MECHANICAL LEGEND

SYMBOL	DESCRIPTION
PLAN-VIEW LINE TYPES	
	WORK SHOWN FADED INDICATES EXISTING WORK TO REMAIN OR NEW WORK BY OTHERS AS APPLICABLE
	WORK SHOWN BOLD-DASHED INDICATES SELECTIVE DEMOLITION WORK
	WORK SHOWN BOLD-CONTINUOUS INDICATES NEW WORK
DRAWING SET APPEARANCE	
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).	
PIPING LINE TYPES	
RL	REFRIGERANT LIQUID
RS	REFRIGERANT SUCTION
CD	CONDENSATE DRAIN
	SUPPLY MAIN OR BRANCH
	RETURN MAIN OR BRANCH
MECHANICAL AIR DEVICES	
RR	RETURN REGISTER
ER	EXHAUST REGISTER
CD	CEILING DIFFUSER
CD-10"Ø	2'x2' SQUARE CEILING DIFFUSER WITH 10" NECK
MECHANICAL DUCTWORK	
UP	SUPPLY DUCT WITH ELBOW TURNED UP
DN	SUPPLY DUCT WITH ELBOW TURNED DOWN
UP	RETURN DUCT WITH ELBOW TURNED UP
DN	RETURN DUCT WITH ELBOW TURNED DOWN
UP	EXHAUST DUCT WITH ELBOW TURNED UP
DN	EXHAUST DUCT WITH ELBOW TURNED DOWN
24X12 SA	SUPPLY DUCT
24X12 RA	RETURN DUCT
24X12 EA	EXHAUST DUCT
24X12 OA	OUTSIDE AIR DUCT
	1" LINED DUCTWORK
	DUCT FLEX CONNECTOR
	FLEXIBLE DUCTWORK CONNECTION
	BRANCH TAKEOFF
24"/12" RA	OVAL DUCT
	REDUCER, CONCENTRIC
	REDUCER, NONCONCENTRIC
MECHANICAL DUCTWORK ACCESSORIES	
	DUCT WITH MANUAL VOLUME DAMPER
	ROUND ELBOW WITH TURNING VANES
	ELBOW WITH TURNING VANES
S	DUCT MOUNTED SMOKE DETECTOR (HARD WIRE INTERLOCK TO FAN MOTOR BY E.C.) FURNISHED BY E.C., INSTALLED BY M.C.
MECHANICAL STATS & SENSORS	
T	LOW VOLTAGE THERMOSTAT
MECHANICAL MISCELLANOUS	
DI	DIGITAL INPUT
DO	DIGITAL OUTPUT
AI	ANALOG INPUT
AO	ANALOG OUTPUT
I	HARD WIRE INTERLOCK

GENERAL DEMOLITION NOTE

MECHANICAL CONTRACTOR TO REMOVE EXISTING HVAC EQUIPMENT, DUCTWORK, HANGERS, INSULATION, AIR DEVICES, CONTROLS AND MISCELLANEOUS EQUIPMENT, ETC... NOT INTENDED FOR REUSE.

NEW WORK GENERAL NOTES

A. PROVIDE ALL LABOR, MATERIAL, AND EQUIPMENT NECESSARY TO COMPLETELY FURNISH, INSTALL, AND PLACE INTO OPERATION, ALL SYSTEMS SHOWN ON THE DRAWINGS AND DELINEATED IN THE SPECIFICATIONS IN ACCORDANCE WITH ALL STATE AND LOCAL CODES AND ORDINANCES. REPORT ANY KNOWN DISCREPANCIES TO THE ARCHITECT/ENGINEER PRIOR TO INSTALLATION.
B. REFER TO ARCHITECTURAL REFLECTED CEILING PLANS FOR EXACT LOCATIONS OF CEILING DIFFUSERS, REGISTERS AND GRILLES.
C. DO NOT SCALE DRAWINGS; REFER TO ARCHITECTURAL DRAWINGS FOR DIMENSIONED LOCATIONS OF WALLS, DOORS, WINDOWS, AND CABINETRY.
D. COORDINATE WORK AND SPACE REQUIREMENTS IN CEILING SPACES WITH OTHER TRADES PRIOR TO INSTALLATION.
E. COORDINATE LOCATIONS AND ORIENTATION OF ROOF MOUNTED EQUIPMENT WITH ARCHITECTURAL AND STRUCTURAL DRAWINGS.
F. COORDINATE WALL LOUVERS WITH ARCHITECTURAL ELEVATIONS AND DETAILS.
G. PROVIDE VOLUME DAMPERS AT ALL SUPPLY, RETURN, AND EXHAUST DUCT BRANCH TAKE-OFFS.
H. PROVIDE TURNING VANES IN ALL 90 DEGREE MITERED ELBOWS. OMIT TURNING VANES IN ACOUSTIC LINED RETURN DUCT ELBOWS.
I. PROVIDE FLEXIBLE DUCT ON INLET TO EACH CEILING DIFFUSER. CUT FLEXIBLE DUCTS TO LENGTH NEEDED AND INSTALL WITHOUT KINKS OR SHARP BENDS (BENDS WITH CENTERLINE RADIUS LESS THAN DUCT DIAMETER). SUPPORT FLEXIBLE DUCTS WITH MINIMUM 1" WIDE METAL STRAPS OR SADDLES.
J. SIZES OF ACOUSTIC LINED DUCTS ARE NET INSIDE DIMENSION. INCREASE SHEET METAL SIZE ACCORDINGLY.
K. RUNOUTS TO CEILING DIFFUSERS ARE THE SAME SIZE AS THE DIFFUSER NECK UNLESS NOTED OTHERWISE.
L. INSTALL ALL EQUIPMENT WITH CODE REQUIRED AND MANUFACTURER RECOMMENDED MINIMUM CLEARANCES FOR SERVICE, ACCESS, AND FIRE PROTECTION.
M. MAINTAIN A MINIMUM OF 10 FEET BETWEEN ALL OUTSIDE AIR INTAKES AND ALL EXHAUST, VENT, AND FLUE OUTLETS.
N. ALL MATERIALS EXPOSED WITHIN PLENUMS SHALL BE NON-COMBUSTIBLE OR SHALL HAVE A FLAME SPREAD INDEX OF NOT MORE THAN 25 AND A SMOKE-DEVELOPED INDEX OF NOT MORE THAN 50 WHEN TESTED IN ACCORDANCE WITH ASTME E 84.

STANDARD HVAC ABBREVIATIONS

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

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RCF INTERIOR OFFICE EXPANSION

6454 CENTRE PARK DRIVE
WEST CHESTER, OHIO 45069

STATE OF OHIO — KRIS T. SCHNITGEN — E-77432 — REGISTERED PROFESSIONAL ENGINEER — MECHANICAL
3/29/2023

REVISIONS	

DWN: CCR CHK: RAL
DATE: 03/21/2023
PROJECT #: RCT01.11

MECHANICAL COVER SHEET

M0-001

1" REFERENCE
KLH PROJECT # 24470

KEYED NOTES

1 MECHANICAL SYSTEM ZONES PLAN - LEVEL 1 - OVERALL
1/8" = 1'-0"

N

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PROJECT #: RCT01.11

MECHANICAL ZONING LEVEL 1 PLAN OVERALL

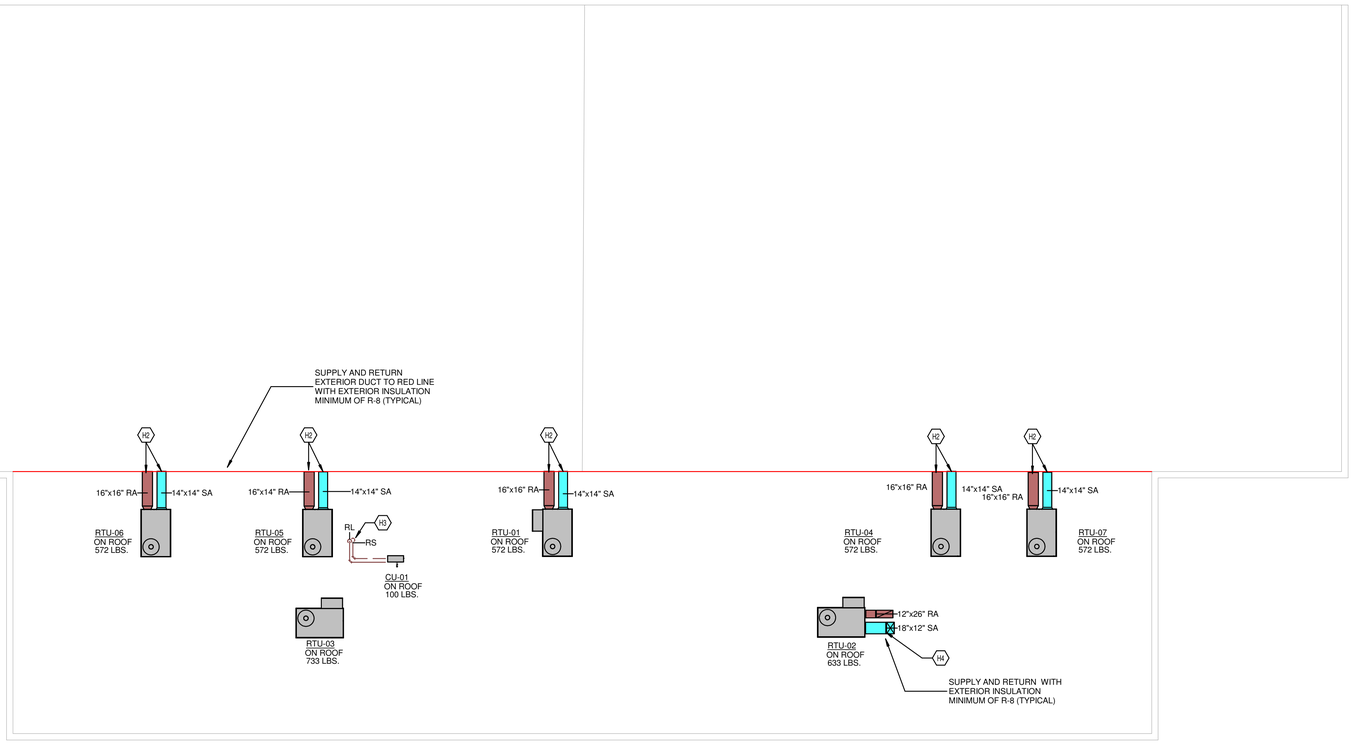
M2-101

1" REFERENCE
KLH PROJECT # 24470

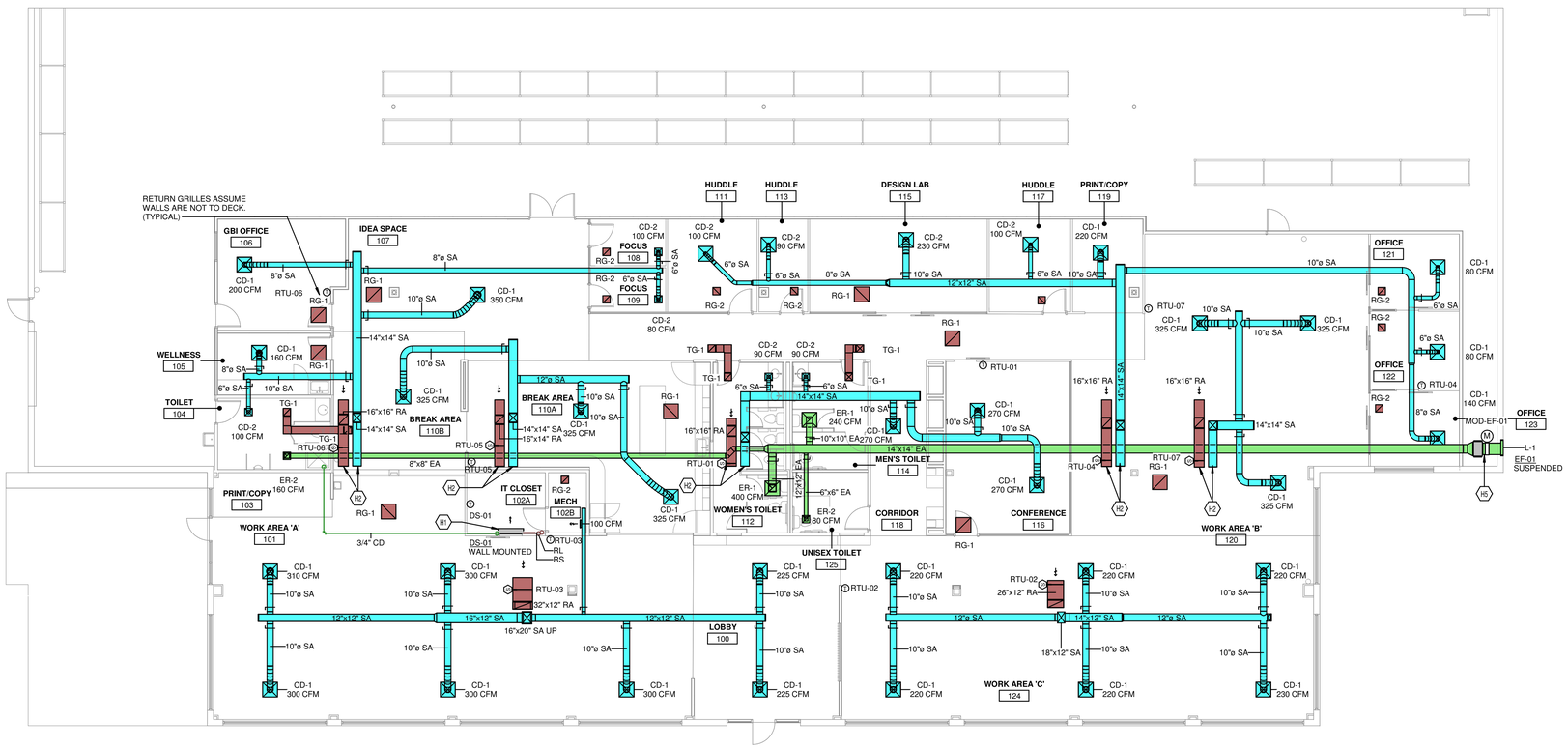
3/29/2023 5:06:04 24470.00-23-MEP-RCF Office Expansion HVAC & Plbg - PROMO_detached.rvt

KEYED NOTES

H1	PROVIDE CONDENSATE PUMP FOR DUCTLESS SPLIT HIGH WALL UNIT.
H2	DUCTWORK THROUGH ROOF SIDEWALL. CUT AND PATCH ALL WALL PENETRATIONS.
H3	REFRIGERANT DOWN THROUGH DOGHOUSE.
H4	PROVIDE DUCT CURB.
H5	DAMPER TO CLOSE WHEN EXHAUST FAN IS NOT IN OPERATION.



2 MECHANICAL PLAN - ROOF - OVERALL
1/8" = 1'-0"



1 MECHANICAL PLAN - LEVEL 1 - OVERALL
1/8" = 1'-0"

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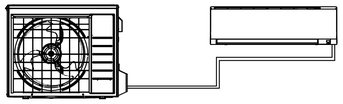
MECHANICAL DUCTWORK LEVEL 1 PLAN OVERALL

M3-101

1" REFERENCE
KLH PROJECT # 24470

3/29/2023 5:06:23 24470.00-23-MEP-RCF Office Expansion HVAC & Plbg - PROMO_detached.rvt

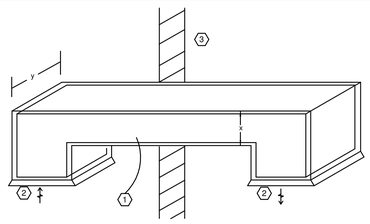
ALL OTHER SEQUENCES ARE IN THE SPECIFICATIONS ON M9-901 UNDER SEQUENCE OF OPERATIONS.



1. Ductless Split System
   a. The unit shall operate to maintain space temperature set point. The fan shall cycle in sequence with the heating/cooling coils to maintain space temperature setpoint. On a call for cooling, the evaporator fan shall start and run continuously and mechanical cooling shall stage on. On a call for heating, the evaporator fan and mechanical cooling shall shut down. On a further call for heating the reversing valve shall move to the heating position and modulate supply fan speed.
   b. Provide Low Ambient Controls on condensing unit for operation down to -20 degrees F.
2. Startup
   a. The unit shall continuously operate.
   b. Provide a 5 minute (adjustable) time delay on compressor start during unoccupied mode to insure flow.
3. Supply Fan Control
   a. The supply fan shall be constant and set to the required CFM.
4. Space Temperature Control
   a. Provide a local wall mounted room temperature sensor with display of space temperature and setpoint (+/- 3 def. F. adjustable from setpoint) and occupant temperature override (3 hours adjustable). Ductless split unit heating and cooling shall be controlled to maintain space temperate setpoint.

