

## MECHANICAL SHEET INDEX

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## RESPONSIBILITY MATRIX

DESCRIPTION	FURNISHED		INSTALLED		REMARKS
	GC	OWNER	GC	OWNER	
<b>DIVISION 23: HEATING, VENTILATING, AND AIR CONDITIONING</b>					
<b>23.1 HVAC DUCTWORK AND PIPING IDENTIFICATION</b>					
HVAC DUCTWORK SYSTEM IDENTIFICATION	•		•		
PIPING SYSTEM IDENTIFICATION	•		•		
UTILITY SHUT OFF IDENTIFICATION IN KITCHEN	•		•		
VALVE TAGS AND CHART	•		•		
HVAC DAMPER IDENTIFICATION	•		•		
<b>23.2 ROOF CURBS</b>					
EXHAUST FAN CURBS	•		•		
ROOFTOP UNIT CURBS	•		•		
CONDENSING UNIT CURBS	•		•		
KITCHEN EXHAUST FAN CURBS	•		•		
<b>23.3 HVAC DUCTWORK SYSTEM COMPONENTS</b>					
HVAC DUCTWORK	•		•		
GREASE DUCTWORK	•		•		
OUTSIDE AIR DUCTWORK	•		•		
SUPPLY AND RETURN AIR DUCTWORK	•		•		
RESTROOM EXHAUST AIR DUCTWORK	•		•		
INSULATION AND FIRE WRAP	•		•		
DAMPERS	•		•		
SMOKE DETECTORS	•		•		
SUPPLY, RETURN, AND EXHAUST GRILLS AND REGISTERS	•		•		
<b>23.4 MECHANICAL PIPING SYSTEM COMPONENTS</b>					
WALK-IN COOLER AND FREEZER CONDENSER REFRIGERANT LINE SETS	•		•		A
REFRIGERANT PIPING FOR HVAC EQUIPMENT	•		•		
VALVES AND ACCESSORIES (E.G. AIR VENTS)	•		•		
<b>23.5 HVAC EQUIPMENT</b>					
RESTROOM EXHAUST FAN	•		•		
KITCHEN EXHAUST FAN WITH CURB EXTENSION	•		•		
DUCTED HEATING AND COOLING UNITS	•		•		
OFFICE HVAC FAN COIL AND CONDENSING UNITS	•		•		
WALK-IN COOLER AND FREEZER CONDENSING UNITS	•		•		A
<b>23.6 KITCHEN EXHAUST WITH FIRE SUPPRESSION SYSTEM</b>					
HOOD CONTROL PANEL	•		•		
REMOTE HOOD SWITCHES IN OFFICE	•		•		
KITCHEN EXHAUST HOOD	•		•		
STRUCTURAL SUPPORT	•		•		
ELECTRICAL AND CONTROL WIRING	•		•		
TANK SYSTEM	•		•		B
TANK SYSTEM WIRING AND UTILITIES CONNECTION	•		•		
TANK SYSTEM GAS VALVE	•		•		
PULL STATION	•		•		
<b>23.7 MECHANICAL SAFETY SENSORS</b>					
CO2 MONITOR	•		•		
<b>23.8 COMMISSIONING ACTIVITIES</b>					
GREASE EXHAUST WATER LEAKAGE TEST	•		•		
TEST AND BALANCE (TAB) REPORT	•		•		
GENERAL NOTES:					
1. INFORMATION CONTAINED WITHIN IS BASED ON OUR INTERPRETATION OF THE FINAL EXECUTED WORK LETTER.					
2. CONTRACTOR TO CONFIRM ALL SCOPE WITH FINAL WORK LETTER PRIOR TO PROCUREMENT OF EQUIPMENT.					
REMARKS:					
A. WALK-IN COOLER AND FREEZER CONDENSING UNITS FURNISHED AND INSTALLED BY OWNER VENDOR.					
B. GENERAL CONTRACTOR TO COORDINATE TANK INSTALLATION TIME WITH OWNER VENDOR AND FACILITATE SYSTEM SIGN-OFF.					

## SUBMITTAL MATRIX

SUBMITTAL DESCRIPTION	Required Review Time (Business Days)	Architect of Record	Shake Shack	Physical Sample Required	Submit for Record	Submit for Record Only
Diffusers, Grills & Registers	5	X			X	
Ductwork Layout (if there are significant changes in field)	5	X			X	
HVAC Equipment (if Captive Aire - Submitted by Owner Vendor directly to Owner/AOR prior to construction)	5	X			X	
MEP Tests, Start-Up, and Programming Reports	5	X			X	

## GENERAL NEW NOTES:

- PRIOR TO SUBMITTING BID, VISIT THE JOB SITE AND BECOME FULLY ACQUAINTED WITH THE EXISTING CONDITIONS OF THE PROJECT. REVIEW THE GENERAL NOTES, SPECIFICATIONS AND OTHER DRAWINGS FOR ADDITIONAL REQUIREMENTS WHICH MAY NOT BE SPECIFICALLY CALLED OUT IN THIS PORTION OF THE CONSTRUCTION DOCUMENTS. NOTIFY ARCHITECT, ENGINEER AND/OR OWNER OF CONFLICTS OR DISCREPANCIES PRIOR TO SUBMISSION OF BID.
- EXISTING CONDITIONS WERE TAKEN FROM ORIGINAL DRAWINGS AND SITE VISITS AND MAY NOT REFLECT EXACT "AS-BUILT" CONDITIONS. FIELD VERIFY EXISTING CONDITIONS PRIOR TO SUBMITTING FINAL BIDS. COORDINATE NEW WORK AND DEMOLITION WITH OTHER DISCIPLINES AND EXISTING CONDITIONS PRIOR TO CONSTRUCTION.
- COORDINATE THE INSTALLATION OF THE MECHANICAL SYSTEMS WITH OTHER TRADES TO ENSURE A NEAT AND ORDERLY INSTALLATION. INSTALL DUCTWORK AND PIPING AS TIGHT TO STRUCTURE AS POSSIBLE. COORDINATE WITH OTHER TRADES TO AVOID CONFLICTS. COORDINATE INSTALLATION OF DUCTWORK AND PIPING TO AVOID CONFLICTS WITH ELECTRICAL PANELS, LIGHTING FIXTURES, ETC. ANY MODIFICATIONS REQUIRED DUE TO LACK OF COORDINATION WILL BE THE RESPONSIBILITY OF THE CONTRACTOR AT NO EXTRA COST TO THE OWNER.
- WHERE SHUTDOWN OF EXISTING SYSTEMS IS REQUIRED DURING NEW WORK, COORDINATE SHUTDOWN TIME AND DURATION WITH THE OWNER TO MINIMIZE DOWNTIME. NOTIFY OWNER SEVEN (7) DAYS PRIOR TO INTERRUPTION OF SERVICE.
- DURING INSTALLATION OF NEW WORK, AVOID DAMAGING EXISTING SURFACES AND EQUIPMENT TO REMAIN. REPAIR DAMAGE CAUSED DURING CONSTRUCTION AT NO EXTRA COST TO THE OWNER.
- PROVIDE TEMPORARY BARRIERS TO CONTAIN DUST AND DEBRIS RESULTING FROM THE PERFORMANCE OF THE WORK TO THE AREA WHERE WORK IS BEING PERFORMED.
- ALL MECHANICAL EQUIPMENT SHOWN ON THE MECHANICAL PLANS SHALL BE PROVIDED BY DIVISION 23 UNLESS OTHERWISE NOTED.
- NEW MECHANICAL EQUIPMENT, DUCTWORK AND PIPING ARE SHOWN AT APPROXIMATE LOCATIONS. FIELD MEASURE FINAL DUCTWORK AND PIPING LOCATIONS PRIOR TO FABRICATION AND MAKE ADJUSTMENTS AS REQUIRED TO FIT THE DUCTWORK AND PIPING WITHIN THE AVAILABLE SPACE. VERIFY THAT FINAL EQUIPMENT LOCATIONS MEET MANUFACTURER'S RECOMMENDATIONS REGARDING SERVICE CLEARANCE AND PROPER AIRFLOW CLEARANCE AROUND EQUIPMENT.
- REFER TO ARCHITECTURAL DRAWINGS FOR RELATED CONSTRUCTION DETAILS AS APPLICABLE TO THE HVAC SYSTEM. VERIFY CHASES AND PENETRATIONS SHOWN ON ARCHITECTURAL DRAWINGS THAT ARE INTENDED FOR DUCTWORK AND PIPING MEET REQUIREMENTS.
- COORDINATE LOCATION OF ROOF MOUNTED HVAC EQUIPMENT AND ROOF PENETRATIONS WITH THE ARCHITECTURAL AND STRUCTURAL DRAWINGS.
- INDOOR AIR QUALITY MEASURES: PROTECT INSIDE OF (INSTALLED AND DELIVERED) DUCTWORK AND HVAC UNITS FROM EXPOSURE TO DUST, DIRT, PAINT AND MOISTURE. REPLACE INSULATION THAT HAS BECOME WET AT ANY TIME DURING CONSTRUCTION, DRYING THE INSULATION IS NOT ACCEPTABLE. SEAL ANY TEARS OR JOINTS OF INTERNAL FIBERGLASS INSULATION. REMOVE DEBRIS FROM CEILING/RETURN AIR PLENUM INCLUDING DUST. AN INDEPENDENT, PROFESSIONAL DUCT CLEANING COMPANY SHALL VACUUM CLEAN ANY DUCTWORK CONNECTED TO HVAC UNITS THAT WERE OPERATED DURING THE CONSTRUCTION PERIOD AFTER NEW FILTERS ARE INSTALLED AND PRIOR TO TURNING SYSTEM OVER TO THE OWNER. THE INTERNAL SURFACES AND ASSOCIATED COILS OF ANY HVAC UNITS THAT WERE OPERATED SHALL ALSO BE CLEANED.
- INSTALL DUCTWORK AND PIPING PARALLEL TO BUILDING COLUMN LINES UNLESS OTHERWISE SHOWN OR NOTED.
- OVERHEAD HANGERS AND SUPPORTS FOR EQUIPMENT, DUCTWORK AND PIPING SHALL BE FASTENED TO BUILDING JOISTS OR BEAMS. DO NOT ATTACH HANGERS AND SUPPORTS TO THE ABOVE FLOOR SLAB OR ROOF EXCEPT WHERE CONCRETE INSERTS IN CONCRETE SLABS ARE ALLOWED BY THE SPECIFICATIONS.
- COORDINATE LOCATION OF EQUIPMENT SUPPORTS WITH LOCATION OF EQUIPMENT ACCESS PANELS/DOORS TO ENABLE SERVICE OF EQUIPMENT AND/OR FILTER REPLACEMENT.
- SEAL PENETRATIONS THROUGH THE BUILDING COMPONENTS IN ACCORDANCE WITH THE CONTRACT SPECIFICATIONS. FIREPROOF PENETRATIONS THROUGH FIRE RATED COMPONENTS IN ACCORDANCE WITH U.L. REQUIREMENTS.
- COORDINATE THE EXACT MOUNTING SIZE AND FRAME TYPE OF DIFFUSERS, REGISTERS AND GRILLES WITH THE SUPPLIER TO MEET THE CEILING, WALL AND DUCT INSTALLATION REQUIREMENTS.
- ADJUST LOCATION OF CEILING DIFFUSERS, REGISTERS AND GRILLES AS REQUIRED TO ACCOMMODATE FINAL CEILING GRID AND LIGHTING LOCATIONS.
- PAINT PORTIONS OF DUCTWORK AND INSULATION THAT ARE EXPOSED TO VIEW BY THE INSTALLATION OF DIFFUSERS, REGISTERS, AND GRILLES IN CEILINGS OR WALLS FLAT BLACK. PORTIONS INCLUDE BOTH THE INTERIOR OF UNLINED DUCTWORK AND THE EXTERIOR OF DUCTWORK AND INSULATION.
- DUCTWORK CROSSING FIRE RATED WALLS OR OTHER FIRE RATED ASSEMBLIES SHALL BE MINIMUM 26 GAUGE SHEET METAL.
- PROVIDE FIRE OR FIRE/SMOKE DAMPERS, AS APPLICABLE, IN DUCTWORK AT CEILINGS AND WALLS AT LOCATIONS SHOWN ON THE PLANS. FIRE AND FIRE/SMOKE DAMPERS SHALL CONFORM TO NFPA AS APPLICABLE. COORDINATE SLEEVE LENGTH WITH REQUIREMENTS OF INSTALLED LOCATION.
- PROVIDE WALL OR DUCT ACCESS PANELS OR DOORS FOR ACCESS TO FIRE AND FIRE/SMOKE DAMPERS. ACCESS PANEL OR DOOR SHALL BE MINIMUM SIZE OF 10" BY 10" AND SHALL BE INSTALLED WITHIN 12" OF DAMPER. PROVIDE A REMOVABLE DUCT SECTION WHERE DUCT SIZE IS TOO SMALL FOR A 10" BY 10" ACCESS DOOR.
- LOCATE AND SET THERMOSTATS AND HUMIDISTATS AT LOCATIONS SHOWN ON PLANS. VERIFY EXACT LOCATIONS WITH ARCHITECT PRIOR TO INSTALLATION. DEVICE MOUNTING HEIGHT SHALL MEET ALL REQUIREMENTS UNLESS OTHERWISE NOTED ON PLANS. PROVIDE INSULATED BACKING FOR THERMOSTATS MOUNTED ON EXTERIOR BUILDING WALLS. INSTALL WIRING IN CONDUIT PROVIDED BY DIVISION 26. AT A MINIMUM, PROVIDE CONDUIT IN THE WALL FROM THE JUNCTION BOX TO 6" ABOVE THE CEILING.
- COORDINATE THE LOCATION AND ELEVATION OF WALL-MOUNTED DEVICES WITH PRESENTATION BOARDS, DISPLAY CABINETS, SHELVES OR OTHER COMPONENTS SHOWN ON THE ARCHITECTURAL DRAWINGS THAT ARE TO BE INSTALLED UNDER OTHER DIVISIONS. CONTRACTOR WILL NOT BE REBURSED FOR RELOCATION OF WALL-MOUNTED DEVICES CAUSED BY A LACK OF COORDINATION.
- PROVIDE A MANUAL BALANCING DAMPER IN EACH DUCT TAKEOFF FROM SUPPLY, RETURN, OUTDOOR AND EXHAUST AIR DUCTS.
- PROVIDE A PREFABRICATED 45 DEGREE, HIGH EFFICIENCY, RECTANGULAR/ROUND BRANCH DUCT TAKEOFF FITTING FOR BRANCH DUCT CONNECTIONS AND TAKE-OFFS TO INDIVIDUAL DIFFUSERS, REGISTERS AND GRILLES. PROVIDE WITH INTEGRAL MANUAL BALANCING DAMPER AND LOCKING QUADRANT WHERE INDICATED ON PLANS.
- BRANCH DUCTWORK TO AIR OUTLETS SHALL BE SAME SIZE AS OUTLET NECK SIZE UNLESS OTHERWISE NOTED.
- REFER TO SPECIFICATIONS FOR DUCTWORK AND PIPING INSULATION REQUIREMENTS. DUCT SIZES ON MECHANICAL PLANS INDICATE CLEAR INSIDE AIRFLOW DIMENSIONS. INCREASE SHEET METAL SIZES ACCORDINGLY TO ACCOUNT FOR THICKNESS OF DUCT LINER.
- FLEXIBLE DUCTWORK SHALL NOT EXCEED 5'-0" IN LENGTH AND SHALL BE INSTALLED AND SUPPORTED TO AVOID SHARP BENDS AND SAGGING. REFER TO SPECIFICATIONS FOR ADDITIONAL REQUIREMENTS.
- PROVIDE EQUIPMENT VENTS AND FLUES PER EQUIPMENT MANUFACTURERS RECOMMENDATIONS AND EQUIPMENT SPECIFICATIONS. KEEP PENETRATIONS THROUGH ROOF A MINIMUM OF 10'-0" FROM HVAC EQUIPMENT FRESH AIR INLETS AND 2'-0" FROM ROOF PARAPETS.
- PROVIDE A NEW SET OF AIR FILTERS IN UNITS PRIOR TO TESTING, ADJUSTING AND BALANCING AND BEFORE TURNING SYSTEM(S) OVER TO OWNER.
- TEMPORARY INSTALLATIONS OF INFECTION CONTROL MEASURES DURING CONSTRUCTION SHALL BE COORDINATED WITH THE FACILITY'S INFECTION CONTROL STAFF. PRIOR TO CONSTRUCTION PROVIDE ALL REQUIRED TEMPORARY INSTALLATIONS, INCLUDING DETAILS OF THE INFECTION CONTROL MEASURES SUCH AS TEMPORARY BARRIERS AND MEMBRANES, PORTABLE EXHAUST FANS AND TEMPORARY DUCTWORK. TEMPORARY INSTALLATIONS MUST NOT HAVE A NEGATIVE IMPACT ON EXISTING SYSTEMS NOR CAUSE UNSAFE CONDITIONS. TEMPORARY INSTALLATIONS SHALL MAINTAIN ADEQUATE CLEARANCE AND SHALL NOT OBSTRUCT EXISTING EXITS. CREATE A FIRE HAZARD OR REDUCE REQUIRED FIRE RESISTANCE. TEMPORARY VENTILATION SYSTEMS SHALL NOT CAUSE THE AIR BALANCE OF ADJACENT ROOMS OR SPACES TO BE IMPACTED OR ALTER THE PERFORMANCE OF PERMANENT BUILDING VENTILATION SYSTEMS. AIRFLOW MEASUREMENTS SHALL BE TAKEN TO VERIFY ADJACENT ROOMS OR SPACES ARE NOT IMPACTED.

