

MECHANICAL LEGEND		MECHANICAL LEGEND	
SYMBOL	DESCRIPTION	SYMBOL	DESCRIPTION
<b>PLAN-VIEW LINE TYPES</b>		<b>MECHANICAL DUCTWORK ACCESSORIES</b>	
	WORK SHOWN FADED INDICATES EXISTING WORK TO REMAIN OR NEW WORK BY OTHERS AS APPLICABLE		DUCT WITH MANUAL VOLUME DAMPER
	WORK SHOWN BOLD-DASHED INDICATES SELECTIVE DEMOLITION WORK		ROUND ELBOW WITH TURNING VANES
	WORK SHOWN BOLD-CONTINUOUS INDICATES NEW WORK		ELBOW WITH TURNING VANES
<b>DRAWING SET APPEARANCE</b>			MOTOR OPERATED DAMPER - LINE VOLTAGE
TO BETTER COMMUNICATE SCOPE TO PERMIT AGENCIES AND CONTRACTORS, EACH DRAWING IN THIS DRAWING SET HAS BEEN CREATED IN BOTH "COLOR" AND "BLACK AND WHITE". THERE EXISTS A COLOR LAYER WITHIN EACH DRAWING WHERE VISIBILITY IS CONTROLLED THROUGH THE PDF LAYER MANAGER. THIS LAYER VISIBILITY CAN BE TOGGLED DISPLAYING EITHER "COLOR" OR "BLACK AND WHITE". TO MAINTAIN SCOPE BASED SHADING WHEN PRINTING TO PAPER, BLACK AND WHITE NEEDS TO BE VISIBLE. FOR FURTHER INSTRUCTIONS, REFER TO CONTRACTOR RESOURCES ON OUR WEBSITE AND DOWNLOAD "DRAWING COLOR INSTRUCTIONS". WWW.KLHENGRS.COM - CONTRACTOR RESOURCES (RIGHT HAND SIDE OF PAGE).			MOTOR OPERATED DAMPER - LOW VOLTAGE
<b>PIPING LINE TYPES</b>			BAROMETRIC DAMPER
	HOT WATER SUPPLY		DUCT MOUNTED SMOKE DETECTOR (HARD WIRE INTERLOCK TO FAN MOTOR BY E.C.) FURNISHED BY E.C., INSTALLED BY M.C.
	HOT WATER RETURN	<b>MECHANICAL STATS &amp; SENSORS</b>	
	CONDENSATE DRAIN		TEMPERATURE SENSOR
	SUPPLY MAIN OR BRANCH		LOW VOLTAGE THERMOSTAT
	RETURN MAIN OR BRANCH		LOW VOLTAGE THERMOSTAT WITH LOCKABLE GUARD
<b>MECHANICAL PIPING ACCESSORIES</b>			INDOOR AIR QUALITY SENSOR
	MANUAL ISOLATION VALVE	<b>MECHANICAL MISCELLANEOUS</b>	
	FLOW DIRECTION		DIGITAL INPUT
	WATER METER		DIGITAL OUTPUT
	Y-STRAINER		ANALOG INPUT
	3 WAY CONTROL VALVE (2 POSITION)		ANALOG OUTPUT
	2 WAY CONTROL VALVE (2 POSITION)		POINT OF DEMOLITION TO EXISTING (FIELD VERIFY EXISTING UTILITY SERVICE TYPE, PRIOR TO TERMINATING CONNECTION)
<b>MECHANICAL DUCTWORK</b>			CONNECT TO EXISTING (FIELD VERIFY EXISTING UTILITY SERVICE TYPE, PRIOR TO MAKING CONNECTION)
	SUPPLY DUCT WITH ELBOW TURNED UP		1' DOOR UNDERCUT
	SUPPLY DUCT WITH ELBOW TURNED DOWN	<b>MECHANICAL AIR DEVICES</b>	
	RETURN DUCT WITH ELBOW TURNED UP		SUPPLY REGISTER
	RETURN DUCT WITH ELBOW TURNED DOWN		RETURN REGISTER
	EXHAUST DUCT WITH ELBOW TURNED UP		EXHAUST REGISTER
	EXHAUST DUCT WITH ELBOW TURNED DOWN		SUPPLY GRILLE
	24X12 SA SUPPLY DUCT		RETURN GRILLE
	24X12 RA RETURN DUCT		CEILING DIFFUSER
	24X12 EA EXHAUST DUCT		2'x2' SQUARE CEILING DIFFUSER WITH 10" NECK
	24X12 OA OUTSIDE AIR DUCT		ROUND CEILING DIFFUSER
	1" LINED DUCTWORK		LINEAR SLOT DIFFUSER
	DUCT FLEX CONNECTOR		
	FLEXIBLE DUCTWORK CONNECTION		
	BRANCH TAKEOFF		
	24"X12" RA OVAL DUCT		
	REDUCER, CONCENTRIC		
	REDUCER, NONCONCENTRIC		

STANDARD HVAC ABBREVIATIONS			
AAV	AUTOMATIC AIR VENT	HD	HEAD
ACCESS	ACCESSORIES	HQA	HAND/OFF/AUTOMATIC
AD	ACCESS DOOR	HP	HORSEPOWER
AFF	ABOVE FINISHED FLOOR	HPR	HIGH PRESSURE RETURN
AMP	AMPERE	HST	HUMIDISTAT
AP	ACCESS PANEL	HSTAT	HUMIDISTAT
APD	AIR PRESSURE DROP	HTR	HEATING HOT WATER RETURN
ARI	AIR CONDITIONING AND REFRIGERATION INSTITUTE	HWS	HEATING HOT WATER SUPPLY
ASME	AMERICAN SOCIETY OF MECHANICAL ENGINEERS	HZ	HERTZ
BAS	BUILDING AUTOMATION SYSTEM	IO	INPUT/OUTPUT
BD	BACKDRAFT DAMPER	IAQ	INDOOR AIR QUALITY
BHP	BRAKE HORSEPOWER	IN HG	INCHES OF MERCURY
BTU	BRITISH THERMAL UNIT	IN WC	INCH WATER COLUMN
BTUH	BRITISH THERMAL UNIT PER HOUR	IN WG	INCH WATER GAUGE
CD	CEILING DIFFUSER	IPLV	INTERGRATED PART LOAD VALUE
CFH	CUBIC FEET PER HOUR	INST	INSTALLED
CFM	CUBIC FEET PER MINUTE	KW	KILOWATT
CHWR	CHILLED WATER RETURN	KWH	KILOWATT HOUR
CHWS	CHILLED WATER SUPPLY	LAT	LEAVING AIR TEMPERATURE
CI	CAST IRON	LBS/HR	POUNDS PER HOUR
CLG	COOLING	LF	LINEAR FOOT (FEET)
CO	CARBON MONOXIDE	LFR	LOW PRESSURE RETURN
CO2	CARBON DIOXIDE	LPS	LOW PRESSURE STEAM
COP	COEFFICIENT OF PERFORMANCE	LWT	LEAVING WATER TEMPERATURE
CV	CONSTANT VOLUME	MAX	MAXIMUM
CWR	CONDENSER WATER RETURN	MBH	1000 BTUH
CWS	CONDENSER WATER SUPPLY	MCA	MINIMUM BRANCH CIRCUIT AMPACITY
DB	DECIBELS	MERV	MINIMUM EFFICIENCY REPORTING VALUE
DB	DRY-BULB TEMPERATURE	MIN	MINIMUM
DC	DISCONNECT	MOD	MOTOR OPERATED DAMPER
DDC	DIRECT DIGITAL CONTROLS	MPR	MEDIUM PRESSURE RETURN
DEG	DEGREE DELTA(CHANGE IN TEMPERATURE)	MPS	MEDIUM PRESSURE STEAM
DI	DIAMETER	MRI	MAGNETIC RESONANCE IMAGING
DIW	DIONIZED WATER	MVD	MANUAL VOLUME DAMPER
DP	DEW POINT TEMPERATURE	NA	NOT APPLICABLE
DX	DIRECT EXPANSION	NC	NOISE CRITERIA
EA	EXHAUST AIR	NC	NORMALLY CLOSED
EAT	ENTERING AIR TEMPERATURE	NO	NORMALLY OPEN
EER	ENERGY EFFICIENCY RATIO	NTS	NOT TO SCALE
EG	EXHAUST GRILLE	OA	OUTSIDE AIR
EMERG	EMERGENCY POWER	OC	OVER CURRENT PROTECTION
ESP	EXTERNAL STATIC PRESSURE	PD	PRESSURE DROP
EWT	ENTERING WATER TEMPERATURE	PPM	PARTS PER MILLION
EX	EXISTING	PRS	PRESSURE REGULATING (VALVE) STATION
F	FAHRENHEIT	PSI	PRESSURE REGULATING VALVE
F&T	FLOAT AND THERMOSTATIC	PSIA	POUNDS PER SQUARE INCH - ABSOLUTE
FA	FREE AREA	PSIG	POUNDS PER SQUARE INCH - GAGE
FD	FIRE DAMPER	RA	RETURN AIR
FLA	FULL LOAD AMPERES	RAT	RETURN AIR TEMPERATURE
FPM	FEET PER MINUTE	RH	RELATIVE HUMIDITY
FPS	FEET PER SECOND	RL	REFRIGERANT LIQUID LINE
FT	FEET	RLA	RUN LOAD AMPERE
FURN	FURNISHED	RO	REVERSE OSMOSIS
GA	GALUGE	RPM	REVOLUTIONS PER MINUTE
GAL	GALLONS	RS	REFRIGERANT SUCTION
GPM	GALLONS PER MINUTE	SA	SUPPLY AIR
		SAT	SUPPLY AIR TEMPERATURE
		SC	SHADING COEFFICIENT
		SCD	SMOKE CONTROL DAMPER
		SD	SMOKE DETECTOR
		SEHS	SENSIBLE HEAT
		SP	STATIC PRESSURE
		TAB	TESTING, ADJUSTING, BALANCE
		TDH	TOTAL DYNAMIC HEAD
		TDS	TOTAL DISSOLVED SOLIDS
		TSP	TOTAL STATIC PRESSURE
		TSTAT	THERMOSTAT
		UL	UNDERWRITERS LABORATORY
		VAV	VARIABLE AIR VOLUME
		VFD	VARIABLE FREQUENCY DRIVE
		WB	WET-BULB (TEMPERATURE)
		WG	WATER GAGE
		WPD	WATER SIDE PRESSURE DROP
		WIRE	WIRED

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REVISIONS	
10-11-24	ISSUED FOR BID

DWN: CES    CHK: KTS

DATE: 10.11.24

PROJECT #: 2024.00

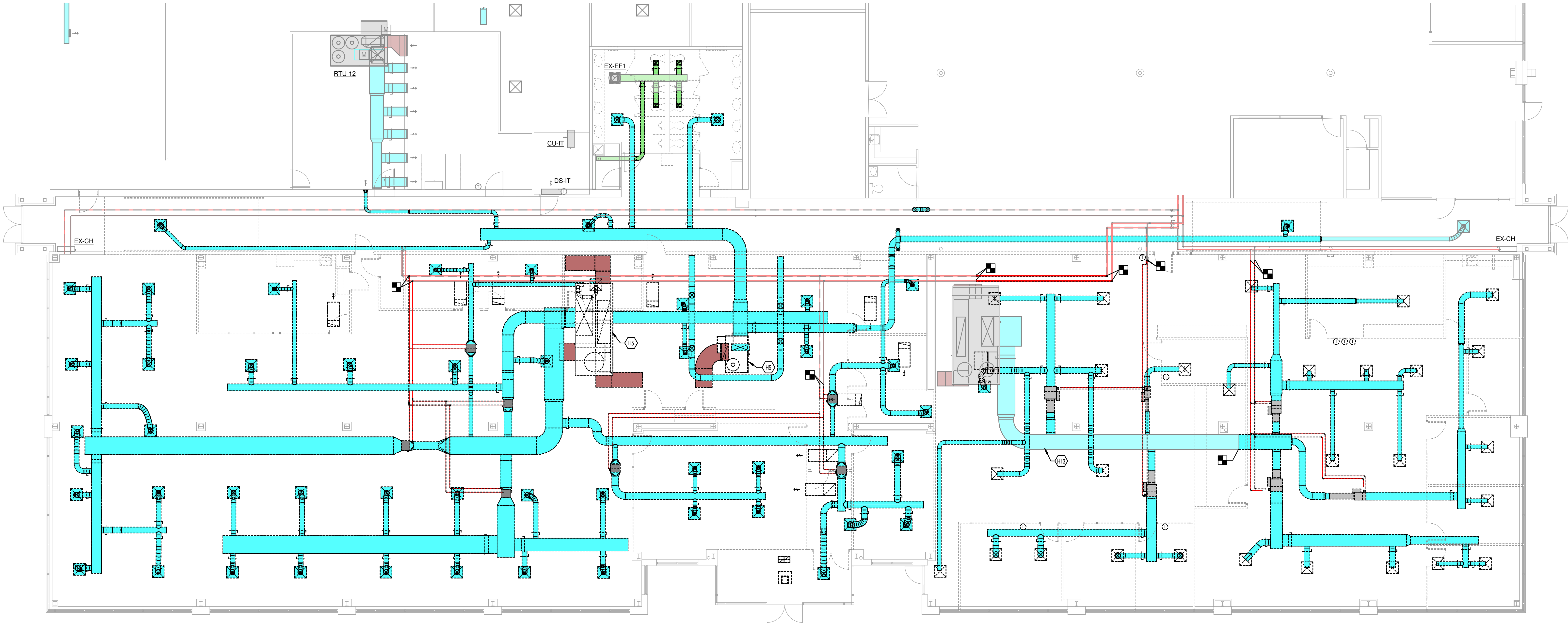
MECHANICAL COVER SHEET

M2-001

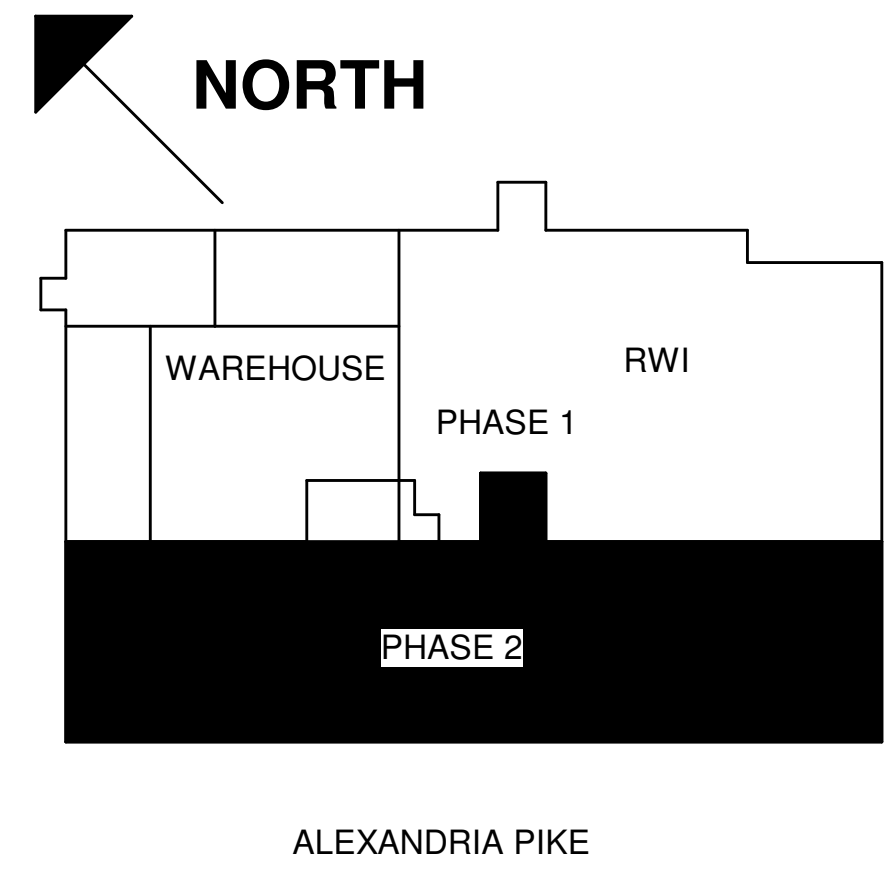
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MECHANICAL DEMOLITION - OVERALL  
1/8" = 1'-0"



KEYED NOTES

- H5 DEMO ROOFTOP UNIT. CAP ROOF CURB AS SHOWN IN DETAIL.
- H13 REMOVE INSULATION ON DUCTWORK INTENDED FOR REUSE.

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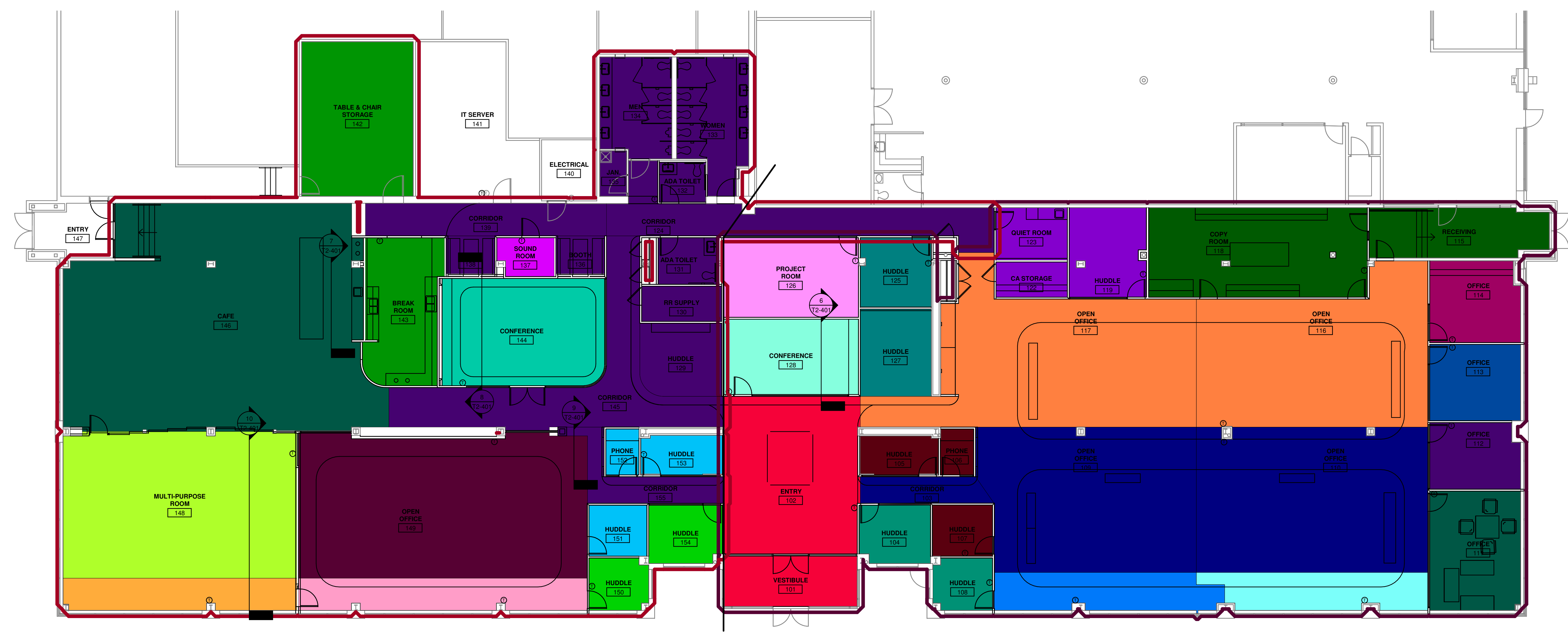
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MECHANICAL DEMOLITION - OVERALL

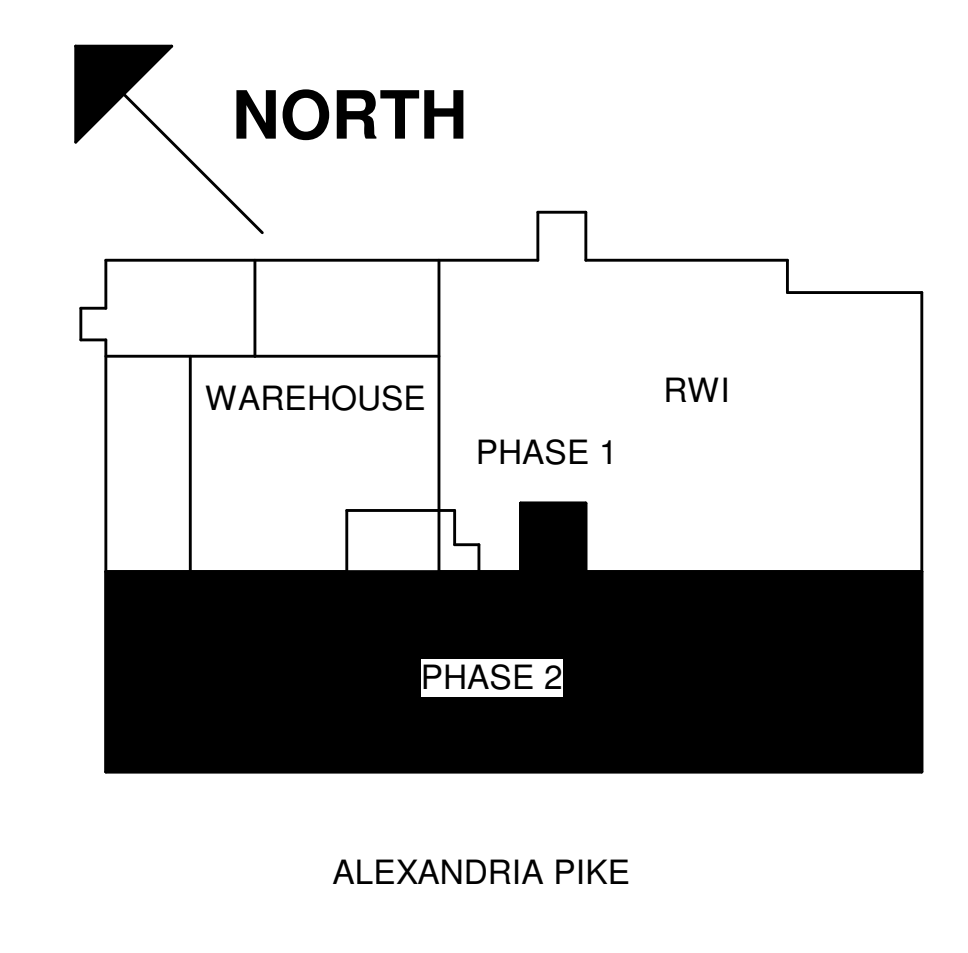
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① MECHANICAL SYSTEM ZONES PLAN - KLH SPACE  
1/8" = 1'-0"



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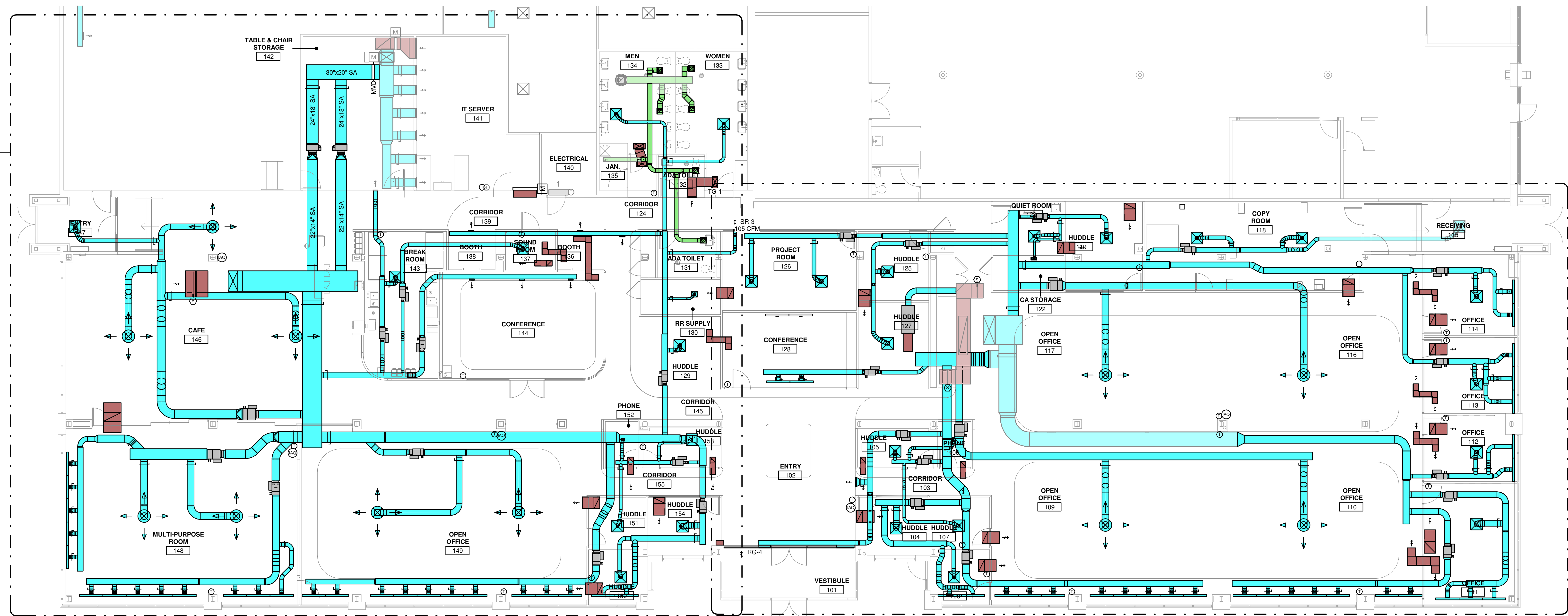
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MECHANICAL ZONING PLAN