23T-071 - DUCTLESS SPLIT SYSTEM - HEAT PUMP SEQUENCE

SCALE: NONE



GENERAL NOTES:

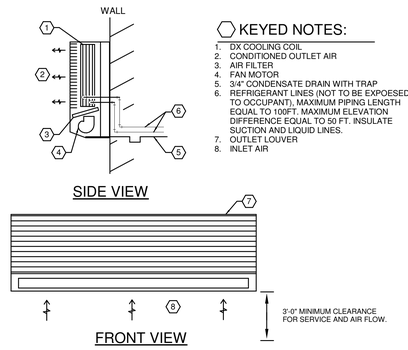
A. SEE NEW WORK PLAN FOR DUCT SIZE
B. x + y DIMENSIONS SHALL BE DETERMINED FROM FLOOR PLANS

KEYED NOTES:

1. 1/2" ACOUSTIC LINING, SEAL AROUND ALL WALL PENETRATIONS
2. SEE NEW WORK PLAN FOR REGISTER
3. INTERIOR WALL/PARTITION

233713.00-19 - TRANSFER GRILLE

SCALE: NONE

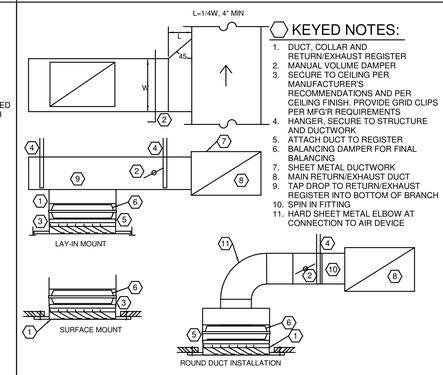


KEYED NOTES:

1. DX COOLING COIL
2. CONDITIONED OUTLET AIR
3. AIR FILTER
4. FAN MOTOR
5. 3/4" CONDENSATE DRAIN WITH TRAP
6. REFRIGERANT LINES (NOT TO BE EXPOSED TO OCCUPANT), MAXIMUM PIPING LENGTH EQUAL TO 100FT. MAXIMUM ELEVATION DIFFERENCE EQUAL TO 50 FT. INSULATE SUCTION AND LIQUID LINES.
7. OUTLET LOUVER
8. INLET AIR

238126.00-06 - DUCTLESS AIR CONDITION UNIT WALL

SCALE: NONE

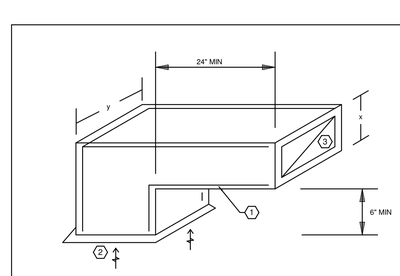


KEYED NOTES:

1. DUCT, COLLAR AND RETURN/EXHAUST REGISTER
2. MANUAL VOLUME DAMPER
3. SECURE TO CEILING PER MANUFACTURER'S RECOMMENDATIONS AND PER CEILING FINISH. PROVIDE GRID CLIPS PER MFG'R REQUIREMENTS
4. HANGER, SECURE TO STRUCTURE AND DUCTWORK
5. ATTACH DUCT TO REGISTER
6. BALANCING DAMPER FOR FINAL BALANCING
7. SHEET METAL DUCTWORK
8. MAIN RETURN/EXHAUST DUCT
9. TAP DROP TO RETURN/EXHAUST REGISTER INTO BOTTOM OF BRANCH
10. SPIN IN FITTING
11. HARD SHEET METAL ELBOW AT CONNECTION TO AIR DEVICE

233713.00-21 - RETURN/EXHAUST REGISTER INSTALLATION

SCALE: NONE



GENERAL NOTES

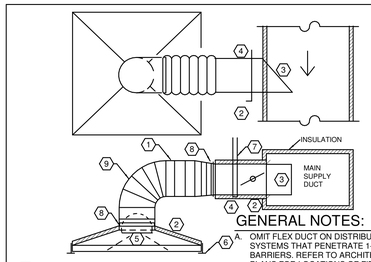
A. OPENING SIZE:
   12x12 RR = 12x12 DUCT
   12x24 RR = 12x18 DUCT
   24x23 RR = 24x18 DUCT

KEYED NOTES:

1. 1/2" ACOUSTIC LINING
2. 12x12 RR OT 24x24 RR (UNLESS OTHERWISE NOTED)
3. OPENING SAME SIZE AS RR NECK

233713.00-13 - PLENUM RETURN GRILLE

SCALE: NONE



GENERAL NOTES:

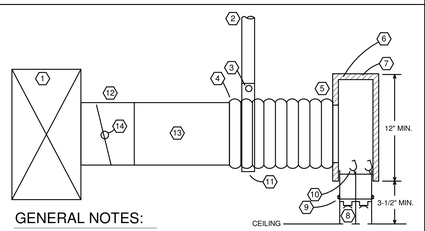
A. OMIT FLEX DUCT ON DISTRIBUTION SYSTEMS THAT PENETRATE 1-HR FIRE BARRIERS. REFER TO ARCHITECTURAL PLANS FOR LOCATIONS OF FIRE BARRIERS.

KEYED NOTES:

1. MAXIMUM LENGTH OF INSUL. FLEX DUCT EQUALS 5 FEET. FLEX NOT PERMITTED IN INACCESSIBLE CEILINGS
2. INSULATED DUCT, COLLAR AND DIFFUSER BY HVAC CONTRACTOR
3. SCOOP
4. SPIN IN FITTING WITH MANUAL VOLUME DAMPER
5. INTERNAL BUTTERFLY DAMPER FOR DRYWALL APPLICATIONS ONLY. (PROVIDE KEY FOR ADJUSTMENT)
6. SECURE TO CEILING PER MANUFACTURER'S RECOMMENDATIONS AND PER CEILING FINISH. PROVIDE GRID CLIPS PER MFG'R REQUIREMENTS. PROVIDE FRAMING FOR DRYWALL INSTALLATION.
7. HANGER, SECURE TO STRUCTURE AND DUCTWORK.
8. PEEL BACK INSULATION AND PROVIDE STRAPPING AND SHEET METAL SCREWS AT FLEX CONNECTION TO DUCT. THEN PROVIDE STRAPPING AROUND INSULATION
9. SUPPORT FLEX TO PREVENT COLLAPSING

233713.00-04 - DIFFUSER INSTALLATION TYPICAL

SCALE: NONE



GENERAL NOTES:

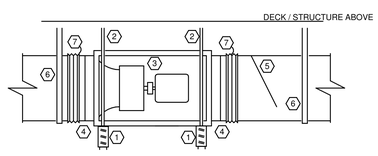
A. WHERE LINEAR DIFFUSER IS ADJACENT TO WINDOWS, ADJUST PATTERN CONTROLLER TO DIRECT AIRFLOW HORIZONTALLY TOWARDS WINDOWS.

KEYED NOTES:

1. LOW PRESSURE SUPPLY DUCT
2. 1" WIDE BAND AND CLAMP
3. SHEET METAL SCREW
4. INSULATED FLEX. DUCT MAX LENGTH 5'-0" ABOVE ACCESSIBLE CEILINGS ONLY.
5. PEEL BACK INSULATION AND PROVIDE STRAPPING AND SHEET METAL SCREWS AT FLEX CONNECTION TO DUCT. THEN PROVIDE STRAPPING AROUND INSULATION
6. SHEET METAL PLENUM
7. 1/2" ACOUSTICAL LINING
8. PATTERN CONTROLLER
9. SCREWS, MIN 6" ON CENTER & SEAL AIRTIGHT, TYP, BOTH SIDES
10. VOLUME ADJUSTER
11. BAND CLAMP MAXIMUM SAG 1/2" PER FOOT BETWEEN SUPPORT BRACING
12. TAKE-OFF SPIN-IN FITTING WITH ADJUSTABLE MANUAL DAMPER. LOCATE ABOVE ACCESSIBLE CEILING OR PROVIDE ACCESS PANEL BELOW DAMPER.
13. SHEET METAL BRANCH DUCT
14. MANUAL VOLUME DAMPER

233713.00-14 - PLENUM-LINEAR DIFFUSER

SCALE: NONE



KEYED NOTES:

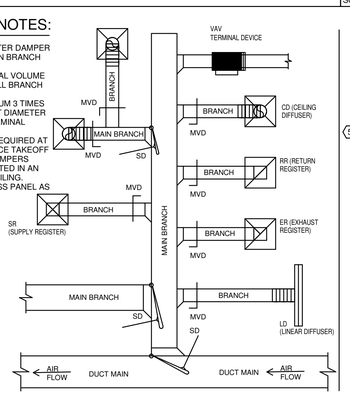
1. SPRING ISOLATORS
2. GALVANIZED ALL THREAD ROD SUSPEND FROM BUILDING STRUCTURE AND FROM FAN MOUNTING FLANGES. USE CHANNELS UNDER FAN AS AN ALTERNATIVE SUPPORT
3. INLINE FAN
4. INLET AND OUTLET DUCT FLANGES, CONNECT TO DUCTWORK
5. BACKDRAFT OR MOTOR OPERATED DAMPER (SEE SCHEDULE)
6. METAL HANGER, SECURE TO STRUCTURE AND TO DUCTWORK
7. FLEXIBLE CANVAS COLLECTION

233423.00-19 - INLINE DIRECT DRIVE GENERAL EXHAUST FAN

SCALE: NONE

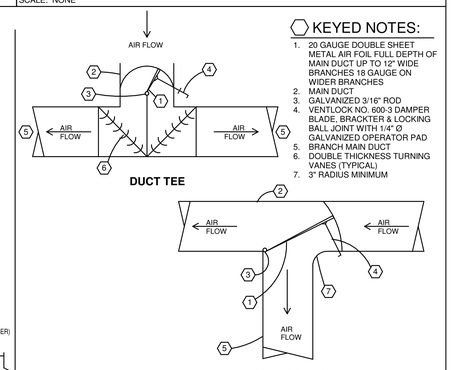
GENERAL NOTES:

1. PROVIDE SPLITTER DAMPER (SD) AT ALL MAIN BRANCH TAKEOFFS
2. PROVIDE MANUAL VOLUME DAMOERS AT ALL BRANCH TAKEOFFS
3. PROVIDE MINIMUM 3 TIMES STRAIGHT INLET DIAMETER TO ALL VAV TERMINAL DEVICES
4. DAMPER NOT REQUIRED AT TERMINAL DEVICE TAKEOFF
5. ALL MANUAL DAMPERS SHALL BE LOCATED IN AN ACCESSIBLE CEILING. PROVIDE ACCESS PANEL AS REQUIRED.



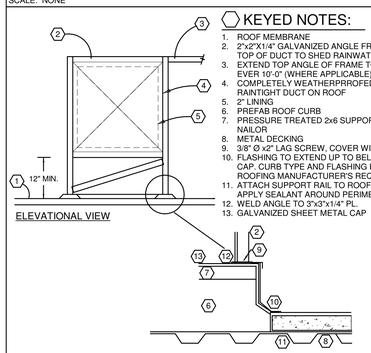
233300.00-01 - MANUAL DAMPER DETAIL

SCALE: NONE



KEYED NOTES:

1. 20 GAUGE DOUBLE SHEET METAL AIR FOIL FULL DEPTH OF MAIN DUCT UP TO 12" WIDE BRANCHES 18 GAUGE ON WIDER BRANCHES
2. MAIN DUCT
3. GALVANIZED 3/16" ROD
4. VENTLOCK NO. 600-3 DAMPER BLADE, BRACKTER & LOCKING BALL JOINT WITH 1/4" Ø GALVANIZED OPERATOR PAD
5. BRANCH MAIN DUCT
6. DOUBLE THICKNESS TURNING VANES (TYPICAL)
7. 3" RADIUS MINIMUM

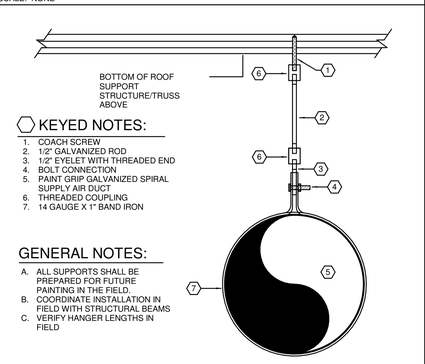


KEYED NOTES:

1. ROOF MEMBRANE
2. 2"x2"X1/4" GALVANIZED ANGLE FRAME. PITCH TOP OF DUCT TO SHED RAINWATER
3. EXTEND TOP ANGLE OF FRAME TO WALL EVER 10'-0" (WHERE APPLICABLE)
4. COMPLETELY WEATHERPROFED & RAINTIGHT DUCT ON ROOF
5. 2" LINING
6. PREFAB ROOF CURB
7. PRESSURE TREATED 2x6 SUPPORT WOOD NAILOR.
8. METAL DECKING
9. 3/8" Ø x2" LAG SCREW, COVER WITH SEALANT
10. FLASHING TO EXTEND UP TO BELOW CURB CAP. CURB TYPE AND FLASHING PER ROOFING MANUFACTURER'S REQUIREMENTS.
11. ATTACH SUPPORT RAIL TO ROOF DECK, APPLY SEALANT AROUND PERIMETER
12. WELD ANGLE TO 3"x3"x1/4" PL.
13. GALVANIZED SHEET METAL CAP

233113.00-07 - ROOF DUCT SUPPORT B

SCALE: NONE



KEYED NOTES:

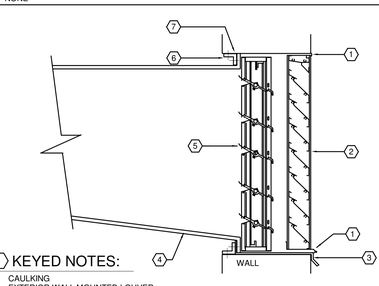
1. COACH SCREW
2. 1/2" GALVANIZED ROD
3. 1/2" EYELET WITH THREADED END
4. BOLT CONNECTION
5. PAINT GRIP GALVANIZED SPIRAL SUPPLY AIR DUCT
6. THREADED COUPLING
7. 14 GAUGE X 1" BAND IRON

GENERAL NOTES:

A. ALL SUPPORTS SHALL BE PREPARED FOR FUTURE PAINTING IN THE FIELD.
B. COORDINATE INSTALLATION IN FIELD WITH STRUCTURAL BEAMS
C. VERIFY HANGER LENGTHS IN FIELD

233113.00-03 - DUCT SUPPORT DETAIL B

SCALE: NONE



KEYED NOTES:

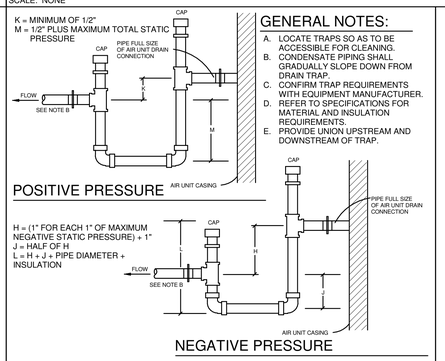
1. CAULKING
2. EXTERIOR WALL MOUNTED LOUVER
3. EXTENDED SILL
4. PITCH INSULATED DUCT 10 DEGREES TOWARD LOUVER AND SEAL WATERTIGHT
5. MOTOR OPER. DAMPER
6. CLIP ANGLE
7. ANCHOR TO WALL AT 12" O.C.

GENERAL NOTES:

A. WALL LOUVERS ARE FURNISHED AND INSTALLED BY THE GENERAL CONTRACTOR. REFER TO ARCHITECTURAL DRAWINGS FOR SIZES AND LOCATIONS, UNLESS SPECIFIED IN SECTION 23 37 13.00.

233713.00-07 - EXHAUST LOUVER DETAIL

SCALE: NONE



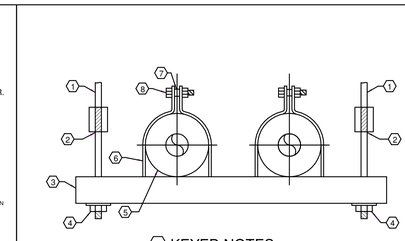
GENERAL NOTES:

A. LOCATE TRAPS SO AS TO BE ACCESSIBLE FOR CLEANING.
B. CONDENSATE PIPING SHALL GRADUALLY SLOPE DOWN FROM DRAIN TRAP.
C. CONFIRM TRAP REQUIREMENTS WITH EQUIPMENT MANUFACTURER.
D. REFER TO SPECIFICATIONS FOR MATERIAL AND INSULATION REQUIREMENTS.
E. PROVIDE UNION UPSTREAM AND DOWNSTREAM OF TRAP.

NOTE: OUTDOOR UNITS AND UNITS LOCATED IN UNCONDITIONED SPACES WHICH PROVIDE COOLING IN THE WINTER MUST HAVE HEAT TRACE ON THE CONDENSATE PIPING.

232113.23-05 - CONDENSATE DRAIN TRAP POSITIVE & NEGATIVE

SCALE: NONE



KEYED NOTES:

1. CONNECT TO STRUCTURE (TYPICAL).
2. GALVANIZED THREADED HANGER RODS (TYPICAL). SEE SPECIFICATIONS.
3. UNISTRUT.
4. PLATED NUT & WASHER (TYPICAL).
5. CONTINUOUS INSULATION AS SPECIFIED, (TYPICAL).
6. CHANNEL MOUNTED CLAMPING SYSTEM (TYPICAL).
7. SPACER SIZED TO PREVENT COMPRESSION OF INSULATION.
8. PLATED DOUBLE NUT AND WASHER.