## MECHANICAL SYMBOLS

THIS IS A MASTER LEGEND AND NOT ALL SYMBOLS OR ABBREVIATIONS ARE USED.

V3.02

STANDARD MOUNTING HEIGHT	HVAC DUCTWORK AND ACCESSORIES	PIPING SYMBOLS
THERMOSTATS (USER ADJUSTABLE) (TOP OF DEVICE) CONTROLS (TOP OF DEVICE) 46"	DUCTWORK/EQUIPMENT TO BE REMOVED OR RELOCATED	DIRECTION OF FLOW CONTROL VALVE
INSTALL DEVICES AT THE MOUNTING HEIGHTS SHOWN ABOVE UNO IN THE CONSTRUCTION DOCUMENTS. MOUNTING HEIGHTS LISTED ABOVE OR ELSEWHERE IN THE CONSTRUCTION DOCUMENTS ARE AFF OR AFG TO TOP OF THE DEVICE UNO. ALL DEVICES SHALL BE INSTALLED IN COMPLIANCE WITH CURRENT ADA AND LOCAL REQUIREMENTS.	EXISTING DUCTWORK/EQUIPMENT TO REMAIN	THREE-WAY CONTROL VALVE
ANNOTATION	LINEAR SLOT DIFFUSER	SHUTOFF VALVE
MECHANICAL PLAN NOTE CALLOUT	INSULATED FLEXIBLE DUCT (MAX. 5'-0" LONG)	CHECK VALVE
MECHANICAL EQUIPMENT DESIGNATION (CONTRACTOR FURNISHED AND INSTALLED UNLESS NOTED OTHERWISE)	BRANCH DUCT WITH 45° RECTANGLE-ROUND BRANCH FITTING AND MANUAL VOLUME DAMPER	BALANCING VALVE WITH PRESSURE PORTS
CONNECTION POINT OF NEW WORK TO EXISTING	ELBOW WITH TURNING VANES	TRIPLE DUTY VALVE WITH PRESSURE PORTS
DETAIL REFERENCE. UPPER NUMBER INDICATES DETAIL NUMBER LOWER NUMBER INDICATES SHEET NUMBER	BRANCH DUCT WITH BELL-MOUTH FITTING & MANUAL VOLUME CONTROL DAMPER	STRAINER
SECTION CUT DESIGNATION	DUCT UP	STRAINER WITH BLOWOFF
DEDICATED EQUIPMENT ACCESS TILE	DUCT DOWN	RELIEF / SAFETY VALVE
ACCESS PANEL	EXHAUST AIR	SOLENOID VALVE
ABBREVIATIONS	EXHAUST AIR - GREASE	PRESSURE REDUCING VALVE
A/C AIR CONDITIONING	EXHAUST AIR - GREASE	GAS PRESSURE REGULATOR
ACC AIR COOLED CHILLER	OUTSIDE AIR	THERMOSTATIC MIXING VALVE
ACCU AIR COOL CONDENSING UNIT	RELIEF AIR	PIPE ANCHOR
AFD ABOVE FINISHED CEILING	RETURN AIR	EXPANSION JOINT
AFB ABOVE FINISHED FLOOR	SPECIAL EXHAUST	PIPE GUIDE
AFG ABOVE FINISHED GRADE	SUPPLY AIR	PIPING SUPPORT
AHJ AUTHORITY HAVING JURISDICTION	EQUIPMENT WITH FLEXIBLE DUCT CONNECTION	F & T TRAP
AHU AIR HANDLING UNIT	10" (NECK SIZE) CSD-1 (TYPE) 300 CFM (CFM OF SUPPLY DIFFUSER OR REGISTER)	BUCKET TRAP
AI ANALOG INPUT	EQUIPMENT ACCESS TILE (IN ACT CEILINGS)	THERMOSTATIC TRAP
AO ANALOG OUTPUT	ACCESS PANEL (IN GYPSUM)	BACKFLOW PREVENTER
AP ACCESS PANEL	MANUAL VOLUME DAMPER	PRESSURE GAUGE
ARD AIR PRESSURE DROP	SQUARE TO ROUND TRANSITION	THERMOMETER
AWG AMERICAN WIRE GAUGE	DUCT MOUNTED SMOKE DETECTOR (SD-SUPPLY/RD-RETURN)	PRESSURE AND TEMPERATURE TEST PLUG
B BOILER	ROUND DUCT TAG INDICATING DIAMETER	UNION
BA BUILDING AUTOMATION SYSTEM	RECTANGULAR DUCT TAG INDICATING INTERNAL DUCT DIMENSIONS.	FLANGE CONNECTION
BB BACKDRAFT DAMPER	FLAT OVAL DUCT TAG INDICATING INTERNAL DUCT DIMENSIONS.	VACUUM RELIEF VALVE
BD BLOWDOWN	RISER DESIGNATION	AUTOMATIC AIR VENT
BFC BELOW FINISHED CEILING	FIRE DAMPER	MANUAL AIR VENT
BFF BELOW FINISHED FLOOR	FIRE SMOKE DAMPER	PRESSURE / VACUUM SWITCH
BFG BELOW FINISHED GRADE	SMOKE DAMPER	CLEANOUT
BFI BOILER FEED PUMP	VOLUME DAMPER	CAP
BHP BRAKE HORSEPOWER	BACKDRAFT DAMPER	ELBOW UP
BI BINARY INPUT	ALL DUCT DIMENSIONS SHOWN ON DRAWINGS ARE INSIDE DIMENSIONS. REFER TO DUCTWORK SPECIFICATIONS FOR DUCTWORK INSULATION AND LINER INFORMATION.	ELBOW DOWN
BO BINARY OUTPUT	HVAC CONTROL DEVICES	TEE UP
BOD BOTTOM OF DUCT	HUMIDISTAT	TEE DOWN
BOS BOTTOM OF STRUCTURE	THERMOSTAT	ELBOW UP WITH SHUT-OFF VALVE (SOV)
BTU BRITISH THERMAL UNIT	CARBON MONOXIDE SENSOR	ELBOW DOWN WITH SHUT-OFF VALVE (SOV)
CFM CUBIC FEET PER MINUTE	CARBON DIOXIDE SENSOR	TEE UP WITH SHUT-OFF VALVE (SOV)
CH CHILLER	DIFFERENTIAL PRESSURE SENSOR	TEE DOWN WITH SHUT-OFF VALVE (SOV)
CLG COOLING	FLOW SWITCH	REDUCER
CPT CONTROL POWER TRANSFORMER	HUMIDITY SENSOR	RECIRCULATION PUMP
CRAC COMPUTER ROOM AIR CONDITIONING UNIT	PULL STATION	P-TRAP
CRU COMPUTER ROOM UNIT	REMOTE TESTING STATION WITH INDICATING LIGHT	GAS COCK
CT COOLING TOWER	STATIC PRESSURE	TOP BEAM CLAMP
CV CONTROL VALVE	TEMPERATURE SENSOR	TRAPEZE HANGER
CWP CONDENSER WATER PUMP		FLEXIBLE CONNECTION
CJ CONDENSING UNIT		
CHWP CHILLED WATER PUMP		
DB DECIBELS		
DBA DECIBEL AVERAGE		
DDC DIRECT DIGITAL CONTROL		
DJ DIGITAL INPUT		
DISC DISCONNECT		
DN DOWN		
DX DUCT SILENCER		
EA ENTERING		
E AIR TEMPERATURE		
EDB EXHAUST AIR ENTERING DRY BULB		
EF EXHAUST FAN EFFICIENCY		
EMS ENERGY MANAGEMENT SYSTEM		
ESP EXTERNAL STATIC PRESSURE		
ETR EXISTING TO REMAIN		
EWB ENTERING WET BULB TEMPERATURE		
EWT ENTERING WATER TEMPERATURE		
FCU FAN COIL UNIT		
FFA FROM FLOOR ABOVE		
FFB FROM FLOOR BELOW		
FF FINISHED FLOOR		
FPI FINS PER INCH		
FPM FEET PER MINUTE		
GC GENERAL CONTRACTOR		
GEA GREASE EXHAUST AIR		
GPM GALLONS PER MINUTE		
HCA HAND-OFF-AUTOMATIC HORSEPOWER		
HTG HEATING		



