

REVISIONS					
-----------	--	--	--	--	--

PROPOSED NEAR FUELING STATION & CONVENIENCE STORE  
**Cincinnati Dayton at Allen Road**  
 WEST CHESTER TOWNSHIP  
 BUTLER COUNTY, OHIO

09/11/23

MECHANICAL COVER SHEET  
**M-001**

**GENERAL NOTES**

A. CONICAL BELLMOUTH FITTINGS WITH MANUAL BALANCING DAMPER TO BE USED FOR ALL ROUND BRANCH TAPS ABOVE ACCESSIBLE LAY-IN CEILINGS. CONICAL BELLMOUTH FITTINGS WITHOUT MANUAL BALANCING DAMPERS TO BE USED FOR ALL ROUND BRANCH TAPS ABOVE INACCESSIBLE DRYWALL CEILINGS WITH BALANCING REQUIRED WITHIN 2 FT. OF DIFFUSER WITH PLASTER FRAME.

B. FLEX DUCT SHALL BE LIMITED TO 5'-0" IN LENGTH. NO DUCT BOARD ALLOWED. WIDTH OF DUCT SUPPORTS SHALL BE 2" WIDER THAN THE DUCT.

C. THE HVAC CONTRACTOR IS RESPONSIBLE FOR COORDINATING BOX-OUT LOCATIONS FOR ALL DRYWALL MOUNTED AIR DEVICES WITH GENERAL CONTRACTOR AND CEILING FRAME.

D. MECHANICAL CONTRACTOR TO PROVIDE TENANT WITH AS-BUILT DRAWINGS, ALL EQUIPMENT SHOP DRAWINGS, INFORMATION ON THERMOSTATS, CONTROL WIRING DIAGRAMS AND OTHER PERTINENT INFORMATION AT COMPLETION OF PROJECT.

E. SEE ARCHITECTURAL DRAWINGS FOR CEILING HEIGHTS.

F. COORDINATE ALL DUCTWORK PRIOR TO DUCTWORK FABRICATION. INSTALL DUCTWORK AS HIGH AS POSSIBLE. COORDINATE THE PATH OF THE DUCTWORK WITH THE LIGHTING PLAN, SPRINKLER PIPING, EXISTING STRUCTURE, EXISTING DUCTWORK AND ALL OTHER EXISTING CONDITIONS (TYPICAL).

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

MECHANICAL LEGEND	
SYMBOL	DESCRIPTION
<b>PLAN-VIEW LINE TYPES</b>	
	WORK SHOWN FADED INDICATES EXISTING WORK TO REMAIN OR NEW WORK BY OTHERS AS APPLICABLE
	WORK SHOWN BOLD-CONTINUOUS INDICATES NEW WORK
<b>PIPING LINE TYPES</b>	
	REFRIGERANT LIQUID
	REFRIGERANT SUCTION
	CONDENSATE DRAIN
	SUPPLY MAIN OR BRANCH
	RETURN MAIN OR BRANCH
<b>MECHANICAL STATS &amp; SENSORS</b>	
	TEMPERATURE SENSOR
	LOW VOLTAGE THERMOSTAT
	LOW VOLTAGE THERMOSTAT WITH LOCKABLE GUARD
	HUMIDITY SENSOR
<b>MECHANICAL DUCTWORK ACCESSORIES</b>	
	DUCT WITH MANUAL VOLUME DAMPER
	MOTOR OPERATED DAMPER - LOW VOLTAGE
	DUCT MOUNTED SMOKE DETECTOR (HARD WIRE INTERLOCK TO FAN MOTOR BY E.C.) FURNISHED BY E.C., INSTALLED BY M.C.
<b>MECHANICAL AIR DEVICES</b>	
	SUPPLY REGISTER
	RETURN REGISTER
	EXHAUST REGISTER
	RETURN GRILLE
	CEILING DIFFUSER
	ROUND CEILING DIFFUSER
<b>MECHANICAL DUCTWORK</b>	
	SUPPLY DUCT WITH ELBOW TURNED UP
	SUPPLY DUCT WITH ELBOW TURNED DOWN
	EXHAUST DUCT WITH ELBOW TURNED UP
	EXHAUST DUCT WITH ELBOW TURNED DOWN
	EXHAUST DUCT WITH ELBOW TURNED DOWN
	EXHAUST DUCT WITH ELBOW TURNED DOWN
	SUPPLY DUCT
	RETURN DUCT
	EXHAUST DUCT
	OUTSIDE AIR DUCT
	FLEXIBLE DUCTWORK CONNECTION
	BRANCH TAKEOFF
	REDUCER, CONCENTRIC
	REDUCER, NONCONCENTRIC

**KEYED NOTES**

- H1 PROVIDE PROGRAMMABLE THERMOSTAT IN BACK OFFICE AREA WITH REMOTE SENSOR IN LOCATIONS AS INDICATED ON PLANS. THERMOSTATS/SENSORS SHALL BE SAME MANUFACTURER AS HVAC UNIT. COORDINATE EXACT LOCATION WITH TENANT, OR TENANT'S REPRESENTATIVE, PRIOR TO INSTALLATION. WIRE TO HVAC UNIT PER MANUFACTURER'S PRINTED INSTRUCTIONS.
- H2 PROVIDE NEW CEILING MOUNTED EXHAUST FAN WITH INTEGRAL BACKDRAFT DAMPER AS SCHEDULED. BALANCE TO THE SCHEDULED AIRFLOW. EXTEND EXHAUST DUCTWORK THROUGH ROOF AND TERMINATE WITH VENT CAP. MAINTAIN A MINIMUM OF 10'-0" FROM ANY BUILDING INTAKE.
- H3 ELECTRICAL CONTRACTOR SHALL FURNISH NEW ADDRESSABLE DUCT MOUNTED SMOKE DETECTOR. MECHANICAL CONTRACTOR SHALL INSTALL SMOKE DETECTOR IN THE RETURN AIR DUCT. MECHANICAL CONTRACTOR SHALL PROVIDE WIRING TO FAN INTERLOCK, E.G. SHALL PROVIDE WIRING FOR CONNECTION TO REMOTE ANNUNCIATOR.
- H4 PERFORATED CEILING DIFFUSER PROVIDED WITHOUT PATTERN CONTROLLER.

**KLH ENGINEERS**  
 KOHRIS LOWMEYER HELL ENGINEERS, INC.  
 WWW.KLHENGINEERS.COM  
 15000 W. WINDY HILL BLVD., SUITE 111  
 BUTLER COUNTY, OHIO 45009  
 800-394-5789 853-442-8050  
 853-442-8058 FAX

REVISIONS

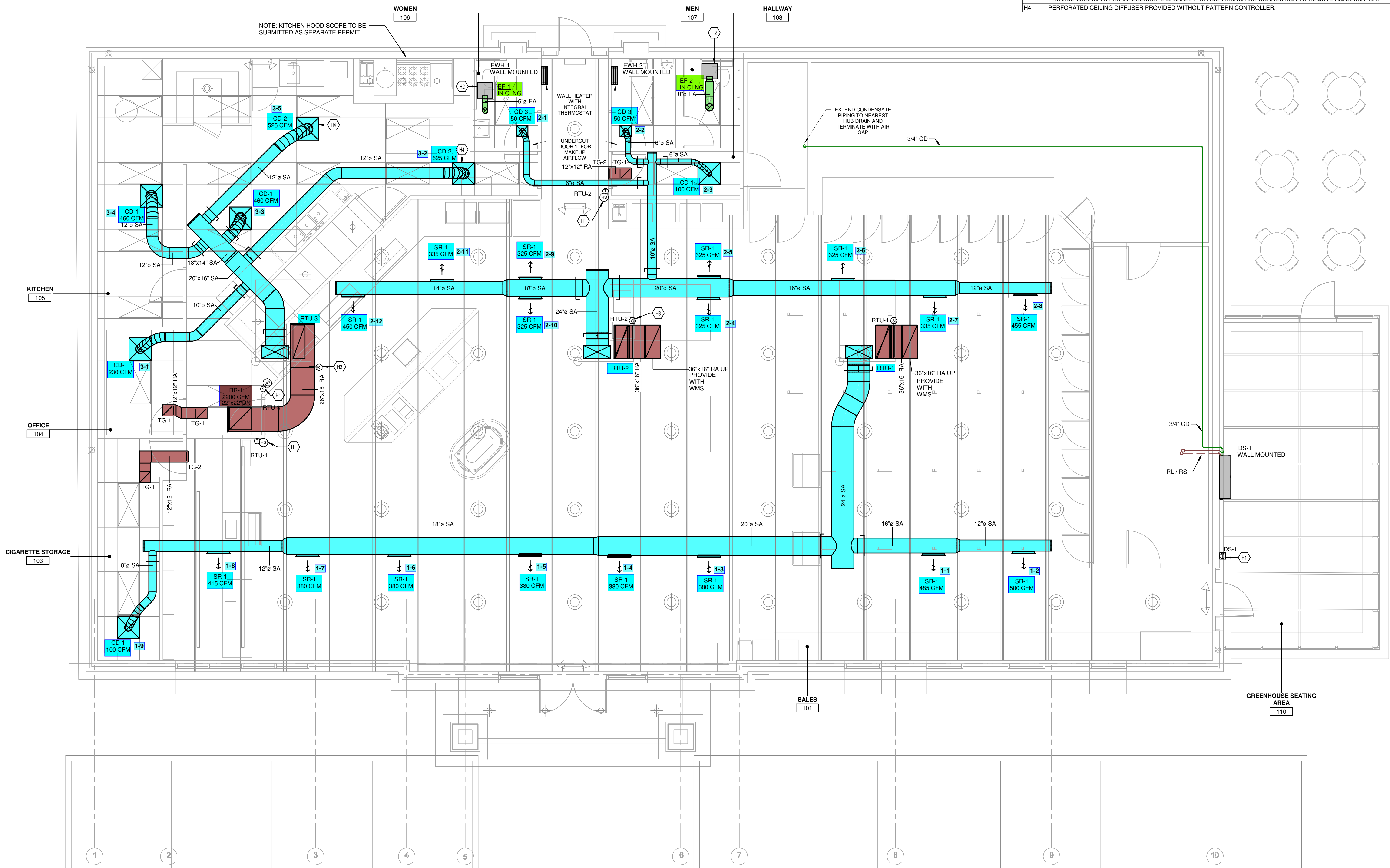
NO.	DATE	DESCRIPTION

PROPOSED NEW FUELING STATION & CONVENIENCE STORE  
**Cincinnati Dayton at Allen Road**  
 WEST CHESTER TOWNSHIP  
 BUTLER COUNTY, OHIO

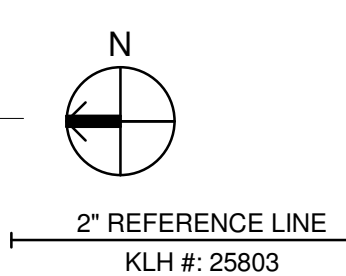
09/11/23

MECHANICAL FLOOR PLAN  
**M-100**

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 therein.