230529.00-02 - REFRIGERANT PIPING SUPPORT

SCALE: NONE

MECHANICAL ELECTRICAL ENGINEERS
WWW.KLHENGRS.COM
LEXINGTON, KENTUCKY
LOUISVILLE, KENTUCKY
COLUMBUS, OHIO
NEW YORK, NEW YORK
KLH ENGINEERS
KOHRS LONNEMANN HEIL ENGINEERS, INC.
1538 ALEXANDRIA PIKE, SUITE 11
FT. THOMAS, KENTUCKY 41075
859-442-8050
859-442-8058 FAX

RCF INTERIOR OFFICE EXPANSION

6454 CENTRE PARK DRIVE
WEST CHESTER, OHIO 45069

STATE OF OHIO
KRIS T. SCHNITGEN
E-77432
REGISTERED PROFESSIONAL ENGINEER
3/29/2023

REVISIONS

DWN: CCR CHK: RAL
DATE: 03/21/2023
PROJECT #: RCT01.11

MECHANICAL - DETAILS

M6-501

1" REFERENCE
KLH PROJECT # 24470

3/29/2023 5:06:30 24470.00-23-MEP-RCF Office Expansion HVAC & Plbg - PROMO_detached.rvt

HVAC DIFFUSERS AND REGISTERS SCHEDULE

TAG	MANUFACTURER	MODEL	FACE	MOUNTING	MATERIAL	FINISH	DAMPER TYPE	BORDER STYLE
CD-1	TITUS	OMNI	24"x24"	CEILING	STEEL	STANDARD WHITE	BUTTERFLY	LAY IN MOUNTING
CD-2	TITUS	OMNI	<varies>	CEILING	STEEL	STANDARD WHITE	BUTTERFLY	LAY IN MOUNTING
ER-1	TITUS	350FL	24"x24"	CEILING	ALUMINUM	STANDARD WHITE	OPPOSED BLADE	LAY IN MOUNTING
ER-2	TITUS	350FL	12"x12"	CEILING	ALUMINUM	STANDARD WHITE	OPPOSED BLADE	LAY IN MOUNTING
RG-1	TITUS	45F	24"x24"	CEILING	ALUMINUM	STANDARD WHITE	(none)	LAY IN MOUNTING
RG-2	TITUS	45F	12"x12"	CEILING	ALUMINUM	STANDARD WHITE	(none)	LAY IN MOUNTING
TG-1	TITUS	45F	12"x12"	CEILING	ALUMINUM	STANDARD WHITE	(none)	LAY IN MOUNTING

HVAC ELECTRICAL COORDINATION SCHEDULE

ABBREVIATIONS

DC	LOCAL DISCONNECT
MC	MOTOR CONTROL (POWER)
SD	DUCT SMOKE DETECTOR
CN	CONTROLS
TS	TOGGLE SWITCH
CB	H.A.C.R. CIRCUIT BREAKER AT SOURCE PANELBOARD
FUSE	FUSE AT LOCAL DISCONNECT (VERIFY FIELD RATING)
FLA	OPERATING FULL LOAD AMPS
MCA	MINIMUM CIRCUIT AMPACITY
CP	CORD AND PLUG CONNECTION

CONTRACTOR TYPE

EC	ELECTRICAL CONTRACTOR
EX	EXISTING
FC	FIRE PROTECTION CONTRACTOR
GC	GENERAL CONTRACTOR
HC	HVAC CONTRACTOR
MFR	MANUFACTURER
PC	PLUMBING CONTRACTOR
OR	OWNER OR OTHERS

MOTOR CONTROL TYPE

CS	COMBINATION STARTER
MCC	MOTOR CONTROL STARTER
MG	MAGNETIC STARTER OR CONTACT
MS	MANUAL STARTER
VFD	VARIABLE FREQUENCY DRIVE
MSR	MANUAL STARTER W/ CONTROL RELAY
OV	OVERCURRENT PROTECTION

CONTROL TYPE

TC	TIMECLOCK
CPT	CONTROL POWER TRANSFORMER
BAS	BUILDING AUTOMATION SYSTEM
LOW	LOW VOLTAGE CONTROLS
LINE	LINE VOLTAGE CONTROLS
RLINE	REVERSE ACTING LINE VOLTAGE THERMOSTAT
MAN	MANUAL
FA	FIRE ALARM
CO	CARBON MONOXIDE SENSOR
INT	INTEGRAL TO EQUIPMENT
ASD	AREA SMOKE DETECTOR
DSD	DUCT SMOKE DETECTOR

EQUIPMENT MARK	DESCRIPTION	VOLTS (V)	PHASE	EMERGENCY	BHP (HP)	HP (HP)	HTG (kW)	WATTS	FLA (A)	MCA (A)	OCP (A)	FED FROM	DC FURN	DC INST	DC WIRE	MC TYPE	MC FURN	MC INST	MC WIRE	CN TYPE	CN FURN	CN INST	CN WIRE	FA SHUTDOWN	AVAILABLE FAULT CURRENT (A)	HVACTYPE
CU-01	DUCTLESS SPLIT OUTDOOR CONDENSING UNIT	208	1							16	25		EC	EC	EC	MG	MFR	MFR	MFR	LOW	MFR	MFR	MFR			23 81 29.00.00
DS-01	DUCTLESS SPLIT HIGH WALL UNIT	208	1						.2			CU-01	EC	EC	EC	MG	MFR	MFR	MFR	LOW	MFR	MFR	MFR			23 81 29.00.01
EF-01	INLINE CENTRIFUGAL FAN	120	1		0.24			467	5				EC	EC	EC	MG	MFR	MFR	MFR	TC	EC	EC	EC			23 34 23.00.05
MOD-EF-01	MOTOR OPERATED DAMPER	120	1						1		15		EC	EC	EC	---	---	---	---	TC	HC	EC	EC			23 34 23.00.05
RTU-01	PACKAGED OUTDOOR ROOFTOP UNIT	208	3				12		44	49	50		EC	EC	EC	MG	MFR	MFR	MFR	LOW	HC	HC	HC	DUCT SMOKE		23 74 33.00.00
RTU-02	PACKAGED OUTDOOR ROOFTOP UNIT	208	3				15.8		59	64	70		EC	EC	EC	MG	MFR	MFR	MFR	LOW	HC	HC	HC	DUCT SMOKE		23 74 33.00.00
RTU-03	PACKAGED OUTDOOR ROOFTOP UNIT	208	3				18.4		72	78	80		EC	EC	EC	MG	MFR	MFR	MFR	LOW	HC	HC	HC	DUCT SMOKE		23 74 33.00.00
RTU-04	PACKAGED OUTDOOR ROOFTOP UNIT	208	3				12		44	49	50		EC	EC	EC	MG	MFR	MFR	MFR	LOW	HC	HC	HC	DUCT SMOKE		23 74 33.00.00
RTU-05	PACKAGED OUTDOOR ROOFTOP UNIT	208	3				12		44	49	50		EC	EC	EC	MG	MFR	MFR	MFR	LOW	HC	HC	HC	DUCT SMOKE		23 74 33.00.00
RTU-06	PACKAGED OUTDOOR ROOFTOP UNIT	208	3				12		44	49	50		EC	EC	EC	MG	MFR	MFR	MFR	LOW	HC	HC	HC	DUCT SMOKE		23 74 33.00.00
RTU-07	PACKAGED OUTDOOR ROOFTOP UNIT	208	3				12		44	49	50		EC	EC	EC	MG	MFR	MFR	MFR	LOW	HC	HC	HC	DUCT SMOKE		23 74 33.00.00

HVAC DUCTLESS SPLIT SYSTEMS (INDOOR 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	FED FROM	WEIGHT (lbs)	MANUFACTURER	MODEL	EMERGENCY	VOLTS	PHASE	NOMINAL TONS	MAT CLG DB (Deg F)	MAT CLG WB (Deg F)	CLG MBH (mbh)	CLG SENS (mbh)	LAT CLG DB (Deg F)	LAT CLG WB (Deg F)
DS-01	DUCTLESS SPLIT HIGH WALL UNIT	IT CLOSET 102A	CU-01	28	CARRIER	40MAHBQ18XA3		208	1	1.5	80	67	18	15	55	54

HVAC DUCTLESS SPLIT SYSTEMS (OUTDOOR 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	WEIGHT (lbs)	MANUFACTURER	MODEL	EMERGENCY	VOLTS	PHASE	MIN EER	HSPF	NOMINAL TONS	CLG MBH (mbh)	CLG SENS (mbh)	HTG MBH (mbh)	FLA (amps)	MCA (amps)	OCP (amps)	AVAILABLE FAULT CURRENT
CU-01	DUCTLESS SPLIT OUTDOOR CONDENSING UNIT	100	CARRIER	38MARBQ18AA3		208	1	12.5	13.0	1.5	18	15	10		16	25	

HVAC ELECTRIC HEAT 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.

DIRECT DRIVE

EQUIPMENT MARK	DESCRIPTION	CONFIGURATION	WEIGHT (lbs)	MANUFACTURER	MODEL	MIN EER	SEER	VOLTS	PHASE	CFM (cfm)	ESP (in WC)	FAN RPM (rpm)	BHP (hp)	HP (hp)	OACFM (cfm)	NOMINAL TONS	MAT CLG DB (Deg F)	MAT CLG WB (Deg F)	CLG MBH (mbh)	CLG SENS (mbh)	LAT DB (Deg F)	LAT CLG WB (Deg F)	HTG MBH (mbh)	HTG KW (kW)	FLA (amps)	MCA (amps)	OCP (amps)	AVAILABLE FAULT CURRENT	ACCESSORIES
RTU-01	PACKAGED OUTDOOR ROOFTOP UNIT	SIDE DISCHARGE	572	CARRIER	50FC-A042A5	14		208	3	990	0.5	0			729	3	80	67	35	25	55	54	24	12	44	49	50		14" ROOF CURB
RTU-02	PACKAGED OUTDOOR ROOFTOP UNIT	SIDE DISCHARGE	633	CARRIER	50FC-A05A2A5	14		208	3	1330	0.5	0			173	4	78	66	36	31	55	54	36	15.8	59	64	70		14" ROOF CURB
RTU-03	PACKAGED OUTDOOR ROOFTOP UNIT	DOWNFLOW	733	CARRIER	50FC-A06A2A5	14		208	3	2060	0.5	0			289	5	78	66	58	48	55	54	56	18.4	72	78	80		14" ROOF CURB, ENTHALPY ECONOMIZER, ECONOMIZER BAROMETRIC RELIEF
RTU-04	PACKAGED OUTDOOR ROOFTOP UNIT	SIDE DISCHARGE	572	CARRIER	50FC-A042A5	14		208	3	1040	0.5	0			177	3	79	67	31	25	55	54	34	12	44	49	50		14" ROOF CURB
RTU-05	PACKAGED OUTDOOR ROOFTOP UNIT	SIDE DISCHARGE	572	CARRIER	50FC-A042A5	14		208	3	975	0.5	0			234	3	80	67	36	25	55	54	21	12	44	49	50		14" ROOF CURB
RTU-06	PACKAGED OUTDOOR ROOFTOP UNIT	SIDE DISCHARGE	572	CARRIER	50FC-A042A5	14		208	3	990	0.5	0			209	3	80	67	32	25	55	54	35	12	44	49	50		14" ROOF CURB
RTU-07	PACKAGED OUTDOOR ROOFTOP UNIT	SIDE DISCHARGE	572	CARRIER	50FC-A042A5	14		208	3	975	0.5	0			195	3	79	67	31	24	55	54	25	12	44	49	50		14" ROOF CURB

HVAC VENTILATION SCHEDULE

NUMBER	NAME	AREA	LEVEL	CEILING HEIGHT	AIR CHGS	OA CHGS	PEOPLE	OA PER PERSON	OA PER SQ FT.	REQ SUP	ACT SUP	REQ OA	ACT OA	ACT RET	ACT EXH	CRIT OA	PRESSURE	PCT OPERABLE	NATURAL VENTILATION
100	LOBBY	490 SF	Level 1	12' - 0"	0	0	5	5	0.06	421	450	59	63	450	0	0.1511	E	0	
101	WORK AREA 'A'	1789 SF	Level 1	12' - 0"	0	0	9	5	0.06	1293	1370	181	192	1370	0	0.1386	E	0	
102A	IT CLOSET	89 SF	Level 1	12' - 0"	0	0	0	0	0	0	600	0	132	600	0	0	E	0	
102B	MECH	43 SF	Level 1	12' - 0"	0	0	0	0	0	93	100	13	14	100	0	0	E	0	
103	PRINT/COPY	95 SF	Level 1	12' - 0"	0	0	0	0	0.06	129	140	18	20	140	0	0.0571	E	0	
104	TOILET	146 SF	Level 1	12' - 0"	0	0	0	0	0	95	100	20	21	0	160	0	N	0	
105	WELLNESS	128 SF	Level 1	12' - 0"	0	0	2	10	0.18	157	160	33	34	160	0	0.3375	E	0	
106	GBI OFFICE	248 SF	Level 1	12' - 0"	0	0	2	5	0.06	195	200	41	42	200	0	0.155	E	0	
107	IDEA SPACE	570 SF	Level 1	12' - 0"	0	0	3	5	0.06	338	350	71	74	350	0	0.1742	E	0	
108	FOCUS	64 SF	Level 1	12' - 0"	0	0	1	5	0.06	95	100	20	21	100	0	0.11	E	0	
109	FOCUS	61 SF	Level 1	12' - 0"	0	0	1	5	0.06	76	80	16	17	80	0	0.1375	E	0	
110A	BREAK AREA	617 SF	Level 1	12' - 0"	0	0	16	5	0.06	571	575	137	138	575	0	0.2539	E	0	
110B	BREAK AREA	327 SF	Level 1	12' - 0"	0	0	9	5	0.06	396	400	95	96	400	0	0.2025	E	0	
111	HUDDLE	152 SF	Level 1	12' - 0"	0	0	2	5	0.06	94	100	16	17	100	0	0.24	E	0	
112	WOMEN'S TOILET	218 SF	Level 1	12' - 0"	0	0	0	0	0	87	90	20	21	0	400	0	N	0	
113	HUDDLE	81 SF	Level 1	12' - 0"	0	0	2	5	0.06	88	90	15	15	90	0	0.2111	E	0	
114	MEN'S TOILET	148 SF	Level 1	12' - 0"	0	0	0	0	0	87	90	20	21	0	240	0	N	0	
115	DESIGN LAB	301 SF	Level 1	12' - 0"	0	0	2	5	0.06	224	230	38	39	230	0	0.1521	E	0	
116	CONFERENCE	390 SF	Level 1	12' - 0"	0	0	20	5	0.06	526	540	121	124	540	0	0.2851	E	0	
117	HUDDLE	138 SF	Level 1	12' - 0"	0	0	2	5	0.06	94	100	16	17	100	0	0.22	E	0	
118	CORRIDOR	Not Placed	Not Placed		0	0	0	0	0.06	323	340	71	75	340	0	0.2	E	0	
118	CORRIDOR	666 SF	Level 1	12' - 0"	0	0	0	0	0.06	243	250	56	58	250	0	0.2	E	0	
119	PRINT/COPY	117 SF	Level 1	12' - 0"	0	0	0	0	0.06	212	220	36	37	220	0	0.0409	E	0	
120	WORK AREA 'B'	1394 SF	Level 1	12' - 0"	0	0	7	5	0.06	745	975	149	195	975	0	0.1528	E	0	
121	OFFICE	123 SF	Level 1	12' - 0"	0	0	1	5	0.06	76	80	13	14	80	0	0.1875	E	0	
122	OFFICE	127 SF	Level 1	12' - 0"	0	0	1	5	0.06	76	80	13	14	80	0	0.2	E	0	
123	OFFICE	123 SF	Level 1	12' - 0"	0	0	1	5	0.06	135	140	23	24	140	0	0.1071	E	0	
124	WORK AREA 'C'	1572 SF	Level 1	12' - 0"	0	0	8	5	0.06	1292	1330	168	173	1330	0	0.1263	E	0	
125	UNISEX TOILET	83 SF	Level 1	12' - 0"	0	0	0	0	0	17	20	4	5	0	80	0	N	0	
TOTAL		10302 SF																	

HVAC LOAD SCHEDULE

THE HEATING AND COOLING LOAD CALCULATIONS ARE BASED ON THE CLTD/CLF (COOLING LOAD TEMPERATURE DIFFERENCE/COOLING LOAD FACTOR) METHOD. ASSUMPTIONS AND EXECUTION OF THESE METHODS ARE PER ASHRAE 183-2007...