Seal



02/20/2025

# DP3 ARCHITECTS

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Drawn By Author  
Checked By Checker  
Date 12 FEB 2025

Revisions  
2-12-2025 PERMIT SET

Drawing

MECHANICAL  
GENERAL  
INFORMATION

# M-001

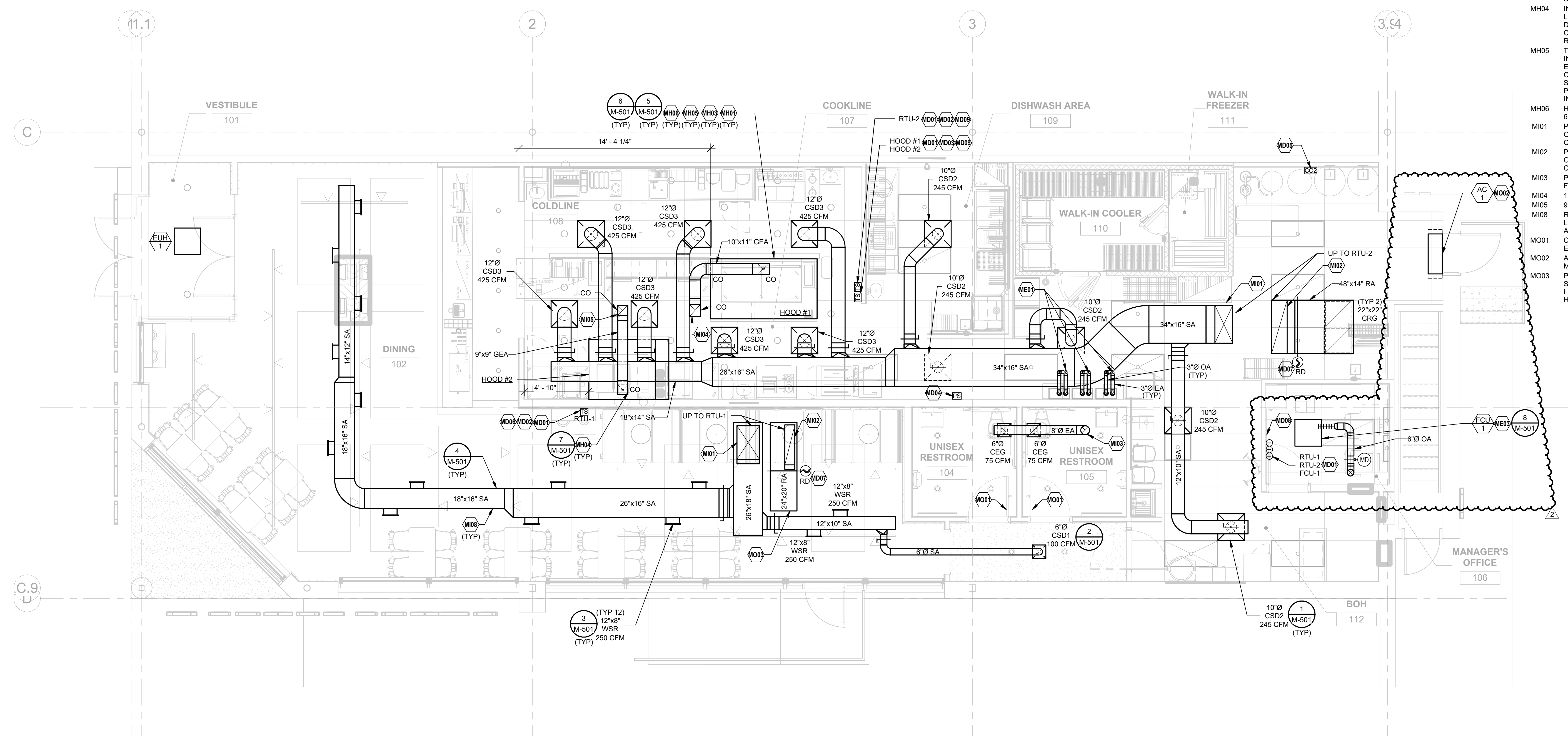
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MECHANICAL GENERAL NOTES:

- DO NOT ROUTE ANY DUCTWORK OR PIPING ABOVE ELECTRICAL PANELS.
- REFER TO SHEET M001 FOR ADDITIONAL GENERAL NOTES AND REQUIREMENTS.
- REFER TO DETAILS AND SCHEDULES SHEETS FOR FURTHER INFORMATION.
- MOUNT ALL THERMOSTATS AND SENSORS CONTROLLING HVAC EQUIPMENT AT 48" AFF UNLESS OTHERWISE NOTED.

MECHANICAL PLAN NOTES:

- MD01 MOUNT THERMOSTATS, HUMIDITY SENSORS, AND TEMPERATURE SENSOR(S) ON WALL. THERMOSTATS AND SENSOR(S) SHALL BE LABELED TO MATCH THE UNIT TAG AND CORRESPOND TO THE ELECTRICAL LEGEND IN THE ELECTRICAL PANELBOARD SERVING THE EQUIPMENT. COORDINATE COLOR WITH ARCHITECT.
- MD02 COMBINATION TEMPERATURE SENSOR AND HUMIDITY SENSOR.
- MD03 MOUNT TEMPERATURE SENSOR PROVIDED WITH KITCHEN EXHAUST HOODS ON WALL.
- MD04 INSTALL HOOD FIRE SUPPRESSION MANUAL PULL STATION. COORDINATE EXACT LOCATION AND REQUIREMENTS WITH FIRE SUPPRESSION SYSTEM INSTALLER AND THE AUTHORITY HAVING JURISDICTION.
- MD05 CARBON DIOXIDE SENSOR WITH REMOTE ALARM REPEATER FURNISHED BY OWNER'S CO2 VENDOR AND LOCATED AT 12' AFF. THE SENSOR SHALL BE EQUIPPED WITH A LOCAL AUDIBLE AND VISUAL ALARM. THE LOW-LEVEL ALARM SHALL ACTIVATE THE LOCAL AUDIBLE AND VISUAL ALARM. IF THE BUILDING HAS A FIRE ALARM, PROVIDE THE APPROPRIATE FIRE ALARM INTERFACE MODULE TO INTERLOCK WITH THE BUILDING FIRE ALARM SYSTEM. THE HIGH-LEVEL CO2 ALARM SHALL SIGNAL BUILDING FIRE ALARM WHEN EQUIPPED. LOW LEVEL ALARM - 0.5% = 5,000 PPM. HIGH LEVEL ALARM - 3.0% = 30,000 PPM.
- MD06 TEMPERATURE SENSOR TO BE INSTALLED 60" A.F.F.
- MD07 INSTALL DUCT SMOKE DETECTOR IN RETURN AIR PLENUM.
- MD08 INSTALL EMERGENCY ALARM IN MANAGER'S OFFICE TO INDICATE CARBON MONOXIDE AND CARBON DIOXIDE DETECTION IN MECHANICAL ROOM. PROVIDE LIGHT IN OFFICE WITH TAG FOR EACH ALARM.
- MD09 INSTALL SENSOR WITH CLEAR PLASTIC BUBBLE COVER.
- ME01 PROVIDE COMBUSTION AIR AND EXHAUST PIPE AND ROUTE TO CONCENTRIC VENT THROUGH ROOF.
- ME03 REFRIGERANT PIPING UP TO CU-1 ON ROOF. REF 1/M150.
- MH01 TYPE I GREASE HOOD EXHAUST DUCTWORK SHALL BE MINIMUM 18 GAUGE STEEL OR MINIMUM 18 GAUGE STAINLESS STEEL WITH LIQUID TIGHT WELDS.
- MH03 INSTALL ACCESS PANELS FOR CLEANING AS REQUIRED BY NFPA 96 AND LOCAL CODES. TRANSITION GREASE DUCTWORK AS REQUIRED TO HOOD AND FAN CONNECTIONS. PROVIDE 45° MAX OFFSETS AS REQUIRED TO COORDINATE WITH STRUCTURE. PROVIDE RADIUS ELBOWS WITHOUT TURNING VANES. SLOPE HORIZONTAL GREASE DUCT BACK TOWARDS HOOD AT MINIMUM OF 1/4" PER LINEAL FOOT. GREASE DUCTS SHALL BE CONTAINED IN A UL APPROVED GREASE DUCT WRAP SYSTEM.
- MH04 INSTALL "DUCTMATE ULTIMATE DOOR" ON DUCTS 12" OR LARGER AND INSTALL "DUCTMATE F2 SANDWICH ACCESS DOOR" FOR DUCTS LESS THAN 12" ON GREASE DUCT FOR CLEANING IN LOCATION SHOWN AT A MINIMUM AND AS REQUIRED BY NFPA 96 AND LOCAL CODES.
- MH05 TYPE I HOODS SHALL BE FURNISHED COMPLETE WITH INTERNALLY PIPED FIRE SUPPRESSION SYSTEM AND EXTERNAL FOAM SUPPLY BOTTLES WITH REMOTE PULL CONTROLS AND IN COMPLIANCE WITH NFPA 96, DIVISION 23 SHALL COORDINATE COMPLETE INSTALLATION WITH FIRE PROTECTION CONTRACTOR TO MEET APPROVAL OF LOCAL INSPECTOR AND CODE COMPLIANCE INCLUDING TESTING.
- MH06 HOOD SHALL OVERHANG THE COOKING SURFACE BY AT LEAST 6" ON BOTH SIDES.
- MI01 PROVIDE SA DUCT THROUGH ROOF. FULL SIZE OF UNIT OPENING, AND CONNECT TO UNIT WITH FLEXIBLE CONNECTOR. TRANSITION 45 DEGREES THROUGH ROOF CURB.
- MI02 PROVIDE RA DUCT THROUGH ROOF. FULL SIZE OF UNIT OPENING, AND CONNECT TO UNIT WITH FLEXIBLE CONNECTOR. TRANSITION 45 DEGREES THROUGH ROOF CURB.
- MI03 PROVIDE EA DUCT THROUGH ROOF. TRANSITION TO EXHAUST FAN INLET SIZE WITHIN CURB.
- MI04 10"x11" GREASE EXHAUST DUCT UP TO KEF-1 ON ROOF.
- MI05 9"x9" GREASE EXHAUST DUCT UP TO KEF-2 ON ROOF.
- MI08 ROUTE DUCTWORK LEVEL, TIGHT TO STRUCTURE, AND ABOVE LIGHTS. COORDINATE WITH STORM DRAINAGE, STRUCTURAL, AND ELECTRICAL.
- MO01 CONTRACTOR TO COORDINATE 1" UNDERCUT ON DOOR FOR EXHAUST AIR PATH.
- MO02 AIR CURTAIN MOUNTED ABOVE DOOR. INSTALL PER MANUFACTURER'S RECOMMENDATIONS.
- MO03 PROVIDE 1/4" GALVANIZED CONSTRUCTION HARDWARE CLOTH SCREEN OVER OPEN END OF RETURN DUCT. PROVIDE DUCT LINER IN BOOT. RETURN AIR DUCT SHALL BE MINIMUM 36" HORIZONTAL EXTENSION FOR SOUND ATTENUATION.