1 MECHANICAL FLOOR PLAN  
 1/4" = 1'-0"



**KEYED NOTES**

H5 PROVIDE AND BALANCE ROOFTOP UNIT AS SCHEDULED WITH NEW ROOF CURB. MAINTAIN ALL CODE AND MANUFACTURER REQUIRED CLEARANCES. OUTSIDE AIR INTAKE SHALL BE LOCATED A MINIMUM OF 10'-0" FROM ANY FLUE OR BUILDING EX-HAUST. PROVIDE CONDENSATE TRAP PER M-200 AND DRIP TO ROOF.

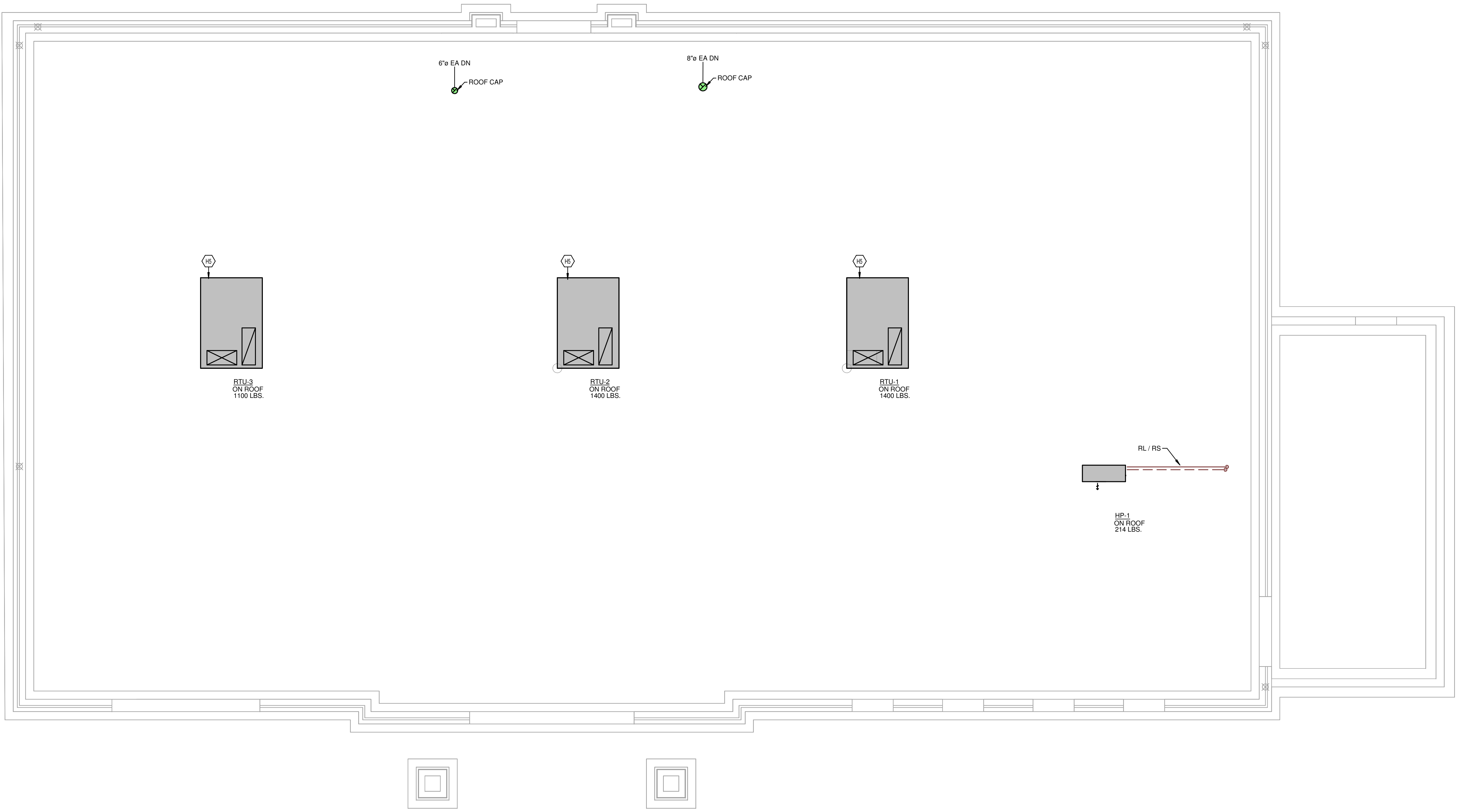
KLH ENGINEERS  
 KOHR'S LOHMEYER HELL ENGINEERS, INC.  
 WWW.KLHENGINEERS.COM  
 1500 W. CHESTER TOWNSHIP  
 10000 W. CHESTER TOWNSHIP  
 BUTLER COUNTY, OHIO 45004  
 800-354-5783 859-442-8050  
 859-442-8058 FAX  
 MECHANICAL  
 ELECTRICAL  
 ENGINEERS

REVISIONS

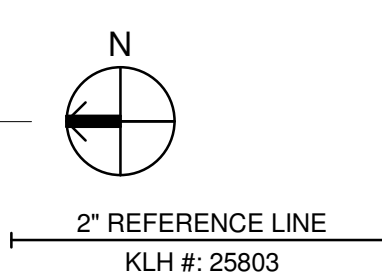

PROPOSED NEW FUELING STATION & CONVENIENCE STORE  
**Cincinnati Dayton at Allen Road**  
 WEST CHESTER TOWNSHIP  
 BUTLER COUNTY, OHIO

09/11/23

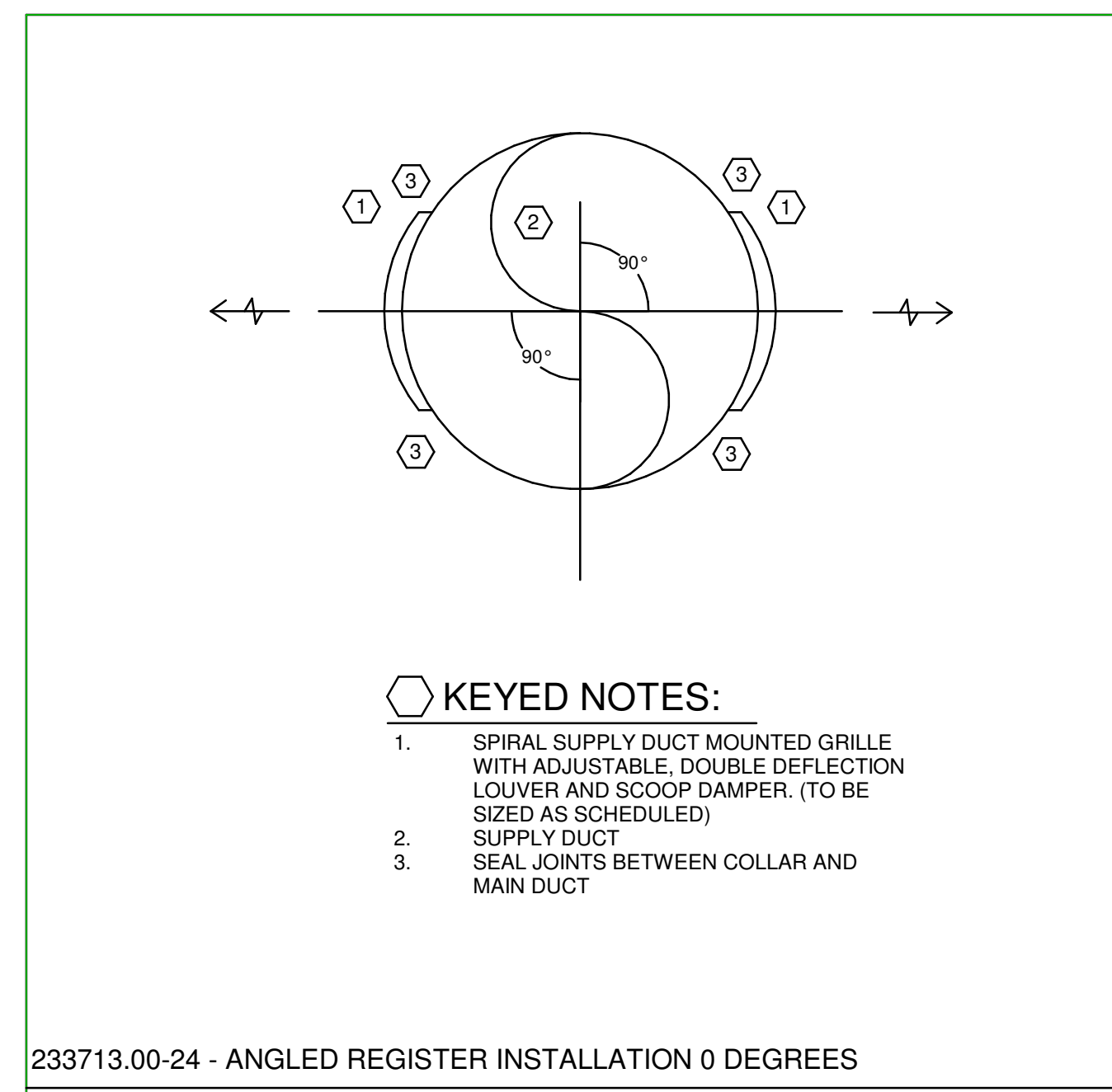
MECHANICAL ROOF PLAN  
**M-101**



① MECHANICAL ROOF PLAN  
 1/4" = 1'-0"