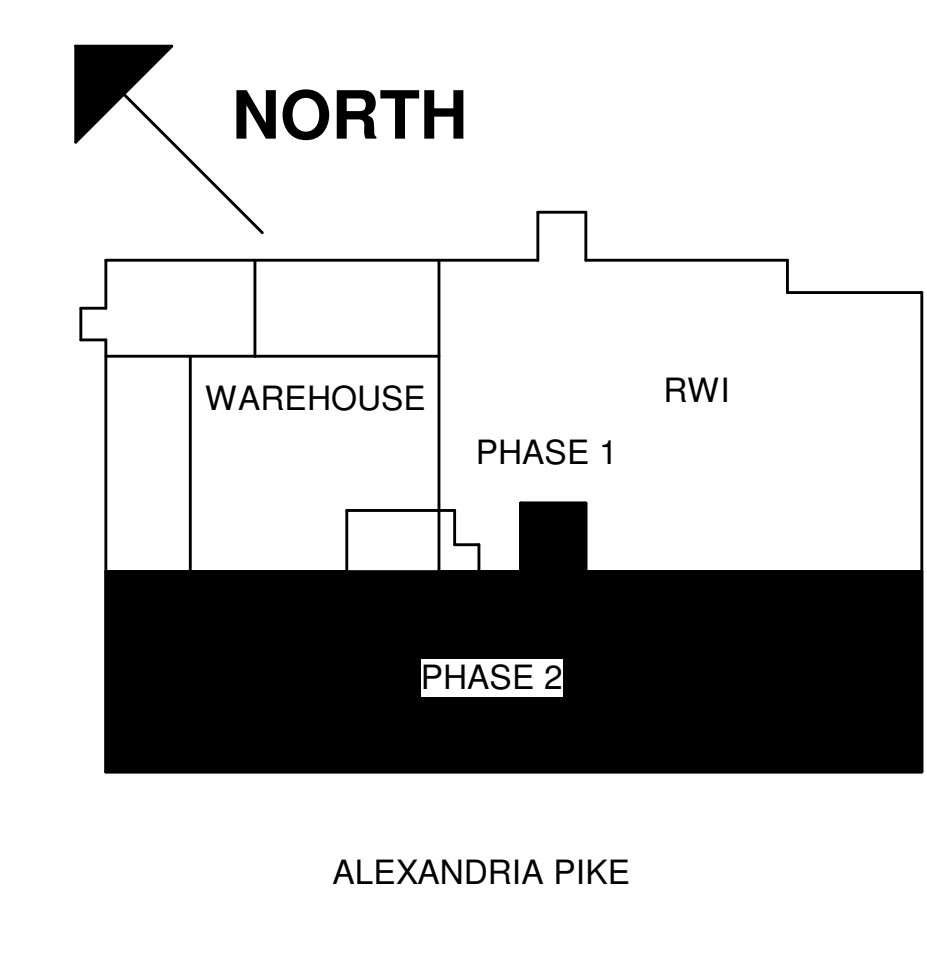
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1 MECHANICAL NEW - DUCTWORK - OVERALL  
 1/8" = 1'-0"



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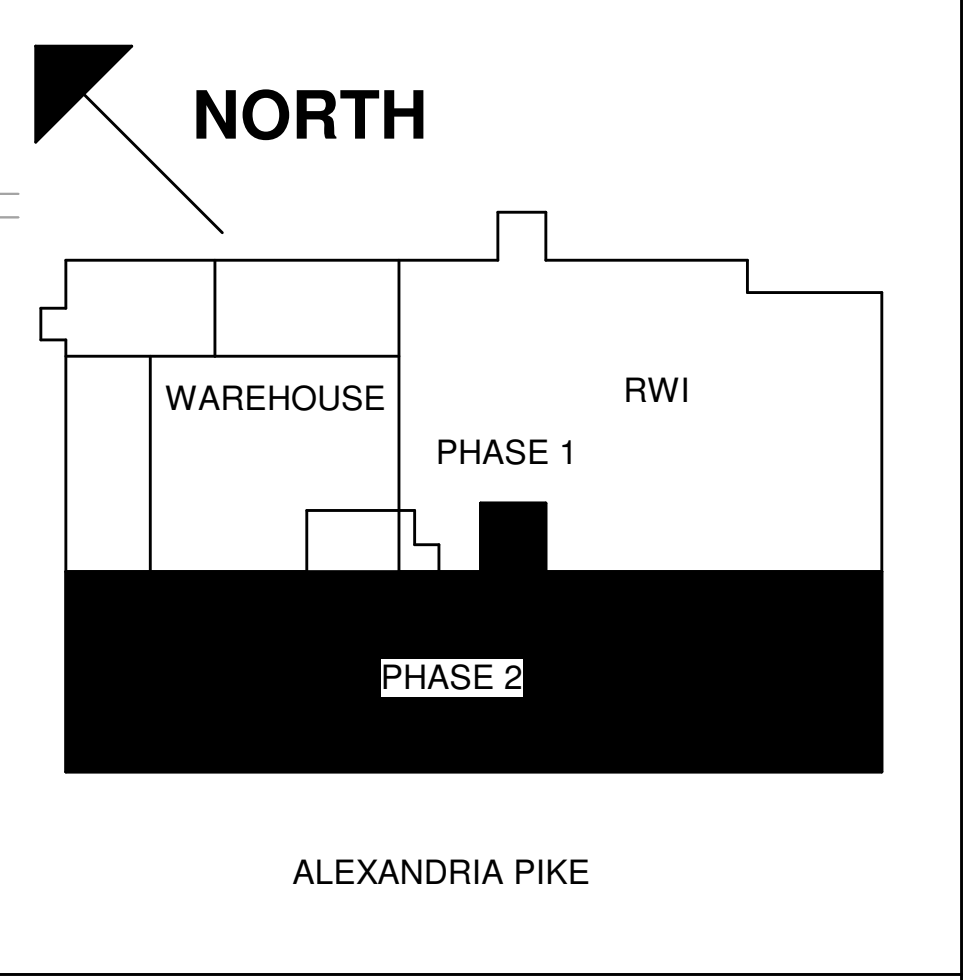
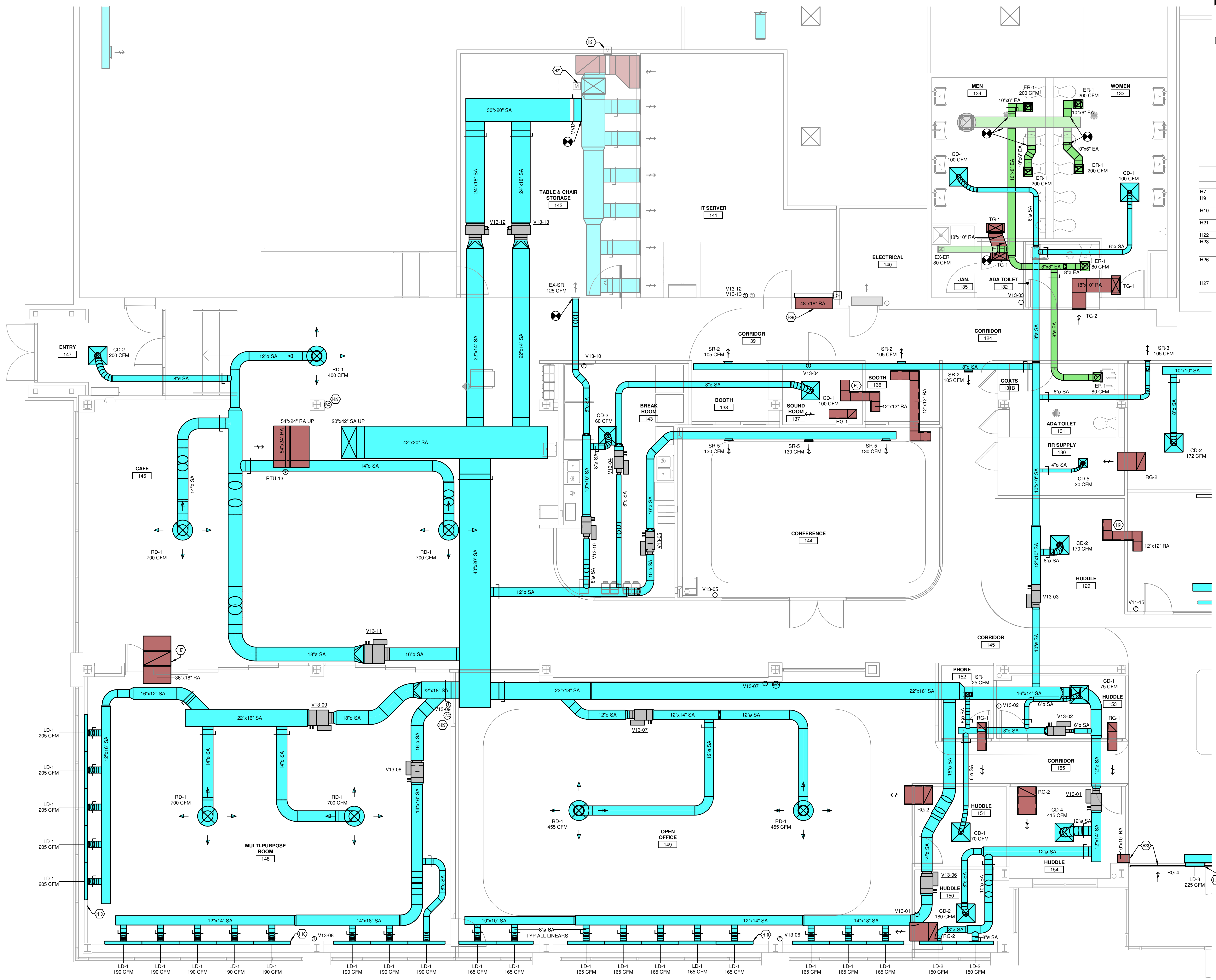
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 DATE: 10.11.24  
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 MECHANICAL  
 NEW -  
 DUCTWORK -  
 OVERALL

M2-201  
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- KEYED NOTES**
- H7 LINED VERTICAL "Z" DUCT FOR RETURN AIR TRANSFER
  - H9 PROVIDE Z DUCT ABOVE CEILING FOR SOUND ATTENUATED AIR TRANSFER.
  - H10 PROVIDE CONTINUOUS SLOT ALIGNED WITH FRONT EDGE OF COLUMNS. FILL WITH BLANKS WHERE NEEDED TO FILL ENTIRE LENGTH.
  - H21 DAMPER INSTALLED IN PREVIOUS PHASE. ACTUATORS TO BE INSTALLED AND WIRED AS PART OF THIS PHASE.
  - H22 BAR GRILLES TO BE PAINTED TO MATCH PT-1.
  - H23 RETURN REGISTER IN VESTIBULE TO ALLOW RETURN AIR INTO SOFFIT, THROUGH TRANSFER DUCT AND INTO PLENUM SPACE OF HUDDLE ROOM.
  - H26 ALTERNATE: PROVIDE OPENING HIGH IN WALL WITH MOTOR OPERATED DAMPER FOR RETURN AIR IN EMERGENCY OPERATION SCENARIO. OPENING TO BE 48"x18" OR HAVE AN EQUIVALENT FREE AREA OPENING OF 6 SQ. FT.
  - H27 PROVIDE INDOOR AIR QUALITY SENSOR TO MONITOR WITH LOCAL REAL TIME DISPLAY AND REPORTING TO BAS.

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 MECHANICAL NEW - DUCTWORK - NORTH

M2-201N  
 1" REFERENCE  
 KLH PROJECT #  
 2024

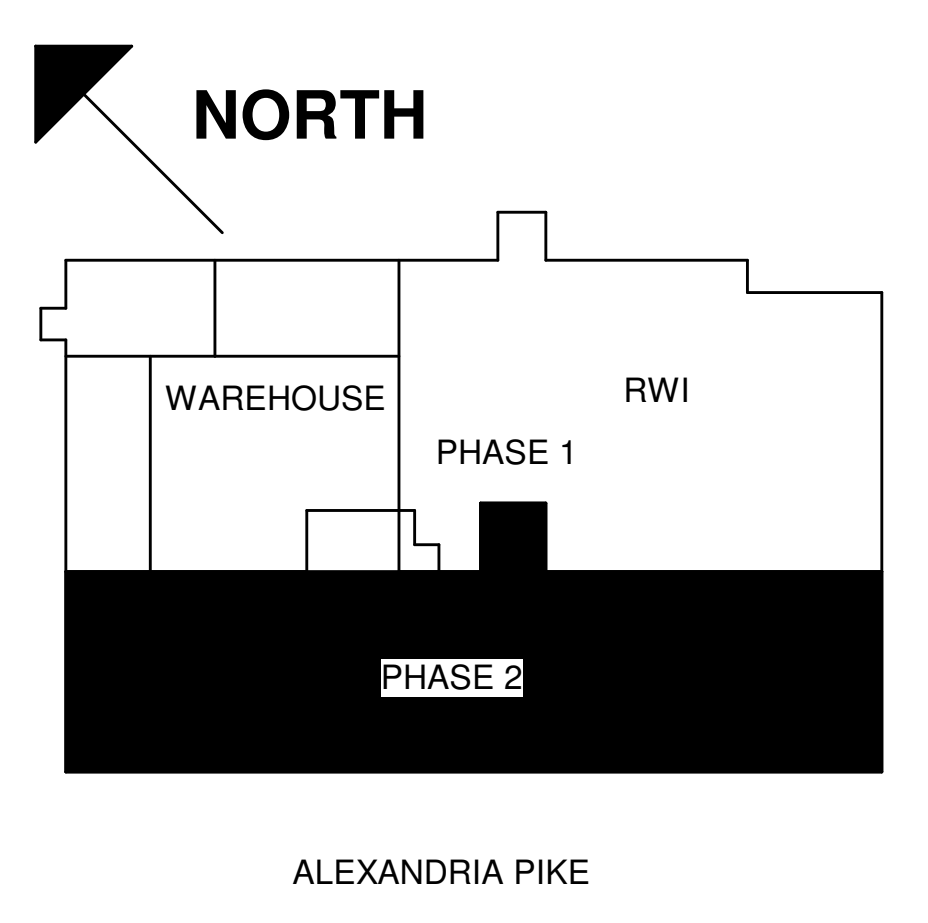
MECHANICAL NEW - DUCTWORK - NORTH  
 1/4" = 1'-0"

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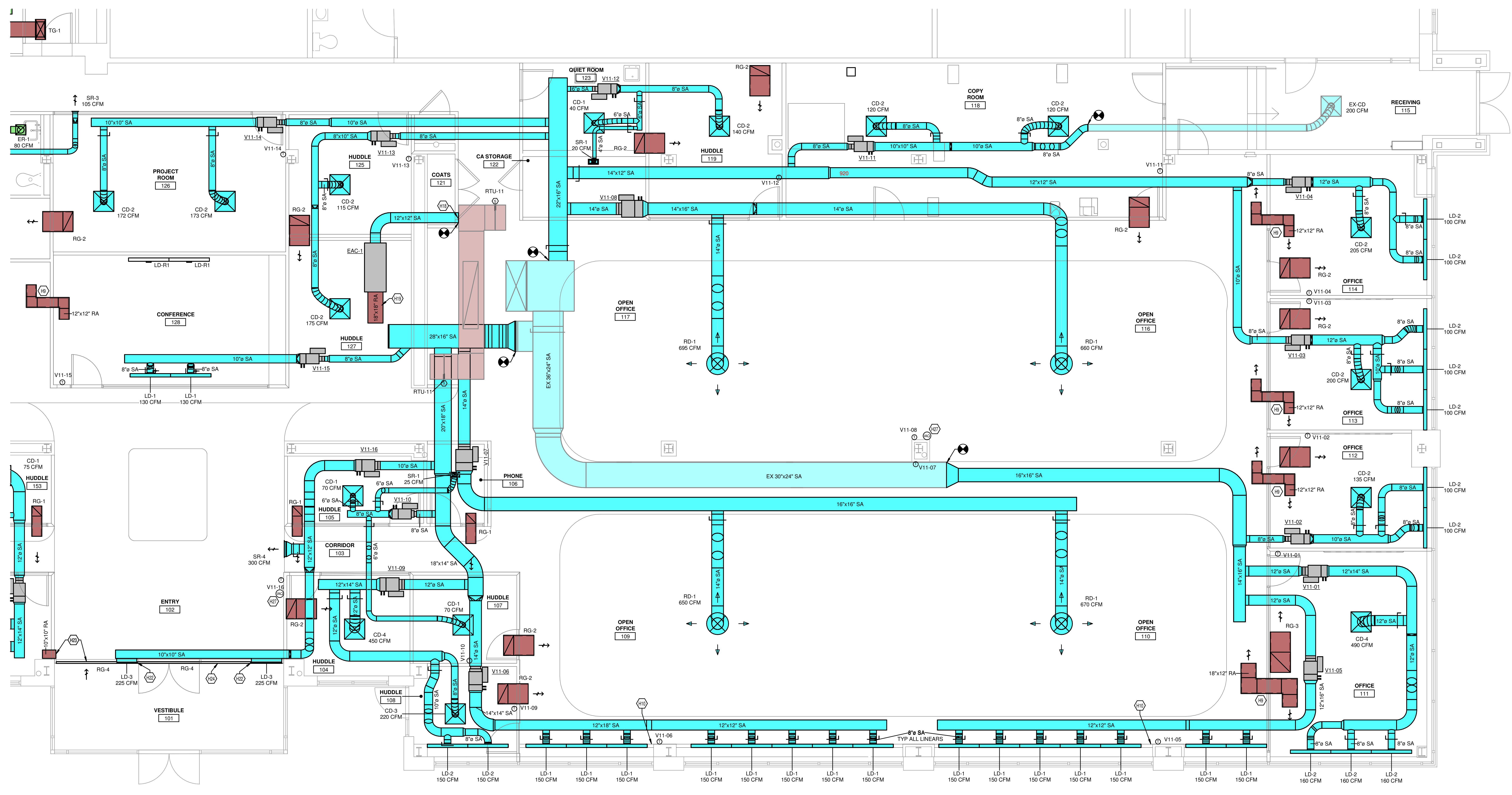
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**KEYED NOTES**

- H9 PROVIDE Z DUCT ABOVE CEILING FOR SOUND ATTENUATED AIR TRANSFER.
- H10 PROVIDE CONTINUOUS SLOT ALIGNED WITH FRONT EDGE OF COLUMNS. FILL WITH BLANKS WHERE NEEDED TO FILL ENTIRE LENGTH.
- H18 CONNECT OUTLET OF AIR SCRUBBER TO EXISTING RETURN DUCTWORK IN PLENUM SPACE.
- H19 AIR SCRUBBER INLET TO PULL FROM PLENUM SPACE.
- H22 BAR GRILLES TO BE PAINTED TO MATCH PT-1.
- H23 RETURN REGISTER IN VESTIBULE TO ALLOW RETURN AIR INTO SOFFIT, THROUGH TRANSFER DUCT AND INTO PLENUM SPACE OF HUDDLE ROOM.
- H24 LINEAR SLOT BLANK SECTION FOR CONTINUOUS LOOK.
- H27 PROVIDE INDOOR AIR QUALITY SENSOR TO MONITOR WITH LOCAL REAL TIME DISPLAY AND REPORTING TO BAS.



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1 MECHANICAL NEW - DUCTWORK - SOUTH  
 1/4" = 1'-0"

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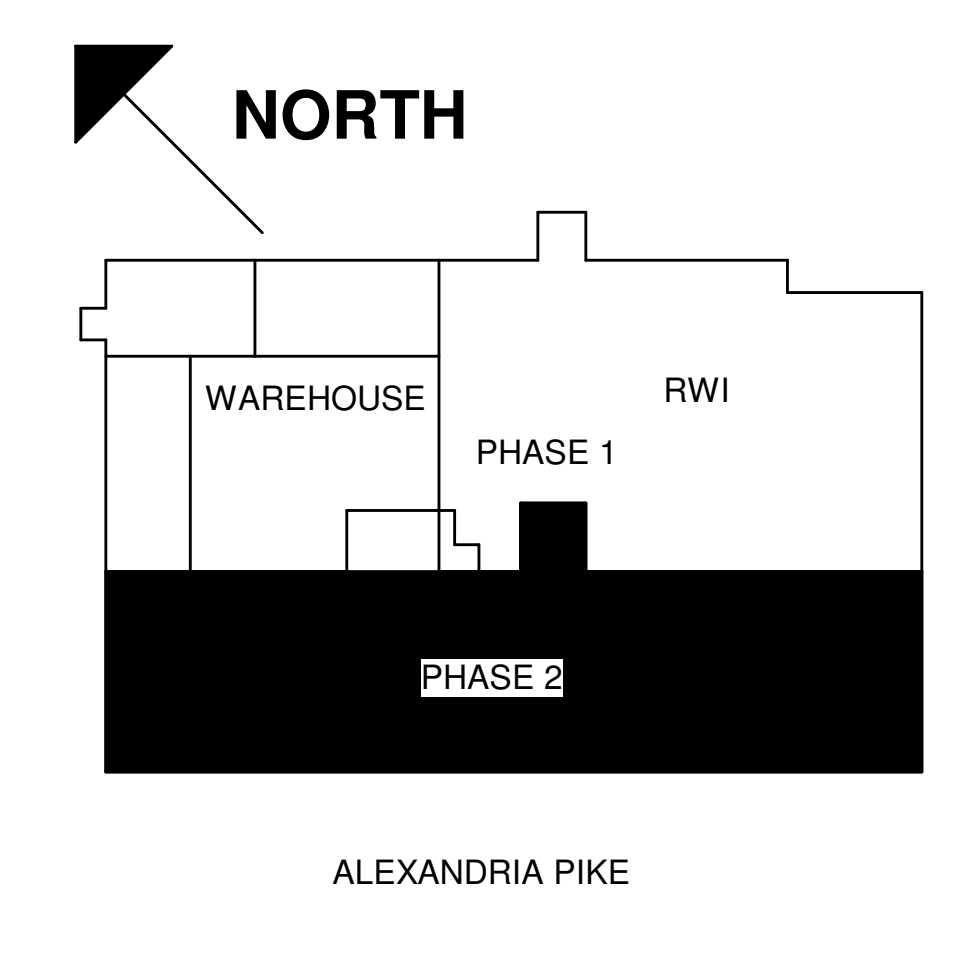
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 NEW -  
 DUCTWORK -  
 SOUTH

M2-201S  
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KEYED NOTES	
H20	REBALANCE EXISTING EXHAUST FAN TO VALUE SHOWN ON SCHEDULE.



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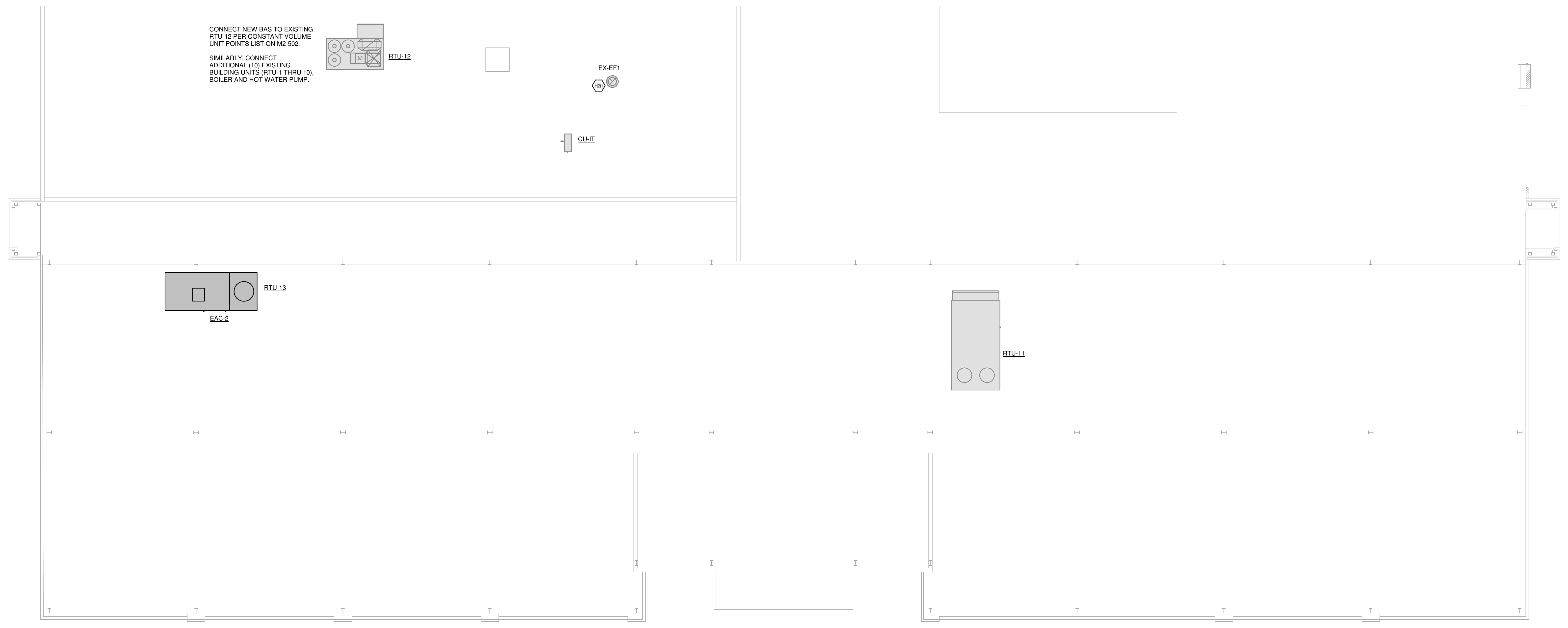
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MECHANICAL  
NEW - ROOF -  
OVERALL

**M2-202**  
1" REFERENCE  
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2024



CONNECT NEW BAS TO EXISTING RTU-12 PER CONSTANT VOLUME UNIT POINTS LIST ON M2-502.  
SIMILARLY, CONNECT ADDITIONAL (10) EXISTING BUILDING UNITS (RTU-1 THRU 10), BOILER AND HOT WATER PUMP.