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



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Revisions		
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6-9-2025	IFC SET	
6-27-2025	REVISION 2	

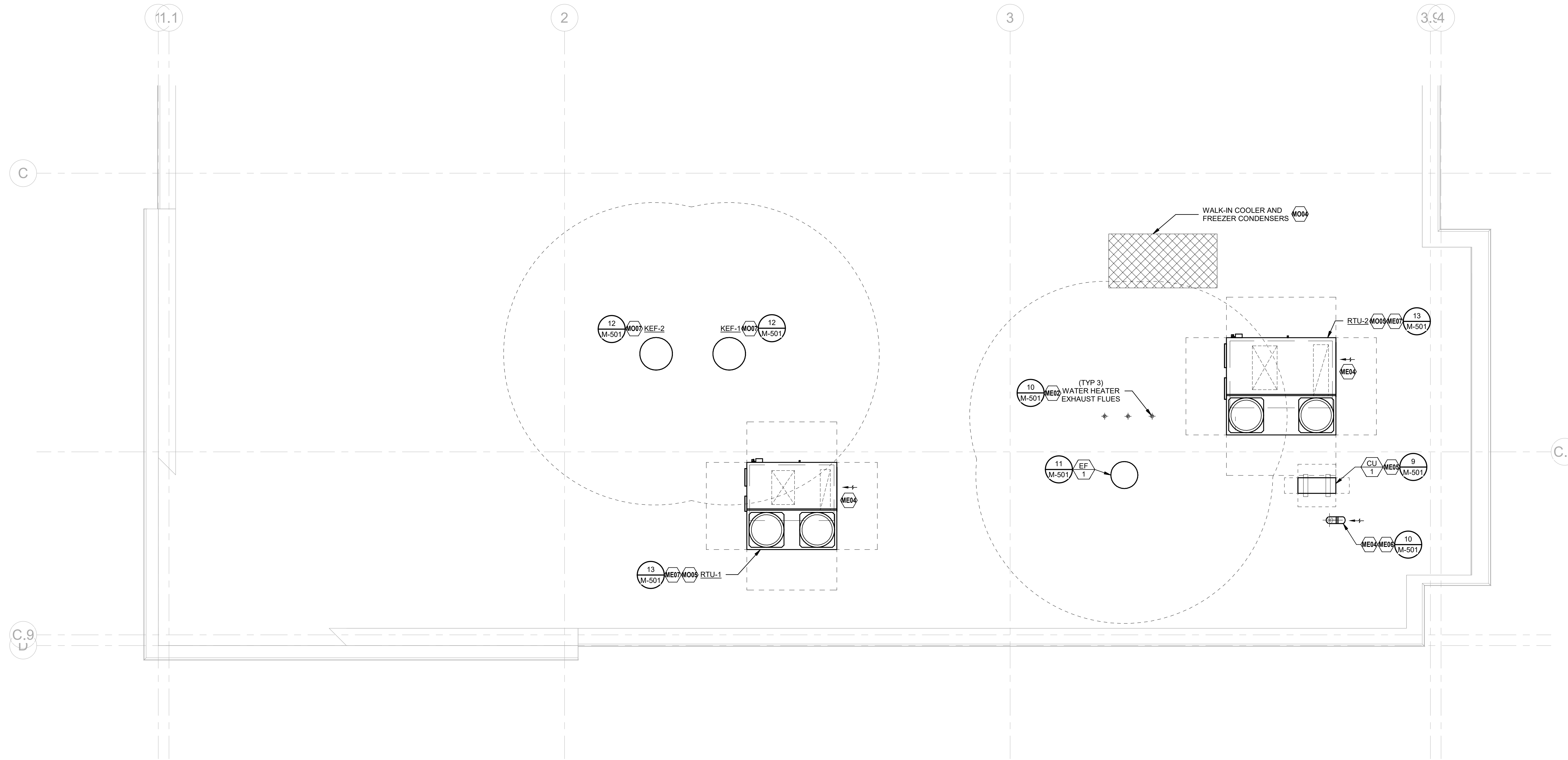
THE BUILDINGS HVAC SYSTEMS SHALL BE BALANCED BY NATIONAL TAB (NO EXCEPTIONS) AND CONTRACTED BY THE GENERAL CONTRACTOR.  
CONTACT: WILL TURNBOUGH, wjt@nationaltab.com, 855-682-6822 ext704

ALL GREASE DUCT TO BE WATER TESTED BY ENVIROMATIC AT MECHANICAL CONTRACTOR'S EXPENSE. CONTACT OWNER'S NATIONAL ACCOUNT VENDOR.  
ENVIROMATIC, DON PFLIEDERER, 1.800.325.8476, inspections@enviromatic.com

Drawing  
MECHANICAL FLOOR PLAN

M-101

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

- MECHANICAL PLAN NOTES:**
- ME02 PROVIDE WATER HEATER CONCENTRIC VENT KIT SPECIFIED IN THE WATER HEATER INSTALLATION MANUAL.
  - ME04 MAINTAIN ALL OUTSIDE AIR INTAKES A MINIMUM OF 10'-0" RADIUS FROM EXHAUST.
  - ME05 CONTRACTOR SHALL VERIFY WITH EQUIPMENT SUPPLIER EXACT ROUTING AND SIZE OF INSULATED REFRIGERANT PIPING. SINGLE LINESET SHOWN FOR CLARITY. INSTALL PER MANUFACTURERS RECOMMENDATIONS.
  - ME06 TURN DOWN 6" INTAKE AND END OPEN OVER ROOF (MIN. 24") WITH INSECT SCREEN.
  - ME07 CONTRACTOR SHALL COORDINATE WITH NATIONAL TAB TO PROVIDE LV-PHI INDOOR AIR PURIFICATION SYSTEM. MODEL PHI-PKG-24V. INSTALL IN UNIT BLOWER COMPARTMENT PER MANUFACTURER'S INSTRUCTIONS.
  - MO04 AREA RESERVED FOR REFRIGERATION CONDENSER(S) PROVIDED BY KITCHEN EQUIPMENT CONTRACTOR. COORDINATE EQUIPMENT LOCATION AND CONDENSER INSTALLATION WITH KITCHEN EQUIPMENT CONTRACTOR.
  - MO05 REFERENCE PLUMBING DRAWINGS FOR CONDENSATE DRAIN ROUTING AND TERMINATION REQUIREMENTS.
  - MO07 REFERENCE THE MECHANICAL RESPONSIBILITY MATRIX ON SHEET MO01 FOR CURB AND EQUIPMENT FURNISHING AND INSTALLATION.

**HENDERSON ENGINEERS**  
8345 LENEZA DRIVE, SUITE 300  
LENEZA, KS 66214  
TEL 913.742.2000 FAX 913.742.5001  
WWW.HENDERSONENGINEERS.COM  
2450004629

Seal  
Professional Engineer  
NATHAN T. LOVE  
PE063145  
KS 02/20/2025

**DP3 ARCHITECTS**

DP3 Architects, Ltd.  
15 South Main Street, Suite 400  
Greenville, SC 29601  
864.232.8200  
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Project