HVAC LOADS

COOLING LOAD BREAKDOWN

CROOF	SENSIBLE HEAT GAIN FROM ROOF
CWALL	SENSIBLE HEAT GAIN FROM EXTERIOR WALLS
CPART	SENSIBLE HEAT GAIN FROM PARITIONS
CGLASS	SENSIBLE HEAT GAIN FROM GLAZING
CSOLAR	SENSIBLE HEAT GAIN FROM SOLAR GAIN THROGH GLAZING
CLIGHTS	SENSIBLE HEAT GAIN FROM INTERIOR LIGHTING
CEQUIP	SENSIBLE HEAT GAIN FROM PLUG LOADS, COMPUTERS, ETC.
CPSENS	SENSIBLE HEAT GAIN FROM PEOPLE
CSSENS	TOTAL SENSIBLE HEAT GAIN TO SPACE
CFAN	SENSIBLE HEAT GAIN FROM AIR HANDLER FAN
COAS	SENSIBLE HEAT GAIN FROM OUTDOOR VENTILATION AIR
CTSENS	TOTAL SENSIBLE HEAT GAIN
CPLAT	LATENT HEAT GAIN FROM PEOPLE
COAL	LATENT HEAT GAIN FROM OUTDOOR VENTILATION AIR
CTLAT	TOTAL LATENT HEAT GAIN
CTOT	TOTAL HEAT GAIN (SENSIBLE + LATENT)

HEATING LOAD BREAKDOWN

HROOF	HEAT LOSS FROM ROOF
HWALL	HEAT LOSS FROM EXTERIOR WALLS
HPART	HEAT LOSS FROM PARTITIONS
HGLASS	HEAT LOSS FROM GLAZING
HSLAB	HEAT LOSS FROM SLAB
HSPACE	TOTAL HEAT LOSS FROM SPACE
HOA	HEAT LOSS FROM OUTDOOR VENTILATION AIR
HTOT	TOTAL HEAT LOSS

EQUIPMENT MARK	CROOF	CWALL	CPART	CGLASS	CSOLAR	CLIGHTS	CEQUIP	CPSENS	CSSENS	CFAN	COAS	CTSENS	CPLAT	COAL	CTLAT	CTOT	HROOF	HWALL	HPART	HGLASS	HSLAB	HSPACE	HOA	HTOT
DS-01	0.1	0	0	0	0	0.4	6.8	0	7.4	0.4	2.6	15	0	3.3	3.3	18.3	0.2	0	0	0	0	0.3	9.8	10.2
RTU-01	0.4	0	0.7	0	0	7.7	0.6	4.9	14.4	0.6	4.5	25.1	4.1	5.7	9.8	34.9	0.9	0	2.7	0	1.5	5.1	17.1	22.2
RTU-02	2.1	0.8	0	2	8.4	8	3.4	1.8	26.7	0.9	3.4	31	0.9	4.3	5.3	36.3	4.4	2.7	0	9.5	5.8	22.6	12.9	35.6
RTU-03	3.2	1	0	3	9.9	12.3	6.8	3.4	40	1.3	5.7	48.1	2.8	7.2	10.1	58.2	6.8	3.6	0	14.4	8.5	33.5	21.6	55.1
RTU-04	0	0.1	3.4	0	1	5.9	7.1	2.6	20.5	0.7	3.5	24.7	2.2	4.4	6.7	31.4	0	0.3	12.9	0.4	6.9	20.6	13.2	33.9
RTU-05	0.1	0	0.3	0	0	4.8	3.4	6.1	14.9	0.6	4.6	25	5.1	5.8	11	36	0.3	0	1.4	0	0.9	2.7	17.5	20.2
RTU-06	0	0	2.1	0	0	6.2	3.7	2.2	14.3	0.6	4.1	24.6	1.8	5.2	7.1	31.7	0	0	8	0	6.1	14.2	15.6	29.8
RTU-07	0.3	0.1	0.3	0.2	0.9	7.1	2.3	1.7	13.3	0.6	3.9	24.2	1.4	4.9	6.3	30.5	0.7	0.6	1.1	0.9	3.7	7.3	14.6	21.9

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.

DIRECT DRIVE

EQUIPMENT MARK	DESCRIPTION	LOCATION	WEIGHT (lbs)	MANUFACTURER	MODEL	VOLTS	PHASE	WATTS (Watts)	CFM (cfm)	ESP (in WC)	FAN RPM (rpm)	BHP (hp)	FLA (amps)	AVAILABLE FAULT CURRENT
EF-01	INLINE CENTRIFUGAL FAN		60	GREENHECK	CSP-A1050	120	1	467	880	0.4	1070	0.24	5	

HVAC LOUVER SCHEDULE

TAG	DESCRIPTION	MANUFACTURER	MODEL	FACE SIZE	AIRFLOW	FREE AREA	MAX PRESSURE DROP (in. w.g.)	MATERIAL	FINISH
L-1	EXHAUST LOUVER	GREENHECK	EDJ-401	26"x18"	880 CFM	1.30 SF	0.07	ALUMINUM	STANDARD WHITE

MECHANICAL/ELECTRICAL ENGINEERS
WWW.KLHENGRS.COM
LEXINGTON, KENTUCKY
LOUISVILLE, KENTUCKY
COVINGTON, KENTUCKY
NEW YORK, NEW YORK
KLH ENGINEERS
KOHRS LONNEMANN HEIL ENGINEERS, INC.
1538 ALEXANDRIA PIKE, SUITE 11
FT. THOMAS, KENTUCKY 41075
859-442-8558 PHONE
859-442-8558 FAX

RCF INTERIOR OFFICE EXPANSION

6454 CENTRE PARK DRIVE
WEST CHESTER, OHIO 45069

STATE OF OHIO
KRIS T. SCHNITGEN
E-77432
REGISTERED
PROFESSIONAL ENGINEER
3/29/2023

REVISIONS

DWN: CCR CHK: RAL

DATE: 03/21/2023

PROJECT #: RCT01.11

MECHANICAL - SCHEDULES

M6-601

1" REFERENCE
KLH PROJECT # 24470

COM*check* Software Version COMcheckWeb
Mechanical Compliance Certificate

Project Information

Energy Code:	90.1 (2010) Standard
Project Title:	RCF Headquarter Expansion
Location:	Cincinnati, Ohio
Climate Zone:	4a
Project Type:	New Construction

Construction Site: Owner/Agent: Designer/Contractor:

Mechanical Systems List

Quantity System Type & Description

1 RTU-03 (Single Zone):
Heating: 1 each - Central Furnace, Electric, Capacity = 54 kBtu/h
No minimum efficiency requirement applies
Cooling: 1 each - Single Package DX Unit, Capacity = 48 kBtu/h, Air-Cooled Condenser
Proposed Efficiency = 14.00 SEER, Required Efficiency = 13.00 SEER
Proposed Part Load Efficiency = 0.00 , Required Part Load Efficiency = 0.00
Fan System: RTU-03 -- Compliance (Motor nameplate HP and fan efficiency method) : Passes

Fans:
FAN 3 Supply, Constant Volume, 2060 CFM, 1.0 motor nameplate hp

1 RTU-02 (Single Zone):
Heating: 1 each - Central Furnace, Electric, Capacity = 60 kBtu/h
No minimum efficiency requirement applies
Cooling: 1 each - Single Package DX Unit, Capacity = 60 kBtu/h, Air-Cooled Condenser, Air Economizer
Proposed Efficiency = 14.00 SEER, Required Efficiency = 13.00 SEER
Proposed Part Load Efficiency = 0.00 , Required Part Load Efficiency = 0.00
Fan System: RTU-02 -- Compliance (Motor nameplate HP and fan efficiency method) : Passes

Fans:
FAN 2 Supply, Constant Volume, 1330 CFM, 0.8 motor nameplate hp

1 RTU-01 (Single Zone):
Heating: 1 each - Central Furnace, Electric, Capacity = 40 kBtu/h
No minimum efficiency requirement applies
Cooling: 1 each - Single Package DX Unit, Capacity = 36 kBtu/h, Air-Cooled Condenser
Proposed Efficiency = 14.00 SEER, Required Efficiency = 13.00 SEER
Proposed Part Load Efficiency = 0.00 , Required Part Load Efficiency = 0.00
Fan System: RTU-01 -- Compliance (Motor nameplate HP and fan efficiency method) : Passes

Fans:
FAN 1 Supply, Constant Volume, 860 CFM, 0.5 motor nameplate hp

1 RTU-04 (Single Zone):
Heating: 1 each - Central Furnace, Electric, Capacity = 40 kBtu/h
No minimum efficiency requirement applies
Cooling: 1 each - Single Package DX Unit, Capacity = 36 kBtu/h, Air-Cooled Condenser
Proposed Efficiency = 14.00 SEER, Required Efficiency = 13.00 SEER
Proposed Part Load Efficiency = 0.00 , Required Part Load Efficiency = 0.00
Fan System: RTU-04 -- Compliance (Motor nameplate HP and fan efficiency method) : Passes

Fans:
FAN 4 Supply, Constant Volume, 1040 CFM, 0.5 motor nameplate hp

1 RTU-05 (Single Zone):
Heating: 1 each - Central Furnace, Electric, Capacity = 40 kBtu/h
No minimum efficiency requirement applies

Quantity System Type & Description

Cooling: 1 each - Single Package DX Unit, Capacity = 36 kBtu/h, Air-Cooled Condenser
Proposed Efficiency = 14.00 SEER, Required Efficiency = 13.00 SEER
Proposed Part Load Efficiency = 0.00 , Required Part Load Efficiency = 0.00
Fan System: RTU-05 -- Compliance (Motor nameplate HP and fan efficiency method) : Passes

Fans:
FAN 5 Supply, Constant Volume, 950 CFM, 0.5 motor nameplate hp

1 RTU-06 (Single Zone):
Heating: 1 each - Central Furnace, Electric, Capacity = 40 kBtu/h
No minimum efficiency requirement applies
Cooling: 1 each - Single Package DX Unit, Capacity = 36 kBtu/h, Air-Cooled Condenser
Proposed Efficiency = 14.00 SEER, Required Efficiency = 13.00 SEER
Proposed Part Load Efficiency = 0.00 , Required Part Load Efficiency = 0.00
Fan System: RTU-06 -- Compliance (Motor nameplate HP and fan efficiency method) : Passes

Fans:
FAN 6 Supply, Constant Volume, 800 CFM, 0.5 motor nameplate hp

1 RTU-07 (Single Zone):
Heating: 1 each - Central Furnace, Electric, Capacity = 40 kBtu/h
No minimum efficiency requirement applies
Cooling: 1 each - Single Package DX Unit, Capacity = 36 kBtu/h, Air-Cooled Condenser
Proposed Efficiency = 14.00 SEER, Required Efficiency = 13.00 SEER
Proposed Part Load Efficiency = 0.00 , Required Part Load Efficiency = 0.00
Fan System: RTU-07 -- Compliance (Motor nameplate HP and fan efficiency method) : Passes

Fans:
FAN 7 Supply, Constant Volume, 900 CFM, 0.5 motor nameplate hp

1 HVAC System (Single Zone):
Split System Heat Pump
Heating Mode: Capacity = 18 kBtu/h,
Proposed Efficiency = 13.00 HSPF, Required Efficiency = 7.70 HSPF
Cooling Mode: Capacity = 18 kBtu/h,
Proposed Efficiency = 20.00 SEER, Required Efficiency = 13.00 SEER
Proposed Part Load Efficiency = 0.00 , Required Part Load Efficiency = 0.00
Fan System: DS-01 -- Compliance (Motor nameplate HP and fan efficiency method) : Passes

Fans:
FAN 8 Supply, Constant Volume, 600 CFM, 0.1 motor nameplate hp

Mechanical Compliance Statement

Compliance Statement: The proposed mechanical design 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 90.1 (2010) Standard requirements in COM*check* Version COMcheckWeb and to comply with any applicable mandatory requirements listed in the Inspection Checklist.

Name - Title Signature Date

COM*check* Software Version COMcheckWeb
Inspection Checklist

Energy Code: 90.1 (2010) Standard

Requirements: 100.0% were addressed directly in the COM*check* 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
4.2.2,6.4.4.2.1,6.7.2 [PR2]^1	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.	☐Complies ☐Does Not ☐Not Observable ☐Not Applicable	Requirement will be met.
4.2.2,8.4.1.1,8.4.1.2,8.7 [PR6]^2	Plans, specifications, and/or calculations provide all information with which compliance can be determined for the electrical systems and equipment and document where exceptions are claimed. Feeder connectors sized in accordance with approved plans and branch circuits sized for maximum drop of 3%.	☐Complies ☐Does Not ☐Not Observable ☐Not Applicable	
6.7.2.4 [PR5]^1	Detailed instructions for HVAC systems commissioning included on the plans or specifications for projects >=50,000 ft2.	☐Complies ☐Does Not ☐Not Observable ☐Not Applicable	**Exception:** Requirement does not apply.

Additional Comments/Assumptions:

1	High Impact (Tier 1)	2	Medium Impact (Tier 2)	3	Low Impact (Tier 3)

Section # & Req.ID	Footing / Foundation Inspection	Complies?	Comments/Assumptions
6.4.3.8 [FO9]^3	Freeze protection and snow/ice melting system sensors for future connection to controls.	☐Complies ☐Does Not ☐Not Observable ☐Not Applicable	Requirement will be met.

Additional Comments/Assumptions:

1	High Impact (Tier 1)	2	Medium Impact (Tier 2)	3	Low Impact (Tier 3)

Section # & Req.ID	Mechanical Rough-In Inspection	Plans Verified Value	Field Verified Value	Complies?	Comments/Assumptions
6.4.1.4,6.4.1.5 [ME1]^2	HVAC equipment efficiency verified. Non-NAECA HVAC equipment labeled as meeting 90.1.	Efficiency:_____	Efficiency:_____	☐Complies ☐Does Not ☐Not Observable ☐Not Applicable	*See the Mechanical Systems list for values.*
6.4.3.4.1 [ME3]^3	Stair and elevator shaft vents have motorized dampers that automatically close.			☐Complies ☐Does Not ☐Not Observable ☐Not Applicable	**Exception:** Requirement does not apply.
6.4.3.4.2, 6.4.3.4.3 [ME4]^3	Outdoor air and exhaust systems have motorized dampers that automatically shut when not in use and meet maximum leakage rates. Check gravity dampers where allowed.			☐Complies ☐Does Not ☐Not Observable ☐Not Applicable	Requirement will be met.
6.4.3.4.5 [ME39]^3	Enclosed parking garage ventilation has automatic contaminant detection and capacity to stage or modulate fans to 50% or less of design capacity.			☐Complies ☐Does Not ☐Not Observable ☐Not Applicable	**Exception:** Requirement does not apply.
6.4.3.4.4 [ME5]^3	Ventilation fans >0.75 hp have automatic controls to shut off fan when not required.			☐Complies ☐Does Not ☐Not Observable ☐Not Applicable	Requirement will be met.
6.4.3.9 [ME6]^1	Demand control ventilation provided for spaces >500 ft2 and >40 people/1000 ft2 occupant density and served by systems with air side economizer, auto modulating outside air damper control, or design airflow >3,000 cfm.			☐Complies ☐Does Not ☐Not Observable ☐Not Applicable	**Exception:** Systems with a design outdoor airflow less than 1200 cfm.
6.4.3.10 [ME40]^2	Single zone HVAC systems with fan motors >=5 hp have variable airflow controls. Air conditioning equipment with a cooling capacity >=110,000 Btu/h has variable airflow controls.			☐Complies ☐Does Not ☐Not Observable ☐Not Applicable	**Exception:** Requirement does not apply. *See the Mechanical Systems list for values.*
6.4.3.10 [ME40]^2	Single zone HVAC systems with fan motors >=5 hp have variable airflow controls. Air conditioning equipment with a cooling capacity >=110,000 Btu/h has variable airflow controls.			☐Complies ☐Does Not ☐Not Observable ☐Not Applicable	**Exception:** Requirement does not apply. *See the Mechanical Systems list for values.*
6.4.3.10 [ME40]^2	Single zone HVAC systems with fan motors >=5 hp have variable airflow controls. Air conditioning equipment with a cooling capacity >=110,000 Btu/h has variable airflow controls.			☐Complies ☐Does Not ☐Not Observable ☐Not Applicable	**Exception:** Requirement does not apply. *See the Mechanical Systems list for values.*
6.4.3.10 [ME40]^2	Single zone HVAC systems with fan motors >=5 hp have variable airflow controls. Air conditioning equipment with a cooling capacity >=110,000 Btu/h has variable airflow controls.			☐Complies ☐Does Not ☐Not Observable ☐Not Applicable	**Exception:** Requirement does not apply. *See the Mechanical Systems list for values.*

1	High Impact (Tier 1)	2	Medium Impact (Tier 2)	3	Low Impact (Tier 3)

Section # & Req.ID	Mechanical Rough-In Inspection	Plans Verified Value	Field Verified Value	Complies?	Comments/Assumptions
6.4.3.10 [ME40]^2	Single zone HVAC systems with fan motors >=5 hp have variable airflow controls. Air conditioning equipment with a cooling capacity >=110,000 Btu/h has variable airflow controls.			☐Complies ☐Does Not ☐Not Observable ☐Not Applicable	**Exception:** Requirement does not apply. *See the Mechanical Systems list for values.*
6.4.3.10 [ME40]^2	Single zone HVAC systems with fan motors >=5 hp have variable airflow controls. Air conditioning equipment with a cooling capacity >=110,000 Btu/h has variable airflow controls.			☐Complies ☐Does Not ☐Not Observable ☐Not Applicable	**Exception:** Requirement does not apply. *See the Mechanical Systems list for values.*
6.4.3.10 [ME40]^2	Single zone HVAC systems with fan motors >=5 hp have variable airflow controls. Air conditioning equipment with a cooling capacity >=110,000 Btu/h has variable airflow controls.			☐Complies ☐Does Not ☐Not Observable ☐Not Applicable	**Exception:** Requirement does not apply. *See the Mechanical Systems list for values.*
6.4.3.10 [ME40]^2	Single zone HVAC systems with fan motors >=5 hp have variable airflow controls. Air conditioning equipment with a cooling capacity >=110,000 Btu/h has variable airflow controls.			☐Complies ☐Does Not ☐Not Observable ☐Not Applicable	**Exception:** Requirement does not apply. *See the Mechanical Systems list for values.*
6.4.4.1.1 [ME7]^3	Insulation exposed to weather protected from damage. Insulation outside of the conditioned space and associated with cooling systems is vapor retardant.			☐Complies ☐Does Not ☐Not Observable ☐Not Applicable	Requirement will be met.
6.4.4.1.2 [ME8]^2	HVAC ducts and plenums insulated. Where ducts or plenums are installed in or under a slab, verification may need to occur during Foundation Inspection.	R-_____	R-_____	☐Complies ☐Does Not ☐Not Observable ☐Not Applicable	Requirement will be met.
6.4.4.1.3 [ME9]^2	HVAC piping insulation thickness. Where piping is installed in or under a slab, verification may need to occur during Foundation Inspection.	_____ in.	_____ in.	☐Complies ☐Does Not ☐Not Observable ☐Not Applicable	Requirement will be met.
6.4.4.1.4 [ME41]^3	Thermally ineffective panel surfaces of sensible heating panels have insulation >= R-3.5.			☐Complies ☐Does Not ☐Not Observable ☐Not Applicable	Requirement will be met.
6.4.4.2.1 [ME10]^2	Ducts and plenums sealed based on static pressure and location.			☐Complies ☐Does Not ☐Not Observable ☐Not Applicable	Requirement will be met.
6.4.4.2.2 [ME11]^3	Ductwork operating >3 in. water column requires air leakage testing.			☐Complies ☐Does Not ☐Not Observable ☐Not Applicable	**Exception:** Requirement does not apply.
6.4.4.2.2 [ME11]^3	Ductwork operating >3 in. water column requires air leakage testing.			☐Complies ☐Does Not ☐Not Observable ☐Not Applicable	**Exception:** Requirement does not apply.