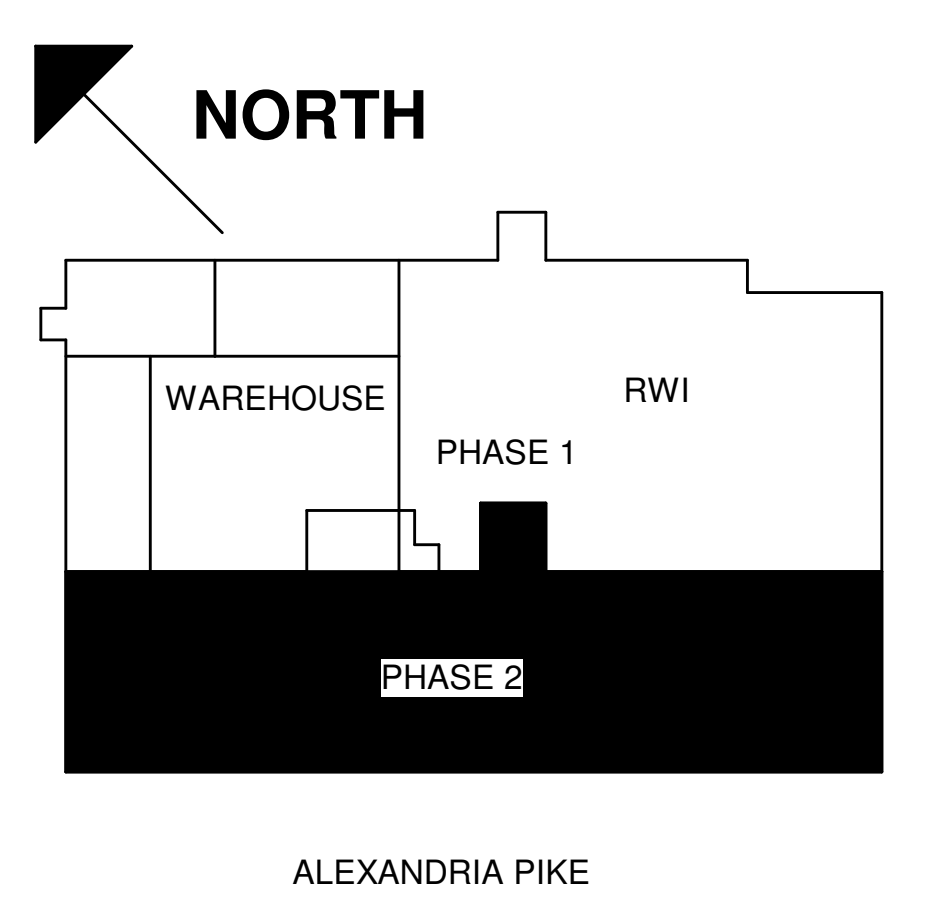
1 MECHANICAL NEW - ROOF - OVERALL  
1/8" = 1'-0"



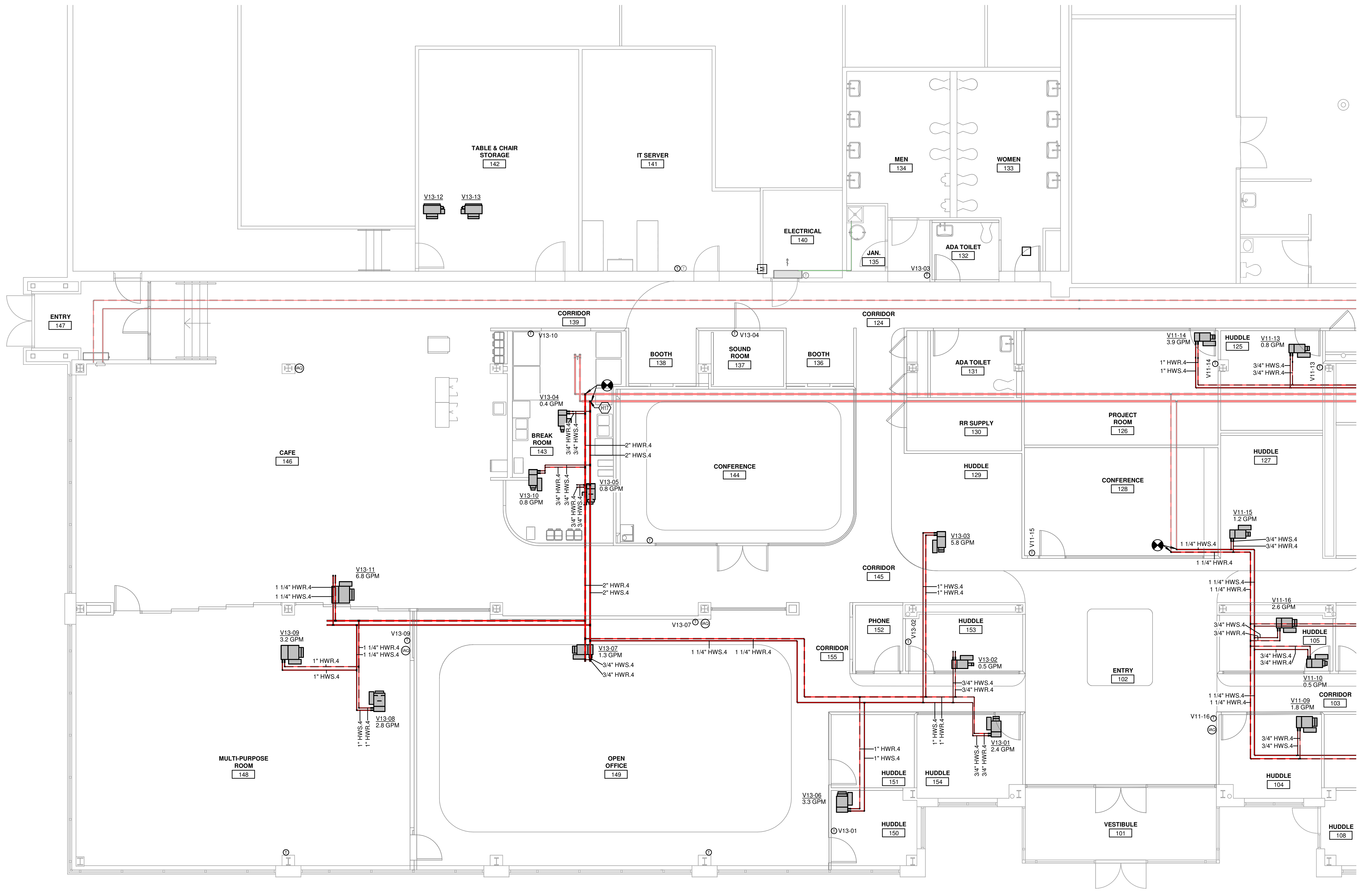
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Pipe Type Legend			
Mark	Color	System Name	Pipe Material
CD.19	<span style="color: green;">■</span>	CD - Condensate	19 - PVC - Schedule 40 - ASTM D1785/D2665
CD.4	<span style="color: green;">■</span>	CD - Condensate	4 - Copper - Type K - ASTM B88
HWR.4	<span style="color: red;">■</span>	HWR - Hot Water Return	4 - Copper - Type K - ASTM B88
HWS.4	<span style="color: red;">■</span>	HWS - Hot Water Supply	4 - Copper - Type K - ASTM B88



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NEW - PIPING - NORTH

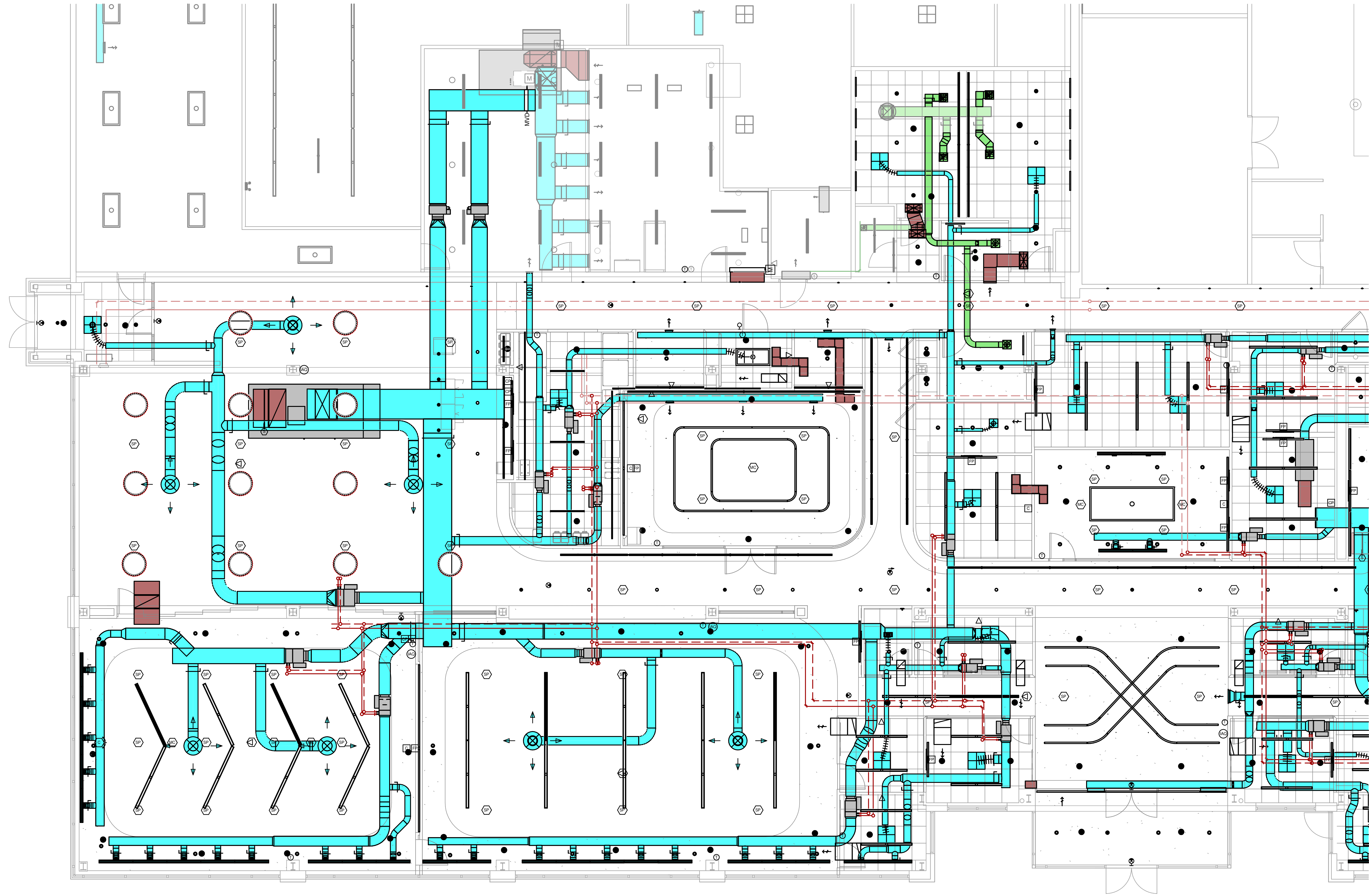
M2-301N  
1" REFERENCE  
KLH PROJECT #  
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MECHANICAL NEW - PIPING - NORTH  
3/16" = 1'-0"

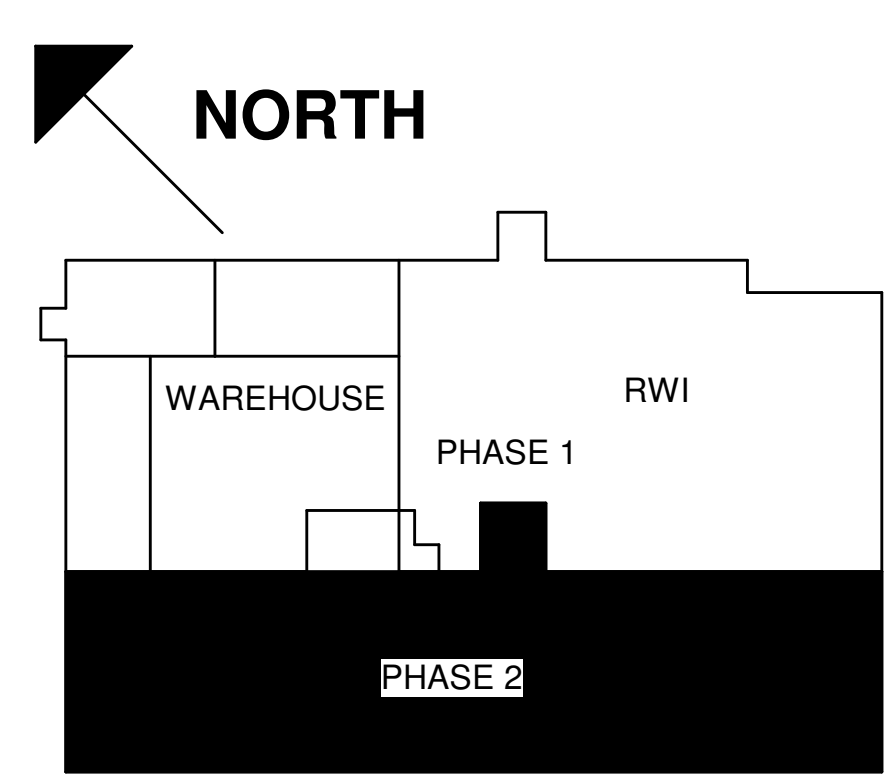


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1 MECHANICAL CEILING PLAN - NORTH  
3/16" = 1'-0"



ALEXANDRIA PIKE

KEYED NOTES

SUPPLY DUCT INSULATION SCHEDULE:  
 CONCEALED ABOVE A CEILING:  
 ALL - EXTERNALLY WRAPPED  
 EXPOSED:  
 ROUND - DOUBLE WALL  
 RECTANGULAR - INTERNALLY LINED

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 FORT THOMAS, KENTUCKY 41075  
 855-446-8558 FAX

PHASE 2 - BID SET  
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 FORT THOMAS, KY 41075

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REVISIONS

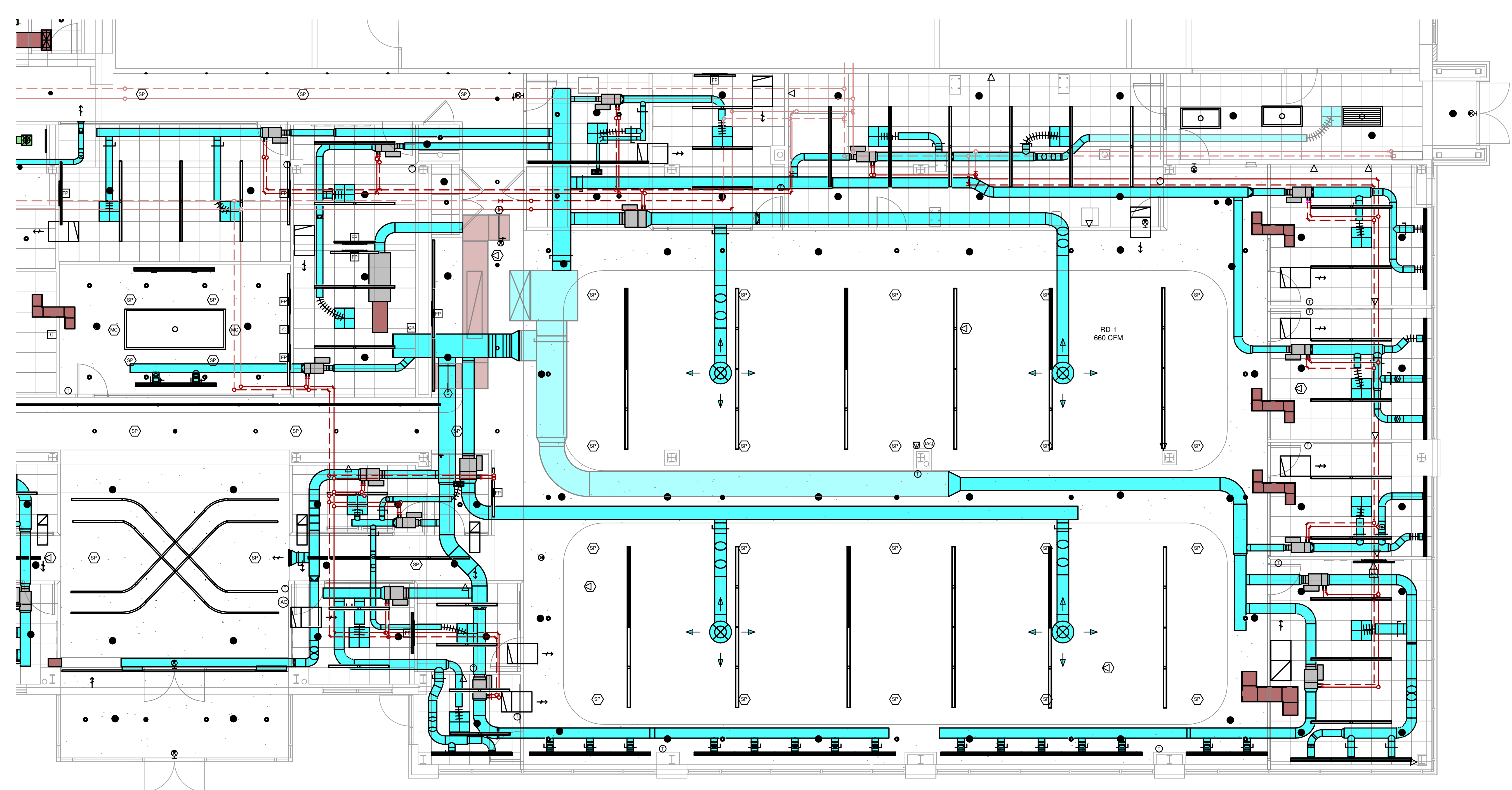
NO.	DATE	DESCRIPTION
10-11-24	ISSUED FOR BID	

DWN: CES CHK: KTS  
 DATE: 10.11.24  
 PROJECT #: 2024.00  
 MECHANICAL  
 NEW - CEILING-  
 NORTH

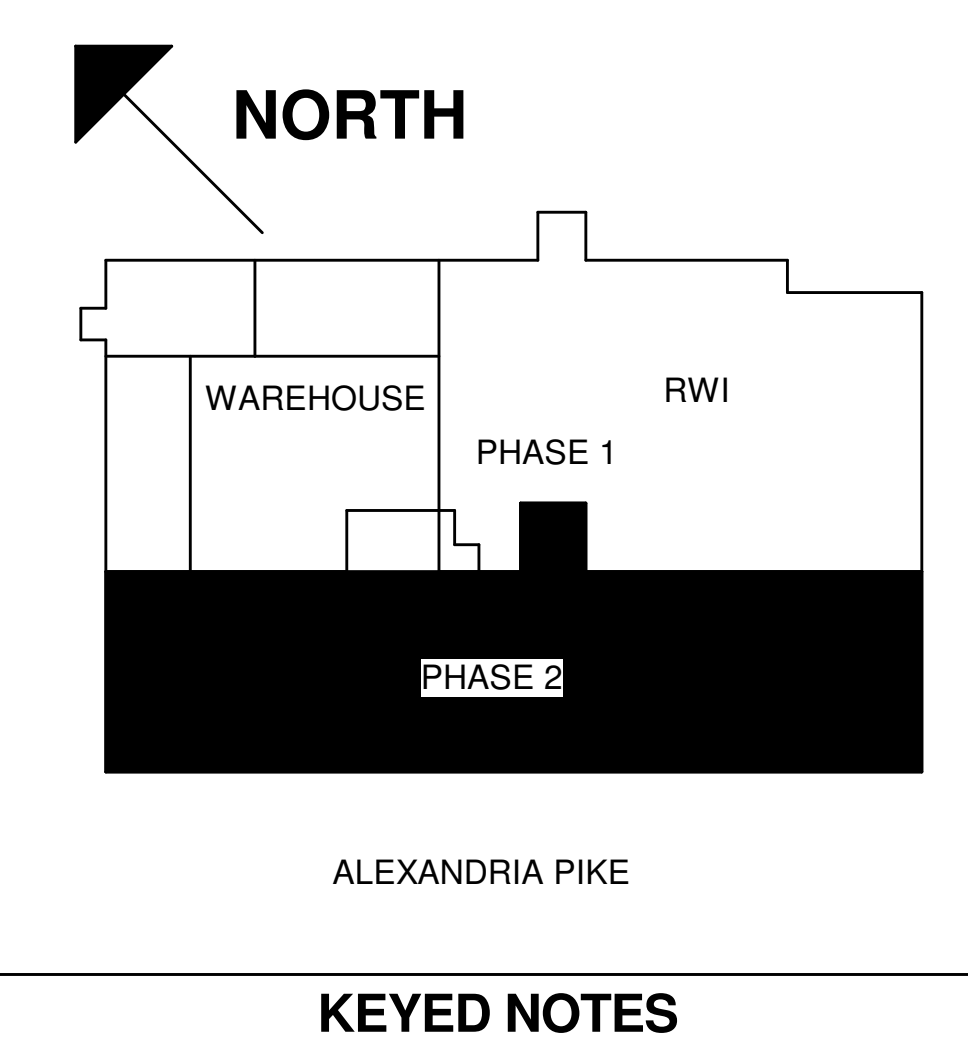
M2-401N  
 1" REFERENCE  
 KLH PROJECT #  
 2024

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1 MECHANICAL CEILING PLAN - SOUTH  
3/16" = 1'-0"



SUPPLY DUCT INSULATION SCHEDULE:  
CONCEALED ABOVE A CEILING:  
ALL - EXTERNALLY WRAPPED  
EXPOSED:  
ROUND - DOUBLE WALL  
RECTANGULAR - INTERNALLY LINED

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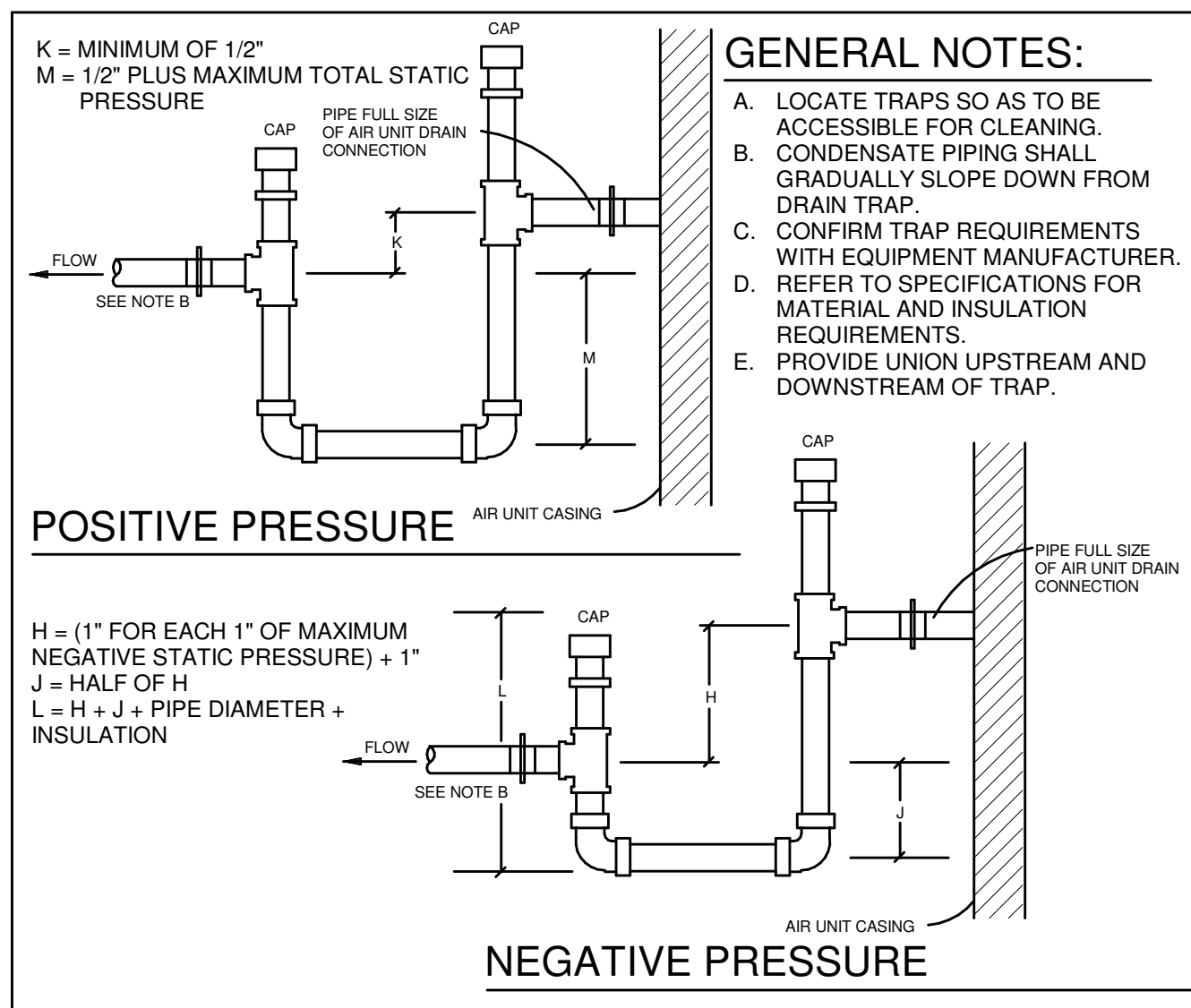
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DWN: CES    CHK: KTS  
DATE: 10.11.24  
PROJECT #: 2024.00  
MECHANICAL  
NEW - CEILING-  
SOUTH