**SHAKE SHACK**  
SHAKE SHACK #1694  
JENKINTOWN, PA

Project Number 24204  
Drawn By Author  
Checked By Checker  
Date 12 FEB 2025

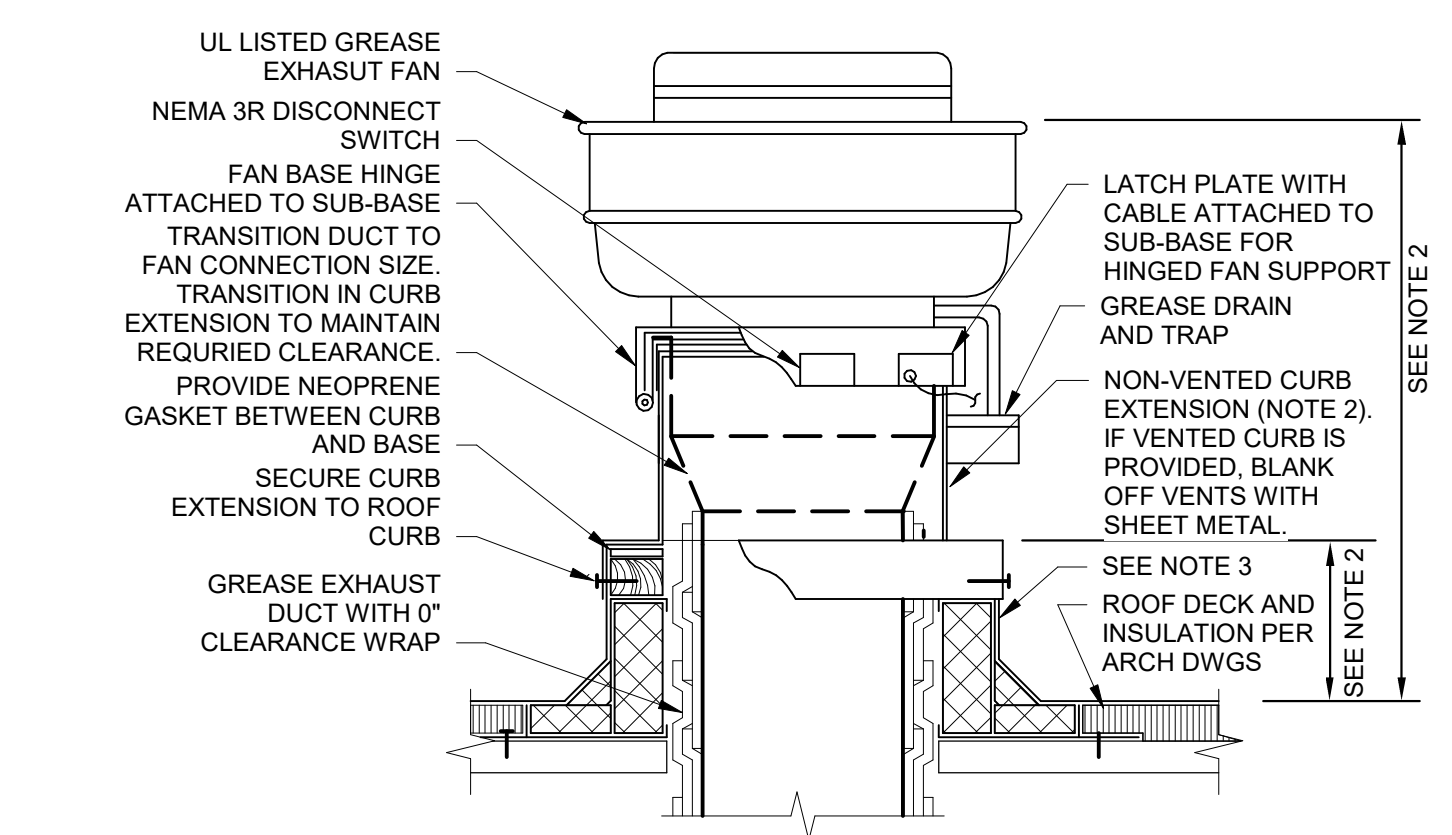
Revisions  
2-12-2025 PERMIT SET

Drawing  
MECHANICAL ROOF PLAN

M-150

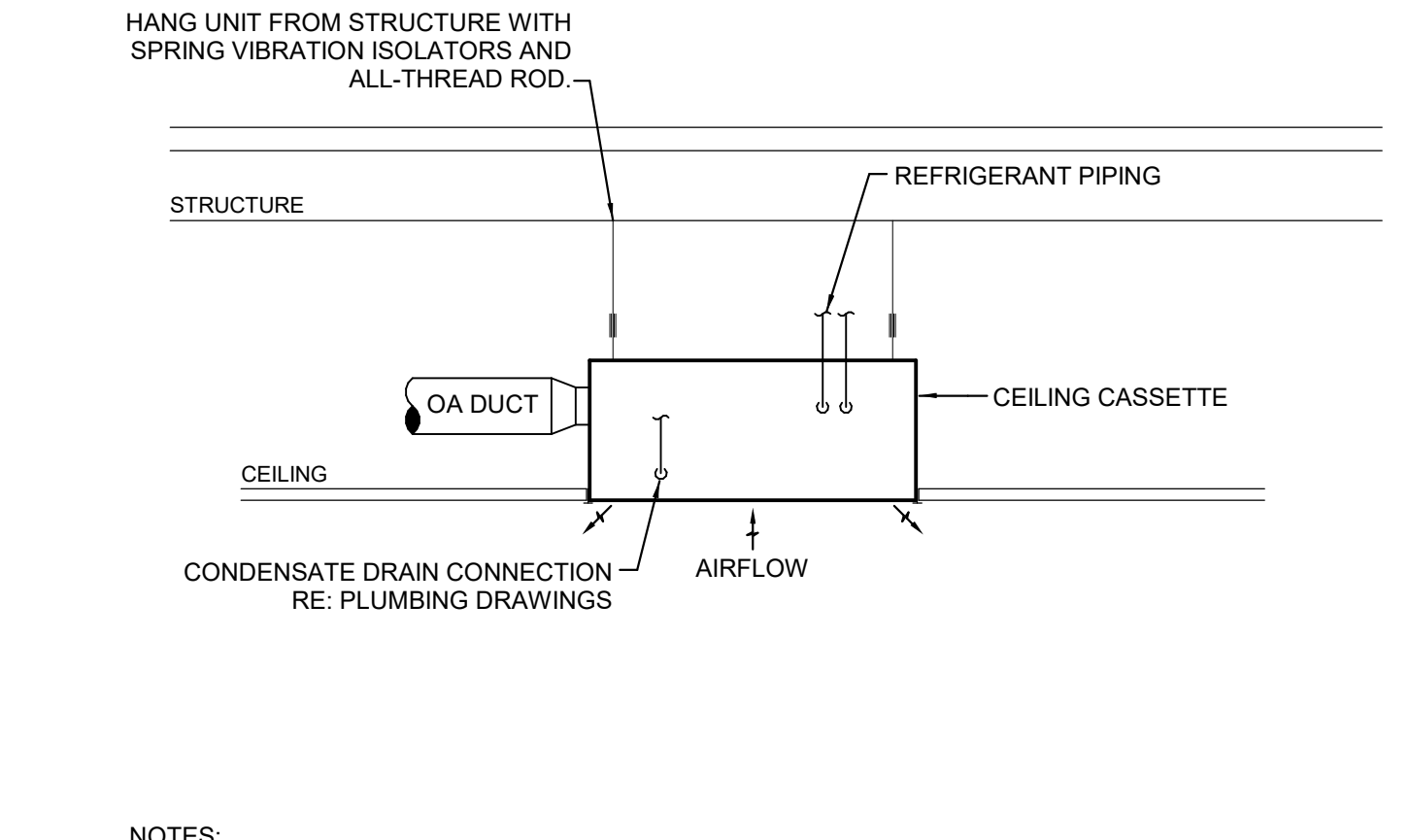
NATHAN T. LOVE

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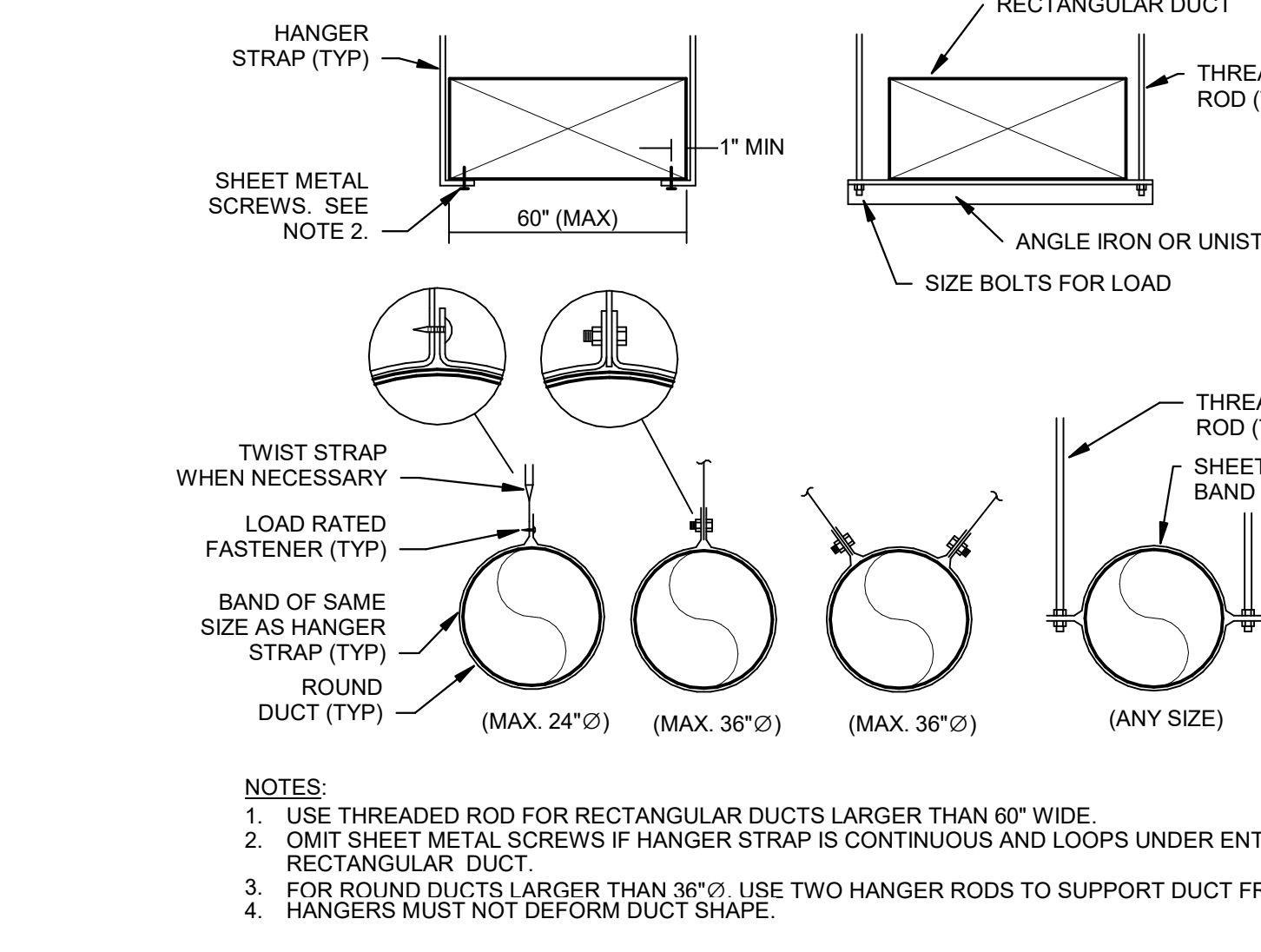


**NOTES:**  
 1. ARRANGEMENT SHOWN IS SCHEMATIC, ADJUST TO SUIT FIELD CONDITIONS AND MEET LOCAL CODE.  
 2. PROVIDE CURB EXTENSION MADE FROM NON-COMBUSTIBLE MATERIAL OF HEIGHT REQUIRED TO MOUNT FAN BASE A MINIMUM 18 INCHES ABOVE COMBUSTIBLE CURB MATERIAL AND DISCHARGE GREASE OUTLET A MINIMUM OF 40 INCHES ABOVE ROOF SURFACE OR ANY ADJACENT BUILDING STRUCTURE WITHIN 10 FEET OF OUTLET, WHICHEVER IS HIGHER.  
 3. PREFABRICATED INSULATED ROOF CURB WITH TREATED WOOD NAILER, CANT, AND STEP AS REQUIRED TO ACCOMMODATE ROOF INSULATION, FRAME AND SECURE CURB TO ROOF WITH METHOD CONSISTENT WITH ROOF CONSTRUCTION. ROOF CURB SHALL BEAR ON ROOF STRUCTURE. FOR SLOPED ROOFS, PROVIDE CURB WITH DIMENSIONS CAPABLE OF COMPENSATING ROOF SLOPE TO ENSURE FAN IS INSTALLED LEVEL. REFER TO ARCHITECTURAL DRAWINGS AND CURB MANUFACTURER'S DETAILS FOR MORE INFORMATION.  
 HIGH WIND STRAPPING: PROVIDE STAINLESS STEEL STRAPS OF LENGTH, WIDTH, THICKNESS, AND SPACING SUFFICIENT TO SECURE FAN TO CURB TO WITHSTAND WIND SPEED REQUIREMENTS PER LOCAL CODE. WRAP STRAPS OVER FAN AND SECURELY ATTACH TO OPPOSITE SIDE OF THE CURB.

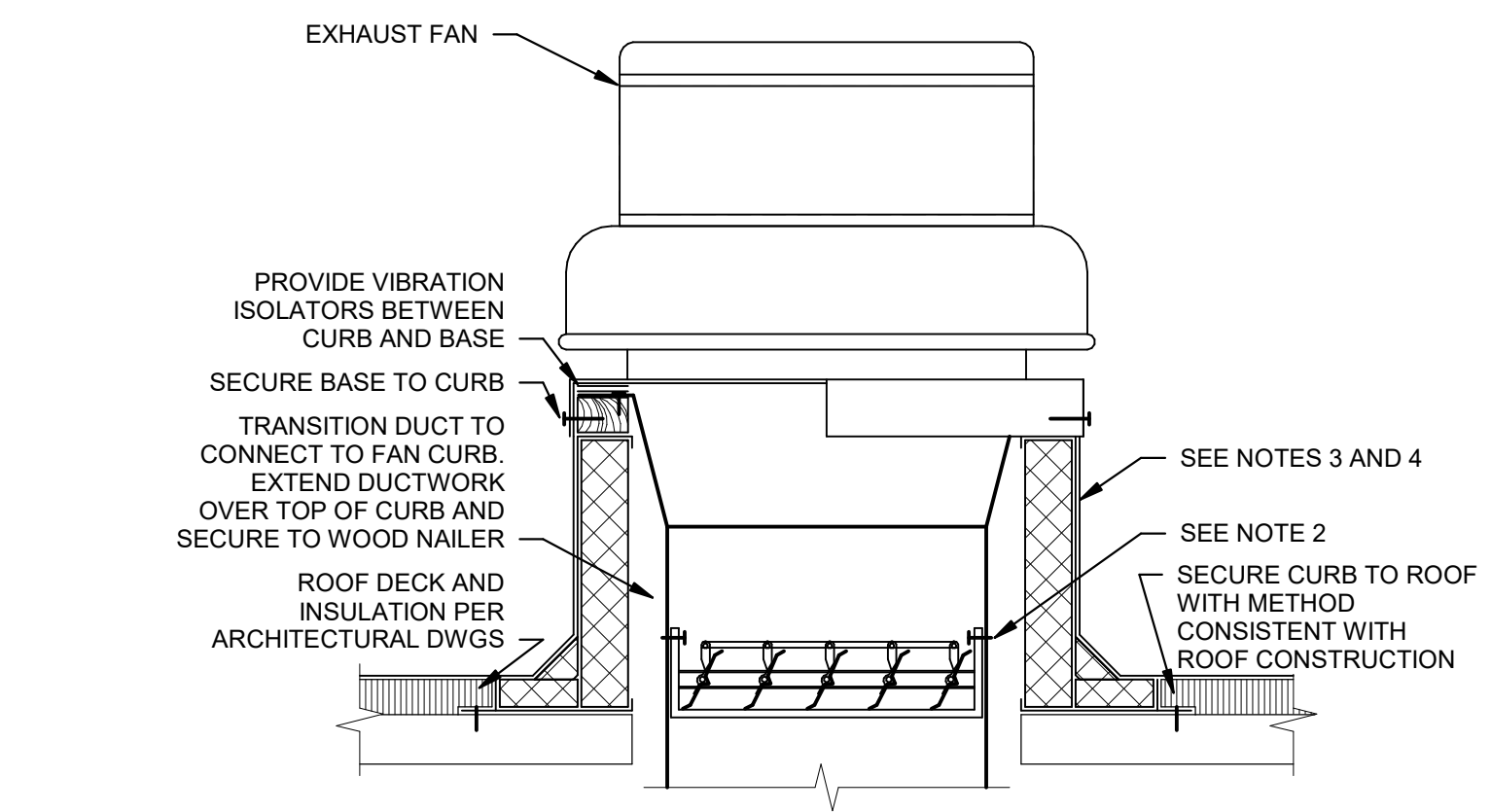
**12 UPBLAST GREASE EXHAUST FAN DETAIL NTS**