1	High Impact (Tier 1)	2	Medium Impact (Tier 2)	3	Low Impact (Tier 3)

Section # & Req.ID	Mechanical Rough-In Inspection	Plans Verified Value	Field Verified Value	Complies?	Comments/Assumptions
6.4.4.2.2 [ME11]^3	Ductwork operating >3 in. water column requires air leakage testing.			☐Complies ☐Does Not ☐Not Observable ☐Not Applicable	**Exception:** Requirement does not apply.
6.4.4.2.2 [ME11]^3	Ductwork operating >3 in. water column requires air leakage testing.			☐Complies ☐Does Not ☐Not Observable ☐Not Applicable	**Exception:** Requirement does not apply.
6.4.4.2.2 [ME11]^3	Ductwork operating >3 in. water column requires air leakage testing.			☐Complies ☐Does Not ☐Not Observable ☐Not Applicable	**Exception:** Requirement does not apply.
6.4.4.2.2 [ME11]^3	Ductwork operating >3 in. water column requires air leakage testing.			☐Complies ☐Does Not ☐Not Observable ☐Not Applicable	**Exception:** Requirement does not apply.
6.4.4.2.2 [ME11]^3	Ductwork operating >3 in. water column requires air leakage testing.			☐Complies ☐Does Not ☐Not Observable ☐Not Applicable	**Exception:** Requirement does not apply.
6.4.4.2.2 [ME11]^3	Ductwork operating >3 in. water column requires air leakage testing.			☐Complies ☐Does Not ☐Not Observable ☐Not Applicable	**Exception:** Requirement does not apply.
6.5.1,6.5.1.1,6.5.1.3 [ME12]^1	Air economizers provided where required, meet the requirements for design capacity, control signal, ventilation controls, high-limit shut-off, integrated economizer control, and provide a means to relieve excess outside air during operation.			☐Complies ☐Does Not ☐Not Observable ☐Not Applicable	
6.5.2.3 [ME19]^3	Dehumidification controls provided to prevent reheating, recooling, mixing of hot and cold airstreams or concurrent heating and cooling of the same airstream.			☐Complies ☐Does Not ☐Not Observable ☐Not Applicable	Requirement will be met.
6.5.3.3 [ME42]^3	Multiple zone VAV systems with DDC of individual zone boxes have static pressure setpoint reset controls.			☐Complies ☐Does Not ☐Not Observable ☐Not Applicable	**Exception:** Requirement does not apply. *See the Mechanical Systems list for values.*
6.5.3.3 [ME42]^3	Multiple zone VAV systems with DDC of individual zone boxes have static pressure setpoint reset controls.			☐Complies ☐Does Not ☐Not Observable ☐Not Applicable	**Exception:** Requirement does not apply. *See the Mechanical Systems list for values.*
6.5.3.3 [ME42]^3	Multiple zone VAV systems with DDC of individual zone boxes have static pressure setpoint reset controls.			☐Complies ☐Does Not ☐Not Observable ☐Not Applicable	**Exception:** Requirement does not apply. *See the Mechanical Systems list for values.*
6.5.3.3 [ME42]^3	Multiple zone VAV systems with DDC of individual zone boxes have static pressure setpoint reset controls.			☐Complies ☐Does Not ☐Not Observable ☐Not Applicable	**Exception:** Requirement does not apply. *See the Mechanical Systems list for values.*

1	High Impact (Tier 1)	2	Medium Impact (Tier 2)	3	Low Impact (Tier 3)

Section # & Req.ID	Mechanical Rough-In Inspection	Plans Verified Value	Field Verified Value	Complies?	Comments/Assumptions
6.5.3.3 [ME42]^3	Multiple zone VAV systems with DDC of individual zone boxes have static pressure setpoint reset controls.			☐Complies ☐Does Not ☐Not Observable ☐Not Applicable	**Exception:** Requirement does not apply. *See the Mechanical Systems list for values.*
6.5.3.3 [ME42]^3	Multiple zone VAV systems with DDC of individual zone boxes have static pressure setpoint reset controls.			☐Complies ☐Does Not ☐Not Observable ☐Not Applicable	**Exception:** Requirement does not apply. *See the Mechanical Systems list for values.*
6.5.3.3 [ME42]^3	Multiple zone VAV systems with DDC of individual zone boxes have static pressure setpoint reset controls.			☐Complies ☐Does Not ☐Not Observable ☐Not Applicable	**Exception:** Requirement does not apply. *See the Mechanical Systems list for values.*
6.5.3.3 [ME42]^3	Multiple zone VAV systems with DDC of individual zone boxes have static pressure setpoint reset controls.			☐Complies ☐Does Not ☐Not Observable ☐Not Applicable	**Exception:** Requirement does not apply. *See the Mechanical Systems list for values.*
6.5.4.1 [ME25]^3	HVAC pumping systems >10 hp designed for variable fluid flow.			☐Complies ☐Does Not ☐Not Observable ☐Not Applicable	Requirement will be met.
6.5.6.1 [ME56]^1	Exhaust air energy recovery on systems meeting Table 6.5.6.1.			☐Complies ☐Does Not ☐Not Observable ☐Not Applicable	Requirement will be met.
6.5.7.1.1 [ME32]^2	Kitchen hoods >5,000 cfm have make up air >=50% of exhaust air volume.			☐Complies ☐Does Not ☐Not Observable ☐Not Applicable	**Exception:** Requirement does not apply.
6.5.7.1.2 [ME46]^3	Conditioned supply air to space with a kitchen hood shall not exceed the greater of a) supply flow required to meet space heating or cooling, or b) hood exhaust flow minus the available air transfer from available spaces.			☐Complies ☐Does Not ☐Not Observable ☐Not Applicable	**Exception:** Requirement does not apply.
6.5.7.1.2 [ME46]^3	Conditioned supply air to space with a kitchen hood shall not exceed the greater of a) supply flow required to meet space heating or cooling, or b) hood exhaust flow minus the available air transfer from available spaces.			☐Complies ☐Does Not ☐Not Observable ☐Not Applicable	**Exception:** Requirement does not apply.
6.5.7.1.2 [ME46]^3	Conditioned supply air to space with a kitchen hood shall not exceed the greater of a) supply flow required to meet space heating or cooling, or b) hood exhaust flow minus the available air transfer from available spaces.			☐Complies ☐Does Not ☐Not Observable ☐Not Applicable	**Exception:** Requirement does not apply.

1	High Impact (Tier 1)	2	Medium Impact (Tier 2)	3	Low Impact (Tier 3)

Section # & Req.ID	Mechanical Rough-In Inspection	Plans Verified Value	Field Verified Value	Complies?	Comments/Assumptions
6.5.7.1.2 [ME46]^3	Conditioned supply air to space with a kitchen hood shall not exceed the greater of a) supply flow required to meet space heating or cooling, or b) hood exhaust flow minus the available air transfer from available spaces.			☐Complies ☐Does Not ☐Not Observable ☐Not Applicable	**Exception:** Requirement does not apply.
6.5.7.1.2 [ME46]^3	Conditioned supply air to space with a kitchen hood shall not exceed the greater of a) supply flow required to meet space heating or cooling, or b) hood exhaust flow minus the available air transfer from available spaces.			☐Complies ☐Does Not ☐Not Observable ☐Not Applicable	**Exception:** Requirement does not apply.
6.5.7.1.2 [ME46]^3	Conditioned supply air to space with a kitchen hood shall not exceed the greater of a) supply flow required to meet space heating or cooling, or b) hood exhaust flow minus the available air transfer from available spaces.			☐Complies ☐Does Not ☐Not Observable ☐Not Applicable	**Exception:** Requirement does not apply.
6.5.7.1.2 [ME46]^3	Conditioned supply air to space with a kitchen hood shall not exceed the greater of a) supply flow required to meet space heating or cooling, or b) hood exhaust flow minus the available air transfer from available spaces.			☐Complies ☐Does Not ☐Not Observable ☐Not Applicable	**Exception:** Requirement does not apply.
6.5.7.1.2 [ME46]^3	Conditioned supply air to space with a kitchen hood shall not exceed the greater of a) supply flow required to meet space heating or cooling, or b) hood exhaust flow minus the available air transfer from available spaces.			☐Complies ☐Does Not ☐Not Observable ☐Not Applicable	**Exception:** Requirement does not apply.
6.5.7.1.5 [ME49]^3	Approved field test used to evaluate design air flow rates and demonstrate proper capture and containment of kitchen exhaust systems.			☐Complies ☐Does Not ☐Not Observable ☐Not Applicable	**Exception:** Requirement does not apply.
6.5.7.2 [ME33]^1	Fume hoods exhaust systems >=15,000 cfm have VAV hood exhaust and supply systems, direct make-up air or heat recovery.			☐Complies ☐Does Not ☐Not Observable ☐Not Applicable	**Exception:** Requirement does not apply.
6.5.8.1 [ME34]^2	Unenclosed spaces that are heated use only radiant heat.			☐Complies ☐Does Not ☐Not Observable ☐Not Applicable	**Exception:** Requirement does not apply.
6.5.9 [ME35]^1	Hot gas bypass limited to: <=240 kBtu/h – 50% >240 kBtu/h – 25%			☐Complies ☐Does Not ☐Not Observable ☐Not Applicable	Requirement will be met.
6.5.9 [ME35]^1	Hot gas bypass limited to: <=240 kBtu/h – 50% >240 kBtu/h – 25%			☐Complies ☐Does Not ☐Not Observable ☐Not Applicable	Requirement will be met.

1	High Impact (Tier 1)	2	Medium Impact (Tier 2)	3	Low Impact (Tier 3)

Section # & Req.ID	Mechanical Rough-In Inspection	Plans Verified Value	Field Verified Value	Complies?	Comments/Assumptions
6.5.9 [ME35]^1	Hot gas bypass limited to: <=240 kBtu/h – 50% >240 kBtu/h – 25%			☐Complies ☐Does Not ☐Not Observable ☐Not Applicable	Requirement will be met.
6.5.9 [ME35]^1	Hot gas bypass limited to: <=240 kBtu/h – 50% >240 kBtu/h – 25%			☐Complies ☐Does Not ☐Not Observable ☐Not Applicable	Requirement will be met.
6.5.9 [ME35]^1	Hot gas bypass limited to: <=240 kBtu/h – 50% >240 kBtu/h – 25%			☐Complies ☐Does Not ☐Not Observable ☐Not Applicable	Requirement will be met.
6.5.9 [ME35]^1	Hot gas bypass limited to: <=240 kBtu/h – 50% >240 kBtu/h – 25%			☐Complies ☐Does Not ☐Not Observable ☐Not Applicable	Requirement will be met.
6.5.9 [ME35]^1	Hot gas bypass limited to: <=240 kBtu/h – 50% >240 kBtu/h – 25%			☐Complies ☐Does Not ☐Not Observable ☐Not Applicable	Requirement will be met.

Additional Comments/Assumptions:

1	High Impact (Tier 1)	2	Medium Impact (Tier 2)	3	Low Impact (Tier 3)

Section # & Req.ID	Rough-In Electrical Inspection	Complies?	Comments/Assumptions
8.4.2 [EL10]^2	At least 50% of all 125 volt 15- and 20-Amp receptacles are controlled by an automatic control device.	☐Complies ☐Does Not ☐Not Observable ☐Not Applicable	
10.4.1 [EL9]^2	Electric motors meet requirements where applicable.	☐Complies ☐Does Not ☐Not Observable ☐Not Applicable	Requirement will be met.

Additional Comments/Assumptions:

1	High Impact (Tier 1)	2	Medium Impact (Tier 2)	3	Low Impact (Tier 3)

Section # & Req.ID	Final Inspection	Complies?	Comments/Assumptions
6.4.3.1.2 [FI3]^3	Thermostatic controls have a 5 °F deadband.	☐Complies ☐Does Not ☐Not Observable ☐Not Applicable	Requirement will be met.
6.4.3.2 [FI20]^3	Temperature controls have setpoint overlap restrictions.	☐Complies ☐Does Not ☐Not Observable ☐Not Applicable	Requirement will be met.
6.4.3.3.1 [FI21]^3	HVAC systems equipped with at least one automatic shutdown control.	☐Complies ☐Does Not ☐Not Observable ☐Not Applicable	Requirement will be met.
6.4.3.3.2 [FI22]^3	Setback controls allow automatic restart and temporary operation as required for maintenance.	☐Complies ☐Does Not ☐Not Observable ☐Not Applicable	Requirement will be met.
6.4.3.5 [FI5]^3	Heat pump controls prevent supplemental electric resistance heat from coming on when not needed.	☐Complies ☐Does Not ☐Not Observable ☐Not Applicable	Requirement will be met.
6.4.3.7 [FI6]^3	When humidification and dehumidification are provided to a zone, simultaneous operation is prohibited.	☐Complies ☐Does Not ☐Not Observable ☐Not Applicable	Requirement will be met.
6.7.2.1 [FI7]^3	Furnished HVAC as-built drawings submitted within 90 days of system acceptance.	☐Complies ☐Does Not ☐Not Observable ☐Not Applicable	Requirement will be met.
6.7.2.2 [FI8]^3	Furnished O&M manuals for HVAC systems within 90 days of system acceptance.	☐Complies ☐Does Not ☐Not Observable ☐Not Applicable	Requirement will be met.
6.7.2.3 [FI9]^1	An air and/or hydronic system balancing report is provided for HVAC systems serving zones >5,000 ft2 of conditioned area.	☐Complies ☐Does Not ☐Not Observable ☐Not Applicable	Requirement will be met.
6.7.2.4 [FI10]^1	HVAC control systems have been tested to ensure proper operation, calibration and adjustment of controls.	☐Complies ☐Does Not ☐Not Observable ☐Not Applicable	Requirement will be met.
10.4.3 [FI24]^2	Elevators are designed with the proper lighting, ventilation power, and standby mode.	☐Complies ☐Does Not ☐Not Observable ☐Not Applicable	**Exception:** Requirement does not apply.

Additional Comments/Assumptions:

1	High Impact (Tier 1)	2	Medium Impact (Tier 2)	3	Low Impact (Tier 3)

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RCF INTERIOR OFFICE EXPANSION

6454 CENTRE PARK DRIVE
WEST CHESTER, OHIO 45069

STATE OF OHIO
KRIS T. SCHNITGEN
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REGISTERED PROFESSIONAL ENGINEER
3/29/2023

REVISIONS

DWN: CCR CHK: RAL
DATE: 03/21/2023
PROJECT #: RCT01.11

MECHANICAL - ENERGY COMPLIANCE

M8-801

1" REFERENCE
KLH PROJECT #
24470

3/29/2023 5:06:42 24470.00-23-MEP-RCF Office Expansion HVAC & Plbg - PROMO_detached.rvt

3/29/2023 5:06:48 24470.00-23-MEP-RCF Office Expansion HVAC & Plbg - PROMO_detached.rvt

M8-802

1" REFERENCE
KLH PROJECT #
24470

MECHANICAL - ENERGY COMPLIANCE

PROJECT #: RCT01.11

DATE: 03/21/2023

DWN: CCR CHK: RAL

REVISIONS

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OWNERSHIP OF INSTRUMENTS OF SERVICE
All reports, plans, specifications, computer files, field data, notes and other documents and instruments prepared by the Consultant as instruments of service shall remain the property of the Consultant. The Consultant shall retain all common law, statutory and other reserved rights, including, without limitation, the copyright thereto.