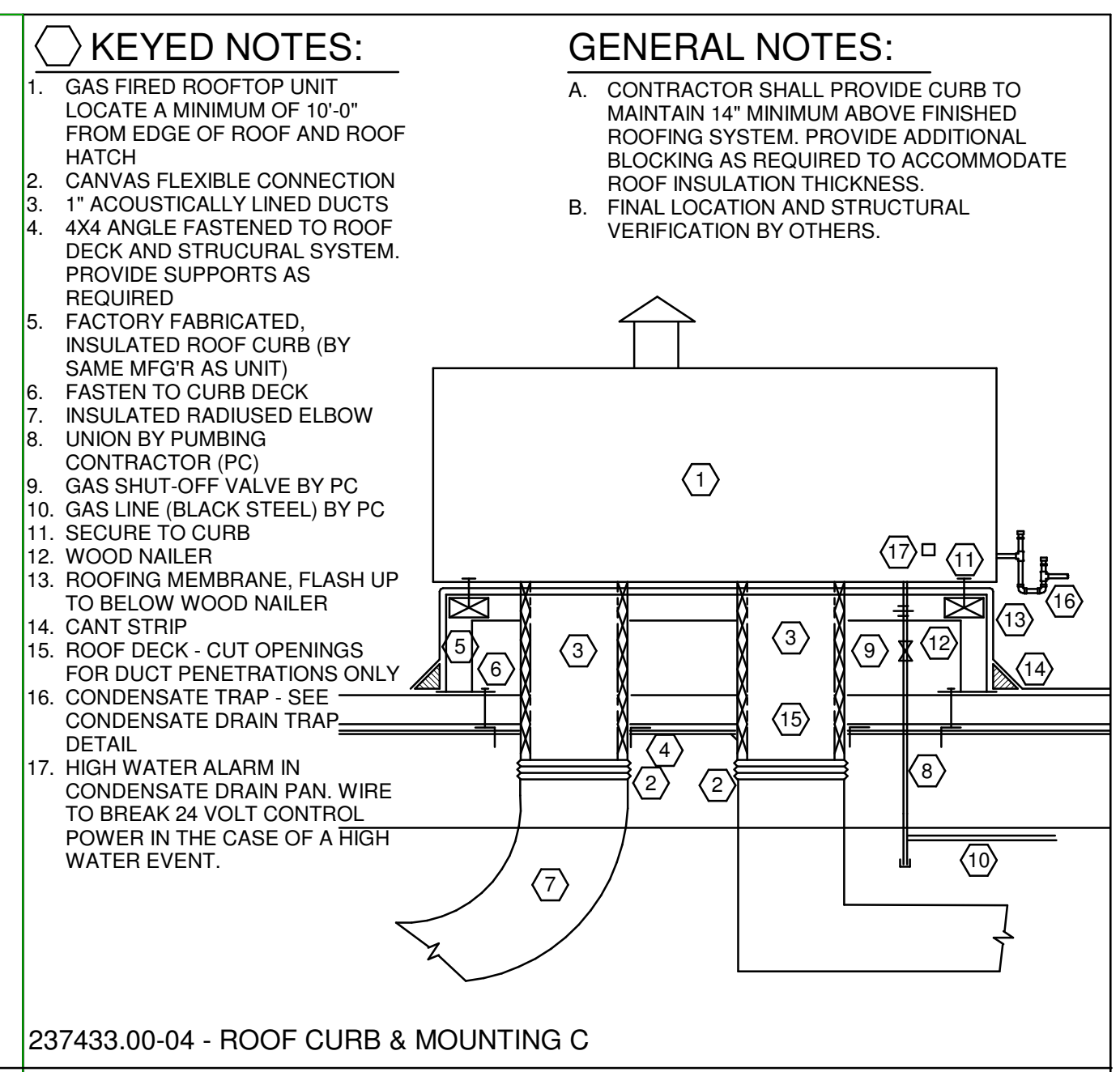


OWNERSHIP OF INSTRUMENTS OF SERVICE  
 All reports, plans, specifications, computer files, field data, notes and other documents and instruments prepared by the Consultant shall remain the property of the Consultant. The Consultant shall retain all common law, statutory and other reserved rights, including,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



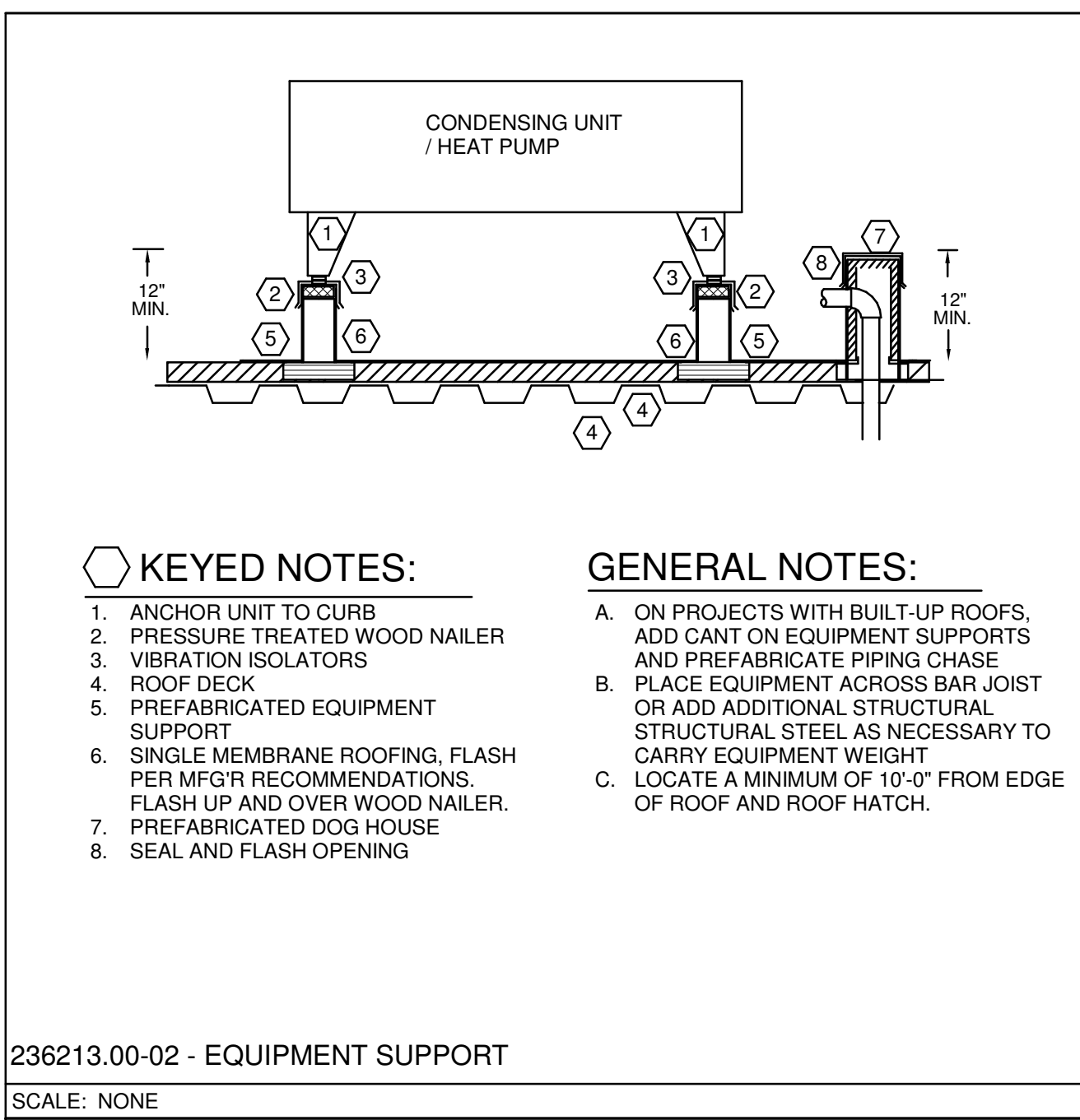
- KEYED NOTES:**
1. SPIRAL SUPPLY DUCT MOUNTED GRILLE WITH ADJUSTABLE, DOUBLE DEFLECTION LOUVER AND SCOOP DAMPER. (TO BE SIZED AS SCHEDULED)
  2. SUPPLY DUCT
  3. SEAL JOINTS BETWEEN COLLAR AND MAIN DUCT

233713.00-24 - ANGLED REGISTER INSTALLATION 0 DEGREES  
SCALE: NONE



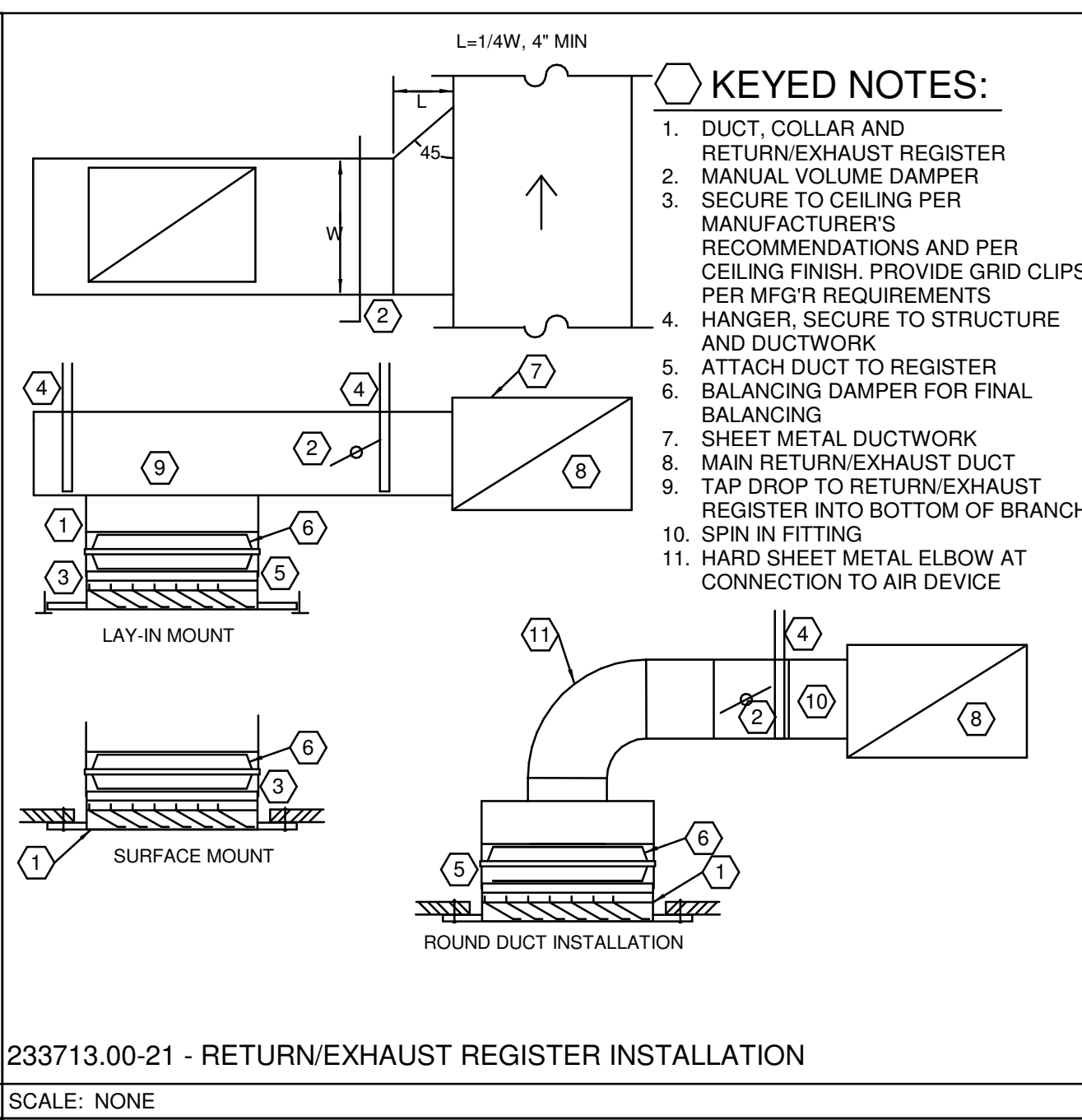
- KEYED NOTES:**
1. GAS FIRED ROOFTOP UNIT LOCATE A MINIMUM OF 10'-0" FROM EDGE OF ROOF AND ROOF HATCH
  2. CANVAS FLEXIBLE CONNECTION
  3. 1" ACOUSTICALLY LINED DUCTS
  4. 4X4 ANGLE FASTENED TO ROOF DECK AND STRUCTURAL SYSTEM. PROVIDE SUPPORTS AS REQUIRED
  5. FACTORY FABRICATED, INSULATED ROOF CURB (BY SAME MFG'R AS UNIT)
  6. FASTEN TO CURB DECK
  7. INSULATED RADIUS ELBOW
  8. UNION BY PUMING CONTRACTOR (PC)
  9. GAS SHUT-OFF VALVE BY PC
  10. GAS LINE (BLACK STEEL) BY PC
  11. SECURE TO CURB
  12. WOOD NAILER
  13. ROOFING MEMBRANE, FLASH UP TO BELOW WOOD NAILER
  14. CANT STRIP
  15. ROOF DECK - CUT OPENINGS FOR DUCT PENETRATIONS ONLY
  16. CONDENSATE TRAP - SEE CONDENSATE DRAIN TRAP DETAIL
  17. HIGH WATER ALARM IN CONDENSATE DRAIN PAN. WIRE TO BREAK 24 VOLT CONTROL POWER IN THE CASE OF A HIGH WATER EVENT.
- GENERAL NOTES:**
- A. CONTRACTOR SHALL PROVIDE CURB TO MAINTAIN 14" MINIMUM ABOVE FINISHED ROOFING SYSTEM. PROVIDE ADDITIONAL BLOCKING AS REQUIRED TO ACCOMMODATE ROOF INSULATION THICKNESS.
  - B. FINAL LOCATION AND STRUCTURAL VERIFICATION BY OTHERS.