**8 CEILING CASSETTE DETAIL NTS**

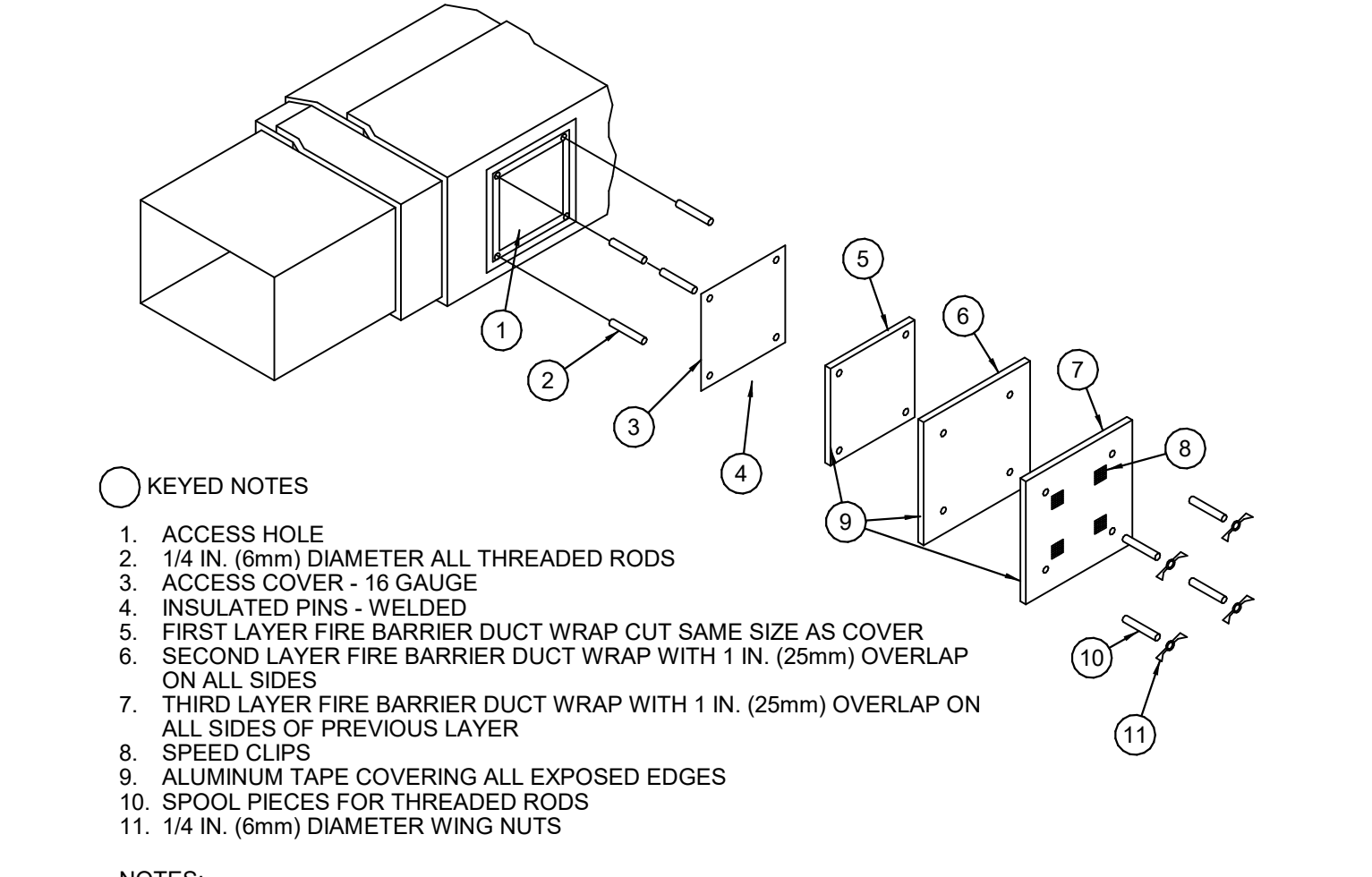


**4 DUCT HANGER LOWER ATTACHMENT DETAILS NTS**



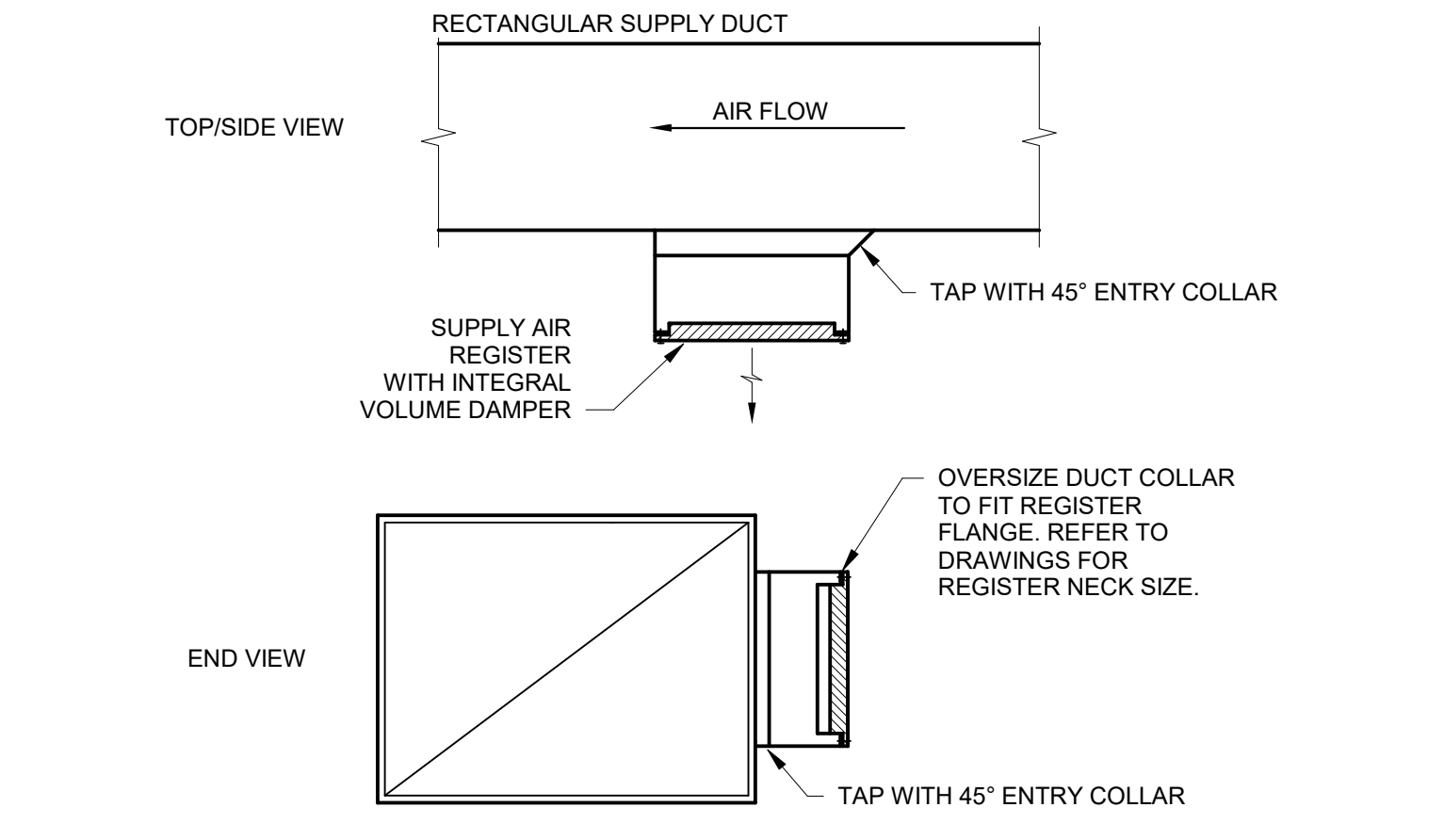
**NOTES:**  
 1. ARRANGEMENT SHOWN IS SCHEMATIC, ADJUST TO SUIT FIELD CONDITIONS AND MEET LOCAL CODE.  
 2. IF DAMPER IS SPECIFIED IN EQUIPMENT SCHEDULE, INSTALL DAMPER AT BASE OF CURB AND SECURE FROM ABOVE TO ALLOW SERVICE THROUGH TOP OF CURB.  
 3. PREFABRICATED INSULATED ROOF CURB WITH TREATED WOOD NAILER, CANT, AND STEP AS REQUIRED TO ACCOMMODATE ROOF INSULATION, FRAME AND SECURE CURB TO ROOF WITH METHOD CONSISTENT WITH ROOF CONSTRUCTION. ROOF CURB SHALL BEAR ON ROOF STRUCTURE. REFER TO ARCHITECTURAL DRAWINGS AND CURB MANUFACTURER'S DETAILS FOR MORE INFORMATION.  
 4. FOR SLOPED ROOFS, PROVIDE CURB WITH DIMENSIONS CAPABLE OF COMPENSATING ROOF SLOPE TO ENSURE FAN IS INSTALLED LEVEL.

**11 ROOF MOUNTED DOWNBLAST FAN DETAIL NTS**



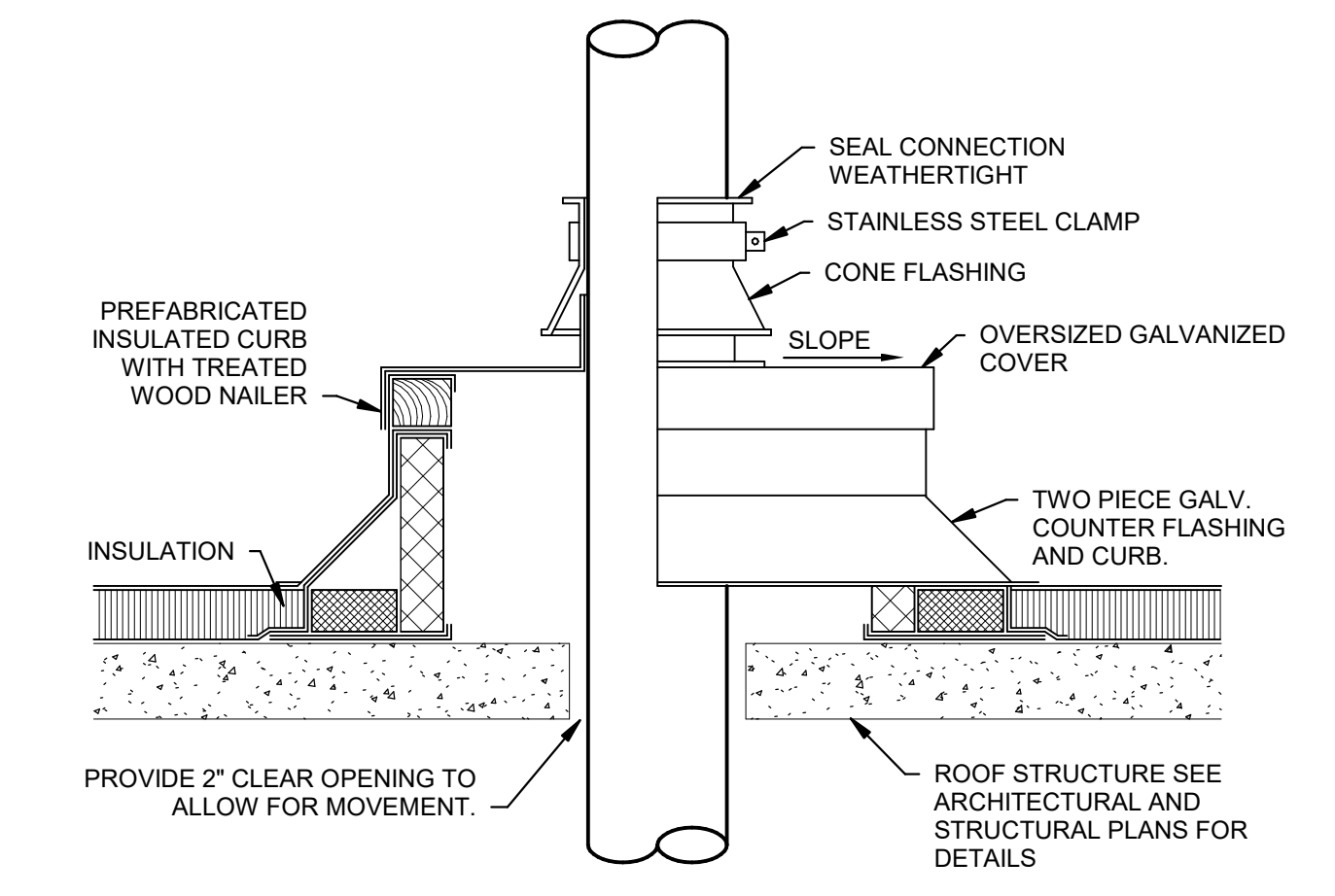
**NOTES:**  
 1. FOR REFERENCE ONLY. INSTALL PER MANUFACTURER'S RECOMMENDATIONS.  
 2. AT CONTRACTOR'S OPTION, A LISTED UL 1979 GREASE ACCESS DOOR PRODUCT MAY BE SUBSTITUTED FOR THE ACCESS DOOR PICTURED IN THIS DETAIL. DOOR SHALL BE RATED FOR UP TO 2,300F AND MEET NFPA66 STANDARDS. BOLTS SHALL BE LONG ENOUGH FOR DUCT WRAP SYSTEM (WHEN USED). INSTALL IN ACCORDANCE WITH MANUFACTURER'S LITERATURE.