SECTION 23 05 01.00 – COMMON REQUIREMENTS FOR HVAC

General
General Provisions of the Contract including General and Supplementary Conditions and General Requirements apply to work of this section.
Scope
The base bid includes furnishing all materials, labor, tools, and equipment and the performance of all work required to install a complete heating and air conditioning system as outlined herein.
Guarantee
The contractor shall provide a guarantee in written form stating that all work under this section shall be free of defective work, materials, or parts for a period of one year from the date of owner's final acceptance and shall repair, revise or replace at no cost to the owner any such defects occurring within the guarantee period. Contractor shall also state in written form that any items or occurrences arising during the guarantee period will be attended to in a timely manner and will in no case exceed four (4) working days from date of notification by owner.
Quality Assurance
Provide a complete installation in conformance with the following standards.
ASHRAE: American Society of Heating, Refrigerating and Air Conditioning Engineers
NFPA: National Fire Protection Association
SMACNA: Sheet Metal and Air Conditioning Contractors National Association.
Statewide Building Code
IMC: International Mechanical Code
Permits, Fees, Inspections, Laws and Regulations
Permits and fees of every nature required in connection with this work shall be obtained and paid for by this contractor who shall also pay for all the installation fees and similar charges. Laws and regulations, which bear upon or affect the various branches of this work shall be complied with by this contractor and are hereby made a part of this contract. All work, which such laws require to be inspected, shall be submitted to the proper public official for inspection and a certificate of final approval must be furnished.
Work in Existing Spaces
General: Care shall be taken when working in existing spaces so as not to damage existing walls and ceilings where work is being performed.
Ceilings: Where work is being performed above ceilings, and the architectural drawings do not indicate ceiling modifications by the general contractor, it shall be the responsibility of this contractor to remove and replace existing ceilings where work is being performed. In those instances, all repair and installation of new grid, ceiling panels, etc shall be the responsibility of this contractor.
Match existing finishes.
Walls & Floors: It shall be the responsibility of this contractor to patch existing walls and floors and match existing finishes where work is being removed or installed and patching is being performed, unless noted otherwise on the architectural drawings.
Demolition
Any Equipment to be demolished shall also include the demolition of any and all ductwork, piping etc serving or served by the equipment, all accessories, air devices, wiring, gas piping, venting, control wiring and power wiring associated with the equipment.
Demolition shall be coordinated with all trades. All materials shall be turned over to the owner or disposed at the owner’s direction.
Contractor is responsible for reclaiming any refrigerant in association with the demolition in accordance with all local, state and federal regulations.
Any roof or wall penetration shall be patched watertight to the satisfaction of the architect.
Tests and Adjustments
No ducts, piping, fixtures or equipment shall be concealed or covered until they have been inspected and approved by the Architect and the inspector who shall be notified by the contractor when the work is ready for inspection.
Work shall be completely installed, tested and leak tight before inspection is required. All tests shall be repeated to the satisfaction of those making the inspection.
Architectural coordination items
Cutting and Patching: Cut and drill all openings in walls and floors required for the installation. Secure approval of Engineer before cutting and drilling. Neatly patch all openings cut.
Fire Caulking: Patching through fire rated walls and enclosures shall not diminish the rating of that wall or enclosure. Patch shall be equal to rockwool, firestop, caulk or approved "rated" patch.
Access Panels and Pathways: Furnish all access panels required for proper servicing of equipment. Provide access panels for all concealed valves, vents, controls, cleanout doors, and sprinkler devices required by NFPA. Provide access panels for all fire and/or fire & smoke dampers. Provide frame as required for finish. Furnish panels to General Contractor. Exact locations to be approved by the Architect. Minimum size to be 12" x 12", units to be 16 gauge steel, locking device shall be screwdriver cam locks.
project conditions
Where new HVAC systems are required to be connected to existing HVAC systems, it is the contractor’s responsibility to verify the location, size, pressure, condition, and they shall verify that the existing HVAC system is indeed the correct and appropriate HVAC system before any work is done. Provide all necessary camera scoping and dye testing as necessary. If there is any need for concern, if it is determined that the existing HVAC system is not a correct or appropriate HVAC system or not connected to a correct or appropriate HVAC system, if the condition of the existing HVAC system is not viable for re-use, or any other condition that would not allow the proper functioning of the new HVAC system, the contractor shall notify the engineer in writing immediately via RFI and wait for direction before proceeding.
Interruption of Existing HVAC Services: Do not interrupt service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary service according to requirements indicated:
Notify, Architect, Construction Manager, and Owner no fewer than seven days in advance of proposed interruption of service.
Do not proceed with interruption of service without Architect's written permission.
DELEGATED DESIGN
For equipment supports, this contractor shall retain a qualified professional engineer to provide support calculations of static and dynamic loading due to operating equipment weight. The signed and sealed calculations and details shall be submitted by the retained professional engineer.
MECHANICAL EQUIPMENT COMMON REQUIREMENTS
INSPECTION
Examine areas and conditions under which mechanical equipment is to be installed. Do not proceed with work until unsatisfactory conditions have been corrected in manner acceptable to Installer.
Uncrate equipment and inspect for damage. Verify that nameplate data corresponds with unit designation.
INSTALLATION
General: Install mechanical equipment as indicated, and in accordance with manufacturer's installation instructions.
Location: Install each unit level/plum and accurately in position indicated in relation to other work; and maintain sufficient clearance for normal service and maintenance, but in no case less than that recommended by manufacturer.
Coordinate with other trades to assure correct recess size for recessed units.
Protect interior mechanical equipment with protective covers during balance of construction.
For ducted equipment, connect ductwork to units with flexible duct connections. Provide transitions to exactly match unit duct connection size. Provide 1" acoustic duct lining on return air side a minimum of 10' from fan.
Piping: Restrictors or piping changes shall be made as necessary to achieve manufacturers recommended pressure drops. The findings shall be reported to the engineer at project closeout.
Provide trap at drain piping connection to unit sized per manufacturer’s recommendations.
Access: Provide access space around and over mechanical equipment for service as indicated, but in no case less than that recommended by manufacturer or required by code in effect.
Access Panels: Furnish all access panels required for proper servicing of equipment. Provide access panels for all concealed valves, vents, controls and cleanout doors, and sprinkler devices required by NFPA. Provide frame as required for finish. Furnish panels to General Contractor. Exact locations to be approved by the Architect. Minimum size to be 12" x 12", units to be 16 gauge steel, locking device shall be screwdriver cam locks.
Rooftop mechanical equipment shall be installed a minimum of 10'-0” from any roof edge regardless of location indicated on plans, unless a screen wall or railing is installed per the local building code. See the architectural plans for coordination.
Roof Curbs: Furnish roof curbs to roofing Installer for installation. Install and secure roof curb to roof structure, in accordance with National Roofing Contractor's Association (NRCA) installation recommendations and shop drawings. Install and secure units on curbs and coordinate roof penetrations and flashing. Install according to roofing manufacturer’s recommendation and specifications.
Rooftop supports: Provide rooftop equipment rails for mechanical equipment located on the roof that spans two or more bar joists. Verify roof structure, mounting supports, and membrane installations are completed to the proper point to allow installation of roof mounted units.
Indoor Suspended Equipment: Install suspended from structure with all threaded rod and vibration isolators.
ELECTRICAL COORDINATION ITEMS
Electrical Wiring: Install electrical devices furnished by manufacturer but not specified to be factory-mounted. Furnish copy of manufacturer's wiring diagram submittal to Electrical Installer.
Verify that electrical wiring installation is in accordance with manufacturer's submittal and installation requirements of Division 26 sections. Do not proceed with equipment start-up until wiring installation is acceptable to equipment installer.
Install electric heating terminal units including components in accordance with equipment manufacturer's written instructions, and with recognized industry practices; complying with applicable installation requirements of NEC and NECA's "Standard of Installation".
Tighten connectors and terminals, including screws and bolts, in accordance with equipment manufacturer's published torque tightening values for equipment connectors. Where manufacturer's torquing requirements are not indicated, tighten connectors and terminals to comply with tightening torques specified in UL Std 486A.
Grounding: Provide equipment grounding connections for electric heating terminals as indicated. Tighten connections to comply with tightening torque values specified in UL Std 486A to assure permanent and effective grounding.
FIELD QUALITY CONTROL
Testing: After installation has been completed, test to demonstrate proper operation of mechanical equipment at performance requirements specified. When possible, field correct malfunctioning units, then retest to demonstrate compliance. Replace units, which cannot be satisfactorily corrected. Test controls and demonstrate compliance with requirements.
Cleaning: After construction is completed, including painting, clean unit exposed surfaces, vacuum clean coils and inside of cabinets. Clean factory-finished surfaces. Repair any marred or scratched surfaces with manufacturer's touch-up paint.
START-UP
Provide the services of a factory-authorized service representative to start-up rooftop units, in accordance with manufacturer's written start-up instructions. Test controls and demonstrate compliance with requirements. Replace damaged or malfunctioning controls and equipment.
TRAINING OF OWNER’S PERSONNEL
Provide services of manufacturer's technical representative for 1-half day to instruct Owner's personnel in operation and maintenance of units. Schedule training with Owner, provide at least 7-day notice to Contractor and Engineer of training date.
SPARE PARTS
Provide one complete extra set of filters for each unit. Install new filters at completion of system work, and prior to testing, adjusting, and balancing work. Obtain receipt from Owner that new filters have been installed.

SECTION 23 05 03.00 – SUBMITTALS FOR HVAC

General
Where submittals are required by the Contract Documents, they shall be prepared and supplied in accordance with the Contract Documents. In addition to Division 01, the Contractor is advised to review and comply with the requirements articulated within each Division and within each section of that Division.
Some Divisions may include a division-specific “Submittal Requirements for ….” section. Where this section exists, it articulates additional requirements for submittals that apply to the work of that Division.
The following requirements help to identify, track and keep the project organized for all parties involved. They are necessary to ensure a timely turnaround and an appropriate technical review. Submittals that do not conform to the administrative requirements are rejected and returned, without technical review.
Requirements
Supply submittals for each section: Submittals shall be supplied on a section-by-section and type-by-type basis. For example, independent product data submittals shall be furnished for each section that requires product data submittals. Independent shop drawing submittals shall be furnished for each section that requires shop drawings. Refer to the specifications for identification of which submittals are required for the project. Separate PDF file packages shall be supplied for each section, for each submittal type, where electronic submittals are required. Each PDF shall represent a single standalone submittal. Separately bound and identified submittals shall be provided where hardcopies are required.
Include a transmittal: Transmittals shall enumerate each submittal for each section of each type and iteration.
Include cover sheet / title page: The cover sheet shall include the information identified in the contract documents. It shall be included as the first page of each electronic and/or hardcopy document-based submittal. An editable and printable PDF form created with editable fields and specification compliant appearance is available from KLH upon request. It is also downloadable from the KLH website at www.klhengrs.com.
Include an index: The index shall enumerate the contents of the submittal.
Include checklists: Where checklists are included with the specifications, complete and include them within the appropriate submittal. Supply complete submittals:
Complete submittals of each type are required. Partial submittals will be rejected. Where a section requires a product data submittal, all product data for that section shall be supplied together, at one time, as one complete submittal. Do not send half the product data as one submittal and the other half as a separate one. When resubmittal is required (e.g. Revise and Resubmit) the revised submittal shall be more complete, more accurate and more contract-compliant than its rejected predecessor. The submittal number (for each section and type) shall increment for each subsequent submittal (00 – Original submission, 01 – First Resubmission, 02 – Second Resubmission, etc…). Resubmittals shall include a copy of the reviewer’s comments supplied with the prior submittal rejection and shall be amended with a description of the specific action taken to comply with the reviewer’s comments. The absence of this on resubmittal is cause for rejection.
Name electronic files to match the submittal ID and cover sheet: The electronic file name of submittals shall match the submittal ID included on the submittals cover page. For example: The original/first product data submittal for Section 234116 would be labeled as “234116.00-PD-00”; the first resubmittal of same shall be labeled “234116.00-PD-01”. The original/first shop drawings submittal file for the same section would be labeled “234116.00-SD-00”; the first resubmittal of same shall be labeled “234116.00-SD-01”.

Use of Electronic Drawings from the Owner’s Design Team
Plan drawings for the Project were created with AutoCAD and Revit.
If expressly permitted by the Owner and the terms of the Contract, editable electronic versions of standard-scale, AutoCAD-based plan drawings may be made available for the creation of shop and as-built drawings.
Upon request when available, electronic versions of standard-scale, Navisworks (.dwf) and (.nwc) or AutoCAD 36 (.dwg) files may be made available for coordination purposes.
Due to the proprietary nature of internal design systems, editable native-software versions of some drawings, including but not limited to system diagrams and details will not be made available in an editable form. In these cases, electronic versions of the drawings may be made available only in PDF, JPG or similar non-editable electronic form, at the sole discretion of the Design Professional.
The Request Drawings form can be accessed, filled out and submitted at the following internet address (scroll down to bottom of home page): http://www.klhengrs.com.

SECTION 23 05 29.00 – HANGERS AND SUPPORTS FOR HVAC PIPING AND EQUIPMENT

Submittal Requirements
Product Data: For each type of product indicated.
Shop Drawings: Fabrication and installation details.

General
Support all piping, ductwork and equipment by hangers or brackets properly from the building structure. Support from decking above is prohibited. Furnish structural steel members where required to support piping and equipment. No portion of piping or valves shall be supported by equipment.
Ductwork - Support by means of hangers as follows:

Duct Width	Hanger Size and Type	Max. Spacing
30 or less	(#16 gage)	8

A pair of hangers shall be located at every transverse joint and elsewhere according to the table.
Piping
Install hangers, supports, clamps and attachments to support piping properly from building structure. Arrange for grouping of parallel runs of horizontal piping supported together on field-fabricated, heavy-duty trapeze hangers where possible. Where piping of various sizes is supported together by trapeze hangers, space hangers for smallest pipe size or install intermediate supports for smaller diameter pipe as specified above for individual pipe hangers.
Individual pipe hangers to be Anvil International Clevis Hanger Fig. 260, Elcen, or approved equal.
Rod sizes to conform to the following: 3/8" rods for 3/4"-2" pipe; 1/2" rods for 2-1/2"-3" pipe; 5/8" for 4"-5" pipe and 3/4" for 6" pipe.
Hangers shall be sized to allow insulation to pass through unobstructed, provide saddle support for insulation at all hanger.
Hanger spacing for steel piping unless otherwise noted is to be as follows: 1-1/4" or smaller to be 8' on center; 1-1/2"-2" to be 10' on center; 2-1/2" and larger to be 12' on center and at each change of direction. Hanger spacing for copper pipe to be as follows: 1" or smaller 6' on center; 1-1/4" or larger 8' on center.
Piping shall be also supported at each change in direction, at valves, and at equipment.

SECTION 23 05 93.00 – TESTING, ADJUSTING AND BALANCING FOR HVAC

Submittal Requirements
Shop Drawings: Certified Reports: Submit testing, adjusting, and balancing reports bearing the seal and signature of the Test and Balance Engineer. The reports shall be certified proof that the systems have been tested, adjusted, and balanced in accordance with the referenced standards; are an accurate representation of how the systems have been installed; are a true representation of how the systems are operating at the completion of the testing, adjusting, and balancing procedures; and are an accurate record of all final quantities measured, to establish normal operating values of the systems. Final Report: Upon verification and approval prepare final reports, type written, and organized and formatted as specified below. Submit 2 complete sets of final report to the landlord.

General
Test, adjust, and balance the following mechanical systems:
Supply air systems, all pressure ranges
Return air systems.
Exhaust air systems.
Test systems for proper sound and vibration levels.
Quality Assurance
Codes and Standards:
AABC: "National Standards for Total System Balance".
ASHRAE: ASHRAE Handbook, 2011 Applications, Chapter 38, Testing, Adjusting, and Balancing.
Qualifications
The contractor shall procure the services of an independent Balance and Testing Agency, approved by the Engineer, and a member of Associated Air Balance Council (AABC) or NEBB, which specializes in the balancing and testing of heating, ventilating and air conditioning systems, to balance, adjust and test all air and water systems and equipment as herein specified. All work by this agency shall be done under direct supervision of a qualified heating and ventilating Engineer employed by this agency. All instruments used by this agency shall be accurately calibrated and maintained in good working order.
Sequencing and Scheduling
Test, adjust, and balance the air systems before hydronic, steam, and refrigerant systems.
Test, adjust and balance air conditioning systems during summer season and heating systems during winter season, including at least a period of operation at outside conditions within 5 deg F wet bulb temperature of maximum summer design condition, and within 10 deg F dry bulb temperature of minimum winter design condition. Take final temperature readings during seasonal operation.
Check all filters for cleanliness, provide new as required.
Check dampers (volume and fire) for correct and locked position, and temperature control for completeness of installation before starting fans. Place outlet dampers in full open position. Lubricate all motors and bearings.
Check fan belt tension. Check fan rotation.
Air balance and testing shall not begin until the system has been completed and is in full working order. The Contractor shall put all heating, ventilating and air conditioning systems and equipment into full operation and shall continue the operation of same during each working day of testing and balancing. The contractor shall submit within 30 days after receipt of contract, 8 copies of submittal data for the testing and balancing of the air conditioning, heating, and ventilating systems. The Air Balance and Testing Agency shall provide proof of having successfully completed at least five projects of similar size and scope.
The air balancing contractor shall include the additional cost to change every fan factory installed sheave, pulley and/or belt of in order to obtain the design air flows.
Performing Testing, Adjusting and Balancing
Perform testing and balancing procedures on each system identified, in accordance with the detailed procedures outlined in the referenced standards.
Cut insulation, ductwork, and piping for installation of test probes to the minimum extent necessary to allow adequate performance of procedures.
Patch insulation, ductwork, and housings, using materials identical to those removed.
Seal ducts and piping, and test for and repair leaks.
Seal insulation to re-establish integrity of the vapor barrier.
Mark equipment settings, including damper control positions; valve indicators, fan speed control levers, and similar controls and devices, to show final settings. Mark with paint or other suitable, permanent identification materials.
Retest, adjust, and balance systems subsequent to significant system modifications, and resubmit test results.

SECTION 23 07 13.00 – DUCT INSULATION

Submittal Requirements
Product Data: For each product indicated.
Shop Drawings: Include plans, elevations, sections, details and attachments to other work.