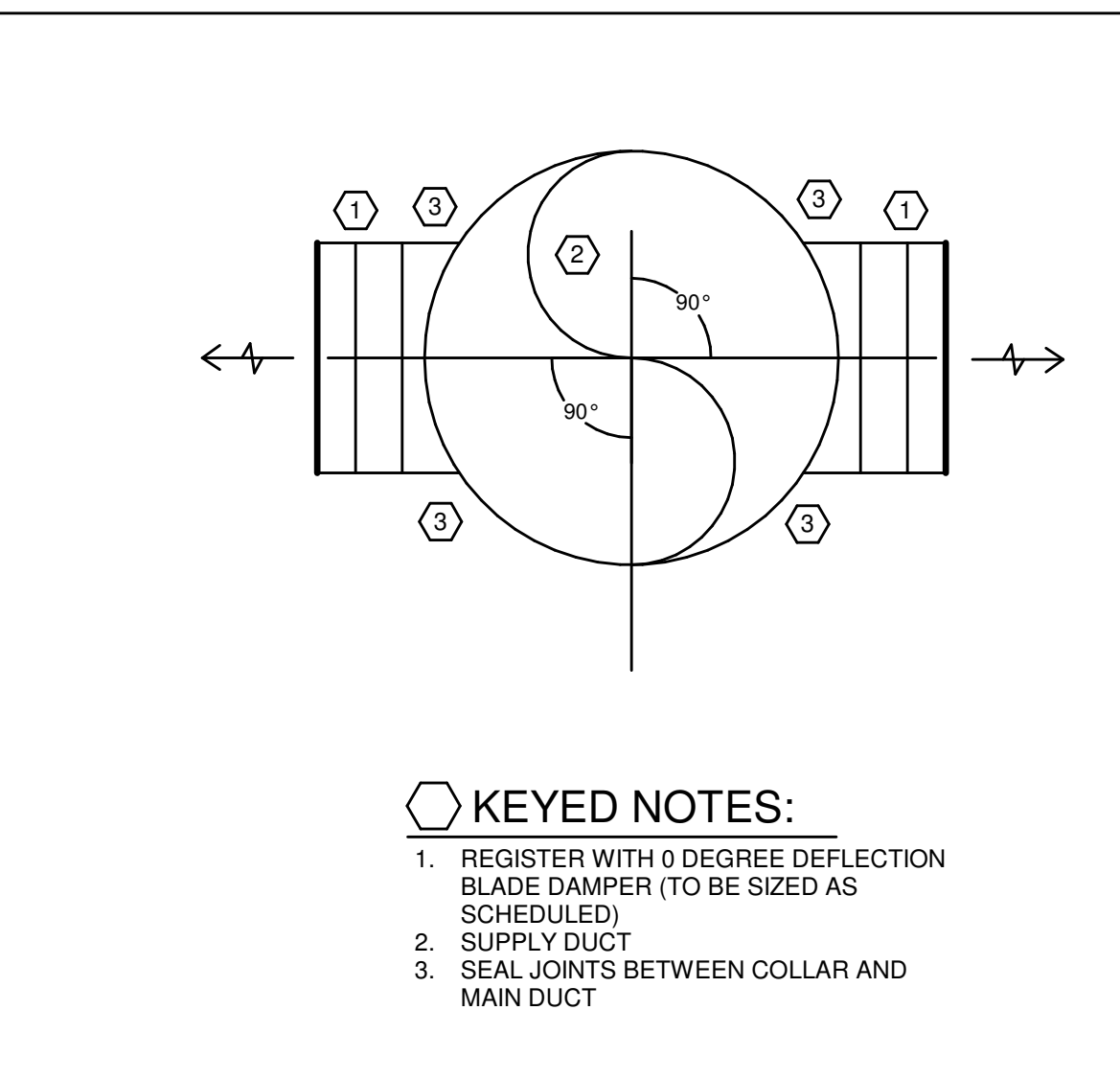
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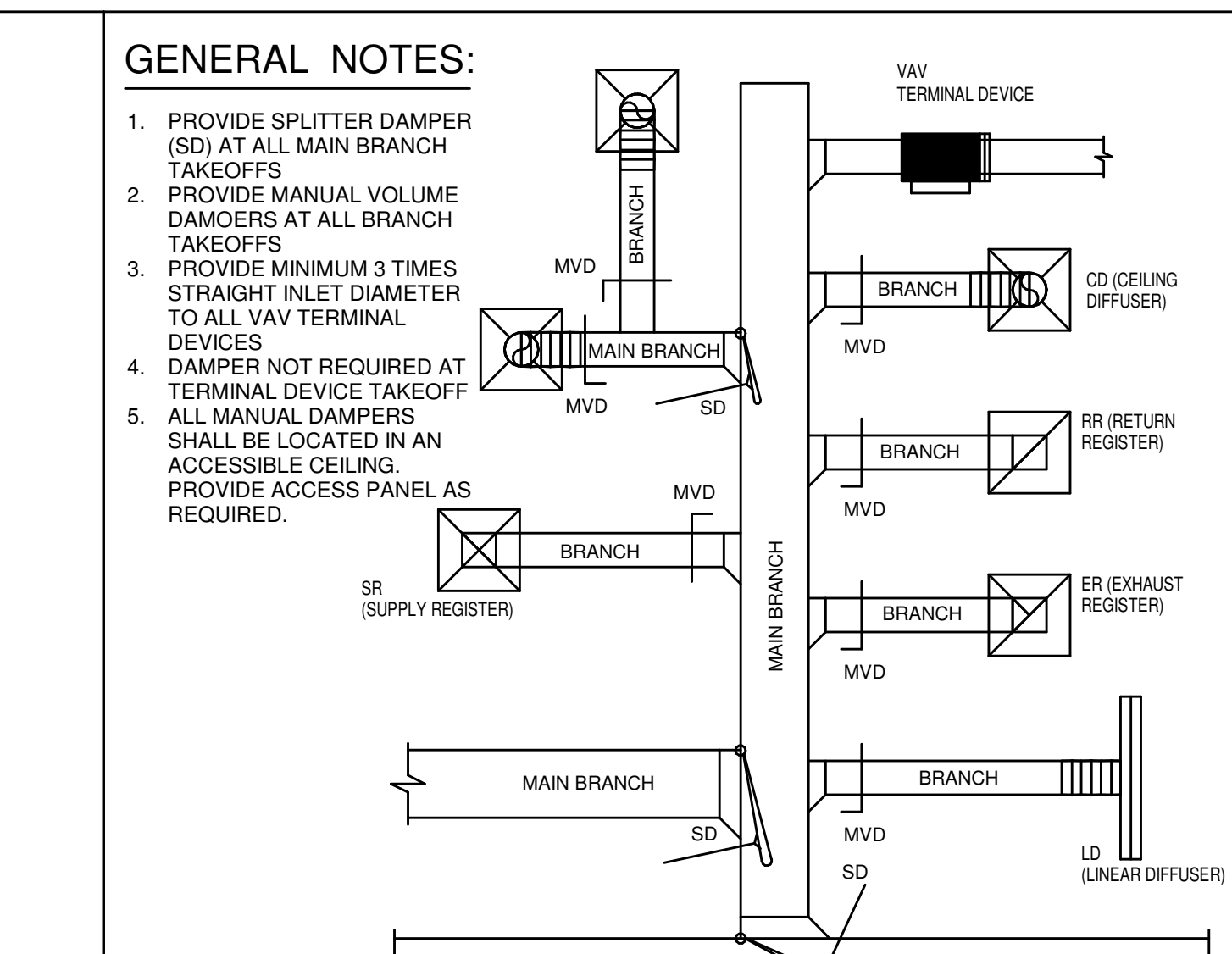
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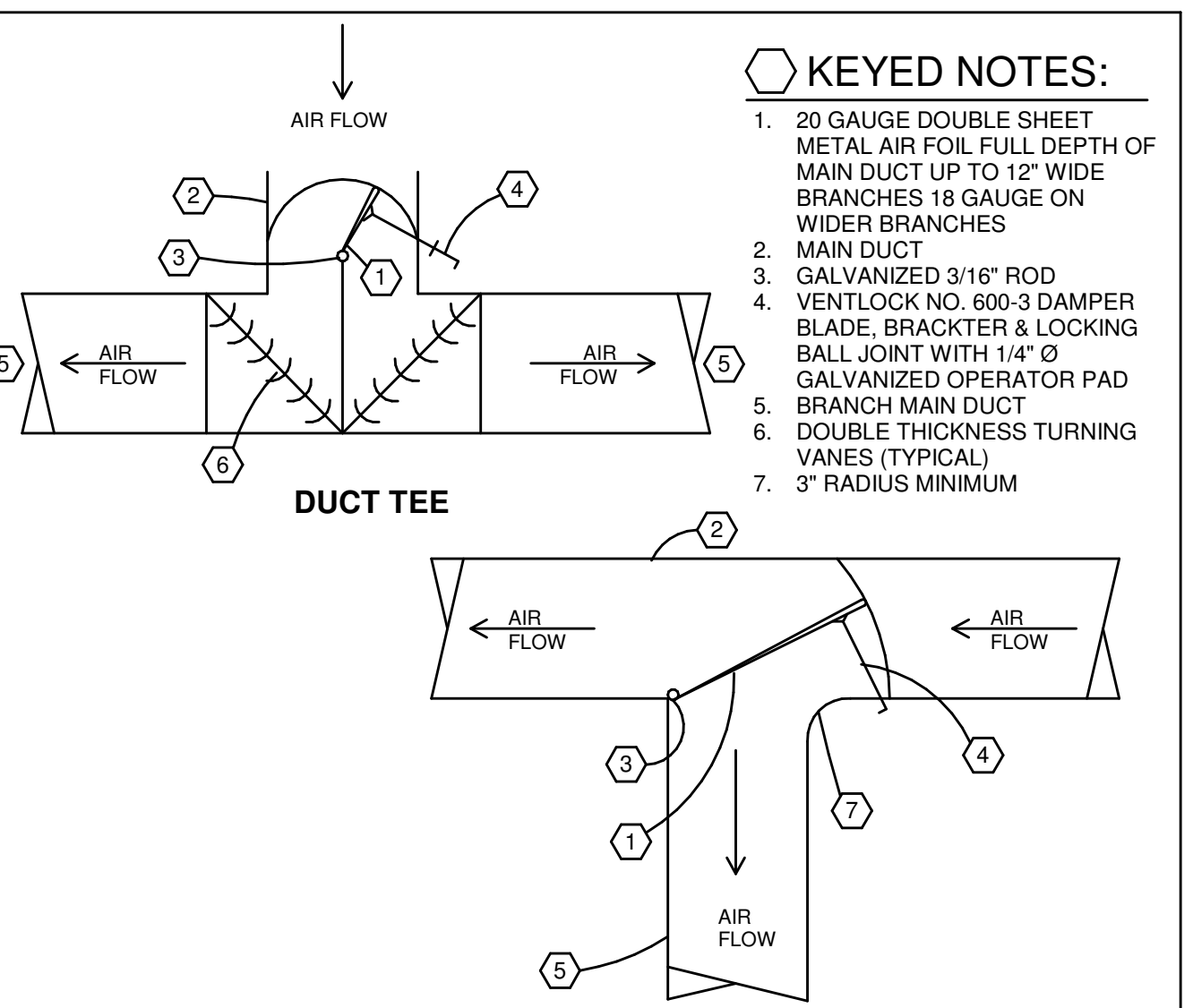
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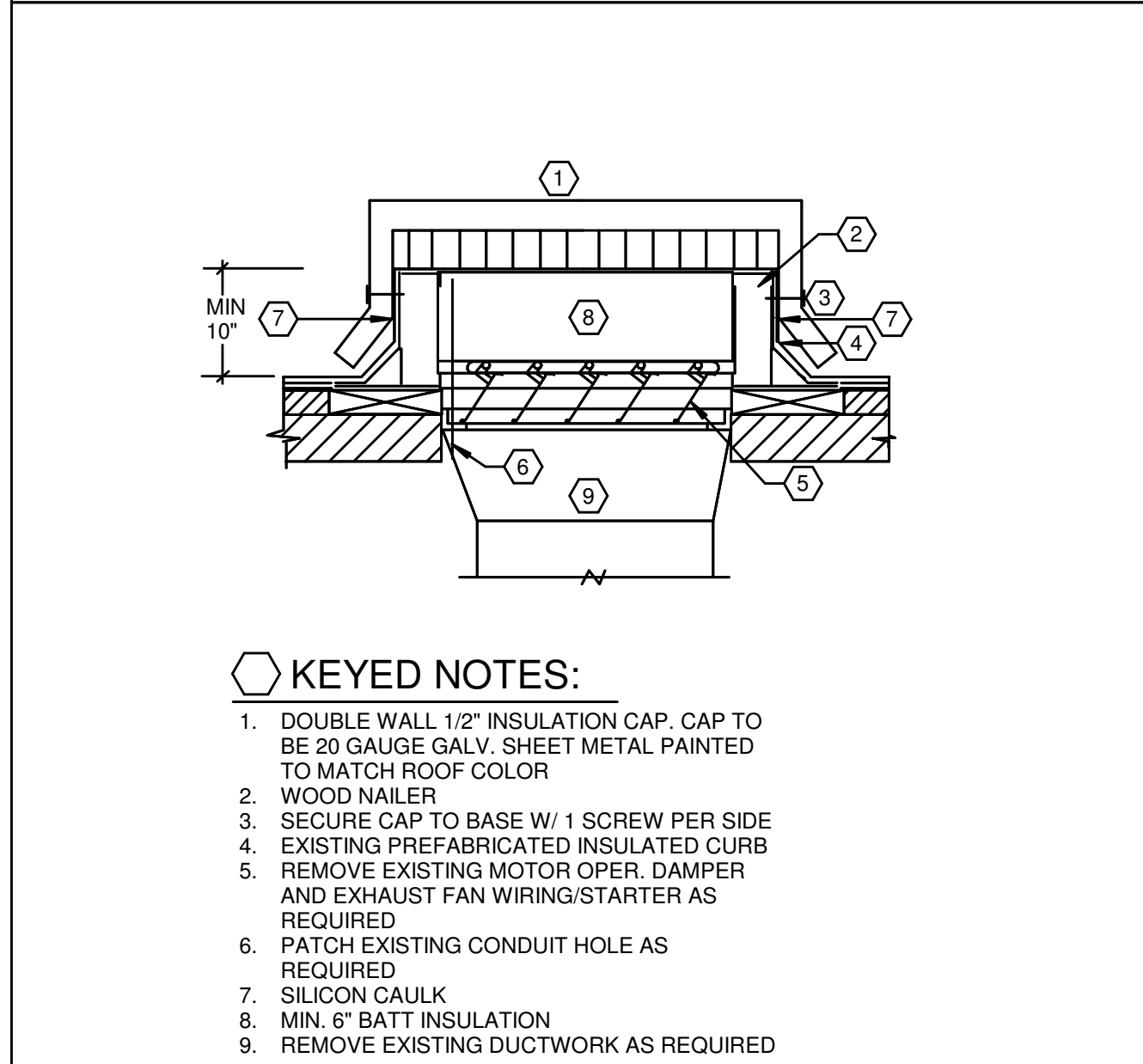
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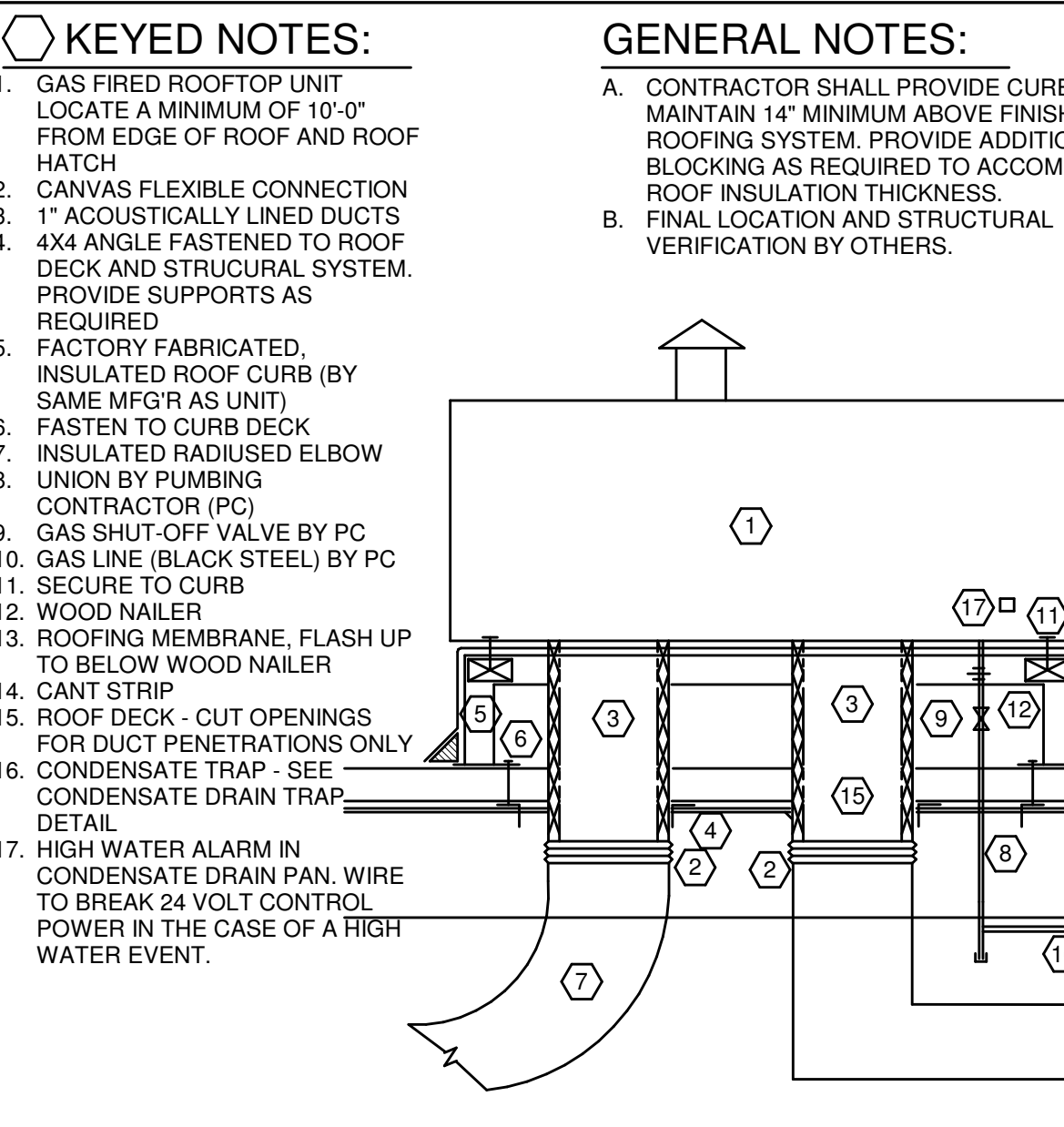
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SCALE: NONE