**7 GREASE DUCT CLEANOUT ACCESS DOOR DETAIL NTS**

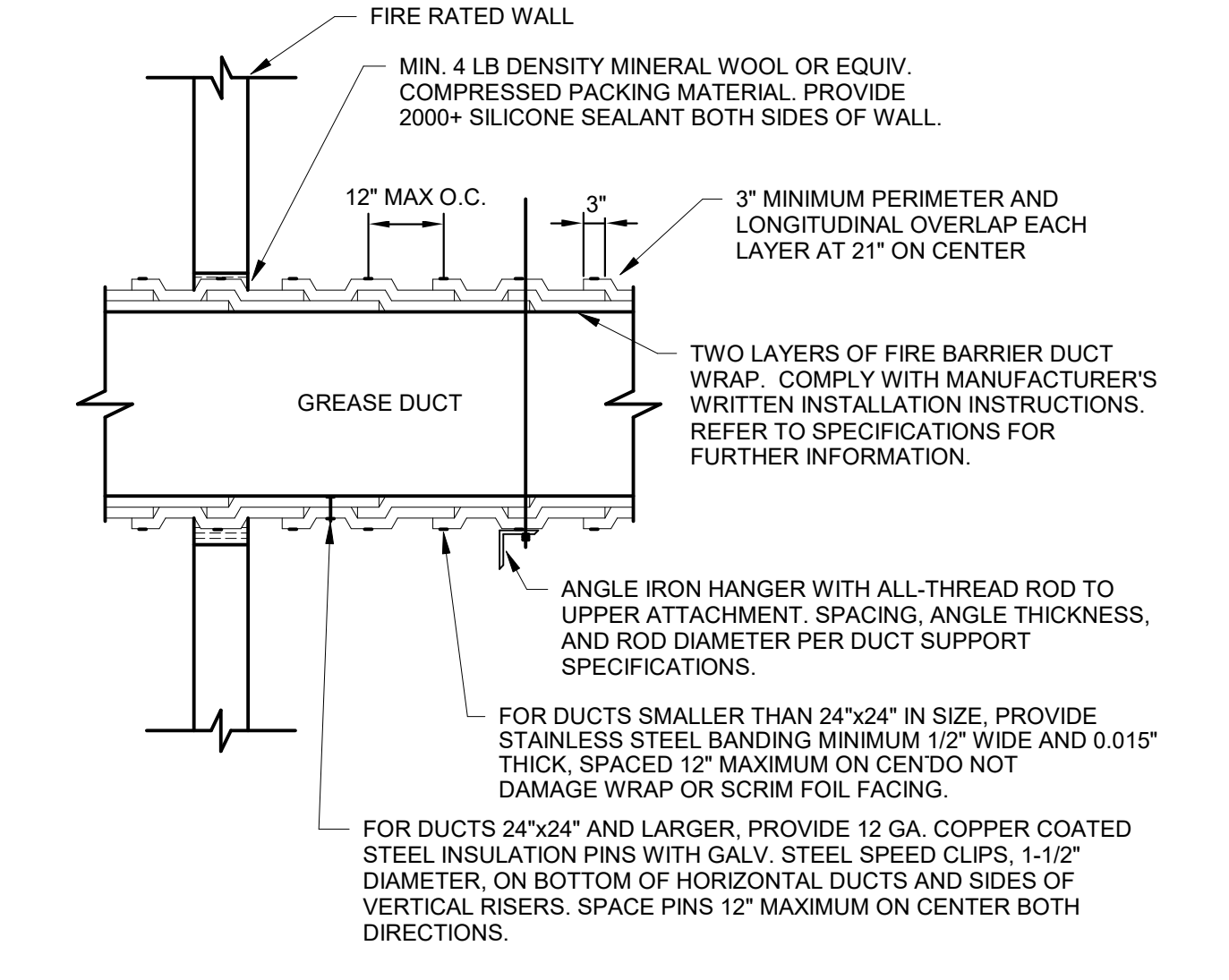


**NOTES:**  
 1. POSITION ADJUSTABLE LOUVERS DURING TESTING AND BALANCING FOR OCCUPANT COMFORT AND TO DECREASE DRAFTS IN THE SPACE.

**3 REGISTER MOUNTING TO RECTANGULAR DUCT DETAIL NTS**

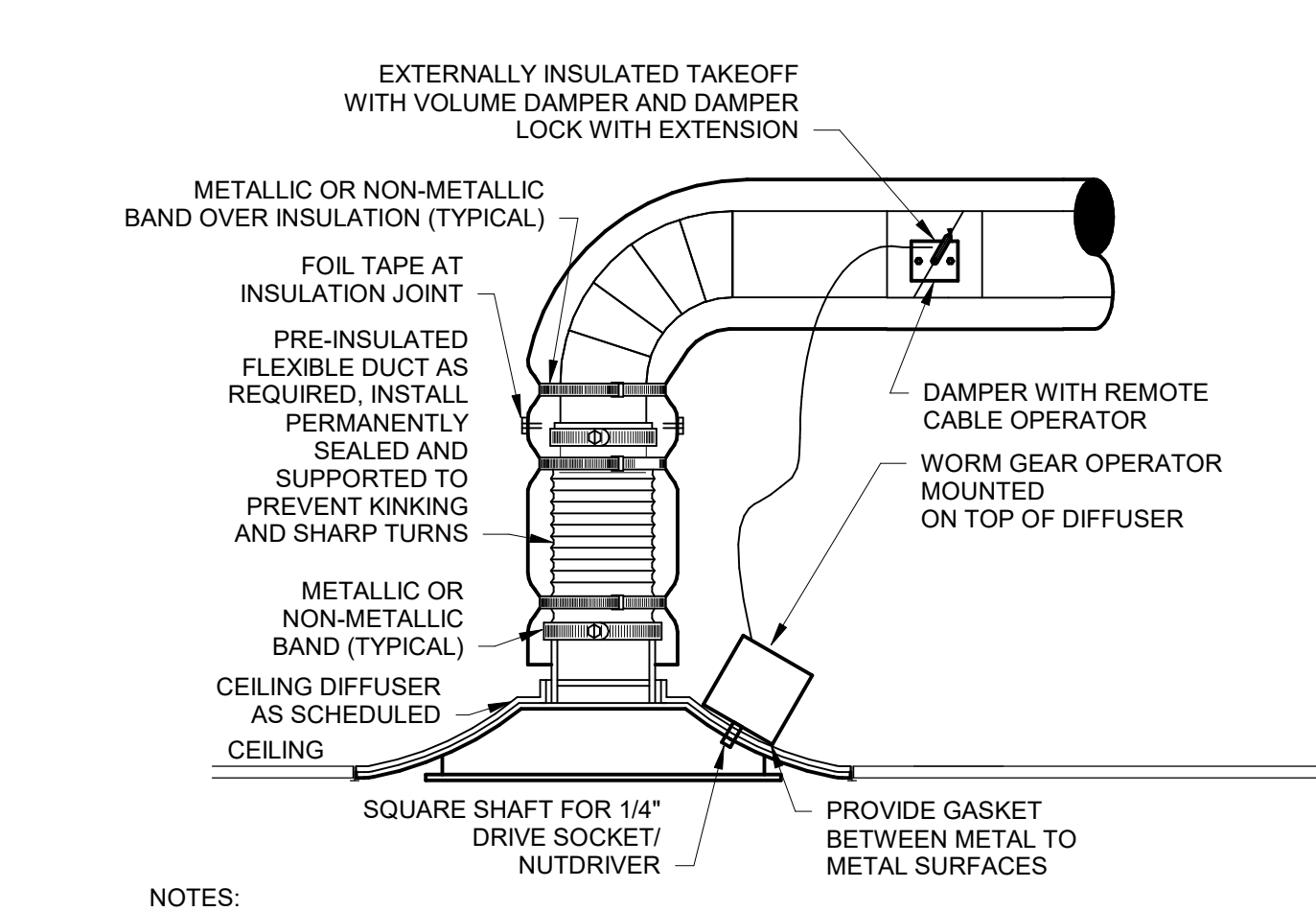


**10 ROUND DUCT PENETRATION THROUGH ROOF DETAIL NTS**



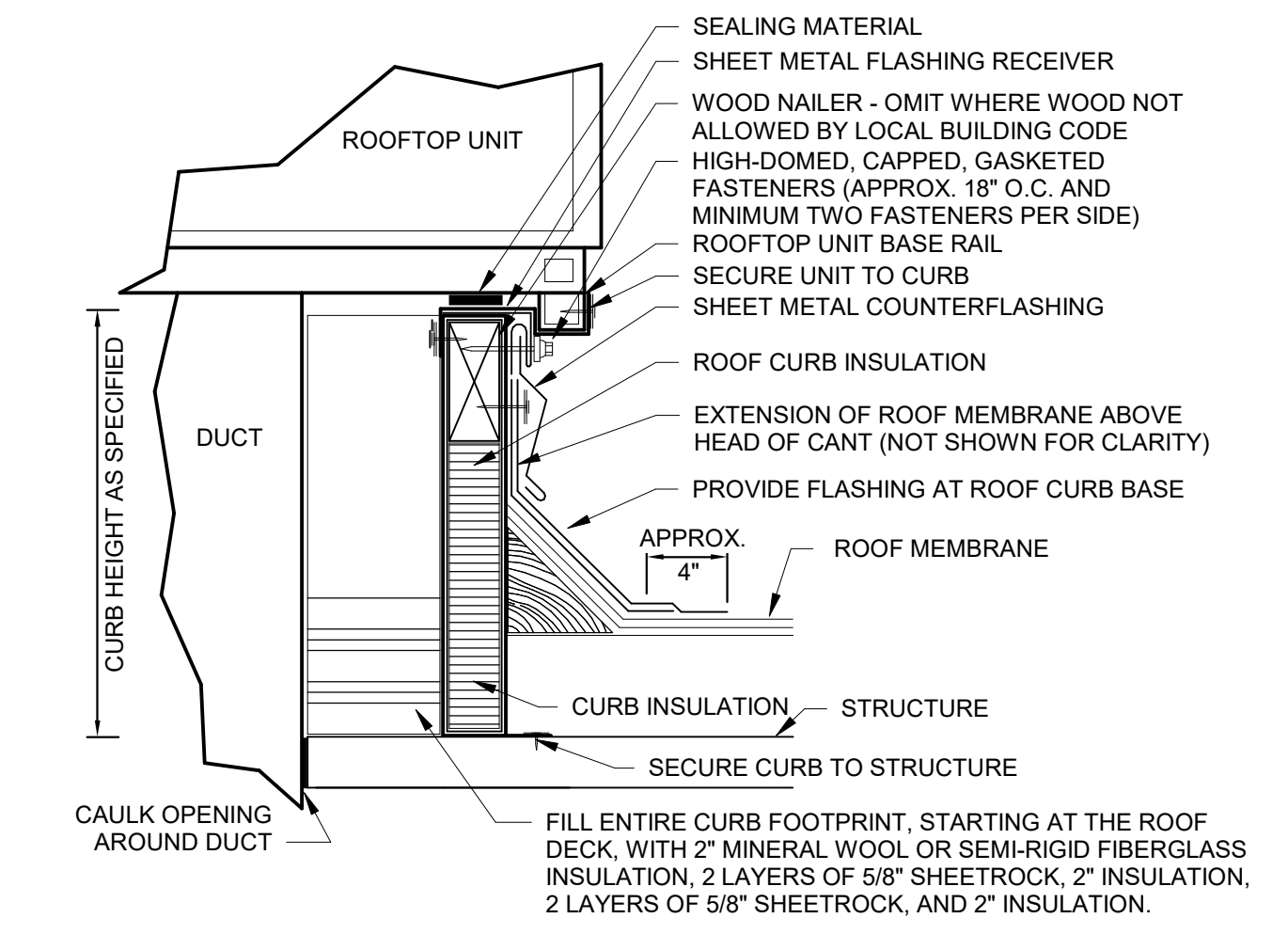
**NOTES:**  
 1. INSTALL GREASE EXHAUST AND FIRE RATED DUCT WRAP IN ACCORDANCE WITH THE MANUFACTURER'S APPROVED INSTRUCTIONS AND UL LISTED INSTALLATION DETAILS. TECHNIQUES THAT DIFFER FROM THE ABOVE METHOD ARE ACCEPTABLE IF THEY ARE UL TESTED AND APPROVED.