All liners, insulation and adhesives shall have a flame spread index not more than 25 and a smoke developed index of not more than 50. Insulation shall have a minimum installed thermal resistance value of R6 or code minimum, whichever higher.
Rigid Fiberglass Ductwork Insulation: Glass fibers bonded with a thermosetting resin. Comply with ASTM C 612, Type IB, without facing and with vapor barrier all-service jacket manufactured from kraft paper, reinforcing scrim, aluminum foil, and vinyl film.
Flexible Fiberglass Ductwork Insulation: Glass fibers bonded with a thermosetting resin. Comply with ASTM C 553, Type II, without facing and with vapor barrier all-service jacket manufactured from kraft paper, reinforcing scrim, aluminum foil, and vinyl film.
Vapor Barrier Material for Ductwork: Paper-backed aluminum-foil, except as otherwise indicated; strength and permeability rating equivalent to factory-applied vapor barriers on adjoining ductwork insulation, where available; with following additional construction characteristics:
High Puncture Resistance: Low vapor transmission (for ducts in exposed areas: Mech. Rooms, etc.)
Moderate Puncture Resistance: Medium vapor transmission (for ducts in concealed areas).
All ductwork shall be insulated except:
Double wall ductwork
Fabric ductwork
Metal ducts with duct liner of sufficient thickness to comply with energy code.
Factory insulated flexible ductwork
Factory insulated plenums and casings
Flexible connectors
Vibration control devices
Factory insulated access panels and doors
Supply ductwork exposed in conditioned spaces excluding mechanical rooms, server rooms and electric equipment rooms
Toilet exhaust, general exhaust and return ductwork in an insulated joist or attic space.
Exterior (outdoor) Ductwork Insulation:
Externally wrapped, rigid. Provide field-applied aluminum service jacketing system (including adhesives, corners, etc... for proper installation) around insulation wrap, 0.016 inch thick.
Aluminum service jacketing may be omitted if the exterior ductwork is internally lined.
Exterior (outdoor) ductwork insulation shall have a minimum installed thermal re-sistance value of R8 or code minimum, whichever higher, and Flame-spread/smoke-developed index of 75/150 or less.
Installation:
All exterior ducts shall have no dips or pockets to collect rainwater.
All outdoor ductwork shall be sloped minimum of 1/8” per foot away from equipment for rain or snow drainage.
Provide insulation continuously through assembly penetrations.
Seal penetrations and jacket to flashing with flashing sealant.
Install service jacket with 2-inch overlap at longitudinal seams and end joints. Overlap longitudinal seams arranged to shed water. Seal end joints with weatherproof sealant recommended by insulation manufacturer. Secure jacket with stainless-steel bands 12 inches o.c. and at end joints.
Factory fabricated and insulated ductwork systems equal to Theramduct may be used in lieu of externally wrapping and jacketing exterior ductwork.

SECTION 23 07 19.00 – HVAC PIPING INSULATION

Submittal Requirements
Product Data: For each type of product indicated.

Provide 3/4" Armaflex on refrigerant piping.
Provide 1” fiberglass insulation on concealed condensate drain piping.
Insulation shall have a minimum thickness as required by Code.
All insulation and adhesives shall have a flame spread index not more than 25 and a smoke developed index of not more than 50.

SECTION 23 09 93.00 – SEQUENCE OF OPERATIONS FOR HVAC CONTROLS

Submittal Requirements
Product Data: Provide written sequences of operation for each controlled system and piece of equipment.
Packaged Rooftop Unit
1. Startup
The unit shall operate on a 7 day/night programmable thermostat.
During startup, the fan shall run with the dampers in the full recirculation position. Provide occupied changeover sequence with optimum start function. When the return air temperature reaches occupied setpoint (adjustable), the minimum outside air damper shall open to the controlled minimum outdoor air position.
2. Supply Fan Control
The supply fan speed shall be constant, run continuously during occupied mode and set to the required CFM.
The supply fan shall be two staged and modulate up and down based on a call for heating or cooling.
3. Space Temperature Control
Provide 7-day programmable thermostat with digital display of space temperature and setpoint (+/- deg. F. adjustable), with override feature.
4. Minimum Outside Air Control
During occupied mode, the minimum outside air damper shall be open to the scheduled minimum outdoor air flow and modulate proportionally with the supply fan speed to maintain the scheduled minimum outside airflow. When the supply fan speed is set to high, outside air damper shall be partially closed allowing minimum outside air flow as scheduled. As supply fan speed is set to low, damper shall fully open allowing minimum outside air flow as scheduled. Provide motor operated dampers.
5. Economizer Control
Provide dual enthalpy economizer control. Economizer control shall be enabled whenever the outside air enthalpy is lower than the return air enthalpy. Enthalpy shall be calculated from sensors which are tied to the same controller for accuracy.
During economizer mode, the outside air damper shall modulate to 100% open. The economizer damper shall modulate open on a call for cooling and modulate closed on a call for heating. The return damper shall modulate inversely with the economizer damper.
6. Cooling Control
Cooling shall be controlled to maintain space temperature setpoint. On a call for cooling, the heating shall be off and supply fan speed shall be low. On a further call for cooling, the economizer shall be enabled. On a further call for cooling, disable the economizer and energize first stage cooling on. On a further call for cooling, the supply fan speed shall be high
Heating Control
Heating shall be controlled to maintain space temperature setpoint. On a call for heating, the mechanical cooling shall be off. On a further call for heating, the economizer mode shall be disabled. On a further call for heating, the supply fan shall be set to low speedand the electric heat shall modulate on via SCR controls. On a further call for heating, the supply fan shall be set to high speed and the electric heat shall modulate on via SCR controls.
7. Smoke Detector
When the smoke detector is alarmed, the system shall be alarmed and the air handler shall fail safe with manual reset.
8. Unoccupied Mode
During the unoccupied mode of operation, the RTU shall go into night setback mode.
Night Setback/Shutdown
At night setback/shutdown the RTU shall go to fail safe position. Fail safe position is defined by the following: The supply fan is off, the outdoor air intake damper is closed, the heating is off and the mechanical cooling is 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.

Exhaust Fans (Timeclock)
Exhaust fans shall be tied to timeclock, which shall be furnished, installed and wired by electrical contractor. When activated, exhaust fan motor damper shall open and fan shall start.
(Indicated by EC on HECS schedule)

Controls
Electrical contractor will provide power wiring. HVAC contractor shall provide all the low voltage wiring of HVAC units and controls, thermostats and controllers.
Thermostat shall be by the manufacturer of the HVAC unit (heat/cool/auto/off) with night setback. Provide plastic protective cover for all thermostats.

Low Voltage Thermostats
Low voltage thermostats shall be furnished, installed and wired by the HVAC contractor. The electrical contractor shall provide 4” square x 1- 1/2” deep wall outlet boxes (with single-gang rings) for all thermostats/sensors. The electrical contractor shall provide one 3/4” empty conduit from each thermostat/sensor location, turned out above accessible ceilings (in joist space or against overhead slab/deck). The HVAC/Temperature Control Contractor shall provide all other necessary conduit, raceway and wiring related work. Conduit shall be identified in ceiling cavity and shall be provided with sweep bends, bushings and dragline.
The HVAC/Temperature Control Contractor shall coordinate with the General Contractor to ensure thermal envelope is maintained at these locations.

Line Voltage Thermostats
The electrical contractor shall provide 4” square x 1- 1/2” deep wall outlet boxes at 48” above finished floor (with single-gang rings) for all thermostats. The electrical contractor shall provide line voltage power wiring, from thermostat outlet box to equipment that is to be controlled by the thermostat, in 3/4” conduit.

General Control Wiring Requirements and Installation Methods
Except where specifically indicated otherwise above, the HVAC/Temperature Control Contractor shall provide all electrical work as required for all temperature control related wiring (i.e. conduit, raceway, outlet boxes, junction boxes, wiring, etc.) in accordance with Electrical Specifications requirements. All conduit shall be 3/4” minimum.
Coordinate all thermostat/sensor locations in field (case by case) with Architect, Owner and Electrical Contractor to ensure that they are placed in locations that will not interfere with furniture, equipment, artwork, wall-hung specialties, room finishes, etc. All thermostat/sensor wall locations indicated on HVAC drawings are schematic only and must be verified case-by-case prior to rough-in.
All electrical work as described in this specification shall be per the latest edition of the National Electrical Code (NEC) and per applicable state and local codes.
Where “free-air” installation methods (either exposed above the ceilings, in bridle rings or in cable trays) are permitted under Electrical Specifications above ceilings, provide plenum-rated cables wherever plenum ceilings (if any) exist and install as defined under Electrical Specifications. Install low voltage circuits, located in concrete slabs and masonry walls, in inaccessible locations, or exposed in occupied areas, in electrical conduit regardless of what wiring methods are permitted under Electrical Specifications.
Where cable trays or bridle rings are provided by the electrical contractor for low voltage cables, these raceways may be utilized for control wiring by this contractor (provide special color coded jackets, label cable jackets per Electrical Specifications and group control wiring cables together). Provide conduit drops from cable tray/bridle ring paths to wall outlet boxes and equipment unless directed otherwise under Electrical Specifications.
Regardless of permitted methods in Electrical Specifications, all cables/wiring installed concealed by gypsum board, masonry or other inaccessible materials in walls or above ceilings shall be installed in conduit, 3/4” minimum.
All conduit, bridle rings, raceway, outlet boxes, etc. necessary for complete operational installation of control wiring shall be provided (furnished and installed) by the temperature control contractor in strict compliance with Electrical Specifications documents. Coordinate all work with all other applicable trades including the electrical contractor.
Provide all required conduit work to and between equipment in a manner compliant with that described above (i.e. between VAV boxes, to boilers, starters, condensing units, etc. as applicable).
Install control wiring without splices between terminal points, color-coded. Install in neat workmanlike manner, securely fastened. Install in accordance with National Electrical Code and per Electrical Specifications.
Install circuits over 25 volt with color-coded No. 12 wire in electrical metallic tubing, per Electrical Specifications.
Install circuits under 25 volt with color-coded No. 18 wire with 0.031" high temperature (105 degs. F) plastic insulation on each conductor and plastic sheath over all.
Install electronic circuits with color-coded No. 22 wire with 0.023" polyethylene insulation on each conductor with plastic-jacketed copper shield over all.

Smoke Detector
All duct smoke detectors will be furnished by electrical contractor, installed by the HVAC contractor, and wired by the electrical contractor per local codes. HVAC contractor will interlock fan with smoke detector.

Motor Operated Dampers
All fresh air intakes and exhaust louvers shall have motor operated dampers. Dampers shall be low leak with blade and edge seals. All motor operated dampers shall be provided and wired by the mechanical contractor unless otherwise noted. Provide all necessary transformers, contactors, controls and wiring for interlocking equipment to motor operated dampers.

SECTION 23 21 13.23 – ABOVEGROUND HYDRONIC PIPING AND SPECIALTIES

Submittal Requirements
Product Data: For each type listed.
Shop Drawings: Detail the piping layout, fabrication of pipe anchors, hangers, supports, alignment guides, expansion joints and loops and attachments of the same to the building structure.
Locations and Arrangements: Drawings (plans, schematics, and diagrams) indicate the general location and arrangement of piping systems.
Locations and arrangements of piping take into consideration pipe sizing and friction loss, expansion, pump sizing, and other design considerations. So far as practical, install piping as indicated. Locate groups of pipes parallel to each other, spaced to permit full insulation and servicing of valves.

Hydronic Piping
Condensate drain piping shall be type L copper with soldered or brazed joints.
Refrigerant Piping
Refrigerant piping shall be ASTM B 280 Type ACR, hard-drawn temper; wrought-copper, solder-joint fittings; brazed joints.
Installation
Install all hydronic piping, except for condensate piping, at a uniform grade of 1 inch per 40 feet upward in the direction of flow.
Install all condensate piping at a uniform grade of 1/8 inch per 1 foot downward in the direction of flow to the nearest drain location.
Refrigerant Piping shall be sized and installed per manufacturer's recommendations including all necessary traps, double suction risers, etc, and pipe size increases based on actual layout, distance and unit sizing.
Install refrigerant piping with 1/4" per foot (1%) downward slope in direction of oil return to compressor.
Clean refrigerant piping by swabbing with dry lintless (linen) cloth, followed by refrigerant oil soaked swab. Remove excess oil by swabbing with cloth soaked in high flash point petroleum solvent, squeezed dry.
Bleed dry nitrogen through refrigerant piping during brazing operations.
Prior to initial operation, clean and test refrigerant piping in accordance with ANSI B31.5, "Refrigeration Piping". Perform initial test with dry nitrogen, using soap solution to test all joints. Perform final test with 27" vacuum, and then 200 psi using halide torch. System must be entirely leak-free. Install core in filter dryer after leak test but before evacuation. Evacuate refrigerant system with vacuum pump; until temperature of 35 degree F is indicated on vacuum dehydration indicator. During evacuation, apply heat to pockets, elbows, and low spots in piping. Maintain vacuum on system for minimum of 5 hours after closing valve between vacuum pump and system. Break vacuum with refrigerant gas, allow pressure to build up to 2 psi. Complete charging of system, using new filter dryer core in charging line. Provide full operating charge.
Provide minimum 3-inch deep P-trap at coil section drain connection. Install all condensate piping at a uniform grade of 1/8 inch per 1 foot downward in the direction of flow to the nearest drain location.
Provide locking-type tamper-resistant caps on refrigerant access ports

SECTION 23 21 23.00 – HYDRONIC PUMPS

Submittal Requirements
Product Data: For each type of pump.

AIR CONDITIONING CONDENSATE PUMPS
General: Packaged units with corrosion-resistant pump and automatic controls. Include factory- or field-installed check valve.
For below ceiling applications, provide electrical cord and plug with 72” cord and 0.33 gallon sump.
Manufacturer: Subject to compliance with requirements, provide condensate pumps of one of the following:
Beckett Corporation
Hartell Pumps Div.; Milton Roy Co.
Little Giant Pump Co.
For above ceiling applications, provide hard-wire electrical connection and 1 gallon sump.
Manufacturer: Subject to compliance with requirements, provide condensate pumps of one of the following:
Hartell Pumps Div.; Milton Roy Co.
Little Giant Pump Co

SECTION 23 31 13.00 – METAL DUCTS

Submittal Requirements
Product Data: For liners, adhesives, sealants and gaskets.
Shop Drawings: Sheet metal thickness, reinforcing details, duct layouts indicating sizes, configuration, liner material, elevation and static pressure class.