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



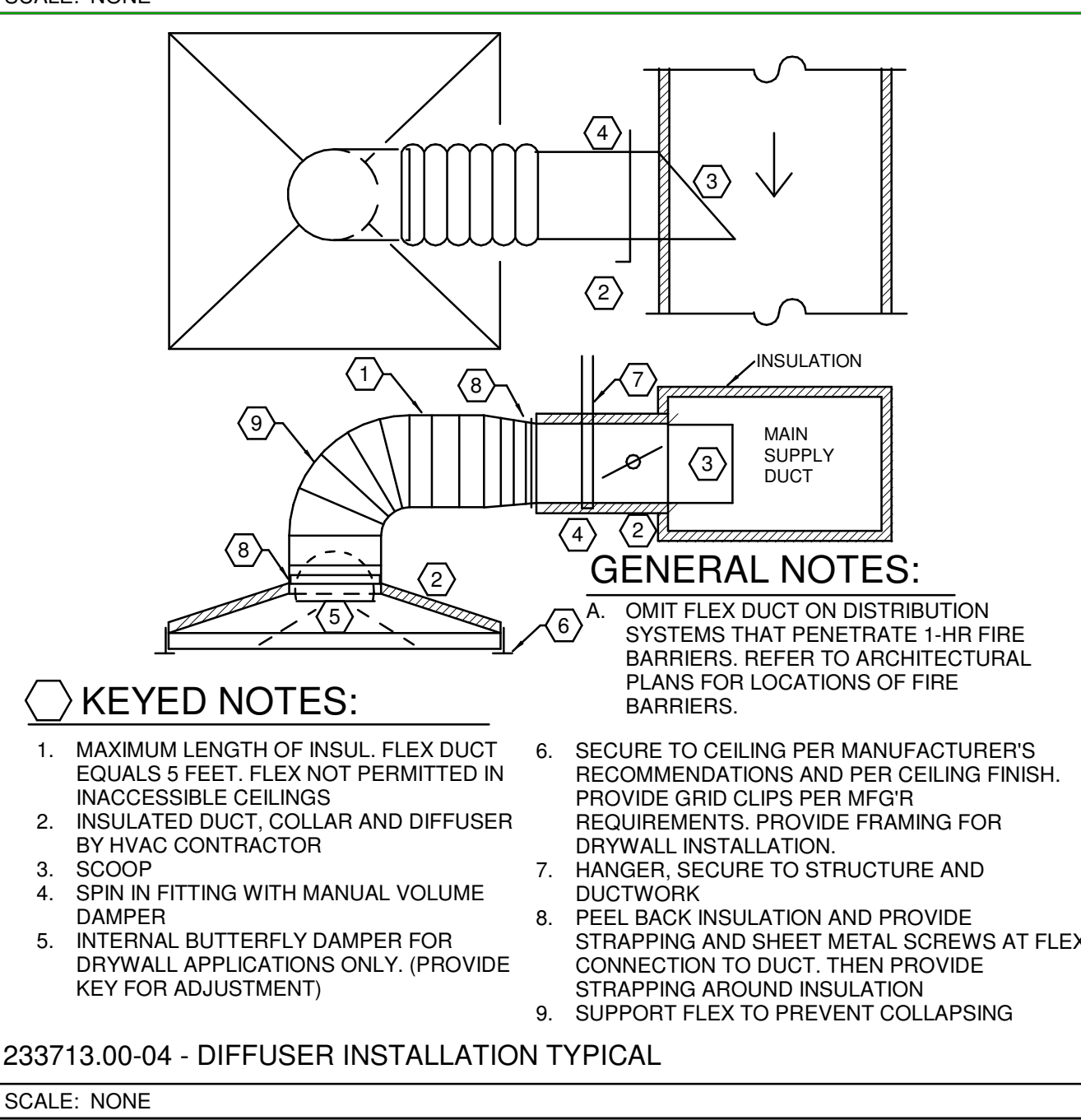
- KEYED NOTES:**
1. ANCHOR UNIT TO CURB
  2. PRESSURE TREATED WOOD NAILER
  3. VIBRATION ISOLATORS
  4. ROOF DECK
  5. PREFABRICATED EQUIPMENT SUPPORT
  6. SINGLE MEMBRANE ROOFING, FLASH PER MFG'R RECOMMENDATIONS. FLASH UP AND OVER WOOD NAILER.
  7. PREFABRICATED DOG HOUSE
  8. SEAL AND FLASH OPENING
- GENERAL NOTES:**
- A. ON PROJECTS WITH BUILT-UP ROOFS, ADD CANT ON EQUIPMENT SUPPORTS AND PREFABRICATE PIPING CHASE
  - B. PLACE EQUIPMENT ACROSS BAR JOIST OR ADD ADDITIONAL STRUCTURAL STEEL AS NECESSARY TO CARRY EQUIPMENT WEIGHT
  - C. LOCATE A MINIMUM OF 10'-0" FROM EDGE OF ROOF AND ROOF HATCH.

236213.00-02 - EQUIPMENT SUPPORT  
SCALE: NONE



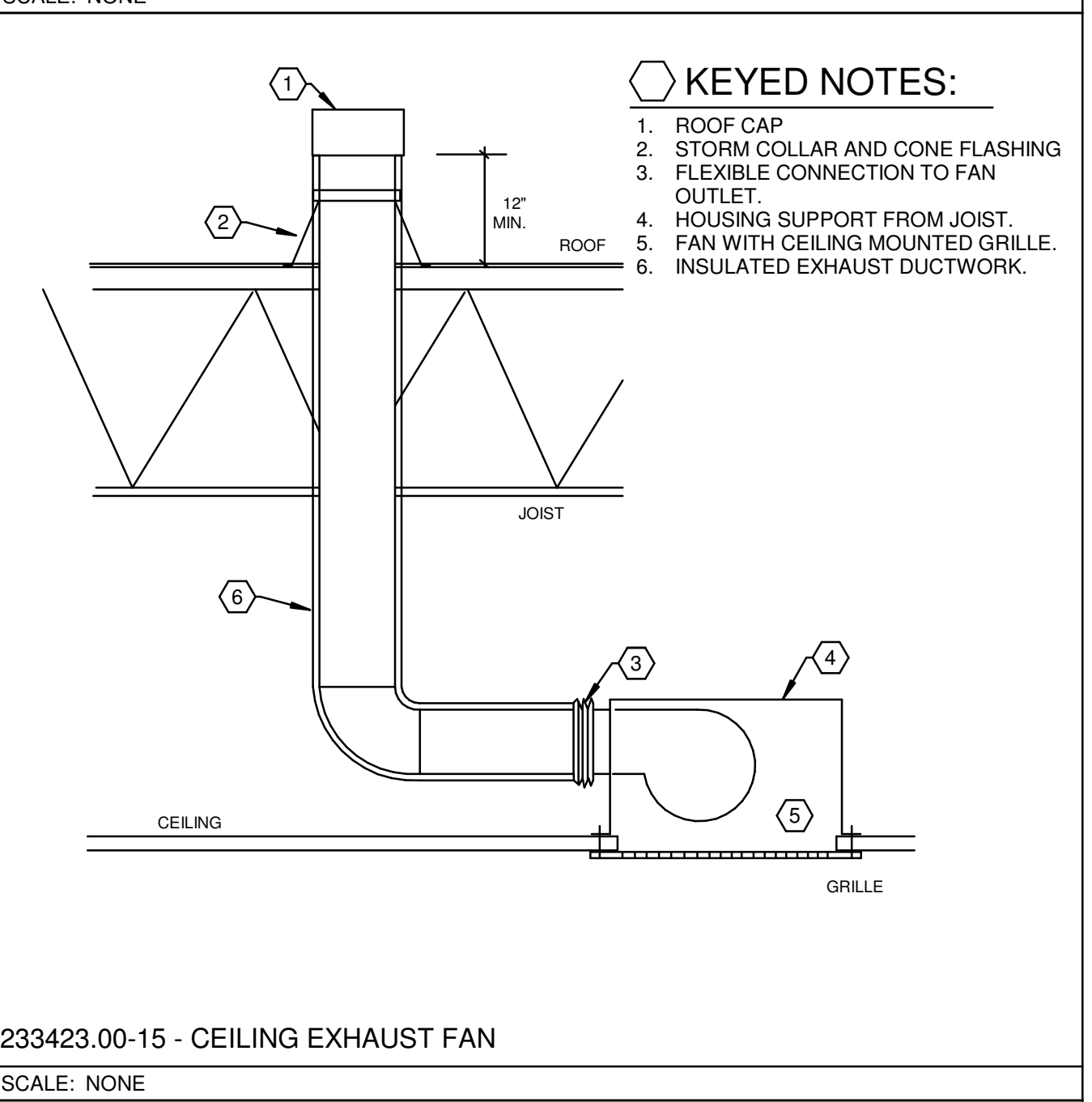
- KEYED NOTES:**
1. DUCT, COLLAR AND RETURN/EXHAUST REGISTER
  2. MANUAL VOLUME DAMPER
  3. SECURE TO CEILING PER MANUFACTURER'S RECOMMENDATIONS AND PER CEILING FINISH. PROVIDE GRID CLIPS PER MFG'R REQUIREMENTS
  4. HANGER, SECURE TO STRUCTURE AND DUCTWORK
  5. ATTACH DUCT TO REGISTER
  6. BALANCING 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