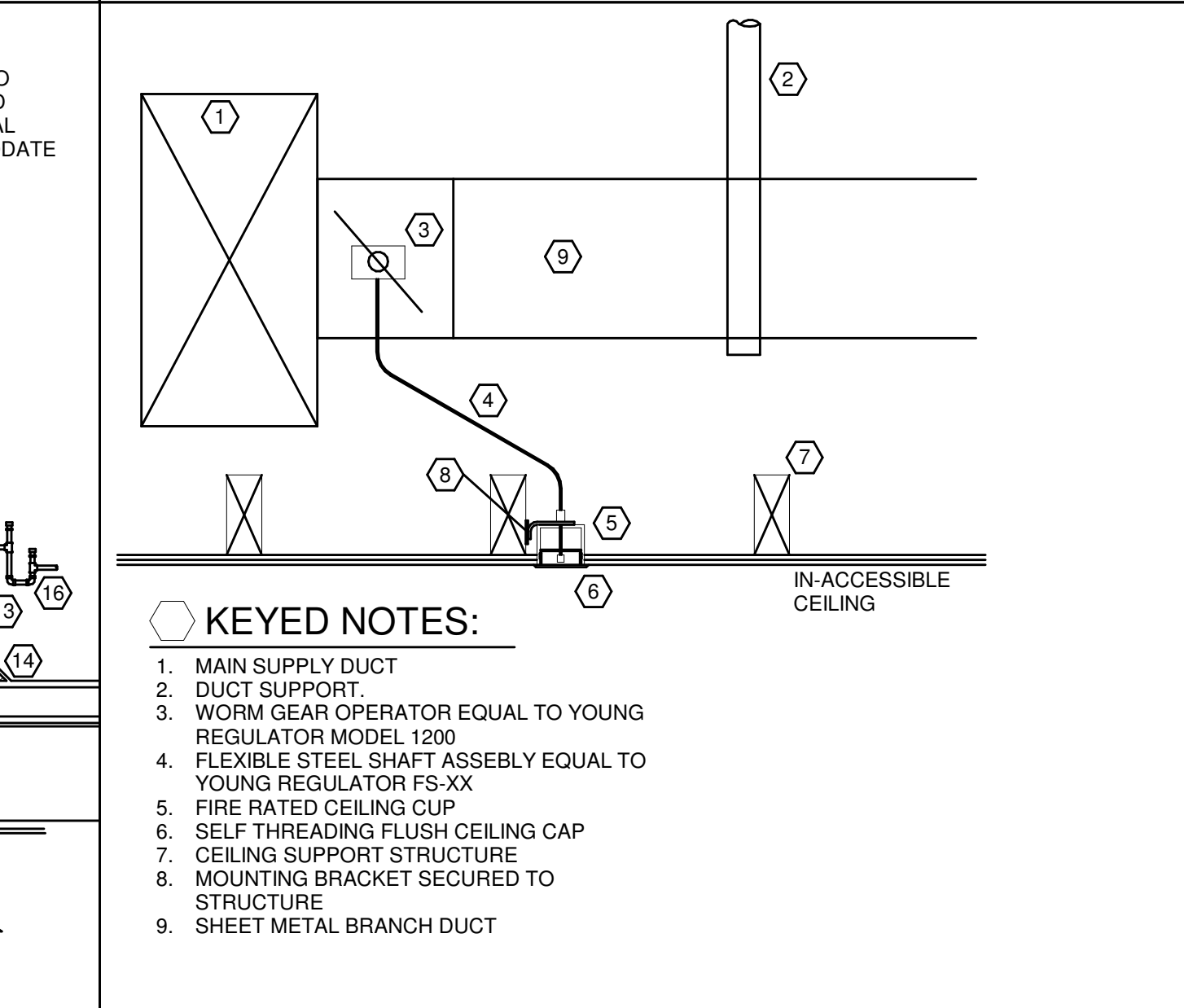
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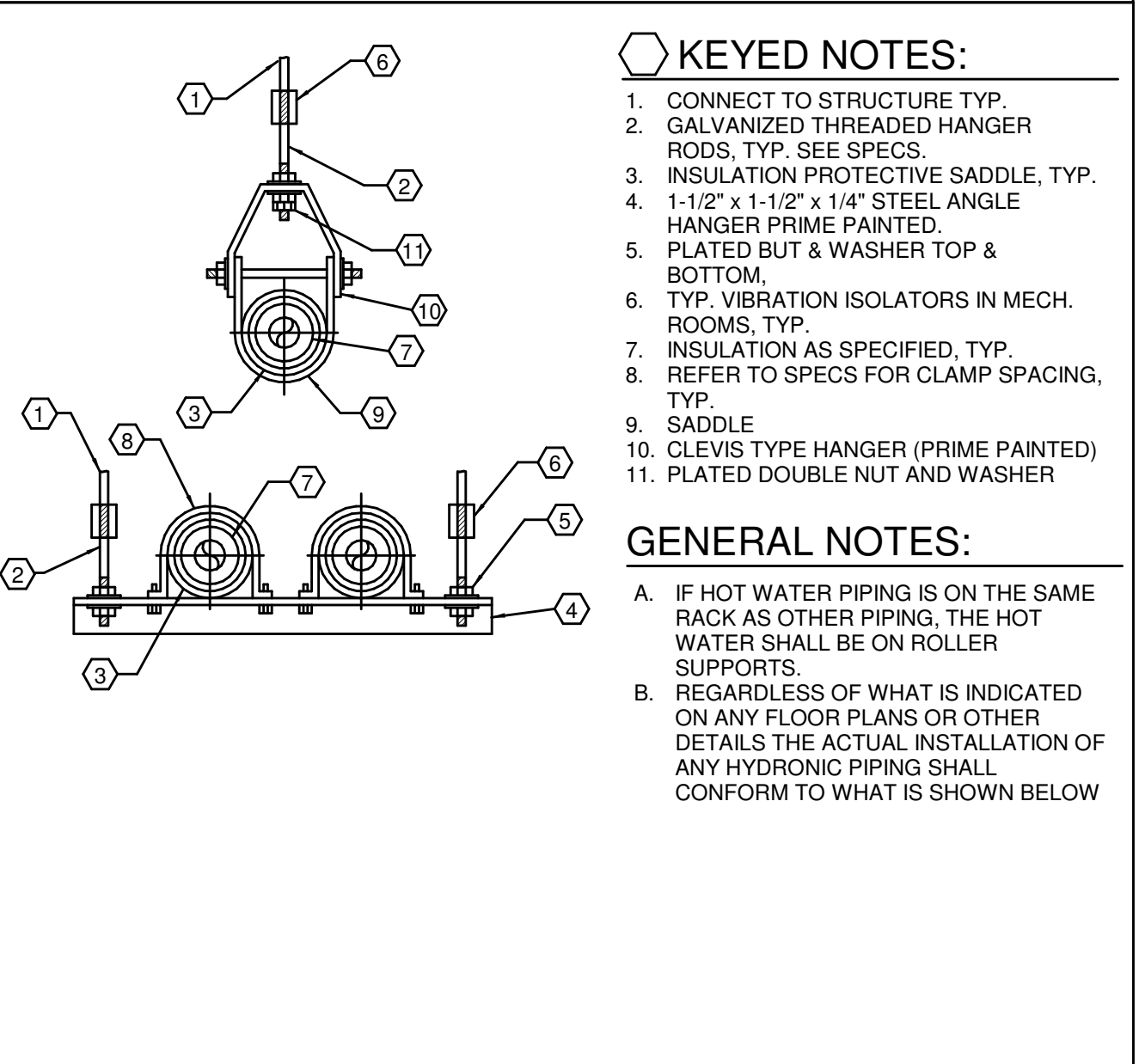
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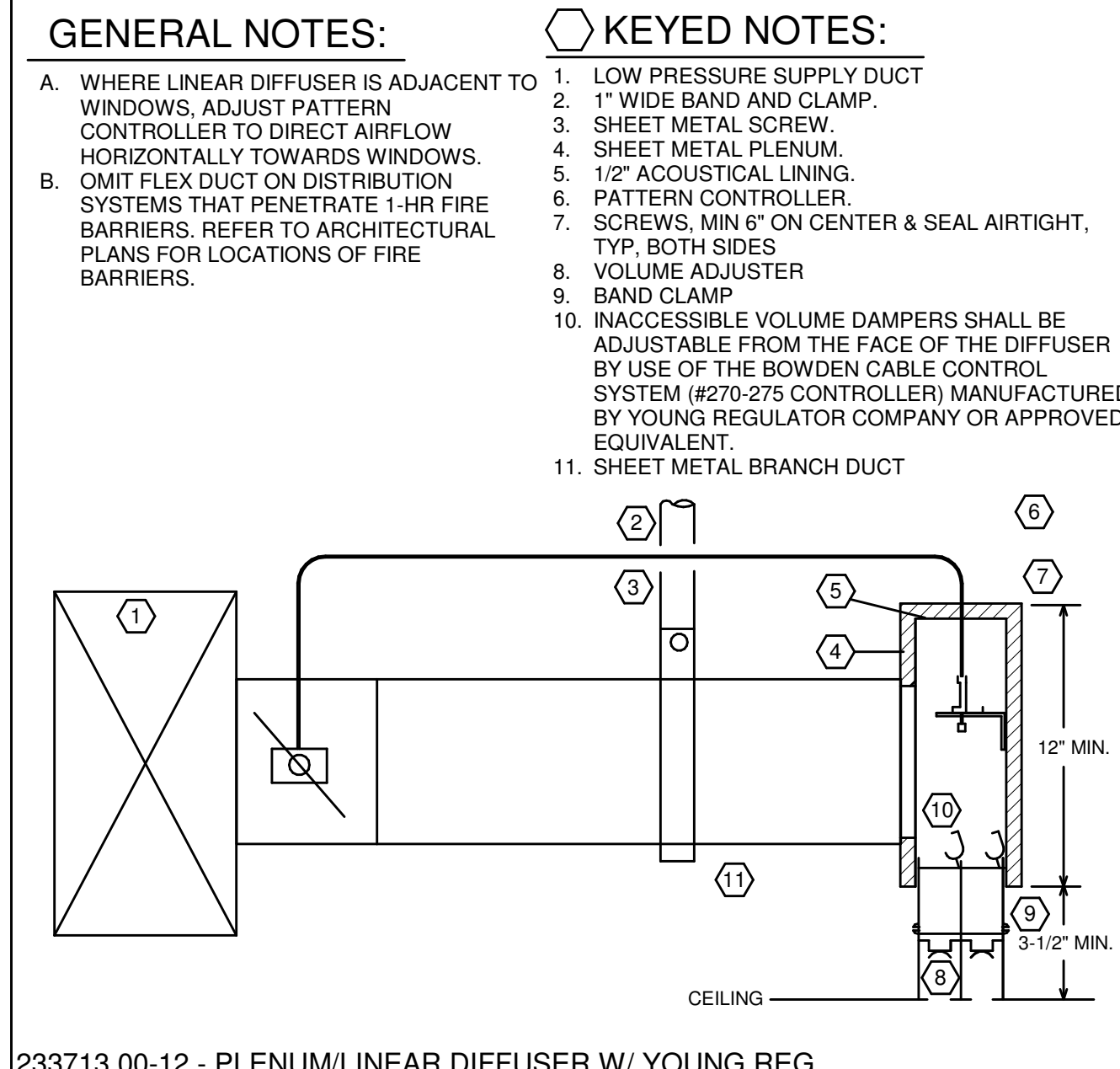
237433.00-04 - ROOF CURB & MOUNTING C  
SCALE: NONE



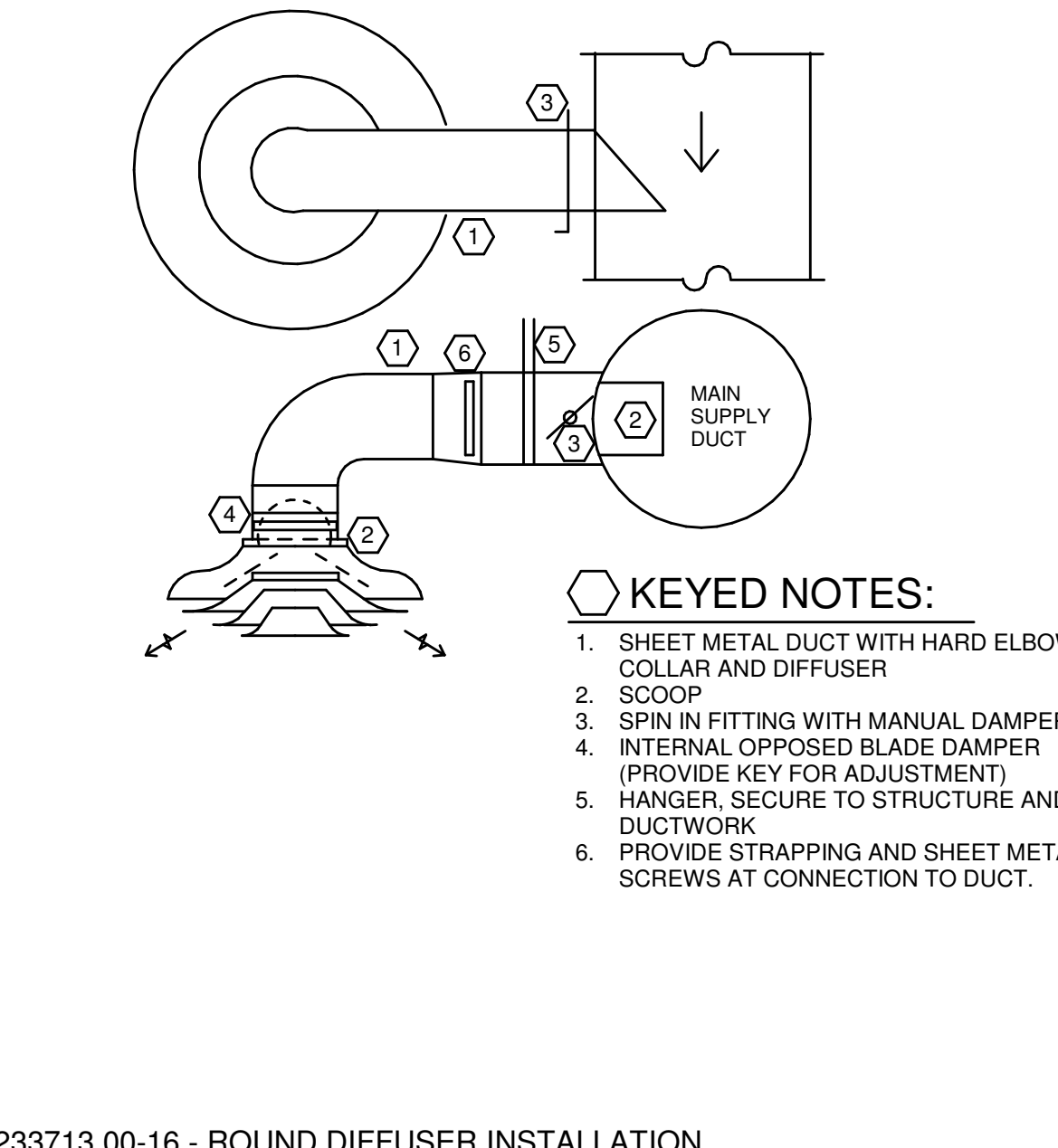
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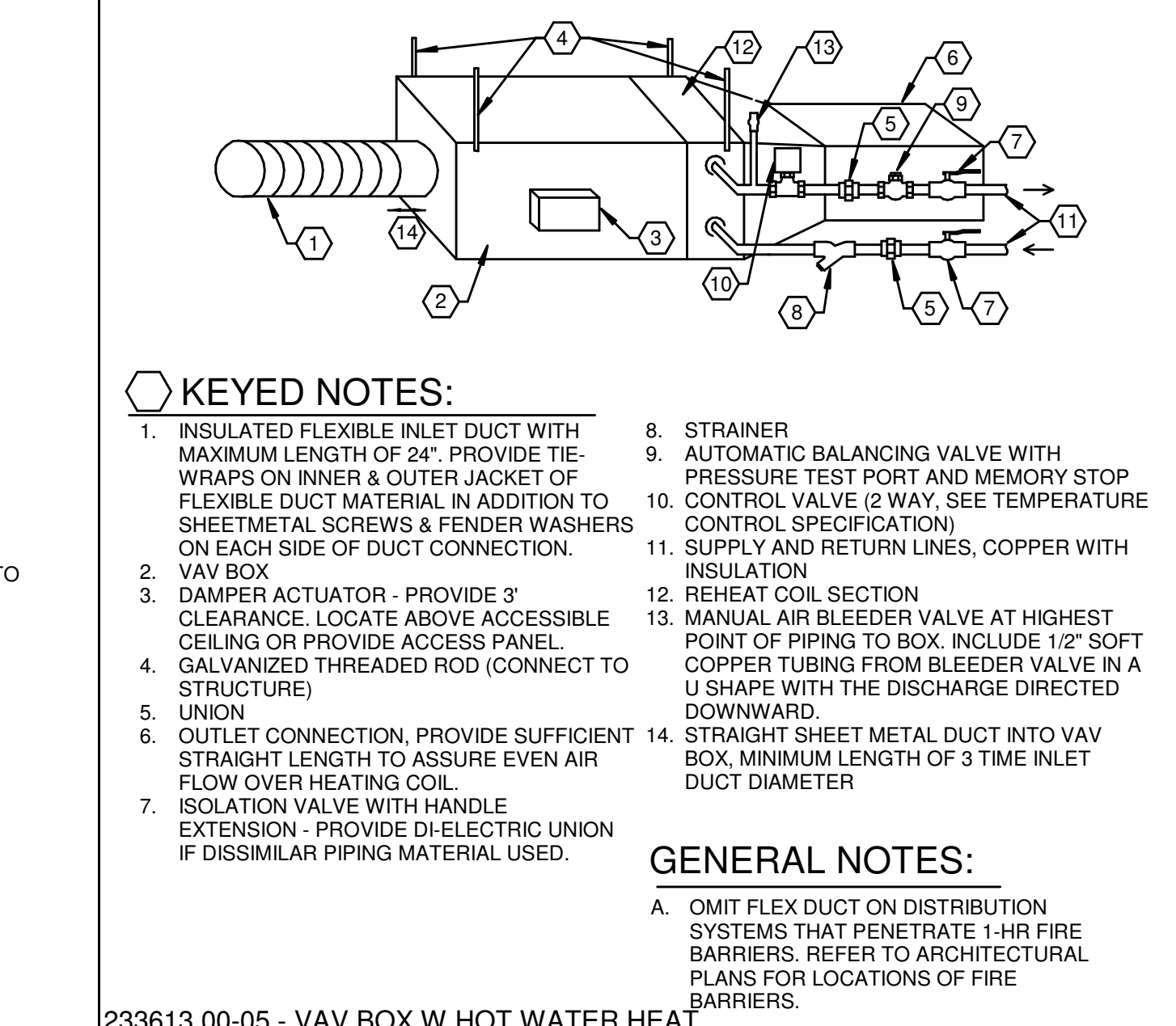
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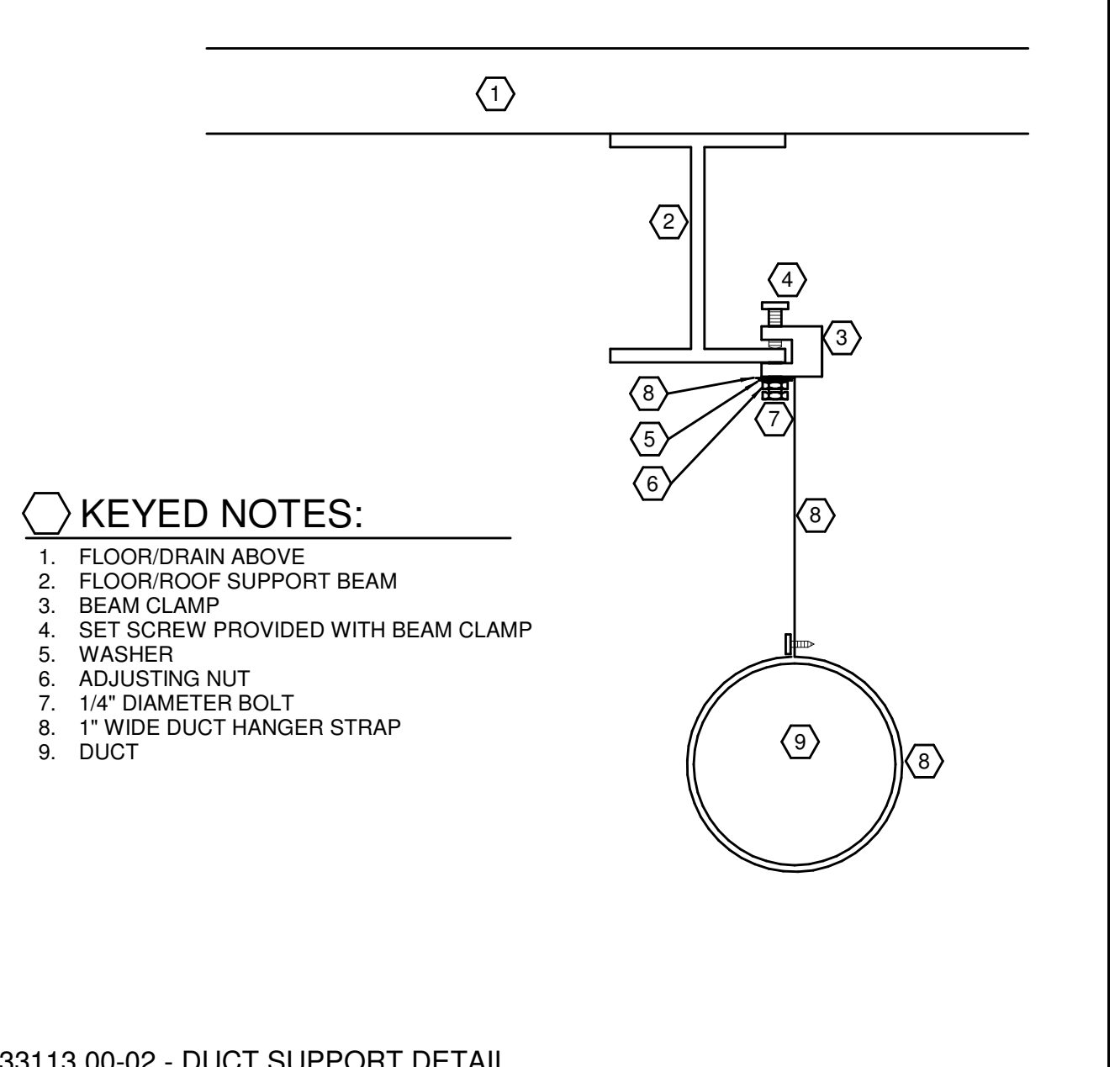
233713.00-12 - PLENUM/LINEAR DIFFUSER W/ YOUNG REG.  
SCALE: NONE



233713.00-16 - ROUND DIFFUSER INSTALLATION  
SCALE: NONE



233613.00-05 - VAV BOX W HOT WATER HEAT  
SCALE: NONE



233113.00-02 - DUCT SUPPORT DETAIL  
SCALE: NONE

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DATE: 10.11.24  
PROJECT #: 2024.00  
MECHANICAL - DETAILS

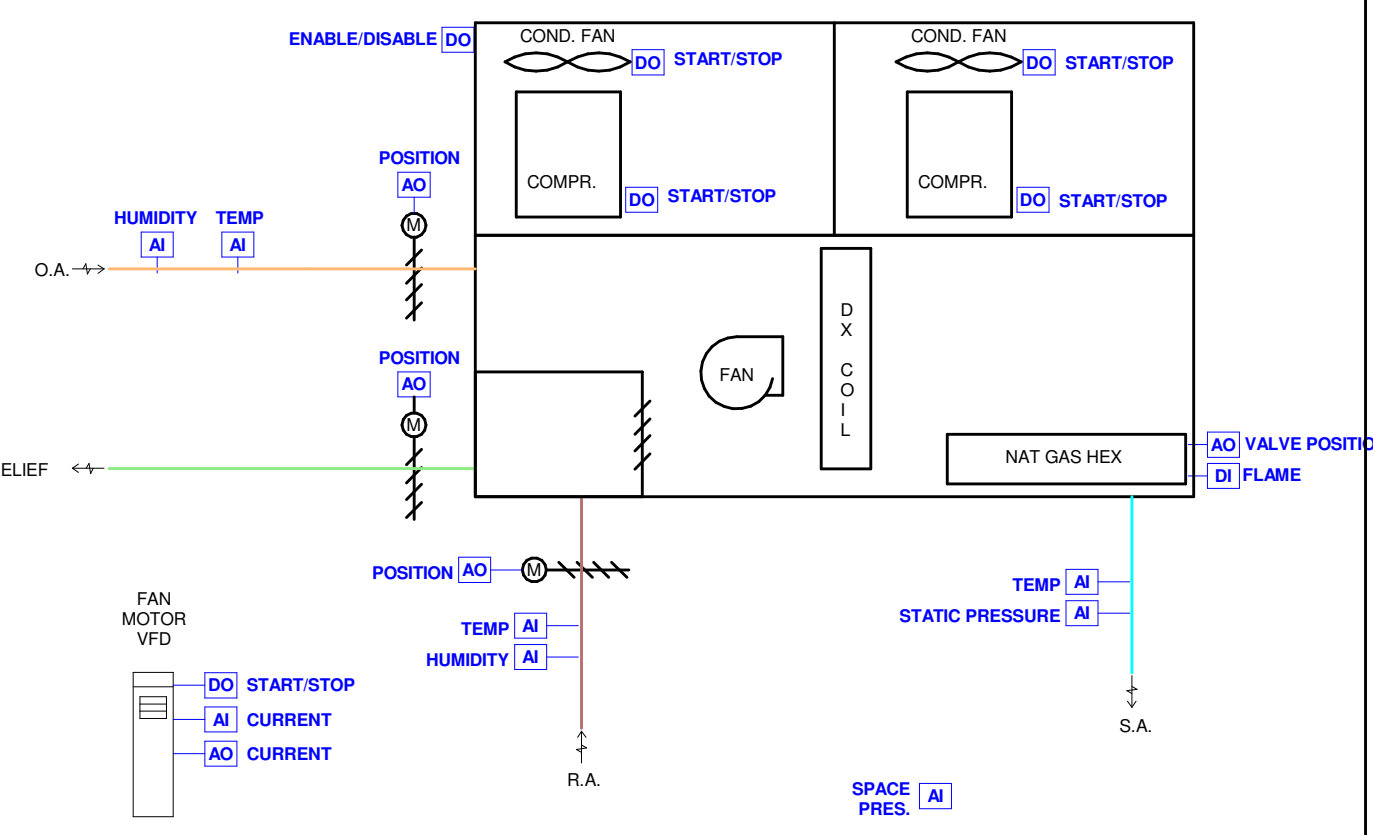
M2-501  
1" REFERENCE  
KLH PROJECT #  
2024

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Control / Monitoring Point Name	RTU-11 & 13 BAS Points List													
	Hardware Points				Software Points					Setpoint Value		Trending		
	AI	AO	DI	DO	AV	DV	Alarms			Display Status	Initial Setpoint 1	Initial Setpoint 2	Change of Value (COV)	Trend Loop Duration
							Low Limit...	High Limit...	General					
VAV Average Space Temperature					x					x			x	3 deg
Occupied Heating Setpoint					x					x	70			
Occupied Cooling Setpoint					x					x	74			
Unoccupied Heating Setpoint					x					x	60			
Unoccupied Cooling Setpoint					x					x	85			
Supply Fan, Enable / Disable				x						x			x	
Supply Fan Status			x							x			x	
Supply Fan VFD Speed		x								x			x	3%
Maximum Supply Duct Static Pressure Setpoint					x					x				
Minimum Supply Duct Static Pressure Setpoint					x					x				
Maximum Damper Position Setpoint					x					x				
Minimum Damper Position setpoint					x					x				
Supply Air Duct Static Pressure	x									x		x	0.2"wc	
High Supply Air Duct Static Pressure Switch					x			x		x				
VAV Total Airflow				x						x		x	300cfm	
Time Schedule					x			x		x				
Supply Fan Fail Alarm					x			x		x				
Supply Fan Hand Alarm					x			x		x				
Supply Fan VFD Alarm					x			x		x				
Fail Safe Command					x			x		x			x	
Optional VFD Points														
VFD HZ					x					x				
VFD Voltage					x					x				
VFD Amps					x					x				
Supply Air Duct High Pressure Switch			x							x		x		
Fail Safe Command					x					x		x		
Outside Air Temperature	x									x				
Supply Air Temp	x									x				
Supply Air Temp High Setpoint					x					x	60			
Supply Air Temp Low Setpoint					x					x	55			
Outside Air Temp High Setpoint					x					x	60			
Outside Air Temp Low Setpoint					x					x	30			
Economizer Damper Position		x								x		x	20 cfm	
Min OA Minimum Damper Position Setpoint					x					x				
Min OA Maximum Damper Position Setpoint					x					x				
Supply Fan Min Speed Setpoint					x					x			x	
Supply Fan Max Fan Speed Setpoint					x					x				
Fail Safe Command					x					x				
Supply Air Temperature Setpoint					x					x	55			
Mixed Air Temperature Differential Setpoint					x					x	2			
Supply Air Temperature	x									x		x	3 deg	
Mixed Air Temperature	x									x		x	3 deg	
Heating Mode					x					x				
Cooling Mode					x					x				
Outside Air Temp	x									x		x	3 deg	
Outside Air Humidity	x									x		x	3%	
Outside Air Enthalpy					x					x		x	1 btu/lb.	
Return Air Temp	x									x		x	3 deg	
Return Air Humidity	x									x		x	3%	
Return Air Enthalpy					x					x		x	1 btu/lb.	
Building Pressure	x									x		x	0.01"	
Building Pressure Setpoint					x					x	0.05"			
Exhaust Fan Signal		x								x		x	0.03	
Fail Safe Command					x					x		x	0.01"	
Supply Air Temperature	x									x		x	3 deg	
Mixed Air Temperature	x									x		x	3 deg	
Return Air Temperature	x									x		x	3 deg	
Time Schedule					x					x				
Cooling Output		x								x		x		
Outside Air Temperature Cooling Disable...					x					x	55			
Supply Air Temperature High Alarm					x			x		x				
Return Air Temperature	x									x				
Gas Heating Output		x								x		x		
Supply Air Temperature Low Alarm					x					x				
Duct Smoke Detector					x					x		x		
Fire Alarm System					x					x		x		
Freeze Stat					x					x		x		
<b>Totals</b>	<b>14</b>	<b>5</b>	<b>5</b>	<b>1</b>	<b>25</b>	<b>16</b>	<b>1</b>	<b>1</b>	<b>9</b>	<b>1</b>	<b>58</b>			
<b>Subtotals</b>		<b>25</b>									<b>53</b>			<b>58</b>
<b>Grand Totals</b>											<b>136</b>			