Ductwork Materials
Exposed Ductwork Materials: Where ductwork is indicated to be exposed to view in occupied spaces, provide materials which are free from visual imperfections including pitting, seam marks, roller marks, stains and discolorations, and other imperfections, including those which would impair painting. Mechanical contractor shall confirm ductwork paint scope and color with architect.
Exposed ductwork which is to be painted shall have paint grip applied and be oil free.
Sheet Metal: Except as otherwise indicated, fabricate ductwork from galvanized sheet steel, lock forming quality; with G 90 zinc coating and mill phosphatized for exposed locations. Minimum gauge shall be 24.
Miscellaneous Ductwork Materials
Volume Dampers: Provide volume dampers in all branch ducts or as required for balancing to required air flows.
Fittings: Provide radius type fittings fabricated of multiple sections with maximum 15 deg. change of direction per section. Unless specifically detailed otherwise, use 45 deg. laterals and 45 deg. elbows for branch takeoff connections. Where 90 deg. branches are indicated, provide conical type tees.
Duct Sealant: Non-hardening, non-migrating mastic or liquid elastic sealant, type applicable for fabrication/installation detail, as compounded and recommended by manufacturer specifically for sealing joints and seams in ductwork.
Duct Cement: Non-hardening migrating mastic or liquid neoprene based cement, type applicable for fabrication/installation detail, as compounded and recommended by manufacturer specifically for cementing fitting components, or longitudinal seams in ductwork.
Ductwork Support Materials: Except as otherwise indicated, provide hot-dipped galvanized steel fasteners, anchors, rods, straps, trim and angles for support of ductwork.
Flexible Ducts
Either spiral-wound spring steel with flameproof vinyl sheathing, or corrugated aluminum. Unless specifically mentioned, the maximum length of flex duct on the supply equals 5 feet. Flex is not allowed for return, relief or exhaust applications. The flexible ducts indicated for use in the H.V.A.C. system shall conform to the requirements of UL 181 for Class 0 or Class 1 flexible air ducts and shall be so identified.
Where installed in unconditioned spaces other than return air plenums, provide 1" thick 1-1/2 lb. continuous flexible fiberglass sheath with vinyl vapor barrier jacket.
Installation is not permitted above drywall ceilings and inaccessible ceilings.
Fabrication
Shop fabricate ductwork in 4, 8, 10 or 12-ft lengths, unless otherwise indicated or required to complete runs. All ductwork shall be Pittsburgh Construction with a minimum of thickness of 24 gauge. In addition, ductwork used in systems over 3" W.G. shall have cold sealant applied.
Shop fabricate ductwork of gauges and reinforcement complying with SMACNA "HVAC Duct Construction Standards".
Lined Duct
Fabricate ductwork with duct liner in each section of duct where indicated. Laminate liner to internal surfaces of duct in accordance with instructions by manufacturers of lining and adhesive, and fasten with mechanical fasteners.
Duct liner to be 3-lb density for acoustic requirements 1" thick or as noted. Size of ductwork shown on the drawings is free net area, outside dimension of ducts will need to be increased if lined duct is used.
Size of ductwork shown on the drawings is free net area, outside dimension of ducts will need to be increased if lined duct is used.
Duct Liner: Fibrous glass of thickness indicated. 3-lb density. All liners, insulation and adhesives shall have a flame spread index not more than 25 and a smoke developed index of not more than 50.
Duct Liner Adhesive: As recommended by insulation manufacturer and complying with NFPA 90A or NFPA 90B.
Duct Liner Fasteners: Comply with SMACNA HVAC Duct Construction Standards.
Installation of Metal Ductwork
General: Assemble and install ductwork in accordance with recognized industry practices which will achieve air-tight (5% leakage for systems rated 3" and under; 1% for systems rated over 3") and noiseless (no objectionable noise) systems, capable of performing each indicated service. Install each run with minimum number of joints. Align ductwork accurately at connections, within 1/8" misalignment tolerance and with internal surfaces smooth. Support ducts rigidly with suitable ties, braces, hangers and anchors of type which will hold ducts true-to-shape and to prevent buckling. Support vertical ducts at every floor.
Sealing: Seal all longitudinal seams, S's and drives and all joints with mastic or cement. Install according to SMACNA standards.
Balancing Dampers: The sheet metal contractor shall be fully responsible for installing balancing dampers in the ductwork, (whether shown on the drawing or not) in order to arrive at the intended air flow. The balancing sub-contractor shall provide direction and assistance in determining locations where dampers are required. Additional dampers, if required shall be installed at no additional cost to the owner.
Wall Penetrations: Seal and pack around all ducts and piping sleeves which pass through walls that extend to bottom side of structure and rated walls.
Field Fabrication: Complete fabrication of work at project as necessary to match shop-fabricated work and accommodate installation requirements.
Routing: Locate ductwork runs, except as otherwise indicated, vertically and horizontally and avoid diagonal runs wherever possible. Run ductwork in shortest route which does not obstruct useable space or block access for servicing building and its equipment. Hold ducts close to walls, overhead construction, columns, and other structural and permanent enclosure elements of building. Limit clearance to 1/2" where furring is shown for enclosure or concealment of ducts, but allow for insulation thickness, if any. Where possible, locate insulated ductwork for 1" clearance outside of insulation. Wherever possible in finished and occupied spaces, conceal ductwork from view, by locating in mechanical shafts, hollow wall construction or above suspended ceilings. Do not encase horizontal runs in solid partitions, except as specifically shown.
Coordinate layout with suspended ceiling and lighting layouts and similar finished work.
Electrical Equipment Spaces: Do not route ductwork through transformer vaults and their electrical equipment spaces and enclosures.
Penetrations: Where ducts pass through interior partitions and exterior walls, and are exposed to view, conceal space between construction opening and duct or duct insulation with sheet metal flanges of same gage as duct. Overlap opening on 4 sides by at least 1-1/2". Fasten to duct and substrate.
Where ducts pass through fire-rated floors, walls, or partitions, provide fire dampers and firestopping between duct and substrate, in accordance with requirements of Division-7 Section "Firestopping".
All fire dampers shall be listed and comply with UL 555.
All dampers shall be low leakage with edge and blade seals. Damper manufacturers are subject to specification compliance. Provide products by one of the following:
Greenheck Fan Corporation
Nailor Industries
Pottorff
Ruskin Company
Young Regulator Company
Coordination: Coordinate duct installations with installation of accessories, dampers, coil frames, equipment, controls and other associated work of ductwork system.
Installation of Duct Liner
General: Install duct liner in accordance with SMACNA HVAC Duct Construction Standards. Size of ductwork shown on the drawings is free net area, outside dimension of ducts will need to be increased if lined duct is used.
Store internally lined ductwork up off of the floor. Protect internally lined ductwork from water and dust.
The following ductwork shall be lined in addition to that shown per plans:
Return from open ceiling plenum return to HVAC unit.
Supply and return ductwork 10 feet downstream of HVAC unit.
Transfer air ducts.
Butter the leading edge of all internal duct lining with the manufacturer's recommended adhesive.
Inspect and repair all damaged lining prior to installation of ductwork.
Installation of Flexible Ducts
Maximum Length: For any duct run using flexible ductwork, do not exceed 5' - 0" extended length.
Installation shall have smooth full radius turns down to diffuser.
Installation not permitted above inaccessible ceilings.

23 37 13.00 – DIFFUSERS, REGISTERS AND LOUVERS

Submittal Requirements
Product Data: For each type of product indicated.

DIFFUSERS, GRILLES AND REGISTERS
Manufacturer: Subject to compliance with requirements, provide diffusers of one of the following:
Anemostat Products Div., Dynamics Corp. of America.
Metal-Aire
Titus Products Div., Philips Industries, Inc.
Tuttle and Bailey.
Price
Louvers and dampers
Provide louvers and dampers of size as noted.
Manufacturer: Subject to compliance with requirements, provide diffusers of one of the following:
Aerolite
Prefco
Pottorff
Greenheck
Ruskin

23 74 33.00 – PACKAGED OUTDOOR ROOFTOP UNITS

Submittal Requirements
Product Data: For each type of product indicated.

Warranty
Warranty on Compressor and Heat Exchanger: Provide written warranty, signed by manufacturer, agreeing to replace/repair, within warranty period, compressors and heat exchangers with inadequate and defective materials and workmanship, including leakage, breakage, improper assembly, or failure to perform as required; provided manufacturer's instructions for handling, installing, protecting, and maintaining units have been adhered to during warranty period. Replacement is limited to component replacement only, and does not include labor for removal and reinstallation.
Warranty Period: 5 years from date of owner acceptance.

CONSTANT VOLUME
General: Rooftop unit shall be factory-assembled and tested, designed for roof or slab installation and, consisting of compressors, condensers, evaporator coils, condenser and evaporator fans, refrigeration and temperature controls, filters, and dampers. Capacities and electrical characteristics are scheduled. Casing manufacturer's standard casing construction, having corrosion protection coating, and exterior finish. Casings shall have removable panels or access doors for inspection and access to internal parts, a minimum of 1" thick thermal insulation, knockouts for electrical and piping connections, and an exterior condensate drain connection, and lifting lugs.
Unit casing shall be single wall construction.
Roof Curbs: Manufacturer's standard construction, insulated and having corrosive protective coating, complete with factory-installed wood nailer and drain nipple. Construction shall be in accordance with NRCA Standards.
Evaporator Fans: Forward-curved, centrifugal, belt-driven fans with adjustable sheaves; and permanently lubricated motor bearings.
Condenser fans: Propeller-type, direct-driven fans with permanently lubricated bearings.
Coils: Aluminum plate fin and seamless copper tube type. Fins shall have collars drawn, belled and firmly bonded to the tubes by means of mechanical expansion of the tubes. No soldering or tinning shall be used in the bonding process. Coils shall have a galvanized steel casing. Coils shall be mounted in the coil casing with same end connections accessible for service. Coils shall be removable from the unit through the roof or through the piping enclosure. Coil section shall be completely insulated.
Refrigerant cooling coils: have an equalizing type vertical distributor to ensure each coil circuit receives the same amount of refrigerant. Coils shall be proof (450 psig) and leak (300 psig) tested with air pressure under water, then cleaned, dehydrated, and sealed with a holding charge of nitrogen.
Condensate Pan: Provide IAQ steel, double sloping drain pain. Provide high condensate in primary condensate pan to de-energize unit upon detection of high condensate levels.
Compressors: Serviceable, semi-hermetic, or hermetic compressors with integral vibration isolators, and crankcase heaters, which de-energize during compressor operation. Units shall also have:

Safety Controls:
low pressure cutout, manual reset;
high pressure cutout, manual reset;
compressor motor overload protection, manual reset;
anti-recycling timing device;
adjustable low-ambient lockout;
oil pressure switch.
Controls:
high limit cutout;
Enthalpy Economizer Control:
Provide dual enthalpy economizer control. Provide return and outside air dampers, outside air filter, fully modulating electric control system with dry control, and adjustable mixed-air thermostat. System shall be capable of driving 100% closed for unoccupied mode, minimum outside air position and modulation to 100 percent open outside air capability. Provide automatic changeover through adjustable control device.
Heating Types:
Electric heat sections: manufacturer's standard construction electric heat coils, factory-wire for single point wiring connection. Complete with over-current and over-heat protection devices.
Temperature Control:
Temperature control: factory-installed, demand-oriented solid-state control system above 5 tons shall have minimum of 2 cooling steps and 2 heating steps. Controls shall include solid-state thermostats with dead-band, and sub-base with system and fan switches. Other control features include:
Relief:
Barometric Relief - Shall include relief damper section with mist eliminator. Dampers open to relieve positive pressure within the building. Available only with economizer.
Filters:
Provide air filters to fit in filter box, with a Maximum filter face velocity of 500 fpm, of the following type:
Disposable Type: Provide 30% efficient disposable type air filters 2" thick, consisting of viscous coated fibers with filtering media encased in fiberboard cell sides having perforated metal grids on each side to provide media support.
Options:
Horizontal Discharge - Provide units where required with horizontal supply and return duct connections. Provide all necessary curbs and modifications as required for horizontal discharge option.
Controls:
Self Contained: Programmable Electronic Night Setback Thermostat - Shall provide heating setback and cooling setup with 7-day, programming capability. Optional remote sensor available.
Manufacturers: Subject to compliance with requirements, provide rooftop units of one of the following:
Aaon
Addison
Carrier Air Conditioning, Div of Carrier Corp.
Lennox Industries Inc.
Trane; a division of Ingersoll Rand.
Daikin
Valent
Greenheck
Captiveaire

23 81 29.00 – DUCTLESS SPLIT SYSTEM AIR CONDITIONING UNITS

Submittal Requirements
Product Data: For each type of product indicated.

Warranty:
Warranty on Motor/Compressor: Provide written warranty, signed by manufacturer, agreeing to replace/repair, within warranty period, motors/compressors with inadequate or defective materials and workmanship, including leakage, breakage, improper assembly, or failure to perform as required; provided manufacturer's instructions for handling, installing, protecting, and maintaining units have been adhered to during warranty period. Replacement is limited to component replacement only, and does not include labor for removal and reinstallation.
Warranty Period: 5 years from date of owner acceptance
Manufacturer: Subject to compliance with requirements, provide ductless split system air conditioning units of one of the following manufacturers:
Carrier
Mitsubishi
Sanyo
EMI
Fujitsu
LG
Daikin
Samsung
Johnson Controls
Outdoor Condensing Units
General: Factory assembled, single piece, air-cooled outdoor unit. Contained within the unit enclosure shall be all factory wiring, piping, controls, compressor, full charge of HFC refrigerant, and special features required prior to field start-up.
Unit Cabinet: Unit cabinet shall be constructed of galvanized steel, bonderized and coated with a baked-enamel finish.
Unit access panels shall be removable with minimal screws and shall provide full acce4ss to the compressor, fan, and control components.
Outdoor compartment shall be isolated and have an acoustic lining to assure quiet operation.
Fans: Outdoor fans shall be direct-drive propeller type, and shall discharge air horizontally. Fans shall below air through the outdoor coil.
Outdoor fan motors shall be totally-enclosed, single-phase motors with Class B insulation and permanently-lubricated sleeve bearings. Motor shall be protected by internal thermal overload protection.
Shaft shall have inherent corrosion resistance.
Fan blades shall be corrosion resistant and shall be statically and dynamically balanced.
Outdoor fan openings shall be equipped with PVC coated protection grille over fan and coil.
Compressor
Compressor shall be fully hermetic reciprocating or scroll type.
Compressor shall be equipped with oil system, operating oil charge, and motor. Internal overloads shall protect the compressor from overtemperature and overcurrent. Scroll compressors shall also have high discharge gas temperature protection if required.
Motor shall be NEMA rated Class F, suitable for operation in a refrigerant atmosphere.
Reciprocating compressors shall be equipped with crankcase heaters to minimize liquid refrigerant accumulation in compressor during shutdown and to prevent refrigerant dilution of oil.
Compressor assembly shall be installed on rubber vibration isolators and shall have internal spring isolation.
Compressors shall be single-phase or 3-phase a specified on the contract drawings.
Outdoor Coil: Coil shall be constructed of aluminum fins mechanically bonded to internally enhanced, seamless copper tubes which are cleaned, dehydrated, and sealed.
Refrigeration Components: Refrigerant circuit components shall include brass external liquid line service valve with service gage port connections, suction line service valve with service gage connection port, service gage port connections on compressor suction and discharge lines with Schrader-type fittings with brass caps, accumulator, pressure relief, and a full charge of refrigerant.
Controls and Safeties: Operating controls and safeties shall be factory selected, assembled, and tested. The minimum control functions shall include the following:
Controls:
Time delay restart to prevent compressor reverse rotation on signal-phase scroll compressors.
Automatic restart on power failure.
Safety lockout if any outdoor unit safety is open.
A time delay control sequence provided through the fan coil board, thermostat, or controller.
High-pressure and liquid line low-pressure switches.
Automatic outdoor fan motor protection.
Start capacitor and relay (single phase units without scroll compressors).
Safeties
System diagnostics.
Compressor motor current and temperature overload protection
High pressure relief.
Outdoor fan failure protection.
Electrical Requirements
Unit electrical power shall be a single point connection.
Unit control voltage to the indoor-fan coil shall be 24 volt
All power and control wiring must be installed per NEC and all local building codes.
High and low voltage terminal block connections.
Special Features (Field Installed)
Low-Ambient Kit: Control shall regulate fan-motor cycles in response to saturated condensing pressure of the unit. The control shall be capable of maintaining a condensing temperature of 100 F +/- 10 F with outdoor temperatures to -20F. Installation of kit shall not require changing the outdoor-fan motor.
Liquid Solenoid Valve: This electronically operated shutoff valve shall close and opening response to compressor operation. The valve should be used with all long-lines applications (over 100 ft.).
Winter Start Control : Field supplied and installed winter start control shall permit start-up for cooling operation under low-load conditions and at low-ambient temperatures by bypassing the low-pressure switch for a 3-minute delay period.
High Wall Units
General: Indoor, direct-expansion, wall-mounted fan coil. Unit shall be complete with cooling/heating (heat pump systems only) coil, fan, fan motor, piping connectors, electrical controls, microprocessor control system, and integral temperature sensing. Unit shall be furnished with integral wall-mounting bracket and mounting hardware.
Unit Cabinet: Cabinet discharge and inlet grilles shall be attractively styled, high-impact polystyrene. Cabinet shall be fully insulated for improved thermal and acoustic performance.
Fans: Fan shall be tangential direct-drive blower type with air intake a t the upper front face of the unit and discharge at the bottom front. Automatic, motor-driven vertical air sweep shall be provided standard.
Air sweep operation shall be user selectable. Horizontal direction may be manually adjusted (using remote controller) and vertical air sweep may be manually set.
Coil: Coil shall be copper tube with aluminum fins and galvanized steel tube sheets. Fins shall be bonded to the tubes by mechanical expansion. A drip pan under the coil shall have a drain connection for hose attachment to remove condensate. Condensate pan shall have internal trap and auxiliary drip pan under coil header.
Motors: Motors shall be open drip-proof, permanently lubricated ball bearing with inherent overload protection. Fan motors shall be 3-speed.
Controls: Controls shall consist of a microprocessor-based control system, which shall control space temperature, determine optimum fan speed, and run self diagnostics. The temperature control range shall be from 64F to 84F. The unit shall have the following functions as a minimum. An automatic restart after power failure at the same operating conditions as at failure.
A timer function to provide a minimum 24-hour timer cycle for system Auto. Start/Stop.
Temperature-sensing controls shall sense return air temperature. Indoor air high discharge temperature shutdown shall be provided.
Indoor coil freeze protection.
Wireless infrared remote control to enter set points and operating conditions.
Auto Stop features shall have integral setback control.
Automatic airsweep control to provide on or off activation of airsweep louvers.
Dehumidification mode shall provide increased latent removal capability by modulating fan speed and set point temperature.
Fan only operation shall provide room air circulation when no cooling is required.
Diagnostics shall provide continuous checks of unit operation and warn of possible malfunctions. Error messages shall be displayed at the unit and at the remote controller.
Fan speed control shall be user-selectable: high, medium, low or microprocessor automatic operation during all operating modes.
A time delay shall prevent compressor restart in less than 3 minutes.
Filters: Unit shall have filter track with factory-supplied cleanable filters.
Electrical Requirements: Unit shall operate on voltage as specified on the equipment schedule. Power and control connections shall have terminal block connections.
Operating Characteristics: The unit shall be matched with an outdoor unit. The combination of the outdoor unit and the indoor fan coil unit shall be sized as scheduled
The system shall have a minimum listed SEER (seasonal energy efficiency ratio) of 10.0 at ARI conditions.
Outdoor unit shall be rated at low decibels at ARI conditions.
Refrigerant Lines: The 009 and 012 units shall have rotatable refrigerant lines for penetration through the wall using flare connections. All units shall have flare connections and a 90-degree suction elbow shall be provided for rear connection.
Special Features (Field Installed):
Condensate Pump: The condensate pump shall remove condensate from the drain pan when gravity drainage cannot be used. Pump shall be designed for quiet operation. Pump shall consist of two parts: an internal reservoir/sensor assembly, and a remote sound-shielded pump assembly. The lift capability of the condensate pump shall be 1 to 10 ft (009 size unit) or 3 to 25 ft (012-024 size units). A level sensor on the condensate pan shall stop cooling operation if the level in the condensate pan is unacceptable.

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REVISIONS

DWN: CCR CHK: RAL
DATE: 03/21/2023
PROJECT #: RCT01.11

MECHANICAL - SPECIFICATIONS

M9-901

1" REFERENCE
KLH PROJECT # 24470

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