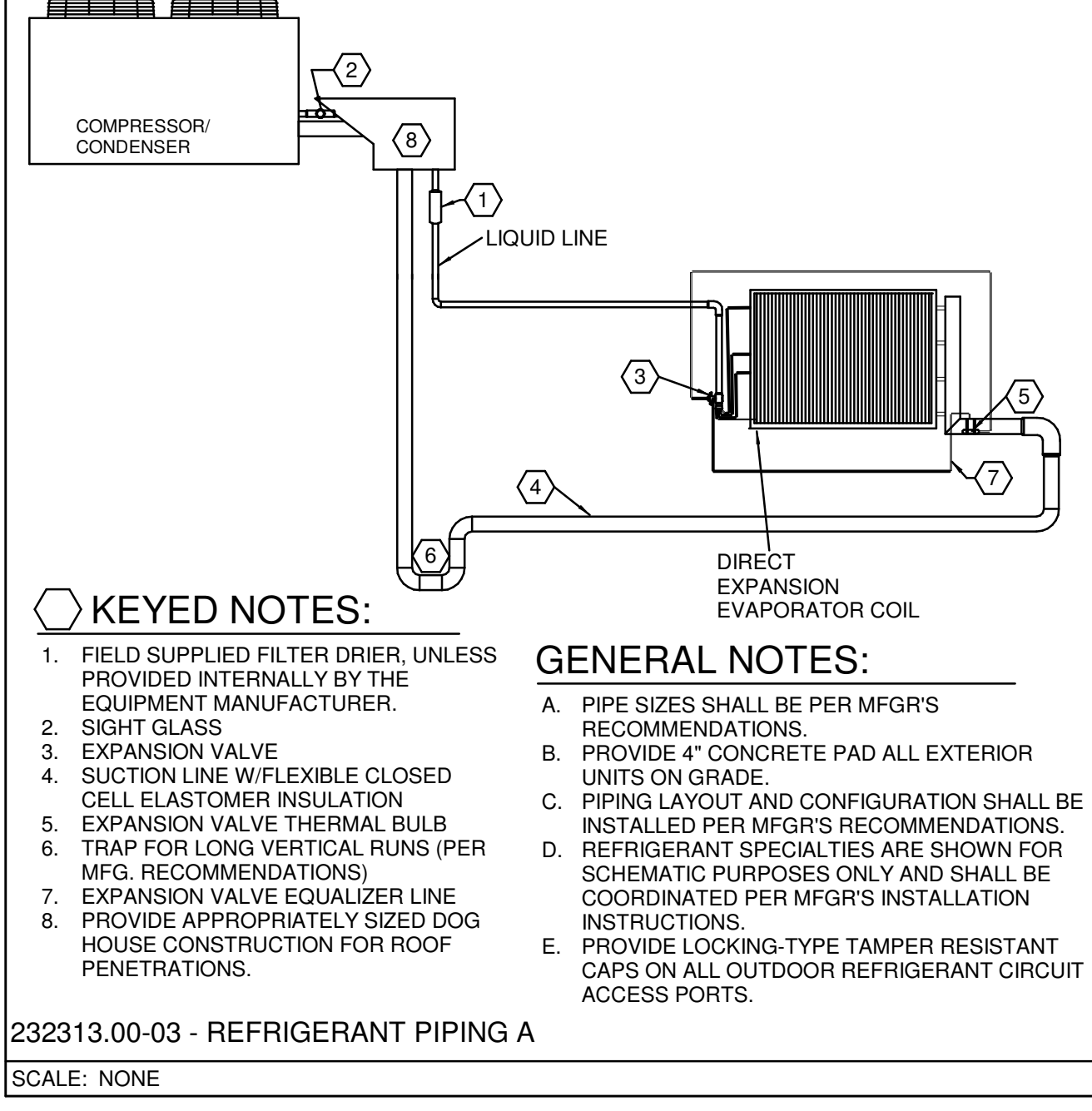
- KEYED NOTES:**
1. MAXIMUM LENGTH OF INSUL FLEX DUCT EQUALS 5 FEET. FLEX NOT PERMITTED IN INACCESSIBLE CEILINGS
  2. INSULATED DUCT, COLLAR AND DIFFUSER BY HVAC CONTRACTOR
  3. SCOOP
  4. SPIN IN FITTING WITH MANUAL VOLUME DAMPER
  5. INTERNAL BUTTERFLY DAMPER FOR DRYWALL APPLICATIONS ONLY. (PROVIDE 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
- GENERAL NOTES:**
- A. OMIT FLEX DUCT ON DISTRIBUTION SYSTEMS THAT PENETRATE 1-HR FIRE BARRIERS. REFER TO ARCHITECTURAL PLANS FOR LOCATIONS OF FIRE BARRIERS.

233713.00-04 - DIFFUSER INSTALLATION TYPICAL  
SCALE: NONE



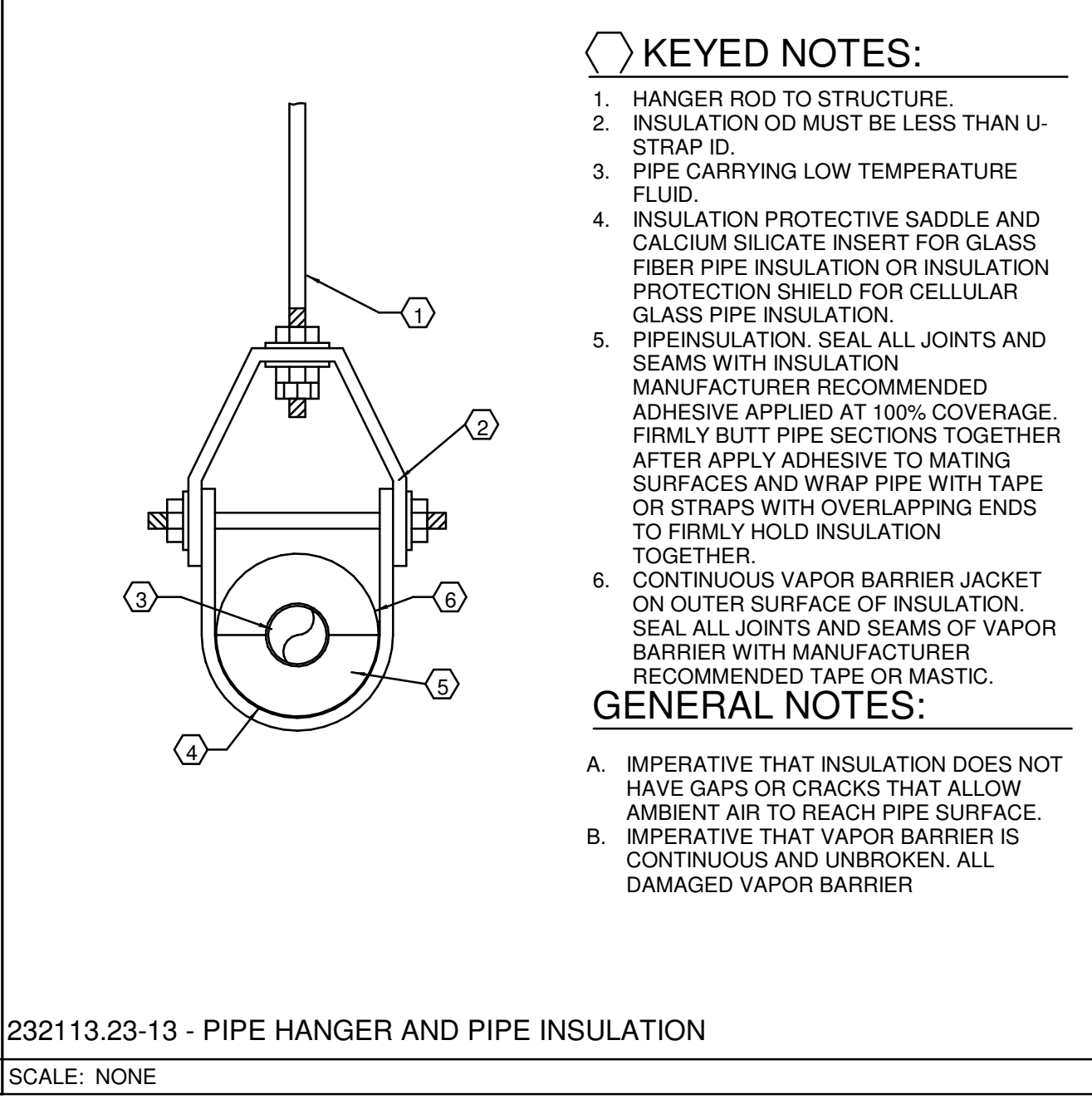
- KEYED NOTES:**
1. ROOF CAP
  2. STORM COLLAR AND CONE FLASHING
  3. FLEXIBLE CONNECTION TO FAN OUTLET.
  4. HOUSING SUPPORT FROM JOIST.
  5. FAN WITH CEILING MOUNTED GRILLE.
  6. INSULATED EXHAUST DUCTWORK.

233423.00-15 - CEILING EXHAUST FAN  
SCALE: NONE



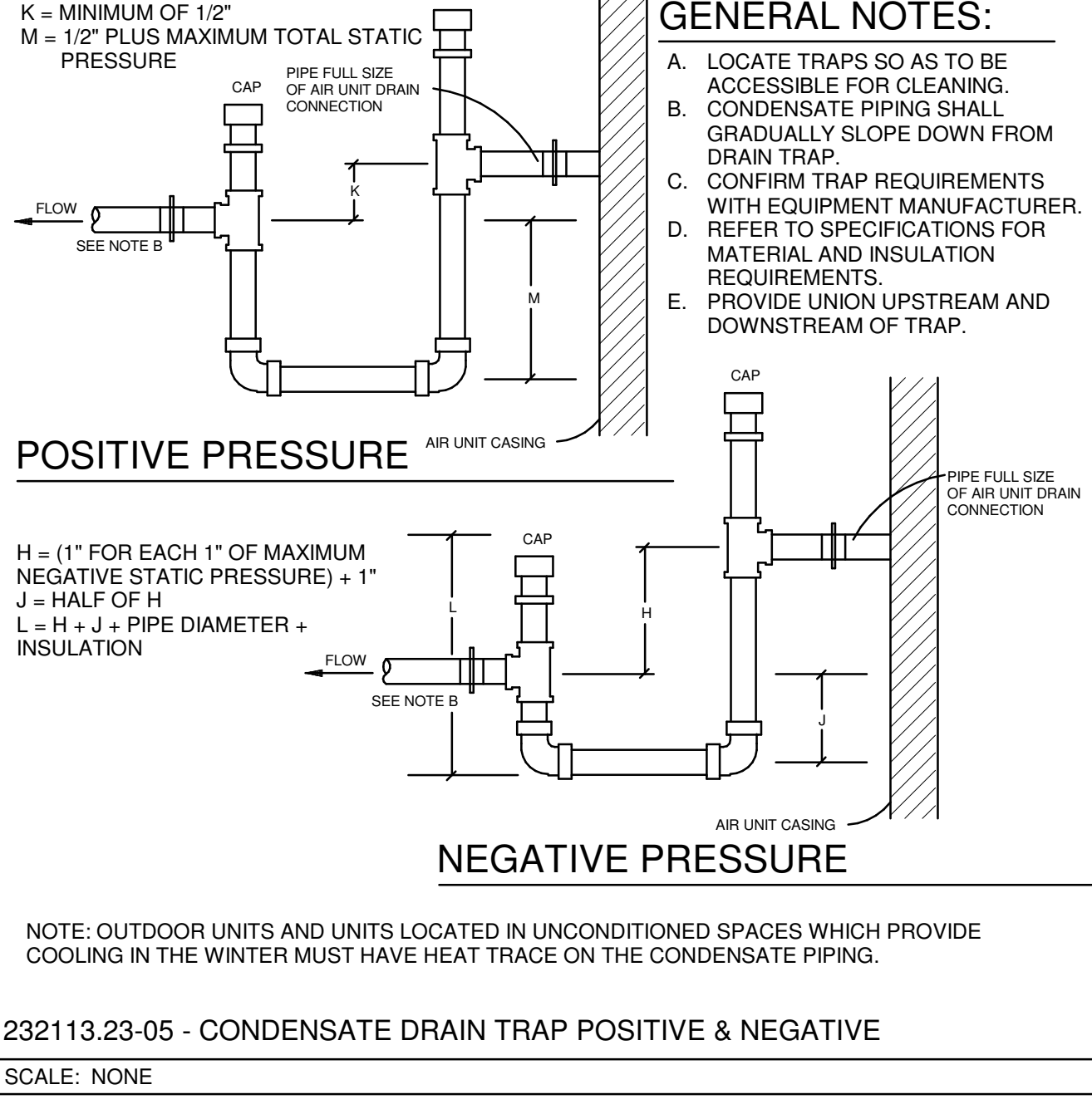
- KEYED NOTES:**
1. FIELD SUPPLIED FILTER DRIER, UNLESS PROVIDED INTERNALLY BY THE EQUIPMENT MANUFACTURER.
  2. SIGHT GLASS
  3. EXPANSION VALVE
  4. SUCTION LINE W/FLEXIBLE CLOSED CELL ELASTOMER INSULATION
  5. EXPANSION VALVE THERMAL BULB TRAP FOR LONG VERTICAL RUNS (PER MFG. RECOMMENDATIONS)
  6. EXPANSION VALVE EQUALIZER LINE
  7. PROVIDE APPROPRIATELY SIZED DOG HOUSE CONSTRUCTION FOR ROOF PENETRATIONS.
  8. DIRECT EXPANSION EVAPORATOR COIL
- GENERAL NOTES:**
- A. PIPE SIZES SHALL BE PER MFG'R'S RECOMMENDATIONS.
  - B. PROVIDE 4" CONCRETE PAD ALL EXTERIOR UNITS ON GRADE.
  - C. PIPING LAYOUT AND CONFIGURATION SHALL BE INSTALLED PER MFG'R'S RECOMMENDATIONS.
  - D. REFRIGERANT SPECIALTIES ARE SHOWN FOR SCHEMATIC PURPOSES ONLY AND SHALL BE COORDINATED PER MFG'R'S INSTALLATION INSTRUCTIONS.
  - E. PROVIDE LOCKING-TYPE TAMPER RESISTANT CAPS ON ALL OUTDOOR REFRIGERANT CIRCUIT ACCESS PORTS.