RTU-11 & 13 Sequence of Operations

- Control Package
  - Equipment shall be provided with BACNET interface card or BACNET controls.
  - Equipment Manufacturer shall provide written sequence of operation
  - Equipment Manufacturer shall provide integration points list
  - Equipment Manufacturer shall provide configuration settings of program
  - Equipment Manufacturer shall provide setpoints that the BAS contractor shall write to, to accomplish sequence
  - BAS contractor shall include the Manufacturers, sequence, integration points list, configuration settings and setpoints in BAS submittal
- Startup
  - The Unit Controller will use an optimal start algorithm for morning start-up. This algorithm will minimize the unoccupied warm-up or cool-down period while still achieving comfort conditions by the start of scheduled occupied period.
- Morning Warm Up
  - Outside Air Damper shall be closed
  - Return Air Damper shall be open
  - Supply Fan shall be on
  - The Heat shall be on until the space temperature or return air temperature or the averaged space temperature satisfies the Occupied Heating Setpoint
  - When Morning Warm up is complete the unit shall return to normal operation
- Morning Cool Down
  - Outside Air Damper shall be closed
  - Return Air Damper shall be open
  - Supply Fan shall be on
  - The Cooling shall be on until the space temperature or return air temperature or the averaged space temperature satisfies the Occupied Cooling Setpoint
  - When Morning Cool Down is complete the unit shall return to normal operation
- Supply Fan Control
  - The BAS shall integrate with the Supply Fan VFD
  - The Unit Controller shall enable the Supply Fan based on a Time Schedule or Unoccupied Setpoints
  - The Unit Controller will use an optimal start algorithm for morning start-up. This algorithm will minimize the unoccupied warm-up or cool-down period while still achieving comfort conditions by the start of scheduled occupied period.
  - The Unit Controller shall monitor the average space temperature from the associated system VAV's
  - The BAS shall monitor all associated system VAV actual CFM, and display the total system VAV CFM
- Occupied Mode
  - The VFD shall modulate the supply fan to maintain the supply air duct static pressure setpoint of 1.5" (adj) default
  - The BAS shall reset supply air duct static pressure setpoint based on the most open VAV damper position.
  - The BAS shall monitor all associated VAV, and sample the damper position every 2 minutes (adj) to determine the most open damper
  - Maximum supply air duct static pressure setpoint 1.5" wc. (adj) as determined by the TAB contractor when all VAV at Maximum Cooling CFM airflow
  - Minimum supply air duct static pressure setpoint 1" wc. (adj) as determined by the TAB contractor when all VAV at Minimum CFM airflow
  - Supply air duct static pressure change setpoint 0.05" wc. (adj)
  - Maximum Damper Position Setpoint shall be 90% (adj)
  - Minimum Damper Position Setpoint shall be 60% (adj)
  - The BAS shall increase the supply air duct static pressure setpoint when the most open VAV damper is below the minimum damper position setpoint and the BAS shall decrease the supply air duct static pressure setpoint when the most open VAV damper is above the maximum damper position setpoint
- Unoccupied Mode
  - The Unit Controller shall enable the supply fan when the VAV average space temperature is below the unoccupied heating setpoint or is above the unoccupied cooling setpoint
- Alarms
  - Fail Safe Mode: Supply Fan shall be disabled when a Fail Safe command is received
  - The Unit Controller shall monitor the supply fan status with a differential pressure switch
  - The Unit Controller Shall monitor the supply air duct static pressure with a pressure transducer
  - The Unit Controller shall monitor the supply air duct static pressure with a high static pressure switch , with manual reset to be interlocked with the VFD to shut down the supply fan, high static pressure switch shall be set at 4" wc. (adj)
  - The Unit Controller shall monitor the supply fan VFD alarm
  - The BAS shall alarm when the supply fan is enabled but the supply fan status is off (Supply Fan Fail Alarm)
  - The BAS shall alarm when the supply fan is disabled and the supply fan status is on (Supply Fan Hand Alarm)
  - The BAS shall alarm when the supply air duct high static pressure switch trips
- Supply Fan Safety
  - A high supply air static pressure switch shall be installed down stream of the supply fan
  - The switch shall be installed within 10 ft of the supply fan and before any dampers
  - The switch shall be interlocked with the supply fan and disable the supply fan when the supply duct static pressure is above 4.0" wc (adj)
  - The switch shall have a manual reset
  - The supply duct static pressure setpoint shall be determined by the TAB contractor
  - The BAS shall monitor the supply duct static pressure switch and alarm when tripped
  - The BAS shall send a fail safe shutdown command to the associated equipment
- Supply Air Temperature Setpoint
  - The BAS shall reset the supply air temperature setpoint based on the outside air temperature
  - The supply air temperature setpoint shall be 55 deg. When the outside air temperature is 60 deg. or above, and 60 deg. when the outside air temperature is 30 deg. Or below
- Minimum Outside Air Control
  - The Economizer shall maintain the minimum OA damper position during occupied mode
  - The economizer damper position shall track the supply fan speed
  - When the supply fan is operating at the Supply Fan Max Speed, the economizer damper shall modulate to the MIN OA Min Damper Position Setpoint
  - When the supply fan speed is at the Supply Fan Min Fan Speed then the economizer damper shall modulate to the Min OA Max damper position setpoint
  - The economizer Min OA Min Damper Position Setpoint and the Min OA Max Damper Position Setpoint shall be determined by the TAB contractor
- Fail Safe Mode : The economizer damper shall close
- Economizer Control
  - The Economizer Mode shall be enabled whenever
    - The outside air temp is below 65 deg (adj)
    - The outside enthalpy is less than the return air enthalpy by 2 btu/lb.
    - The supply fan is on
    - Cooling Mode is enabled when the economizer damper is open 100% and the mixed air temperature setpoint is not satisfied
    - Heating Mode is disabled
  - The economizer damper shall modulate to maintain a mixed air temperature of 2 deg. (adj) below the supply air temperature setpoint
- Fail Safe Mode : The economizer damper shall close
- Relief Control
  - The controller will measure building static pressure and modulate the exhaust fan to maintain a building static pressure setpoint 0.05" wc. (adj)
  - The building static pressure sensor shall be located in the space and reference the outdoor pressure
  - The BAS shall send a fail safe shutdown command to the associated equipment
- Cooling Control
  - The Unit Controller shall enable DX Cooling based on a Time Schedule or Unoccupied Setpoints and supply fan status
  - The Unit Controller shall monitor the supply air temperature from a duct mounted supply air temperature sensor
  - DX Cooling shall be disabled below 55 deg. (adj) Outside air temp
- Occupied Mode
  - The Unit Controller shall monitor the supply fan status and once the supply fan is proven on, shall enable the DX cooling to maintain the supply air temperature setpoint 55 deg. (adj)
- Unoccupied Mode
  - The BAS shall monitor the supply fan status and once the supply fan is proven on, shall enable the DX cooling to maintain the supply air temperature setpoint
- Alarms
  - Fail Safe Mode: Cooling shall be disabled when a Fail Safe command is received
  - The BAS shall alarm when the Supply air temperature is 5 deg. (adj.) above the supply air temperature setpoint for 10 min. (adj)
- Heating Control
  - The Unit Controller shall enable Gas Heating based on a Time Schedule or Unoccupied Setpoints and supply fan status
  - The Unit Controller shall monitor the supply air temperature from a duct mounted supply air temperature sensor
  - Gas Heating shall be disabled above 75 deg. (adj) Outside air temp
- Occupied Mode
  - The Unit Controller shall monitor the supply fan status and once the supply fan is proven on, shall enable and modulate the Gas Heating to maintain the supply air temperature setpoint
- Unoccupied Mode
  - The Unit Controller shall monitor the supply fan status and once the supply fan is proven on, shall enable the gas heating to maintain the supply air temp setpoint
- Alarms
  - Fail Safe Mode: Gas Heating shall be disabled when a Fail Safe command is received
  - The BAS shall alarm when the Supply air temp is 5 deg. (adj.) below the supply air temperature setpoint for 10 min. (adj) ( Supply Air Low Temperature Alarm)
- Smoke Detector
  - A Duct Smoke Detector shall be installed per local codes to shutdown the equipment
  - The Unit Controller shall monitor the Duct Smoke Detector and shall enable Fail Safe Mode
- Fire Alarm Shut Down
  - The Unit Controller shall monitor the Fire Alarm System and shall enable Fail Safe Mode
  - The Unit Controller shall reset Fail safe Mode when the Fire Alarm input is cleared
- Filter Pressure Drop
  - Provide static pressure differential switch across each filter which will alarm the system on high static pressure limits.
- Shut Down
  - At shutdown the rooftop unit shall go to fail safe position. Fail safe position is defined by the following.
    - The supply fan is off, the outside air damper is closed, the compressor(s) are off.
    - The supply fan shall cycle in conjunction with either the heating or cooling system to maintain a minimum/maximum space temperature depending on the season.
- Freeze Stat
  - A Freeze Stat shall be installed upstream of any water coil
  - The Freeze Stat shall trip below 38 deg. (adj)
  - The Unit Controller shall monitor the Freeze Stat and shall enable Fail Safe Mode
  - The Freeze Stat shall have a manual reset



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FORT THOMAS, KY 41075

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MECHANICAL - SEQUENCES  
**M2-502**  
1" REFERENCE PROJECT # 2024

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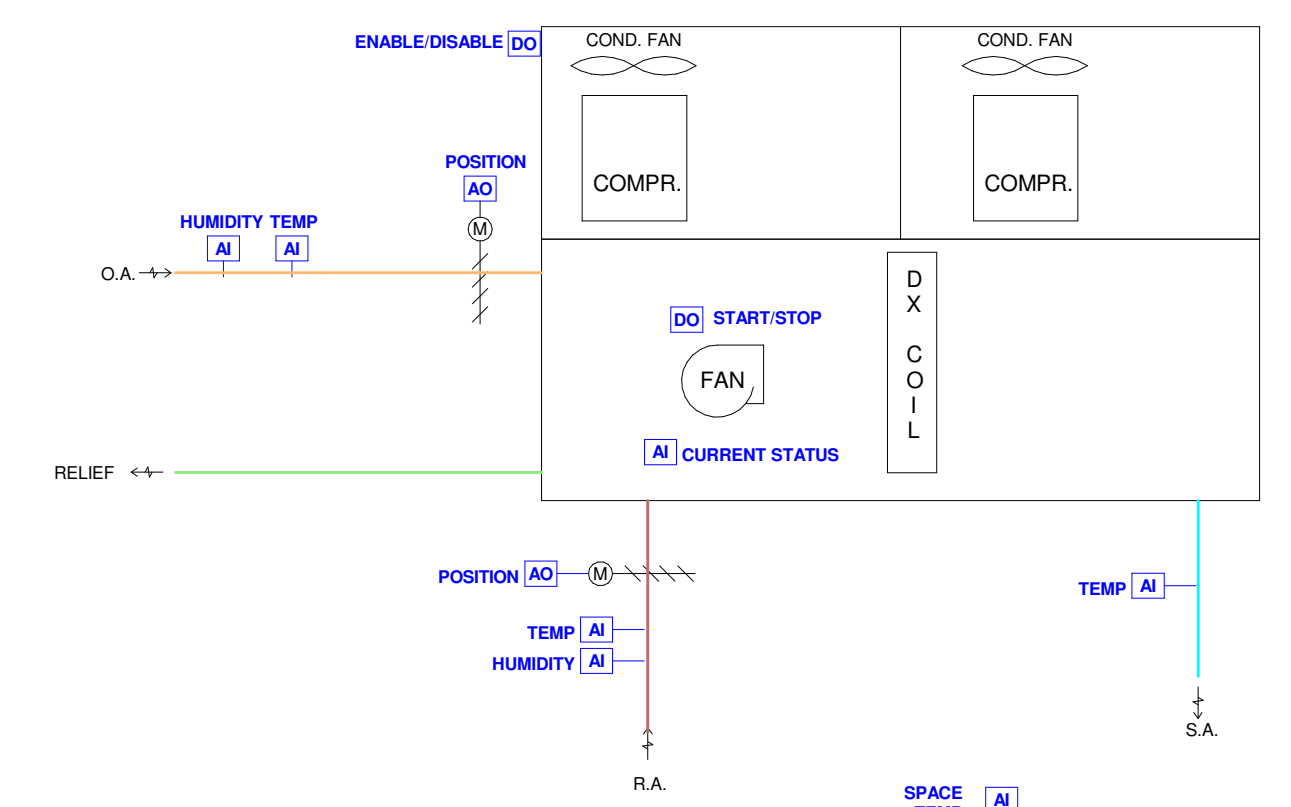
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Control / Monitoring Point Name	RTU-1 thru 10 BAS Points List										Display Status	Setpoint Value			Trending
	Hardware Points					Software Points						Initial Setpoint 1	Initial Setpoint 2	Change of Value (COV)	
	AI	AO	DI	DO	AV	DV	Alarms								
							Low Limit...	High Limit...	General	Critical w/Man...					
Space Temperature	x										x			x	3 deg
Occupied Heating Setpoint					x						x	70		x	
Occupied Cooling Setpoint					x						x	74		x	
Unoccupied Heating Setpoint					x						x	60		x	
Unoccupied Cooling Setpoint					x						x	85		x	
Supply Fan, Enable / Disable				x							x			x	
Supply Fan Status			x								x			x	
Time Schedule						x					x				
Supply Fan Fail Alarm										x	x				
Supply Fan Hand Alarm										x	x				
Fail Safe Command										x	x				
Supply Air Duct High Pressure Switch			x							x	x				
Fail Safe Command										x	x				
Minimum OA Damper Position Setpoint						x					x	55			
Economizer Position	x										x			x	3%
Supply Air Temperature Setpoint					x						x	55			
Mixed Air Temperature Differential Setpoint					x						x	2			
Supply Air Temperature	x													x	3 deg
Mixed Air Temperature	x													x	3 deg
Heating Mode						x					x				
Cooling Mode							x				x				
Outside Air Temperature	x										x			x	3 deg
Outside Air Humidity	x										x			x	3%
Outside Air Enthalpy											x			x	1 btu/lb.
Economizer Damper Position			x								x			x	3%
Supply Air Temperature	x										x			x	3 deg
Return Air Temperature	x										c			x	3 deg
Mixed Air Temperature	x										x			x	3 deg
Occupied Cooling Setpoint						x					x	74			
Unoccupied Cooling Setpoint						x					x	85			
Cool Stage 1				x							x			x	
Cool Stage 2				x							x			x	
Cool Stage 3				x							x			x	
Cool Stage 4				x							x			x	
Outside Air Temperature Cooling Disable...						x					x	55			
Space Temperature High Alarm							x				x				
No Cooling Alarm										x	x				
Occupied Heating Setpoint						x					x	74			
Unoccupied Heating Setpoint						x					x	85			
Heating Stage 1				x							x			x	
Heating Stage 2				x							x			x	
Heating Stage 3				x							x			x	
Heating Stage 4				x							x			x	
Space Temperature Low Alarm										x	x				
No Heating Alarm										x	x				
Duct Smoke Detector				x							x			x	
Fire Alarm System				x							x			x	
<b>Totals</b>	<b>9</b>	<b>1</b>	<b>4</b>	<b>9</b>	<b>12</b>	<b>12</b>	<b>1</b>	<b>1</b>	<b>8</b>	<b>1</b>	<b>44</b>				
<b>Subtotals</b>			<b>23</b>								<b>35</b>				
<b>Grand Totals</b>								<b>102</b>							

RTU-1 thru 10 Sequence of Operations

- Control Package
  - Equipment shall be provided with BACNET interface card or BACNET controls.
  - Equipment Manufacturer shall provide written sequence of operation
  - Equipment Manufacturer shall provide integration points list
  - Equipment Manufacturer shall provide configuration settings of program
  - Equipment Manufacturer shall provide setpoints that the BAS contractor shall write to, to accomplish sequence
  - BAS contractor shall include the Manufacturers, sequence, integration points list, configuration settings and setpoints in BAS submittal
- Startup
  - The Unit Controller will use an optimal start algorithm for morning start-up. This algorithm will minimize the unoccupied warm-up or cool-down period while still achieving comfort conditions by the start of scheduled occupied period.
- Morning Warm Up
  - Outside Air Damper shall be closed
  - Return Air Damper shall be open
  - Supply Fan shall be on
  - The Heat shall be on until the space temperature or return air temperature or the averaged space temperature satisfies the Occupied Heating Setpoint
  - When Morning Warm up is complete the unit shall return to normal operation
- Morning Cool Down
  - Outside Air Damper shall be closed
  - Return Air Damper shall be open
  - Supply Fan shall be on
  - The Cooling shall be on until the space temperature or return air temperature or the averaged space temperature satisfies the Occupied Cooling Setpoint
  - When Morning Cool Down is complete the unit shall return to normal operation
- Supply Fan Control
  - The Unit Controller shall enable the Supply Fan based on a Time Schedule or Unoccupied Setpoints
  - The Unit Controller will use an optimal start algorithm for morning start-up. This algorithm will minimize the unoccupied warm-up or cool-down period while still achieving comfort conditions by the start of scheduled occupied period.
  - The Unit Controller shall monitor the space temperature from a wall mounted temperature sensor
- Occupied Mode
  - The Supply Fan Shall run continuously
- Unoccupied Mode
  - The Supply Fan will cycle on / off based on the unoccupied heating and cooling setpoints
- Alarms
  - The Unit Controller shall monitor the supply fan status with a differential pressure switch
  - Fail Safe Mode: Supply Fan shall be disabled when a Fail Safe command is received
  - The BAS shall alarm when the supply fan is enabled but the supply fan status is off (Supply Fan Fail Alarm)
  - The BAS shall alarm when the supply fan is disabled and the supply fan status is on (Supply Fan Hand Alarm)
- Supply Fan Safety
  - A high supply air static pressure switch shall be installed down stream of the supply fan
  - The switch shall be installed within 10 ft of the supply fan and before any dampers
  - The switch shall be interlocked with the supply fan and disable the supply fan when the supply duct static pressure is above 4.0" wc (adj)
  - The switch shall have a manual reset
  - The supply duct static pressure setpoint shall be determined by the TAB contractor
  - The BAS shall monitor the supply duct static pressure switch and alarm when tripped
  - The BAS shall send a fail safe shutdown command to the associated equipment
- Minimum Outside Air Control
  - The Economizer shall maintain a minimum position during occupied mode
  - The Economizer Minimum Position shall be determined by the TAB Contractor
  - The Economizer shall be closed during unoccupied mode
  - Fail Safe Mode : The economizer damper shall close
- Economizer Control
  - The Economizer Mode shall be enabled whenever
    - The outside air temperature is below 65 deg (adj)
    - The outside enthalpy is less than 22 btu / lb. (adj)
    - The supply fan is on
    - Cooling Mode is enabled when the economizer damper is open 100% and the mixed air temperature setpoint is not satisfied
    - Heating Mode is disabled
  - The economizer damper shall modulate to maintain a mixed air temperature of 2 deg. (adj) below the supply air temperature setpoint
  - Fail Safe Mode : The economizer damper shall close
- Relief Control
  - Unit shall have barometric relief damper.
- Cooling Control
  - The Unit Controller shall enable DX Cooling based on a Time Schedule or Unoccupied Setpoints and supply fan status
  - The Unit Controller shall monitor the space temperature from a wall mounted temperature sensor
  - DX Cooling shall be disabled below 55 deg. (adj) Outside Air Temperature
- Occupied Mode
  - The Unit Controller shall monitor the supply fan status and once the supply fan is proven on, shall enable the DX cooling to maintain the occupied cooling setpoint
  - The DX Cooling shall stage on and off based on a PID Loop algorithm
- Unoccupied Mode
  - Unoccupied Mode- The BAS shall monitor the supply fan status and once the supply fan is proven on, shall enable the DX cooling to maintain the unoccupied cooling setpoint
  - The DX Cooling shall stage on and off based on a PID Loop algorithm
- Alarms
  - Fail Safe Mode: Cooling shall be disabled when a Fail Safe command is received
  - The BAS shall alarm when the space temperature is 5 deg. (adj.) above the space temperature cooling setpoint (Space Temperature High Alarm)
  - The BAS shall alarm when cooling is enabled and the supply air temperature is not 10 deg. (adj) below the space temperature (No Cooling Alarm)
- Heating Control
  - The Unit Controller shall enable Gas Heat based on a Time Schedule or Unoccupied Setpoints and supply fan status
  - The Unit Controller shall monitor the space temperature from a wall mounted temperature sensor
  - Gas Heating shall be disabled above 75 deg (adj) Outside air temp
- Occupied Mode
  - The Unit Controller shall monitor the supply fan status and once the supply fan is proven on, shall enable the gas heating to maintain the occupied heating setpoint
- Unoccupied Mode
  - The BAS shall monitor the supply fan status and once the supply fan is proven on, shall enable the Gas Heating to maintain the unoccupied heating setpoint
- Alarms
  - Fail Safe Mode: Gas Heating shall be disabled when a Fail Safe command is received
  - The BAS shall alarm when the space temperature is 5 deg. (adj.) below the space temperature heating setpoint for 10 min. (adj) (Space Temperature Low Alarm)
  - The BAS shall alarm when heating is enabled and the supply air temperature is not 10 deg. (adj) above the space temperature for 10 min. (adj) (No Heating Alarm)
- Smoke Detector
  - A Duct Smoke Detector shall be installed per local codes to shutdown the equipment
  - The Unit Controller shall monitor the Duct Smoke Detector and shall enable Fail Safe Mode
- Fire Alarm Shut Down
  - The Unit Controller shall monitor the Fire Alarm System and shall enable Fail Safe Mode
  - The Unit Controller shall reset Fail safe Mode when the Fire Alarm input is cleared
- Shut Down
  - At shutdown the rooftop unit shall go to fail safe position. Fail safe position is defined by the following.
    - The supply fan is off, the outside air damper is closed, the compressor(s) are off.
    - The supply fan shall cycle in conjunction with either the heating or cooling system to maintain a minimum/maximum space temperature depending on the season.



