BAS CONTROLLER CONTROLS THE ANALOG SPEED SIGNAL THAT IS SENT TO THE PUMP VARIABLE FREQUENCY DRIVE TO MAINTAIN A HOT WATER DIFFERENTIAL PRESSURE SET POINT PER THE HOT WATER PRESSURE SET POINT OPTIMIZATION SECTION OF THIS SPECIFICATION. IF THE LEAD HOT WATER PUMP VFD REACHES 70 % CAPACITY (ADJ) FOR A PERIOD OF 15 MINUTES (ADJ), THE LAG-1 HOT WATER PUMP SHALL BE ENABLED AND THE LEAD AND LAG-1 PUMP VFD'S SHALL MODULATE TOGETHER AT THE SAME SPEED TO MAINTAIN THE HOT WATER PRESSURE DIFFERENTIAL SET POINT. THE CRITICAL PRESSURE OF THE SENSORS SHALL BE USED AS THE CONTROL POINT. WHEN OPERATING PUMP VFD'S ARE RUNNING 30% CAPACITY FOR A PERIOD OF 15 MINUTES (ADJ), THE LAG HOT WATER PUMP WILL BE DISABLED AND THE LEAD, PUMP SHALL MODULATE TO MAINTAIN THE DIFFERENTIAL PRESSURE SET POINT.

HOT WATER PUMP FAILURE: IF THE LEAD START/STOP RELAY IS ENABLED AND THE CURRENT SWITCH STATUS IS OFF FOR MORE THAN 30 SECONDS (ADJ.), THE BAS CONTROLLER ANNUNCIATES A HOT WATER PUMP FAILURE ALARM TO THE BAS WORKSTATION AND STARTS THE LEAD/LAG PUMP.

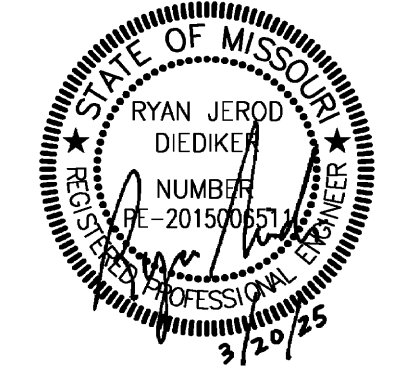
HOT WATER PUMP LEAD/LAG: THE HOT WATER PUMP LEAD/LAG SEQUENCE IS ROTATED ON A WEEKLY SCHEDULE. THE SEQUENCE IS BASED ON CALCULATED RUN TIME WITH THE PUMP HAVING THE LEAST RUN TIME AS LEAD, THE PUMP WITH THE LOWER RUN TIME WILL BE THE LAG PUMP. FROM THE BAS, AN OPERATOR IS ABLE TO MANUALLY CHANGE THE LEAD/LAG SEQUENCE.

HOT WATER PRESSURE SET POINT OPTIMIZATION: THE BUILDING AUTOMATION SYSTEM SHALL CONTINUOUSLY MONITOR THE VALVE POSITION OF ALL HOT WATER VALVES. WHEN ANY VALVE IS MORE THAN 95% (ADJ.) OPEN, THE HOT WATER PRESSURE SET POINT SHALL BE RESET UPWARD BY 5% (ADJ.) OF THE MAXIMUM SYSTEM PRESSURE SET POINT AT A FREQUENCY OF 10 MINUTES (ADJ.) UNTIL NO VALVE IS MORE THAN 95% OPEN OR THE PRESSURE SET POINT HAS RESET UPWARD TO THE SYSTEM MAXIMUM SETTING OR VARIABLE FREQUENCY DRIVE IS AT MAXIMUM SETTING. WHEN ALL VALVES ARE LESS THAN 85% (ADJ.) OPEN, THE HOT WATER PRESSURE SET POINT SHALL BE RESET DOWNWARD BY 5% (ADJ.) OF THE MAXIMUM SYSTEM PRESSURE SET POINT AT A FREQUENCY OF 10 MINUTES (ADJ.) UNTIL AT LEAST ONE VALVE IS MORE THAN 85% OPEN OR THE PRESSURE SET POINT HAS RESET DOWNWARD TO THE SYSTEM MINIMUM SETTING OR VARIABLE FREQUENCY DRIVE IS AT MINIMUM SETTING. THE CONTROL BANDS, SET POINT INCREMENT VALUES, SET POINT DECREMENT VALUES AND ADJUSTMENT FREQUENCIES SHALL BE ADJUSTED TO MAINTAIN MAXIMUM PRESSURE OPTIMIZATION WITH STABLE SYSTEM CONTROL AND MAXIMUM COMFORT CONTROL.

ENGAGE THE TAB CONTRACTOR TO MEASURE THE SYSTEM DIFFERENTIAL PRESSURE AT FULL LOAD TO DETERMINE AND SET THE INITIAL DIFFERENTIAL SET POINT.

COORDINATE WITH OWNER FOR CRITICAL ALARMS AND NOTIFICATION ALARMS.

HEATING HOT WATER SYSTEM
NOT TO SCALE



ISSUE DATE:	03/20/2025
PROJECT #:	24158
REVISION	DATE

COORDINATE WITH OWNER FOR CRITICAL ALARMS AND NOTIFICATION ALARMS.

PROJECT NAME: 2314708 Liberty SD 2023 Heritage MS Renovations
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PLOTTED BY: Booty Charles
DATE: Thursday, March 20, 2025 11:44:41 AM
TIME: Thursday, March 20, 2025 4:26:07 PM