232313.00-03 - REFRIGERANT PIPING A  
SCALE: NONE



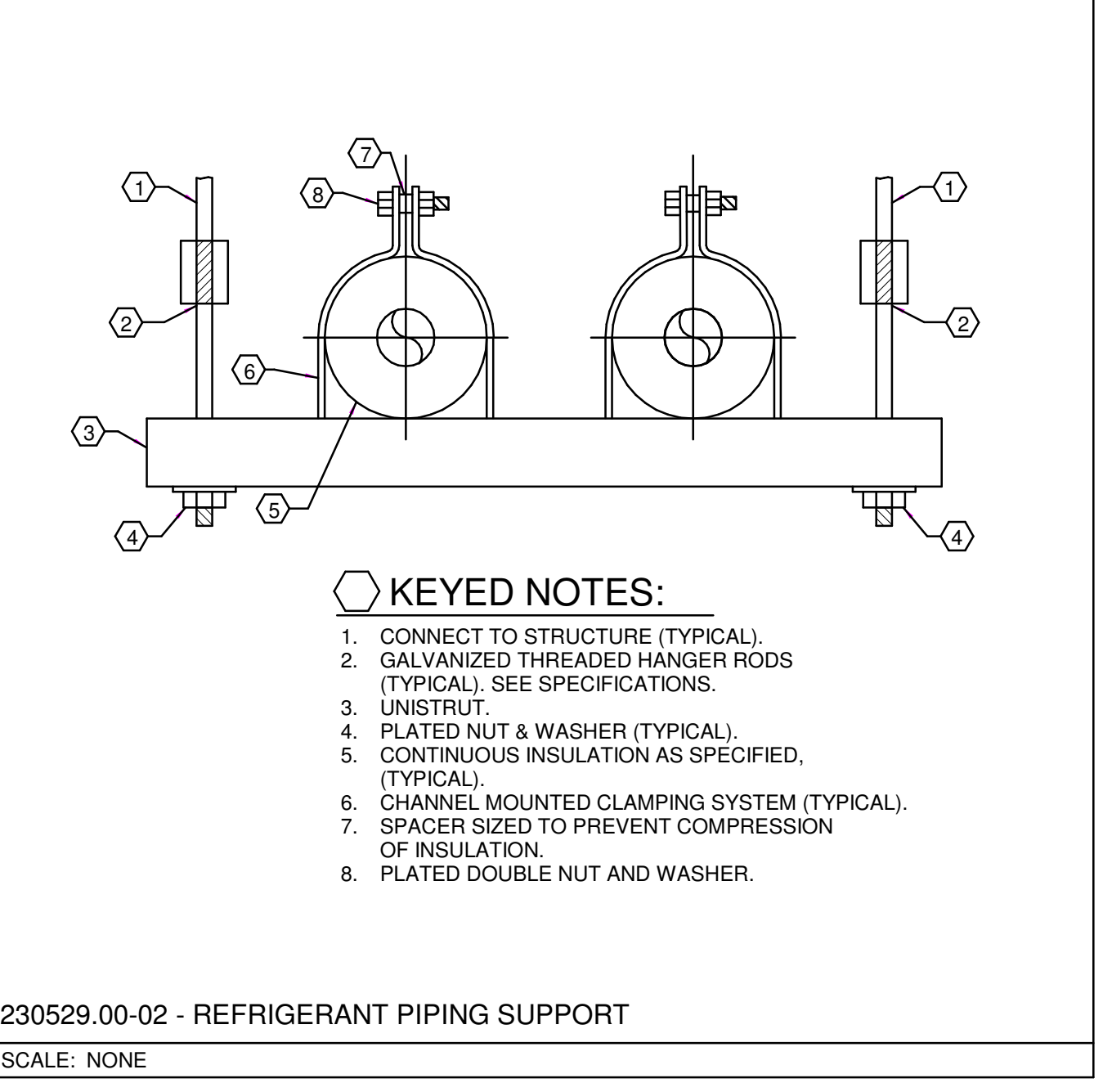
- KEYED NOTES:**
1. HANGER ROD TO STRUCTURE.
  2. INSULATION OD MUST BE LESS THAN U-STRAP ID.
  3. PIPE CARRYING LOW TEMPERATURE FLUID.
  4. INSULATION PROTECTIVE SADDLE AND CALCIUM SILICATE INSERT FOR GLASS FIBER PIPE INSULATION OR INSULATION PROTECTION SHIELD FOR CELLULAR GLASS PIPE INSULATION.
  5. PIPE INSULATION. SEAL ALL JOINTS AND SEAMS WITH INSULATION MANUFACTURER RECOMMENDED ADHESIVE APPLIED AT 100% COVERAGE. FIRMLY BUTT PIPE SECTIONS TOGETHER AFTER APPLY ADHESIVE TO MATING SURFACES AND WRAP PIPE WITH TAPE OR STRAPS WITH OVERLAPPING ENDS TO FIRMLY HOLD INSULATION TOGETHER.
  6. CONTINUOUS VAPOR BARRIER JACKET ON OUTER SURFACE OF INSULATION. SEAL ALL JOINTS AND SEAMS OF VAPOR BARRIER WITH MANUFACTURER RECOMMENDED TAPE OR MASTIC.
- GENERAL NOTES:**
- A. IMPERATIVE THAT INSULATION DOES NOT HAVE GAPS OR CRACKS THAT ALLOW AMBIENT AIR TO REACH PIPE SURFACE.
  - B. IMPERATIVE THAT VAPOR BARRIER IS CONTINUOUS AND UNBROKEN. ALL DAMAGED VAPOR BARRIER

232113.23-13 - PIPE HANGER AND PIPE INSULATION  
SCALE: NONE



- KEYED 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.
- POSITIVE PRESSURE**
- $K = \text{MINIMUM OF } 1/2" \text{ PRESSURE}$   
 $M = 1/2" \text{ PLUS MAXIMUM TOTAL STATIC PRESSURE}$
- NEGATIVE PRESSURE**
- $H = (1" \text{ FOR EACH } 1" \text{ OF MAXIMUM NEGATIVE STATIC PRESSURE}) + 1"$   
 $J = \text{HALF OF } H$   
 $L = H + J + \text{PIPE DIAMETER} + \text{INSULATION}$
- 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

**KLH ENGINEERS**  
 KOHRIS LONNEMANN HEIL ENGINEERS, INC.  
 WWW.KLHENGINEERS.COM  
 15000 WILSON AVENUE, SUITE 111  
 FARMERS BRANCH, TEXAS 75115  
 800-394-5789 855-442-8050  
 855-442-8058 FAX

MECHANICAL/ELECTRICAL ENGINEERS

NO.	DATE	DESCRIPTION

PROPOSED NEAR FUELING STATION & CONVENIENCE STORE

**Cincinnati Dayton at Allen Road**

WEST CHESTER TOWNSHIP  
 BUTLER COUNTY, OHIO

09/11/23

MECHANICAL - DETAILS  
**M-200**

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 therein.

## WALL UNIT HEATERS 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	HTG KW	Volts	Phase	AVAILABLE FAULT CURRENT
EW-1	WALL HEATER	25	QMARK	AWH4408F	2	208	1	2068
EW-2	WALL HEATER	25	QMARK	AWH4408F	2	208	1	1874

## 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	FED FROM	WEIGHT (lbs)	MANUFACTURER	MODEL	VOLTS	PHASE	CFM (cfm)	NOMINAL TONS	MCA (amps)	AVAILABLE FAULT CURRENT
DS-1	DUCTLESS SPLIT HIGH WALL UNIT	HP-1	46	MITSUBISHI	TPKA0A0361KA70A	208	1	900	3	1	

## 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	VOLTS	PHASE	MIN EER	MIN COP	NOMINAL TONS	CLG MBH (mbh)	CLG SENS (mbh)	HTG MBH (mbh)	MCA (amps)	OCP (amps)	AVAILABLE FAULT CURRENT
HP-1	DUCTLESS SPLIT OUTDOOR CONDENSING UNIT	214	MITSUBISHI	TRUZA0361KA70BA	208	1	10.8	2.85	3	37	36	25	25	30	2218

## HVAC DIFFUSERS AND REGISTERS SCHEDULE

TAG	MANUFACTURER	MODEL	FACE	MOUNTING	MATERIAL	FINISH	DAMPER TYPE	BORDER STYLE	REMARKS
CD-1	TITUS	OMNI	24"x24"	CEILING	STEEL	STANDARD WHITE	OPPOSED BLADE	LAY IN MOUNTING	
CD-2	TITUS	PAS-AA	24"x24"	CEILING	ALUMINUM	STANDARD WHITE	(none)	LAY IN MOUNTING	
CD-3	TITUS	OMNI	12"x12"	CEILING	STEEL	STANDARD WHITE	OPPOSED BLADE	LAY IN MOUNTING	
RR-1	TITUS	350RL	24"x24"	CEILING	STEEL	METALISENT ALUM. BAKED ENAMEL	PARALLEL BLADE	LAY IN MOUNTING	
SR-1	TITUS	S300FL	24"x6"	DUCT	ALUMINUM	STANDARD WHITE	SCOOP DAMPER	SURFACE MOUNT	
TG-1	TITUS	350RL	12"x12"	CEILING	STEEL	STANDARD WHITE	(none)	LAY-IN PANEL, PROVIDE FRAME FOR CEILING MOUNTING	
TG-2	TITUS	350RL	12"x12"	SIDEWALL	STEEL	STANDARD WHITE	(none)	SURFACE MOUNT	