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NOT FOR CONSTRUCTION

REVISIONS	
10-11-24	ISSUED FOR BID

DWN: CES    CHK: KTS  
 DATE: 10.11.24  
 PROJECT #: 2024.00

MECHANICAL - SEQUENCES

**M2-503**

1" REFERENCE  
KLH PROJECT # 2024

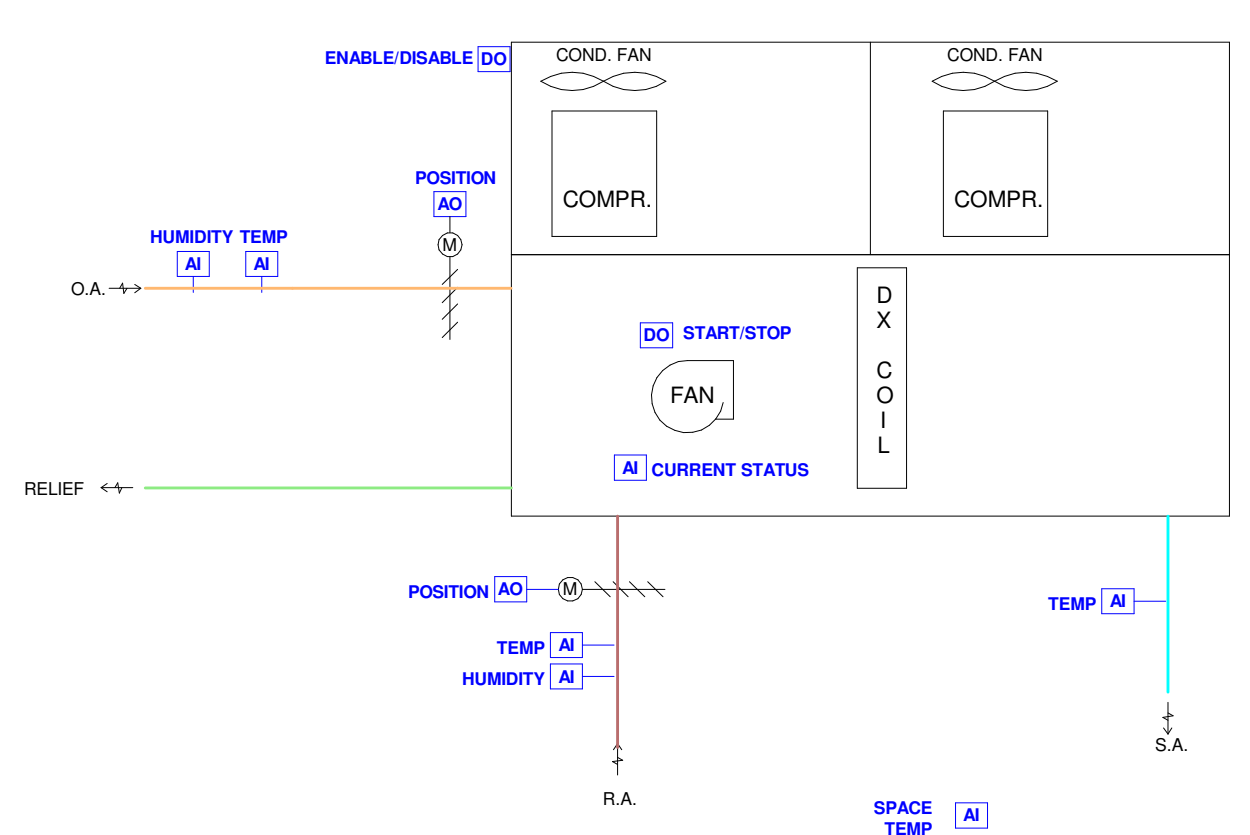
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Control / Monitoring Point Name	RTU-12 BAS Points List														
	Hardware Points					Software Points					Setpoint Value		Trending		
	AI	AO	DI	DO	AV	DV	Low Limit...	High Limit...	General	Critical w/Man...	Display Status	Initial Setpoint 1	Initial Setpoint 2	Change of Value (COV)	Trend Loop Duration
	Alarms														
Space Temperature	x									x				x	3 deg
Occupied Heating Setpoint					x					x	70			x	
Occupied Cooling Setpoint					x					x	74			x	
Unoccupied Heating Setpoint					x					x	60			x	
Unoccupied Cooling Setpoint					x					x	85			x	
Supply Fan, Enable / Disable				x						x				x	
Supply Fan VFD Speed	x									x				x	3%
Time Schedule						x				x					
Supply Fan Fail Alarm					x				x	x					
Supply Fan Hand Alarm					x				x	x					
Supply Fan VFD Alarm					x				x	x					
Fail Safe Command					x				x	x				x	
Optional VFD Points															
VFD HZ						x				x					
VFD Voltage						x				x					
VFD Amps						x				x					
Supply Air Duct High Pressure Switch			x							x				x	
Fail Safe Command						x				x				x	
Supply Air Temperature Setpoint					x					x	55				
Mixed Air Temperature Differential Setpoint					x					x	2				
Supply Air Temperature	x									x				x	3 deg
Mixed Air Temperature	x									x				x	3 deg
Heating Mode						x				x				x	
Cooling Mode						x				x				x	
Outside Air Temp	x									x				x	3 deg
Outside Air Humidity	x									x				x	3%
Outside Air Enthalpy						x				x				x	1 btu/lb.
Return Air Temp	x									x				x	3 deg
Return Air Humidity	x									x				x	3%
Return Air Enthalpy						x				x				x	1 btu/lb.
Supply Air Temperature	x									x				x	3 deg
Return Air Temperature	x									c				x	3 deg
Mixed Air Temperature	x									x				x	3 deg
Occupied Cooling Setpoint					x					x	74				
Unoccupied Cooling Setpoint					x					x	85				
Cool Stage 1			x							x				x	
Cool Stage 2			x							x				x	
Cool Stage 3			x							x				x	
Cool Stage 4			x							x				x	
Outside Air Temperature Cooling Disable...					x					x	55				
Space Temperature High Alarm						x			x	x					
No Cooling Alarm						x			x	x					
Occupied Heating Setpoint					x					x	74				
Unoccupied Heating Setpoint					x					x	85				
Heating Stage 1				x						x				x	
Heating Stage 2				x						x				x	
Heating Stage 3				x						x				x	
Heating Stage 4				x						x				x	
Space Temperature Low Alarm						x				x				x	
No Heating Alarm						x				x				x	
Duct Smoke Detector					x					x				x	
Fire Alarm System					x					x				x	
<b>Totals</b>	<b>10</b>	<b>1</b>	<b>4</b>	<b>9</b>	<b>14</b>	<b>14</b>	<b>1</b>	<b>1</b>	<b>9</b>	<b>1</b>	<b>50</b>				
<b>Subtotals</b>		<b>24</b>									<b>40</b>				
<b>Grand Totals</b>											<b>114</b>				

RTU-12 Sequence of Operations

- Control Package
  - Equipment shall be provided with BACNET interface card or BACNET controls.
  - Equipment Manufacturer shall provide written sequence of operation
  - Equipment Manufacturer shall provide integration points list
  - Equipment Manufacturer shall provide configuration settings of program
  - Equipment Manufacturer shall provide setpoints that the BAS contractor shall write to, to accomplish sequence
  - BAS contractor shall include the Manufacturers, sequence, integration points list, configuration settings and setpoints in BAS submittal
- Startup
  - The Unit Controller will use an optimal start algorithm for morning start-up. This algorithm will minimize the unoccupied warm-up or cool-down period while still achieving comfort conditions by the start of scheduled occupied period.
  - Morning Warm Up
    - Outside Air Damper shall be closed
    - Return Air Damper shall be open
    - Supply Fan shall be on
    - The Heat shall be on until the space temperature or return air temperature or the averaged space temperature satisfies the Occupied Heating Setpoint
    - When Morning Warm up is complete the unit shall return to normal operation
  - Morning Cool Down
    - Outside Air Damper shall be closed
    - Return Air Damper shall be open
    - Supply Fan shall be on
    - The Cooling shall be on until the space temperature or return air temperature or the averaged space temperature satisfies the Occupied Cooling Setpoint
    - When Morning Cool Down is complete the unit shall return to normal operation
- Supply Fan Control
  - The Unit Controller shall integrate with the Supply Fan VFD
  - The Unit Controller shall enable the Supply Fan based on a Time Schedule or Unoccupied Setpoints
  - The unit will use an optimal start algorithm for morning start-up. This algorithm will minimize the unoccupied warm-up or cool-down period while still achieving comfort conditions by the start of scheduled occupied period.
  - The Unit Controller shall monitor the space temperature from a wall mounted temperature sensor
  - Occupied Mode
    - A VFD shall modulate the supply fan from 50% fan speed to 100% fan speed during the Occupied Mode based on the occupied heating and cooling setpoints
    - When the heating and cooling setpoints are satisfied, the supply fan shall operate at 50% design CFM
    - When the space temperature is below the heating setpoint the supply fan VFD speed will increase to maintain the heating setpoint.
    - When the space temperature is above the cooling setpoint, the supply fan VFD speed will increase to maintain the cooling setpoint. Supply Fan VFD speed will be controlled by a PID
  - Unoccupied Mode
    - The Supply Fan will cycle on / off at 100% fan speed based on the unoccupied setpoints
  - Alarms
    - Fail Safe Mode: Supply Fan shall be disabled when a Fail Safe command is received
    - The BAS shall monitor the supply fan status with a differential pressure switch
    - The BAS shall monitor the supply fan VFD alarm
    - The BAS shall alarm when the supply fan is enabled but the supply fan status is off (Supply Fan Fail Alarm)
    - The BAS shall alarm when the supply fan is disabled and the supply fan status is on (Supply Fan Hand Alarm)
- Supply Fan Safety
  - A high supply air static pressure switch shall be installed down stream of the supply fan
  - The switch shall be installed within 10 ft of the supply fan and before any dampers
  - The switch shall be interlocked with the supply fan and disable the supply fan when the supply duct static pressure is above 4.0" wc (adj)
  - The switch shall have a manual reset
  - The supply duct static pressure setpoint shall be determined by the TAB contractor
  - The BAS shall monitor the supply duct static pressure switch and alarm when tripped
  - The BAS shall send a fail safe shutdown command to the associated equipment
- Economizer Control
  - The Economizer Mode shall be enabled whenever
    - The outside air temp is below 55 deg (adj)
    - The outside enthalpy is less than the return air enthalpy by 2 btu/lb.
    - The supply fan is on
    - Cooling Mode is enabled when the economizer damper is open 100% and the mixed air temperature setpoint is not satisfied
    - Heating Mode is disabled
  - The economizer damper shall modulate to maintain a mixed air temperature of 2 deg. (adj) below the supply air temperature setpoint
  - Fail Safe Mode : The economizer damper shall close
- Relief Control
  - Unit shall have barometric relief damper.
- Cooling Control
  - The Unit Controller shall enable DX Cooling based on a Time Schedule or Unoccupied Setpoints and supply fan status
  - The Unit Controller shall monitor the space temperature from a wall mounted temperature sensor
  - DX Cooling shall be disabled below 55 deg. (adj) Outside Air Temperature
  - Occupied Mode
    - The Unit Controller shall monitor the supply fan status and once the supply fan is proven on, shall enable the DX cooling to maintain the occupied cooling setpoint
    - The DX Cooling shall stage on and off based on a PID Loop algorithm
  - Unoccupied Mode
    - Unoccupied Mode- The BAS shall monitor the supply fan status and once the supply fan is proven on, shall enable the DX cooling to maintain the unoccupied cooling setpoint
    - The DX Cooling shall stage on and off based on a PID Loop algorithm
  - Alarms
    - Fail Safe Mode: Cooling shall be disabled when a Fail Safe command is received
    - The BAS shall alarm when the space temperature is 5 deg. (adj.) above the space temperature cooling setpoint (Space Temperature High Alarm)
    - The BAS shall alarm when cooling is enabled and the supply air temperature is not 10 deg. (adj) below the space temperature (No Cooling Alarm)
- Heating Control
  - The Unit Controller shall enable Gas Heat based on a Time Schedule or Unoccupied Setpoints and supply fan status
  - The Unit Controller shall monitor the space temperature from a wall mounted temperature sensor
  - Gas Heating shall be disabled above 75 deg (adj) Outside air temp
  - Occupied Mode
    - The Unit Controller shall monitor the supply fan status and once the supply fan is proven on, shall enable the gas heating to maintain the occupied heating setpoint
  - Unoccupied Mode
    - The BAS shall monitor the supply fan status and once the supply fan is proven on, shall enable the Gas Heating to maintain the unoccupied heating setpoint
  - Alarms
    - Fail Safe Mode: Gas Heating shall be disabled when a Fail Safe command is received
    - The BAS shall alarm when the space temperature is 5 deg. (adj.) below the space temperature heating setpoint for 10 min. (adj) (Space Temperature Low Alarm)
    - The BAS shall alarm when heating is enabled and the supply air temperature is not 10 deg. (adj) above the space temperature for 10 min. (adj) (No Heating Alarm)
- Smoke Detector
  - A Duct Smoke Detector shall be installed per local codes to shutdown the equipment
  - The Unit Controller shall monitor the Duct Smoke Detector and shall enable Fail Safe Mode
- Fire Alarm Shut Down
  - The Unit Controller shall monitor the Fire Alarm System and shall enable Fail Safe Mode
  - The Unit Controller shall reset Fail safe Mode when the Fire Alarm input is cleared
- Shut Down
  - At shutdown the rooftop unit shall go to fail safe position. Fail safe position is defined by the following.
    - The supply fan is off, the outside air damper is closed, the compressor(s) are off.
    - The supply fan shall cycle in conjunction with either the heating or cooling system to maintain a minimum/maximum space temperature depending on the season.



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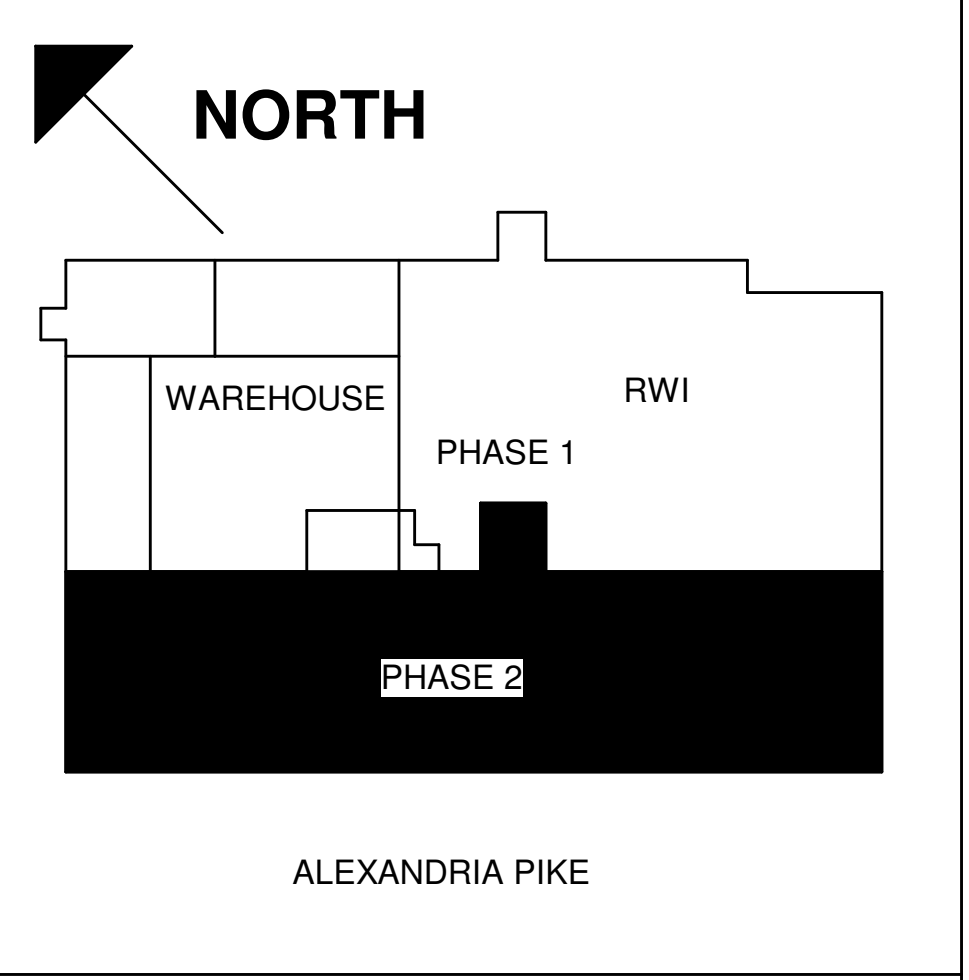
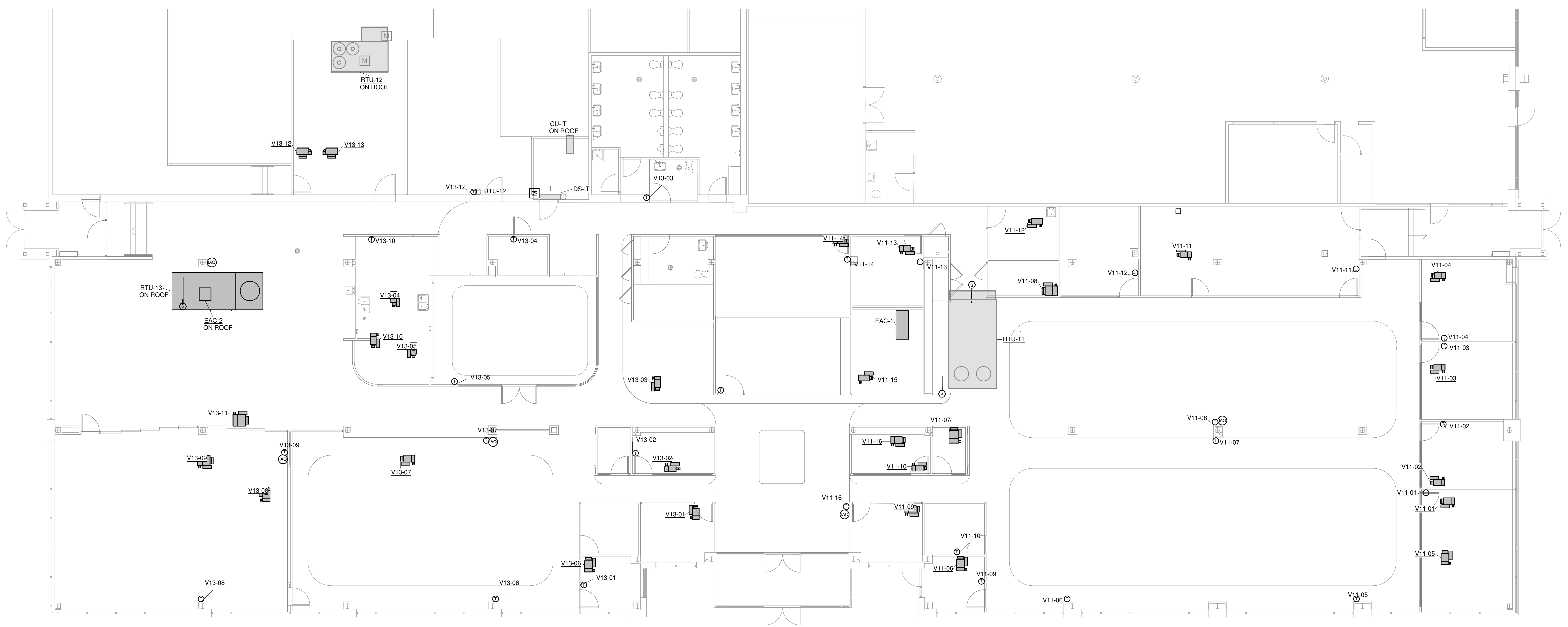
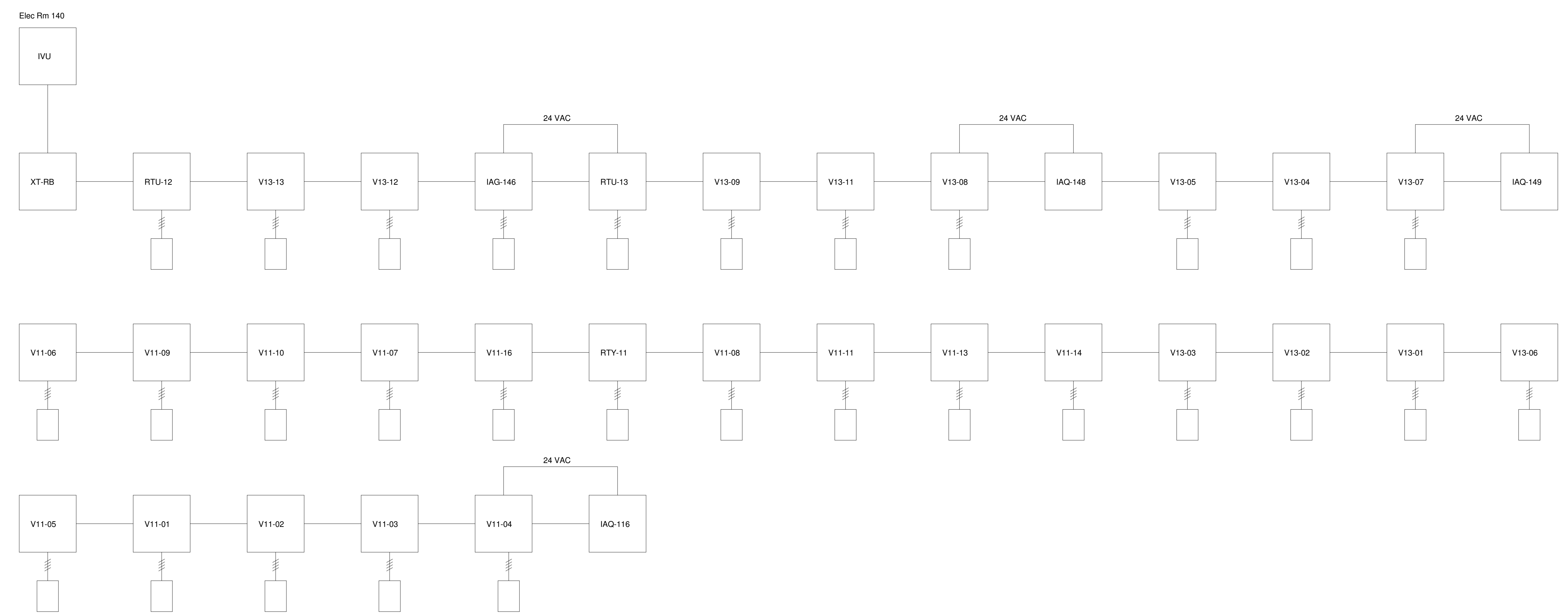
REVISIONS	
10-11-24	ISSUED FOR BID

DWN: CES    CHK: KTS  
 DATE: 10.11.24  
 PROJECT #: 2024.00  
 MECHANICAL - SEQUENCES

M2-504  
1" REFERENCE  
 KLH PROJECT #  
 2024

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DATE: 10.11.24  
PROJECT #: 2024.00

MECHANICAL - CONTROL WIRING

M2-505

1" REFERENCE  
KLH PROJECT #  
2024

1 MECHANICAL NEW - CONTROL WIRING  
1/8" = 1'-0"

### HVAC ACCESSORIES

#### ACCESSORIES:

- |                        |                        |                             |
|------------------------|------------------------|-----------------------------|
| 1. MOTOR DAMPER        | 9. ACCESS DOOR         | 17. DUCT FLANGES            |
| 2. ECONOMIZER          | 10. FLEX CONNECTIONS   | 18. BASE RAIL               |
| 3. ROOF CURB           | 11. MOUNTING COLLAR    | 19. HUMIDIFIER              |
| 4. HAIL GUARDS         | 12. HOT GAS BYPASS     | 20. CO2 SENSORS             |
| 5. INTAKE HOOD         | 13. FACE-BYPASS DAMPER | 21. ECON POWERED EXHAUST    |
| 6. VIBRATION ISOLATION | 14. CONDENSATE PUMP    | 22. ECON BAROMETRIC RELIEF  |
| 7. FLAT FILTER         | 15. MOTOR GUARD        | 23. HOT GAS REHEAT COIL     |
| 8. FILTER/MIXING BOX   | 16. GREASE TRAP        | 24. SHAFT GROUNDING BRUSHES |

### HVAC FANS SCHEDULE

Equipment shall be braced and labeled by the equipment manufacturer to withstand the minimum scheduled available fault current value for listed equipment.

EQUIPMENT MARK	DESCRIPTION	STATUS	WEIGHT (lbs)	MANUFACTURER	MODEL	CFM	EMERGENCY	ELECTRIC CONNECTION SUMMARY
EX-EF1	HVAC FAN	EXISTING	-	GREENHECK	GB101-4	1040	NO	EX-EF1-120V/1PH, 0.25 HP

### HVAC ROOFTOP UNITS SCHEDULE

Equipment shall be braced and labeled by the equipment manufacturer to withstand the minimum scheduled available fault current value for listed equipment.

EQUIPMENT MARK	DESCRIPTION	LOCATION	STATUS	EQUIP SERVED BY	MANUFACTURER	MODEL	EMERGENCY	ELECTRIC CONNECTION SUMMARY	AVAILABLE FAULT CURRENT	ACCESSORIES
RTU-11	PACKAGED ROOFTOP UNIT, GAS HEAT	EXISTING	4000	DAIKIN	MPS026G	10.9	NO	EAC-1-208V/1PH, 3.6 MCA, 15A OCP	2147	
RTU-13	PACKAGED ROOFTOP UNIT, GAS HEAT	NEW	2500	DAIKIN	MPS026G	11.9	NO	EAC-2-208V/1PH, 3.6 MCA, 15A OCP	7622	2.3, 10, 21

\* RTU-13 TO BE PROCURED BY OWNER, RECEIVED AND INSTALLED BY HC

### HVAC AIR CLEANER SCHEDULE

Equipment shall be braced and labeled by the equipment manufacturer to withstand the minimum scheduled available fault current value for listed equipment.