## HVAC VENTILATION SCHEDULE

NUMBER	NAME	AREA	PEOPLE	OA PER PERSON	OA PER SQ FT.	REQ SUP	ACT SUP	REQ OA	ACT OA	ACT RET	ACT EXH	CRIT OA	PRESSURE	PCT OPERABLE	NATURAL VENTILATION
101	SALES	1604 SF	25	7.5	0.12	2390	3300	478	660	3300	0	0.1439	E	0	
103	CIGARETTE STORAGE	102 SF	0	0	0.12	70	100	14	20	100	0	0.15	E	0	
104	OFFICE	66 SF	1	5	0.06	5	230	1	46	230	0	0.0478	E	0	
105	KITCHEN	661 SF	0	0	0	50	1970	10	394	1970	463	0	N	0	
106	WOMEN	43 SF	0	0	0	40	50	8	10	0	75	0	N	0	
107	MEN	84 SF	0	0	0	40	50	8	10	0	150	0	N	0	
108	HALLWAY	46 SF	2	7.5	0.06	80	100	16	20	100	0	0.22	E	0	
110	GREENHOUSE SEATING AREA	319 SF	4	5	0.06	0	2600	0	0	2600	0	0	E	0.1253	YES
111	SALES - INTERIOR	1616 SF	25	7.5	0.12	2530	3200	506	640	3200	0	0.1487	E	0	
TOTAL		4542 SF													

## HVAC ACCESSORIES

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

## EXHAUST FANS SCHEDULE

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

EQUIPMENT MARK	DESCRIPTION	WEIGHT (lbs)	MANUFACTURER	MODEL	VOLTS	PHASE	WATTS (Watts)	ESP (in WC)	FLA (amps)	OCP (amps)	AVAILABLE FAULT CURRENT
EF-1	CEILING MOUNTED VENTILATOR	12	GREENHECK	SP-A50-90-VG	120	1	6	0.3	29	15	1532
EF-2	CEILING MOUNTED VENTILATOR	24	GREENHECK	CSP-A390-VG	120	1	24.42	0.35	1.5	15	1045

## LOAD SCHEDULE

THE HEATING AND COOLING LOAD CALCULATIONS ARE BASED ON THE RTS (RADIANT TIME SERIES) METHOD. ASSUMPTIONS AND EXECUTION OF THESE METHODS ARE PER ASHRAE 183-2007...

EQUIPMENT MARK	COOLING LOAD BREAKDOWN													HEATING LOAD BREAKDOWN										
	CRF	CWALL	CPART	CGLASS	CSOLAR	CLIGHTS	CEQUIP	CPSENS	CSSENS	CFAN	COAS	CTOT	CTLAT	CTOT	CRF	HWALL	HPART	HGLASS	HSLAB	HSPACE	HOA	HTOT		
RTU-1	2.2	2	0	3.3	13	8.7	20.4	6.1	56	2.7	13.6	84.4	5.1	17.1	22.2	106.6	4.8	6.8	0	15.5	7.6	35	50.9	85.9
RTU-2	2.3	0.4	0	0	0	9.1	20.4	6.6	39.1	2.7	13.6	84.2	5.5	17.1	22.6	106.8	5	1.6	0	2.9	9.6	50.9	60.5	
RTU-3	0.9	1.3	0	0	0	3.7	37.5	0.2	43.8	1.4	8.8	54.5	0.2	11	11.2	65.7	2	4.4	0	3.8	10.3	32.9	43.3	

## ROOFTOP UNITS SCHEDULE

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

EQUIPMENT MARK	DESCRIPTION	WEIGHT (lbs)	MANUFACTURER	MODEL	VOLTS	PHASE	CFM (cfm)	ESP (in WC)	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)	GAS HTG IN (mbh)	GAS HTG OUT (mbh)	MIN GAS PRESSURE (in WC)	MAX GAS PRESSURE (in WC)	MCA (amps)	OCP (amps)	AVAILABLE FAULT CURRENT	ACCESSORIES
RTU-1	PACKAGED OUTDOOR ROOFTOP UNIT	1400	CARRIER	48GCCN12AZM5-6W0A0	208	3	3400	0.6	680	10	79	67	107	84	55	54	93	180	147.6	4.5	13.5	56	70	3792	2,3,4,10,21,23
RTU-2	PACKAGED OUTDOOR ROOFTOP UNIT	1400	CARRIER	48GCCN12AZM5-6W0A0	208	3	3400	0.6	680	10	79	67	107	84	55	54	88	180	147.6	4.5	13.5	56	70	4766	2,3,4,10,21,23
RTU-3	PACKAGED OUTDOOR ROOFTOP UNIT	1100	CARRIER	48GCCN07AZM5-6W0A0	208	3	2200	0.5	440	6	79	67	66	55	55	54	43	72	59	4.5	13.5	39	50	4680	2,3,4,10,21,23

## ELECTRICAL HVAC COORDINATION SCHEDULE

CONNECTION MARK	DESCRIPTION	VOLTAGE	PHASE	BHP	HP	WATTS	HTG KW	FLA	MCA	OCP	FED FROM	MOTOR CONTROL TYPE												SHORT CIRCUIT RATING CODE REQUIRED?	AVAILABLE FAULT CURRENT (A)
												DC FURN	DC INST	DC WIRE	MC TYPE	MC FURN	MC INST	MC WIRE	CN TYPE	CN FURN	CN INST	CN WIRE			
DS-1	DUCTLESS SPLIT HIGH WALL UNIT	208 V	1						1			EC	EC	EC	MG	MFR	MFR	MFR	LOW	MFR	MFR	MFR	No		
EF-1	CEILING MOUNTED VENTILATOR	120 V	1			6	29	15				EC	EC	EC	MG	MFR	MFR	MFR	MAN	EC	EC	EC	No	1532	
EF-2	CEILING MOUNTED VENTILATOR	120 V	1			24.42	1.5	15				EC	EC	EC	MG	MFR	MFR	MFR	MAN	EC	EC	EC	No	1045	
EW-1	WALL AND CEILING HEATER	208 V	1									EC	EC	EC	---	---	---	---	INT	MFR	MFR	MFR	No	2068	
EW-2	WALL AND CEILING HEATER	208 V	1									EC	EC	EC	---	---	---	---	INT	MFR	MFR	MFR	No	1874	
HP-1	DUCTLESS SPLIT OUTDOOR CONDENSING UNIT	208 V	1			25	31					EC	EC	EC	MG	MFR	MFR	MFR	LOW	MFR	MFR	MFR	No	2218	
RTU-1	PACKAGED OUTDOOR ROOFTOP UNIT	208 V	3						56	70		EC	EC	EC	MG	MFR	MFR	MFR	LOW	HC	HC	HC	No	3792	
RTU-2	PACKAGED OUTDOOR ROOFTOP UNIT	208 V	3						56	70		EC	EC	EC	MG	MFR	MFR	MFR	LOW	HC	HC	HC	No	4766	
RTU-3	PACKAGED OUTDOOR ROOFTOP UNIT	208 V	3						39	50		EC	EC	EC	MG	MFR	MFR	MFR	LOW	HC	HC	HC	No	4680	

**KLH ENGINEERS**  
MECHANICAL - ELECTRICAL ENGINEERS

KOHRS LONNEMANN HEIL ENGINEERS, INC.  
WWW.KLHENGINEERS.COM  
1500 MAIN STREET, SUITE 111  
TOWNSHIP OF WINDY HILLS, OHIO  
900-354-5783 859-442-8050  
859-442-8058 FAX

REVISIONS					
-----------	--	--	--	--	--

PROPOSED NEAR FUELING STATION & CONVENIENCE STORE

Cincinnati Dayton at Allen Road

WEST CHESTER TOWNSHIP  
BUTLER COUNTY, OHIO

09/11/23

MECHANICAL - SCHEDULES

# M-300

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 therein.

**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.

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.

**Tests and Adjustments**

No ducts, piping, fixtures or equipment shall be concealed or covered until they have been inspected and approved by the architect or authority who is 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.

**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.

Unrated 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/plumb 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.

Provide trap at drain piping connection to unit sized per manufacturer's recommendations.

**Access:** Provide access space around and over mechanical equipment 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.

**Roofing 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 torque 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 electrical 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 test in accordance with equipment manufacturer's published torque tightening values for equipment connectors. Where manufacturer's torque requirements are not indicated, tighten connectors and terminals to comply with tightening torques specified in UL Std 486A.

**Painting:** After construction is completed, including cleaning, clean unit exposed surfaces, vacuum clean coils and other mechanical equipment. Clean exterior 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.

**SECTION 23 05 03.00 – SUBMITTALS FOR HVAC**

**General**  
Where submittals are required by the Contract Documents, they shall be prepared and submitted 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 shall be read in conjunction with 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 furnished for 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 KHLH upon request. It is also downloadable from the KHLH website at [www.klhengrs.com](http://www.klhengrs.com).

**Include an index:** The index shall enumerate the contents covers during balance of construction.

**Checklist:** 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. Where a section requires a shop drawing submittal and the other half as a separate one.

**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.

**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
31 to 60 (#14 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 and supports.

**Individual pipe hangers to be Anvil International Clevis Hanger Fig. 260, Elen, 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 8' 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 owner.

**General**  
Test, adjust, and balance the following mechanical systems: Supply air systems, all pressure ranges Return air systems. Exhaust air systems. Verify temperature control system operation. 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.

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.

**Ordering 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 shut 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 in of 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.

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 requirements and 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 owner.

**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.

**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. Start-up The unit shall operate on a 7 day/night programmable thermostat. During start-up, 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 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 and remote space temperature sensor.

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 air flow. 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 and the system shall be controlled through a 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. Economizer shall have powered relief.

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 and energized second stage of cooling.

7. 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 speed and the gas heating shall be disabled. On a further call for heating, the supply fan shall be set to high speed and the gas heating shall be staged on.

8. Dehumidification Provide a hot gas reheat coil for dehumidification. Provide space humidity sensor. When the space humidity rises above 60% (RH), provide full cooling and modulate the hot gas reheat coil to maintain space temperature setpoint. When the space humidity reaches setpoint, resume with normal heating & cooling operation.

9. Smoke Detector When the smoke detector is alarmed, the system shall be alarmed and the air handler shall fail safe with manual reset.

10. 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. On setback, provide full cooling and modulate 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.

Ductless Split System ACU Unit shall operate on a 7-day/night schedule with three hour occupied and/or unoccupied override. The fan shall cycle in sequence with the heating/cooling coils to maintain space temperature setpoint.

**Condensing Units**  
All safeties interlocks associated with the condensing unit shall be hard wired. Software interlocks are acceptable as secondary additional safeties. Unit shall have self-contained controls by unit manufacturer.

On a call for cooling, with all safety devices satisfied, the first stage compressor shall be energized causing the compressor and condenser fan motor to operate (the indoor fan condenser shall be wired to start at the same time as the compressor). A liquid line solenoid valve will open when the first stage compressor starts.

On a further call for cooling, the second stage compressor condenser fan motor to operate. A corresponding liquid line solenoid valve will close when the second stage compressor starts. As cooling demand decreases, the second stage compressor condenser fan motor to operate. A corresponding liquid line solenoid valve will close when the second stage compressor is off preventing refrigerant migration back to the compressor during the off cycle.

**Exhaust Fans** (Manual) Exhaust fans shall be controlled by local manual switch furnished, installed and hard 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 covers 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/ceiling). 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 dragsline.

The HVAC/Temperature Control Contractor shall coordinate with the General Contractor to ensure thermal envelope is maintained at these locations.

**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 bridge 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 bridge rings are provided by the electrical contractor for low voltage wiring, 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/bridge ring paths to wall outlet boxes and equipment unless otherwise 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, bridge 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, all 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 schedule 40 PVC piping with PVC cement 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 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 31 13.00 – METAL DUCTS**



KOHRS LONNEMANN HELL ENGINEERS, INC.  
WWW.KHLHENGINEERS.COM  
1500 CENTENNIAL BLVD., SUITE 111  
DES MOINES, IOWA 50319  
800-354-5753 853-442-8050  
853-442-8058 FAX

REVISIONS					

PROPOSED NEW FUELING STATION & CONVENIENCE STORE  
Cincinnati Dayton at Allen Road  
WEST CHESTER TOWNSHIP  
BUTLER COUNTY, OHIO

MECHANICAL - SPECIFICATIONS  
M-400

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 therein.</

**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 arc 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 duct sealant, type applicable for ductwork 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 Standard 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 fitting 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.

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 34 23.00 – HVAC POWER VENTILATORS**  
**Submittal Requirements**  
Product Data: For each type of product indicated.  
Ceiling Ventilators  
Centrifugal Ceiling Exhausters: Provide centrifugal ceiling exhausters, designed for ceiling or wall mounting, of type, size and capacity as scheduled.  
Provide AMCA Certified Ratings Seal.  
Type: Provide galvanized steel housing lined with acoustical insulation, adaptable for ceiling or wall installation. Provide centrifugal fan wheels mounted on motor shaft with fan shrouds, all removable for service. Provide integral backdraft damper fan discharge.  
Grille: Provide steel louvered grille with flange on intake with thumbscrew attachment to fan housing.  
Motor: Provide permanent split-capacitor motor, permanently lubricated.

**Accessories:** Provide manufacturer's standard roof jack, wall cap, and transition fittings as indicated on drawings or schedules.  
**Duct Lining:** Provide 1" thick, 3-lb density duct liner a minimum of 5' (five feet) up and down stream of fan.  
**Manufacturer:** Subject to compliance with requirements, provide centrifugal ceiling exhausters of one of the following:  
Acme  
Cook (Loren) Co.  
Greenheck.  
Twin City Fan & Blower

**INSTALLATION**  
Coordinate ventilator work with work of roofing, walls, and ceilings, as necessary for proper interfacing.  
Provide access door in duct below ventilator to service damper.  
Solder bottom joints and up 2" of side joints of duct under roof ventilator to retain any moisture entering ventilator.

**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  
Prestco  
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.

**STAGED 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.  
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 pan. 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:  
Lead compressor shall be 2-stage.

**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:**  
redundant gas valves;  
intermittent pilot ignition;  
electronic spark ignition system;  
high limit cutout;  
forced draft proving switch;  
flame roll-out switch.  
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:**  
Heat exchangers: Provide manufacturer's construction of aluminumized steel gas-fired heat exchangers and burners, designed for minimum of 2-stage operation. Provide single gas connection.  
**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:  
Power Exhaust Fan – Shall be factory installed for units larger than 5 tons. 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:  
Hair guards protecting the condenser fins.  
**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  
Captivaevae

**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  
Hill 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, bonded/zinc and coated with a baked-enamel finish.

Unit access panels shall be removable with minimal screws and shall provide full access 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 be 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 adjustable 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 as 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 to match original finishes.  
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.  
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.

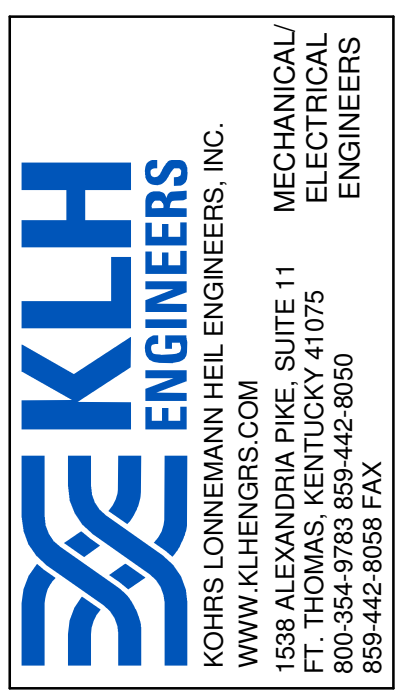
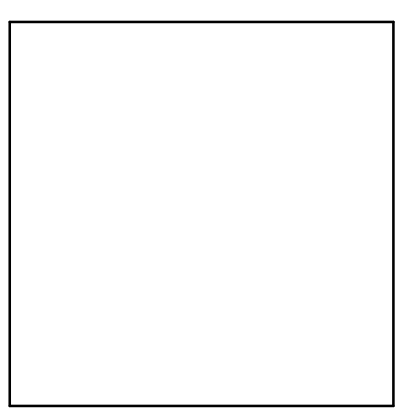
Fans: Fan shall be tangential direct-drive blower type with air intake at the upper front face of the unit and discharge at the bottom front. Automatic, motor-driven vertical air sweep shall be provided standard.  
Air sweep operation shall be user selectable. Horizontal direction may be manually adjusted (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 air-sweep control to provide on or off activation of air-sweep 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 shaft elbow shall be provided for rear connection.

**23 82 39.00 – UNIT HEATERS**  
**Submittal Requirements**  
Product Data: For each type of product indicated.

**General:** Provide unit heaters in locations as indicated, and of capacities, style, and having accessories as scheduled. Provide temperature control valves with modulation during a call for heat and closed during cooling.  
**Wall and ceiling unit heaters**  
General: Provide a heavy duty fan forced wall heater. Heating grid shall be made up of rugged steel fins, copper brazed to non glowing, steel sheathed elements.  
Unit to have built in, lamp proof thermostat or remote thermostat, built in disconnect switch.  
Front cover shall be decorative 16 gage welded bar grille.  
Fan delay and thermal cutout are standard.  
Provide all required control transformers.

**Accessories:**  
Surface mounting box.  
Provide wall heaters with the following devices:  
Thermally activated fan switch to keep fan motor operating until residual heat is dissipated.  
Disconnect switch.  
Automatic reset, high limit cut-out switch located in discharge air stream  
Manual "Summer-OFF-Winter" switch.  
Control Power Transformer  
Magnetic Contactor (Relay Kit)  
Manufacturers: Subject to compliance with requirements, provide wall heaters of one of the following:  
Berko  
Qmark  
Trane Co.  
Markel  
Raywall  
Installation  
Coordinate with other electrical work, including wiring/cabing, as necessary to properly interface installation of heating terminal units with other work.  
Clean dust and debris from each heating terminal as it is installed to ensure cleanliness.  
Comb out damaged fins where bent or crushed before covering elements with enclosures.  
Touch-up scratched or marred heating terminal enclosure surfaces to match original finishes.  
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.



REVISIONS					

PROPOSED NEW FUELING STATION & CONVENIENCE STORE  
Cincinnati Dayton at Allen Road  
WEST CHESTER TOWNSHIP  
BUTLER COUNTY, OHIO

09/11/23

MECHANICAL - SPECIFICATIONS  
M-401

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 therein.

ENERGY COMPLIANCE TO BE COMPLETED AT  
PERMIT ISSUANCE

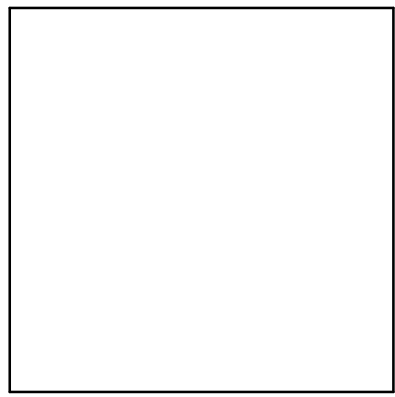
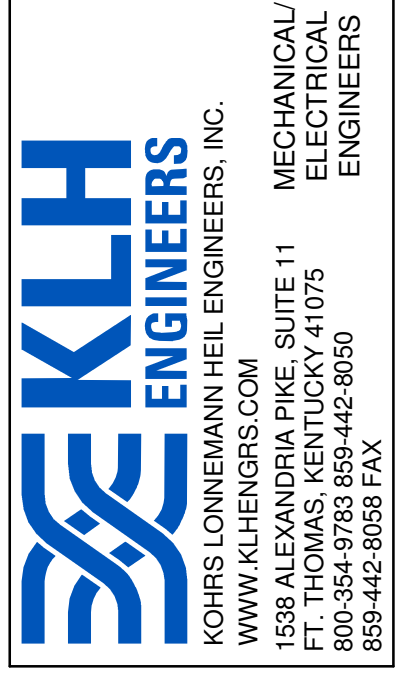
2" REFERENCE LINE  
KLH #: 25803

MECHANICAL -  
COMPLIANCE  
**M-500**

09/11/23

PROPOSED NEW FUELING STATION & CONVENIENCE STORE  
**Cincinnati Dayton at Allen Road**  
WEST CHESTER TOWNSHIP  
BUTLER COUNTY, OHIO

REVISIONS



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

ENERGY COMPLIANCE TO BE COMPLETED AT  
PERMIT ISSUANCE

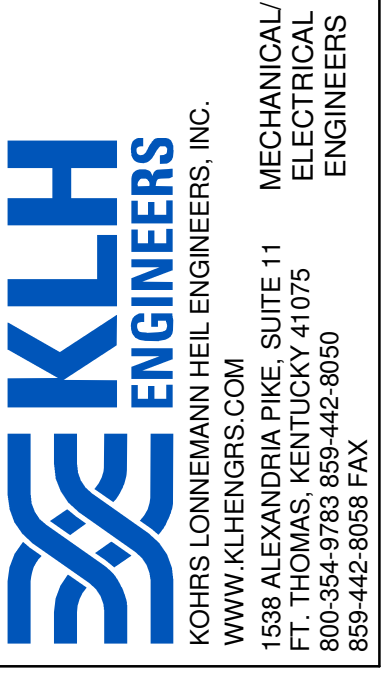
2" REFERENCE LINE  
KLH #: 25803

MECHANICAL -  
COMPLIANCE  
**M-501**

09/11/23

PROPOSED NEW FUELING STATION & CONVENIENCE STORE  
**Cincinnati Dayton at Allen Road**  
WEST CHESTER TOWNSHIP  
BUTLER COUNTY, OHIO

REVISIONS



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 therein.