EQUIPMENT MARK	DESCRIPTION	LOCATION	STATUS	EQUIP SERVED BY	MANUFACTURER	MODEL	EMERGENCY	ELECTRIC CONNECTION SUMMARY	AVAILABLE FAULT CURRENT
EAC-1	AIR CLEANING MODULE	HUDDLE 127 CEILING	NEW	RTU-11	ENERVID	HLR-100M	NO	EAC-1-208V/1PH, 3.6 MCA, 15A OCP	2147
EAC-2	AIR CLEANING MODULE	HUDDLE 127 CEILING	NEW	RTU-13	ENERVID	HLR-100-12	NO	EAC-2-208V/1PH, 3.6 MCA, 15A OCP	653

\*EAC-1 AND 2 TO BE PROCURED BY OWNER, RECEIVED AND INSTALLED BY HC

### HVAC VENTILATION SCHEDULE SYSTEM 1

NUMBER	NAME	AREA	PEOPLE	OA PER PERSON	OA PER SQ.FT.	REQ SUP	ACT SUP	REQ OA	ACT OA	ACT RET	ACT EXH	CRIT OA	PRESSURE
101	VESTIBULE	194 SF	0	0	0.00	450	450	31	31	0	0	0	Neutral
102	ENTR	810 SF	7	5	0.06	295	300	70	20	300	0	28.9	Neutral
103	CORRIDOR	99 SF	0	0	0.00	25	25	4	2	25	0	28.7	Neutral
104	HUDDLE	118 SF	4	5	0.06	450	450	70	31	450	0	7.5	Neutral
107	HUDDLE	89 SF	2	5	0.06	70	70	16	5	70	0	27.2	Neutral
106	PHONE	44 SF	1	5	0.06	25	25	4	2	25	0	28.9	Neutral
107	HUDDLE	89 SF	2	5	0.06	70	70	16	5	70	0	27.2	Neutral
108	HUDDLE	90 SF	2	5	0.06	500	500	122	35	500	0	3	Neutral
109	OPENOFFICE	229 SF	0	5	0.06	1180	1200	261	62	1200	0	2	Neutral
109	OPENOFFICE	881 SF	12	5	0.06	650	650	153	44	650	0	21.8	Neutral
110	OPENOFFICE	229 SF	0	5	0.06	1025	1050	229	71	1050	0	2.2	Neutral
110	OPENOFFICE	972 SF	12	5	0.06	670	670	167	46	670	0	2	Neutral
111	OFFICE	314 SF	2	5	0.06	970	970	228	66	970	0	3.7	Neutral
112	OFFICE	171 SF	1	5	0.06	335	335	79	23	335	0	5.7	Neutral
113	OFFICE	201 SF	1	5	0.06	500	500	117	34	500	0	4.3	Neutral
114	RECEIVING	251 SF	0	0	0.00	400	400	96	28	400	0	5.4	Neutral
115	RECEIVING	251 SF	0	0	0.00	255	200	47	14	200	0	9.4	Neutral
116	OPENOFFICE	925 SF	12	5	0.06	980	980	144	45	980	0	21.9	Neutral
119	HUDDLE	196 SF	5	5	0.06	140	140	33	10	140	0	32.9	Neutral
122	CA STORAGE	79 SF	0	0	0.00	20	20	6	1	20	0	34.7	Neutral
123	QUIET ROOM	105 SF	1	5	0.06	40	40	9	3	40	0	36	Neutral
125	HUDDLE	142 SF	4	5	0.06	115	115	27	8	115	0	31	Neutral
126	PROJECT ROOM	312 SF	6	5	0.06	340	340	81	23	340	0	17.7	Neutral
127	HUDDLE	177 SF	7	5	0.06	175	175	41	12	175	0	32.7	Neutral
128	CONFERENCE	295 SF	10	5	0.06	290	290	61	18	290	0	32.5	Neutral
TOTAL		8662 SF				10580	2422	722					

### HVAC VENTILATION SCHEDULE SYSTEM 2

NUMBER	NAME	AREA	PEOPLE	OA PER PERSON	OA PER SQ.FT.	REQ SUP	ACT SUP	REQ OA	ACT OA	ACT RET	ACT EXH	CRIT OA	PRESSURE	
124	CORRIDOR	347 SF	0	0	0.00	90	90	21	3	90	0	30.3	Neutral	
129	RR SUPPLY	82 SF	0	0	0.12	20	20	8	2	20	0	61.3	Neutral	
131	ADA TOILET	89 SF	0	0	0	25	25	10	2	0	0	80	Negative	
132	ADA TOILET	54 SF	0	0	0.00	15	15	6	1	0	0	0	Negative	
133	WOMEN	247 SF	0	0	0	60	100	39	9	0	400	0	Negative	
134	MEN	205 SF	0	0	0	50	100	39	9	0	400	0	Negative	
135	JNK	39 SF	0	0	0.00	10	10	4	1	10	0	80	0	Negative
136	BOOTH	53 SF	0	0	0	15	15	6	1	15	0	0	Neutral	
137	SOUND ROOM	63 SF	1	5	0.06	60	100	39	9	100	0	10.8	Neutral	
138	BOOTH	53 SF	0	0	0	15	15	6	1	15	0	0	Neutral	
139	CORRIDOR	227 SF	0	0	0.06	55	55	22	5	55	0	31	Neutral	
142	TABLE & CHAIR STORAGE	500 SF	0	0	0.12	120	125	49	12	125	0	60	Neutral	
143	BREAKROOM	318 SF	0	0	0.00	160	160	63	16	160	225	0	Negative	
144	CONFERENCE	503 SF	16	5	0.06	380	390	153	36	390	0	35.3	Neutral	
145	CORRIDOR	523 SF	0	0	0.06	120	120	47	11	120	0	32.6	Neutral	
146	CAFE	1905 SF	50	7.5	0.18	1795	1800	705	167	1800	0	49.8	Neutral	
147	ENTRY	109 SF	0	0	0.06	200	200	78	19	200	0	41.1	Neutral	
148	MULTI-PURPOSE ROOM	215 SF	10	5	0.06	1490	1500	501	141	1500	0	5.2	Neutral	
148	MULTI-PURPOSE ROOM	986 SF	30	5	0.06	2405	2425	948	226	2425	0	16	Neutral	
149	OPENOFFICE	293 SF	0	5	0.06	1625	1650	543	153	1650	0	1.6	Neutral	
149	OPENOFFICE	1182 SF	17	5	0.06	905	910	356	85	910	0	21.5	Neutral	
151	HUDDLE	87 SF	2	5	0.06	480	480	188	45	480	0	4	Neutral	
151	HUDDLE	86 SF	2	5	0.06	70	70	27	7	70	0	27.1	Neutral	
152	PHONE	44 SF	1	5	0.06	25	25	10	2	25	0	38.2	Neutral	
153	HUDDLE	90 SF	2	5	0.06	75	75	29	7	75	0	28.8	Neutral	
154	HUDDLE	122 SF	4	5	0.06	415	415	162	39	415	0	8.2	Neutral	
155	CORRIDOR	132 SF	0	0	0.06	35	35	14	3	35	0	29.4	Neutral	
TOTAL		8683 SF				11120	4157	1033						

### HVAC ELECTRICAL COORDINATION SCHEDULE - PHASE 2

CONNECTION	DESCRIPTION	VOLTAGE	PHASE	EMERGENCY	HP	WATTS	HTG KW	FLA	MCA	OCP	FED FROM	DC TYPE	DC FURN	DC INST	DC WIRE	MC TYPE	MC FURN	MC INST	MC WIRE	CN TYPE	CN FURN	CN INST	CN WIRE	SHORT CIRCUIT RATING CODE REQUIRED?	AVAILABLE FAULT CURRENT
EAC-1	AIR CLEANING MODULE	208 V	1	NO					3.8	15			EC	EC	EC	MG	MFR	MFR	MFR	BAS	HC	HC	HC	No	2147
EAC-2	AIR CLEANING MODULE	120 V	1	NO					8.5	15			EC	EC	EC	MG	MFR	MFR	MFR	BAS	HC	HC	HC	No	653
RTU-13	PACKAGED ROOFTOP UNIT, GAS HEAT	480 V	3	NO					80.2	100			EC	EC	EC	MG	MFR	MFR	MFR	BAS	HC	HC	HC	Yes	7622

### RTU-13

**System Selection**  
 System Type: Multiple Zone  
 Filter Location: A1  
 System Efficiency Calculation Method: Appendix A Method

**System Inputs**  
 Design System Population (optional): occupants  
 System Design Airflow (optional): cfm  
 Cleaned Air Rate (Location A1): 1000 CFM

**Calculation Results**  
 Occupant Diversity: 1.00  
 Zone outdoor airflow: 650 CFM  
 Uncorrected outdoor air intake: 890 CFM  
 Minimum outside air intake, Vent-Vou/Ev: 0.90 CFM  
 Calculated Vent satisfies IAQP requirements.

**Mixtures Check**  
 Outside Air Intake Override: 650 CFM  
 Mixed Exposure Sum: 0.35  
 Eye Irritation: 0.78  
 Mixed Exposure Sum: 0.83  
 Central Nervous System: 0.03  
 Carbon Dioxide: 0.80  
 Pass Mixtures Check? Yes

**Required Zone Information**

Zone Name	Room Number	Space Type	Use Default Occupancy?	Zone Floor Area	Zone Population	Zone Air Distribution Effectiveness	Primary Zone Airflow	Zone Recirculation	Uncorrected IAQP OA
Total: 8,607 163 12,008 1,000 890									
Vestibule	101	Corridors	Yes	194	445	1.0	445	41	27
Entry	102	Main entry lobbies	Yes	814	7	1.0	295	27	18
Corridors	103	Corridors	Yes	96	1.0	1.0	25	2	2
Huddle	104	Conference/meeting	Yes	119	4	1.0	455	28	28
Huddle	105	Conference/meeting	Yes	44	1	1.0	35	3	2
Phone	106	Office space	Yes	87	1	1.0	25	2	2
Phone	107	Office space	Yes	107	2	1.0	80	7	3
Huddle	108	Conference/meeting	Yes	88	2	1.0	495	46	30
Open Office	109	Office space	Yes	86	9	1.0	415	37	37
Open Office	109B	Office space	Yes	1090	119	1.0	1,200	119	78
Open Office	110	Office space	Yes	89	52	1.0	880	89	52
Open Office	111	Office space	Yes	297	2	1.0	1,655	145	94
Open Office	111	Office space	Yes	314	2	1.0	870	30	32
Office	112	Office space	Yes	171	1	1.0	340	32	21
Office	113	Office space	Yes	201	1	1.0	505	47	31
Office	114	Office space	Yes	211	1	1.0	551	51	33
Receiving	115	Shipping/receiving	Yes	251	4	1.0	60	6	4
Open Office	116	Office space	Yes	925	10	1.0	670	62	41
Open Office	117	Office space	Yes	1,072	14	1.0	600	61	39
Copy Room	118	Office space	Yes	666	2	1.0	220	23	13
Huddle	119	Occupiable storage room	Yes	196	5	1.0	140	11	8
CA Storage	122	Occupiable storage room	Yes	73	1	1.0	40	2	1
Quiet Room	123	Office space	Yes	140	1	1.0	40	4	3
Huddle	125	Conference/meeting	Yes	142	4	1.0	115	7	4
Huddle	126	Conference/meeting	Yes	177	6	1.0	345	32	21
Huddle	127	Conference/meeting	Yes	180	7	1.0	175	16	11
Conference	128	Conference/meeting	Yes	295	10	1.0	260	24	16

MECHANICAL ELECTRICAL ENGINEERS  
 WWW.KLHENGINEERS.COM  
 LEONING, KENTUCKY  
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 FT THOMAS, KENTUCKY 41075  
 502-446-8258 FAX  
 502-446-8258 FAX

PHASE 2 - BID SET  
**KLH ENGINEERS INC. HEADQUARTERS**  
 1538 ALEXANDRIA PIKE  
 FORT THOMAS, KY 41075

NOT FOR CONSTRUCTION

REVISIONS

NO.	DATE	DESCRIPTION
10-11-24	ISSUED FOR BID	

DWN: CES CHK: KTS  
 DATE: 10.11.24  
 PROJECT #: 2024.00  
 MECHANICAL - SCHEDULES  
 M2-101  
 1\* REFERENCE KLH PROJECT # 2024

OWNERSHIP OF INSTRUMENTS OF SERVICE: This schedule and other documents prepared by the Consultant as instruments of service shall remain the property of the Consultant. The Consultant shall retain all copyright and other reserved rights, including, without limitation, the copyright thereto.  
 10/10/2024, 10:03:10 AM, C:\Users\dpnce\Documents\Rev\2024.00.23-MEP-KLH-Headquarters Renovation\_dpnce.rvt

### COMcheck Software Version COMcheckWeb Mechanical Compliance Certificate

**Project Information**  
Energy Code: 2012 IECC  
Project Title: KLH Office Phase 2  
Location: Fort Thomas, Kentucky  
Climate Zone: 4a  
Project Type: Alteration

Construction Site: \_\_\_\_\_ Owner/Agent: \_\_\_\_\_ Designer/Contractor: \_\_\_\_\_

#### Mechanical Systems List Quantity System Type & Description

1 HVAC System (Multiple Zone):  
Heating: 1 each - Central Furnace, Gas, Capacity = 240 kBtu/h  
Proposed Efficiency = 80.00% Et, Required Efficiency = 80.00% Et  
Cooling: 1 each - Single Package DX Unit, Capacity = 298 kBtu/h, Air-Cooled Condenser, Unknown Economizer  
Proposed Efficiency = 11.30 EER, Required Efficiency = 9.80 EER  
Proposed Part Load Efficiency = 19.60 IER, Required Part Load Efficiency = 9.90 IER  
Fan System: FAN SYSTEM 1 - Compliance (Motor nameplate HP and fan efficiency method) : Passes  
Fans:  
FAN 1 Supply, Multi-Zone VAV, 11000 CFM, 15.0 motor nameplate hp

#### Mechanical Compliance Statement

Compliance Statement: The proposed mechanical alteration project represented in this document is consistent with the building plans, specifications, and other calculations submitted with this permit application. The proposed mechanical systems have been designed to meet the 2012 IECC requirements in COMcheck Version COMcheckWeb and to comply with any applicable mandatory requirements listed in the Inspection Checklist.

Name - Title \_\_\_\_\_ Signature \_\_\_\_\_ Date \_\_\_\_\_

Project Title: KLH Office Phase 2 Report date: 09/12/24  
Data filename: \_\_\_\_\_ Page 1 of 7

Section # & Req.ID	Mechanical Rough-In Inspection	Complies?	Comments/Assumptions
C403.4.2.1 (ME67)	VAV fans have static pressure sensors positioned so setpoint <= 1/3 total design pressure.	<input type="checkbox"/> Complies <input type="checkbox"/> Does Not <input type="checkbox"/> Not Observable <input type="checkbox"/> Not Applicable	
C403.4.2.2 (ME24)	Reset static pressure setpoint for DDC controlled VAV boxes reporting to central controller based on the zones requiring the most pressure.	<input type="checkbox"/> Complies <input type="checkbox"/> Does Not <input type="checkbox"/> Not Observable <input type="checkbox"/> Not Applicable	
C403.2.6 (ME57)	Exhaust air energy recovery on systems meeting Table C403.2.6	<input type="checkbox"/> Complies <input type="checkbox"/> Does Not <input type="checkbox"/> Not Observable <input type="checkbox"/> Not Applicable	
C403.2.11 (ME71)	Unenclosed spaces that are heated use only radiant heat.	<input type="checkbox"/> Complies <input type="checkbox"/> Does Not <input type="checkbox"/> Not Observable <input type="checkbox"/> Not Applicable	

Additional Comments/Assumptions:

1 | High Impact (Tier 1) | 2 | Medium Impact (Tier 2) | 3 | Low Impact (Tier 3)  
Project Title: KLH Office Phase 2 Report date: 09/12/24  
Data filename: \_\_\_\_\_ Page 5 of 7

### COMcheck Software Version COMcheckWeb Inspection Checklist

Energy Code: 2012 IECC  
Requirements: 2.0% were addressed directly in the COMcheck software  
Text in the "Comments/Assumptions" column is provided by the user in the COMcheck Requirements screen. For each requirement, the user certifies that a code requirement will be met and how that is documented, or that an exception is being claimed. Where compliance is itemized in a separate table, a reference to that table is provided.

Section # & Req.ID	Plan Review	Complies?	Comments/Assumptions
C103.2 (PR2)	Plans, specifications, and/or calculations provide all information with which compliance can be determined for the mechanical systems and equipment and document where exceptions to the standard are claimed. Load calculations per acceptable engineering standards and handbooks.	<input type="checkbox"/> Complies <input type="checkbox"/> Does Not <input type="checkbox"/> Not Observable <input type="checkbox"/> Not Applicable	

Additional Comments/Assumptions:

1 | High Impact (Tier 1) | 2 | Medium Impact (Tier 2) | 3 | Low Impact (Tier 3)  
Project Title: KLH Office Phase 2 Report date: 09/12/24  
Data filename: \_\_\_\_\_ Page 2 of 7

Section # & Req.ID	Final Inspection	Complies?	Comments/Assumptions
C403.2.4 (FI47)	Heating and cooling to each zone is controlled by a thermostat control. Minimum one humidity control device per installed humidification/dehumidification system.	<input type="checkbox"/> Complies <input type="checkbox"/> Does Not <input type="checkbox"/> Not Observable <input type="checkbox"/> Not Applicable	
C403.2.4.2 (FI38)	Thermostatic controls have a 5 °F deadband.	<input type="checkbox"/> Complies <input type="checkbox"/> Does Not <input type="checkbox"/> Not Observable <input type="checkbox"/> Not Applicable	
C403.2.4.2 (FI20)	Temperature controls have setpoint overlap restrictions.	<input type="checkbox"/> Complies <input type="checkbox"/> Does Not <input type="checkbox"/> Not Observable <input type="checkbox"/> Not Applicable	
C403.2.4.3 (FI39)	Each zone equipped with setback controls using automatic time clock or programmable control system.	<input type="checkbox"/> Complies <input type="checkbox"/> Does Not <input type="checkbox"/> Not Observable <input type="checkbox"/> Not Applicable	
C403.2.4.4 (FI40)	Automatic Controls: Setback to 55°F (heat) and 85°F (cool), 7-day clock, 2-hour occupant override, 10-hour backup.	<input type="checkbox"/> Complies <input type="checkbox"/> Does Not <input type="checkbox"/> Not Observable <input type="checkbox"/> Not Applicable	
C403.2.4.5.3 (FI41)	Systems include optimum start controls.	<input type="checkbox"/> Complies <input type="checkbox"/> Does Not <input type="checkbox"/> Not Observable <input type="checkbox"/> Not Applicable	
C408.2.5.1 (FI17)	Furnished HVAC as-built drawings submitted within 90 days of system acceptance.	<input type="checkbox"/> Complies <input type="checkbox"/> Does Not <input type="checkbox"/> Not Observable <input type="checkbox"/> Not Applicable	
C408.2.5.3 (FI18)	Furnished O&M manuals for HVAC systems within 90 days of system acceptance.	<input type="checkbox"/> Complies <input type="checkbox"/> Does Not <input type="checkbox"/> Not Observable <input type="checkbox"/> Not Applicable	
C408.2.5.3 (FI43)	An air and/or hydronic system balancing report is provided for HVAC systems.	<input type="checkbox"/> Complies <input type="checkbox"/> Does Not <input type="checkbox"/> Not Observable <input type="checkbox"/> Not Applicable	
C408.2.3 (FI10)	HVAC control systems have been tested to ensure proper operation, calibration and adjustment of controls.	<input type="checkbox"/> Complies <input type="checkbox"/> Does Not <input type="checkbox"/> Not Observable <input type="checkbox"/> Not Applicable	
C403.2.2 (FI27)	HVAC systems and equipment capacity does not exceed calculated loads.	<input type="checkbox"/> Complies <input type="checkbox"/> Does Not <input type="checkbox"/> Not Observable <input type="checkbox"/> Not Applicable	
C408.2.1 (FI26)	Commissioning plan developed by registered design professional or approved agency.	<input type="checkbox"/> Complies <input type="checkbox"/> Does Not <input type="checkbox"/> Not Observable <input type="checkbox"/> Not Applicable	

1 | High Impact (Tier 1) | 2 | Medium Impact (Tier 2) | 3 | Low Impact (Tier 3)  
Project Title: KLH Office Phase 2 Report date: 09/12/24  
Data filename: \_\_\_\_\_ Page 6 of 7

Section # & Req.ID	Footing / Foundation Inspection	Complies?	Comments/Assumptions
C403.2.4 (FO9)	Freeze protection and snow/ice melting system sensors for future connection to controls.	<input type="checkbox"/> Complies <input type="checkbox"/> Does Not <input type="checkbox"/> Not Observable <input type="checkbox"/> Not Applicable	

Additional Comments/Assumptions:

1 | High Impact (Tier 1) | 2 | Medium Impact (Tier 2) | 3 | Low Impact (Tier 3)  
Project Title: KLH Office Phase 2 Report date: 09/12/24  
Data filename: \_\_\_\_\_ Page 3 of 7

Section # & Req.ID	Final Inspection	Complies?	Comments/Assumptions
C408.2.4 (FI29)	Preliminary commissioning report completed and certified by registered design professional or approved agency.	<input type="checkbox"/> Complies <input type="checkbox"/> Does Not <input type="checkbox"/> Not Observable <input type="checkbox"/> Not Applicable	
C408.2.5.4 (FI30)	Final commissioning report due to building owner within 90 days of receipt of certificate of occupancy.	<input type="checkbox"/> Complies <input type="checkbox"/> Does Not <input type="checkbox"/> Not Observable <input type="checkbox"/> Not Applicable	
C408.2.3 (FI31)	HVAC equipment has been tested to ensure proper operation.	<input type="checkbox"/> Complies <input type="checkbox"/> Does Not <input type="checkbox"/> Not Observable <input type="checkbox"/> Not Applicable	

Additional Comments/Assumptions:

1 | High Impact (Tier 1) | 2 | Medium Impact (Tier 2) | 3 | Low Impact (Tier 3)  
Project Title: KLH Office Phase 2 Report date: 09/12/24  
Data filename: \_\_\_\_\_ Page 7 of 7

Section # & Req.ID	Mechanical Rough-In Inspection	Complies?	Comments/Assumptions
C403.2.3 (ME55)	HVAC equipment efficiency verified.	<input type="checkbox"/> Complies <input type="checkbox"/> Does Not <input type="checkbox"/> Not Observable <input type="checkbox"/> Not Applicable	See the Mechanical Systems list for values.
C403.2.5.1 (ME59)	Demand control ventilation provided for spaces >500 sq.ft. and >25 people/1000 sq.ft. occupant density and served by systems with air side economizer, auto modulating outside air damper control, or design airflow >= 3.000 cfm.	<input type="checkbox"/> Complies <input type="checkbox"/> Does Not <input type="checkbox"/> Not Observable <input type="checkbox"/> Not Applicable	
C403.4.2 (ME75)	VAV fan >= 7.5 hp are driven by mechanical or electrical variable speed drive, or driven by vane-axial with variable speed blades, or operate with motor demand <= 30% design kW at 50% design flow - calculations required.	<input type="checkbox"/> Complies <input type="checkbox"/> Does Not <input type="checkbox"/> Not Observable <input type="checkbox"/> Not Applicable	Requirement will be met. See the Mechanical Systems list for values.
C403.2.7 (ME60)	HVAC ducts and plenums insulated. Where ducts or plenums are installed in or under a slab, verification may need to occur during Foundation Inspection.	<input type="checkbox"/> Complies <input type="checkbox"/> Does Not <input type="checkbox"/> Not Observable <input type="checkbox"/> Not Applicable	
C403.2.8 (ME61)	HVAC piping insulation thickness. Where piping is installed in or under a slab, verification may need to occur during Foundation Inspection.	<input type="checkbox"/> Complies <input type="checkbox"/> Does Not <input type="checkbox"/> Not Observable <input type="checkbox"/> Not Applicable	
C403.2.8 (ME7)	Piping insulation exposed to weather is protected from damage (due to sun, moisture, wind, etc.).	<input type="checkbox"/> Complies <input type="checkbox"/> Does Not <input type="checkbox"/> Not Observable <input type="checkbox"/> Not Applicable	
C403.2.8 (ME41)	Thermally ineffective panel surfaces of sensible heating panels have insulation >= R-3.5.	<input type="checkbox"/> Complies <input type="checkbox"/> Does Not <input type="checkbox"/> Not Observable <input type="checkbox"/> Not Applicable	
C403.2.7 (ME10)	Ducts and plenums sealed based on static pressure and location.	<input type="checkbox"/> Complies <input type="checkbox"/> Does Not <input type="checkbox"/> Not Observable <input type="checkbox"/> Not Applicable	
C403.2.7.1.3 (ME11)	Ductwork operating >3 in. water column requires air leakage testing.	<input type="checkbox"/> Complies <input type="checkbox"/> Does Not <input type="checkbox"/> Not Observable <input type="checkbox"/> Not Applicable	
C408.2.2.1 (ME33)	Air outlets and zone terminal devices have means for air balancing.	<input type="checkbox"/> Complies <input type="checkbox"/> Does Not <input type="checkbox"/> Not Observable <input type="checkbox"/> Not Applicable	
C403.2.10 (ME65)	HVAC fan systems at design conditions do not exceed allowable fan system motor nameplate hp or fan system bhp.	<input type="checkbox"/> Complies <input type="checkbox"/> Does Not <input type="checkbox"/> Not Observable <input type="checkbox"/> Not Applicable	See the Mechanical Systems list for values.
C403.4.2 (ME66)	VAV fan motors >= 7.5 hp to be driven by variable speed drive, have a vane-axial fan with variable pitch blades, or have controls to limit fan motor demand.	<input type="checkbox"/> Complies <input type="checkbox"/> Does Not <input type="checkbox"/> Not Observable <input type="checkbox"/> Not Applicable	

1 | High Impact (Tier 1) | 2 | Medium Impact (Tier 2) | 3 | Low Impact (Tier 3)  
Project Title: KLH Office Phase 2 Report date: 09/12/24  
Data filename: \_\_\_\_\_ Page 4 of 7

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DWN: CES CHK: KTS  
DATE: 10.11.24  
PROJECT #: 2024.00

MECHANICAL ENERGY COMPLIANCE

M2-701  
1" REFERENCE  
KLH PROJECT # 2024