**6 GREASE DUCT FIRE WRAP INSULATION INSTALLATION DETAIL NTS**



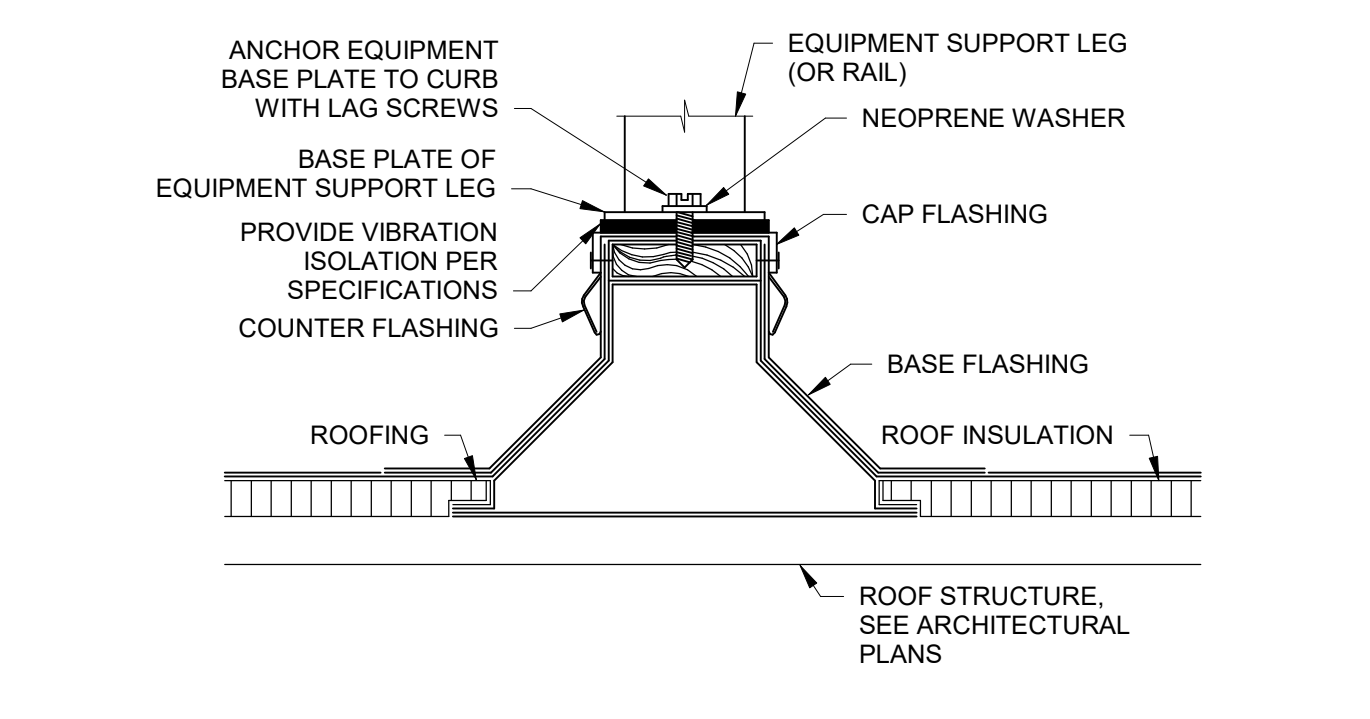
**NOTES:**  
 1. FLEXIBLE DUCT LENGTH MAY NOT EXCEED 5'-0\"/>

**2 CEILING DIFFUSER DETAIL NTS**



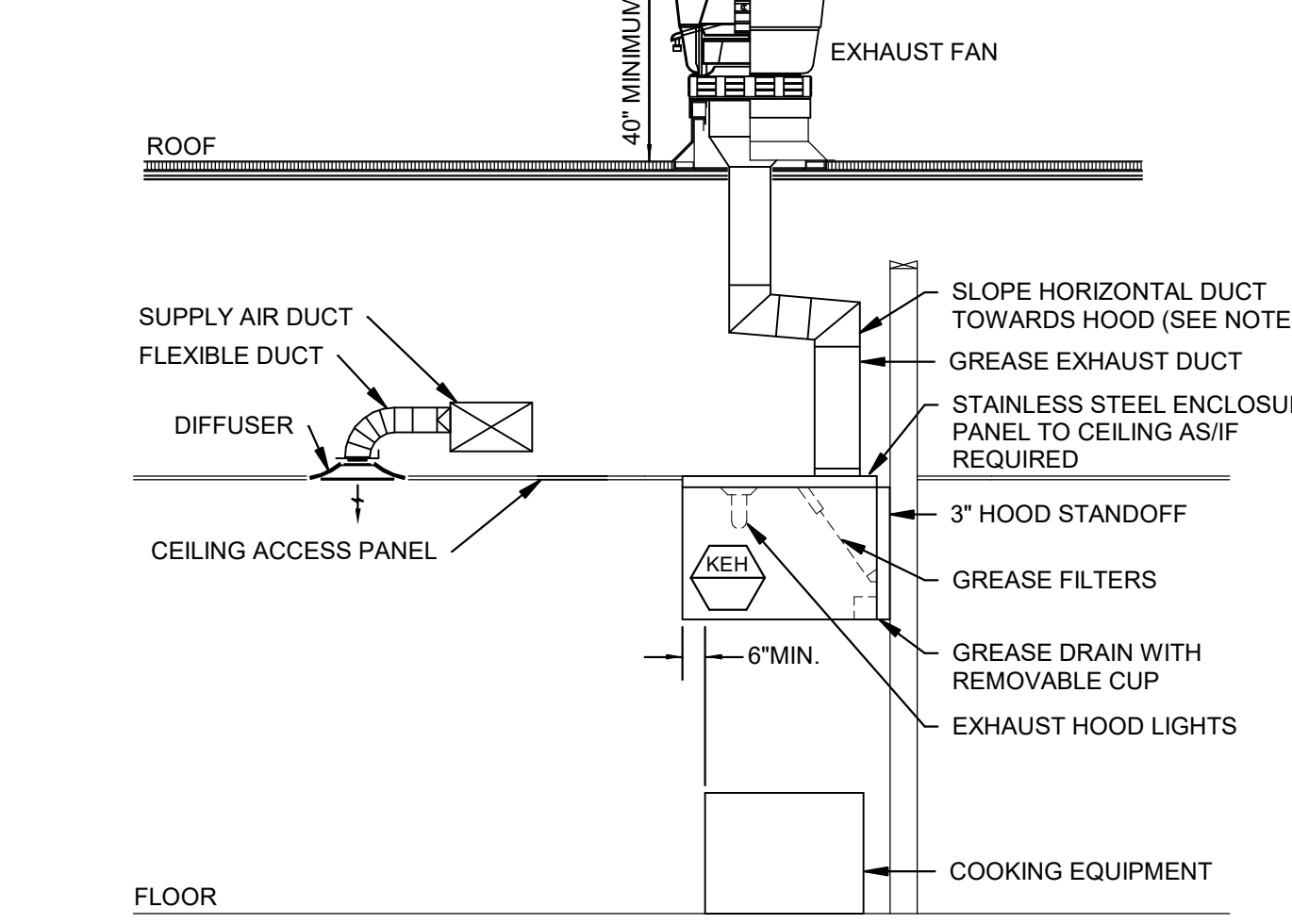
**NOTES:**  
 1. CUT METAL DECKING TO ALLOW CURB INSTALLATION ON STEEL FRAMING AFTER CURB IS SET IN PLACE. TRIM REMAINING METAL DECKING AND INSTALL WITHIN CURB. TACK WELD DECKING TO SUPPORT STEEL. DO NOT WELD INTERIOR DECKING TO ROOF CURB. PROVIDE ADDITIONAL CROSS FRAMING TO SUPPORT INTERIOR DECKING AND FILL MATERIAL AS REQUIRED.  
 2. REFER TO SPECIFICATIONS FOR ADDITIONAL REQUIREMENTS FOR ROOF CURBS, ANCHORING AND SEISMIC/WIND RESISTANCE.

**13 ROOF CURB DETAIL NTS**



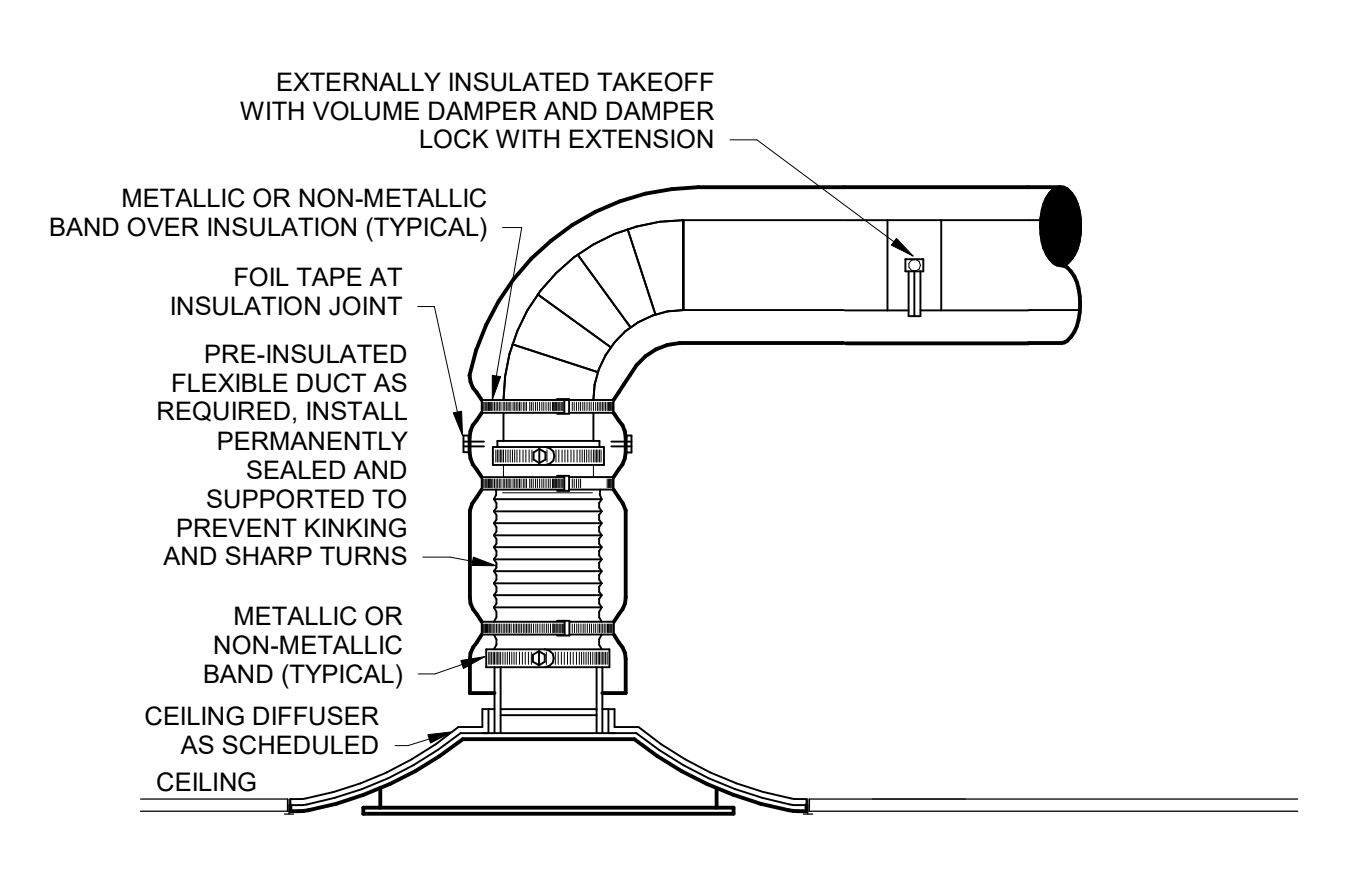
**NOTES:**  
 1. REFER TO SPECIFICATIONS FOR ADDITIONAL REQUIREMENTS FOR EQUIPMENT SUPPORTS, ANCHORING AND SEISMIC/WIND RESISTANCE.

**9 ROOF EQUIPMENT SUPPORT RAIL DETAIL NTS**



**NOTES:**  
 1. SUBMIT SHOP DRAWINGS OF ALL HOOD SYSTEMS TO CITY FOR APPROVAL PRIOR TO INSTALLATION.  
 2. TOTAL HOOD SYSTEM TO BE IN COMPLETE CONFORMANCE WITH NFPA, AND ALL LOCAL CODES AND REGULATIONS.  
 3. COORDINATE ALL FIRE PROTECTION SYSTEMS WITH FIRE PROTECTION CONTRACTOR WHO SHALL ALSO BE RESPONSIBLE FOR ALL PERMITS AND TESTING REQUIRED.  
 4. PROVIDE SEAL SYSTEM WHERE APPROVED BY LOCAL CODES IN LIEU OF RATED ENCLOSURE.  
 5. PROVIDE ACCESS PANELS AS REQUIRED BY LOCAL CODE AND PER PLAN.  
 6. HOODS SHALL EXTEND MINIMUM 6\"/>

**5 KITCHEN EXHAUST HOOD ELEVATION DETAIL NTS**



**NOTES:**  
 1. FLEXIBLE DUCT LENGTH MAY NOT EXCEED 5'-0\"/>

**1 CEILING DIFFUSER DETAIL NTS**

**HENDERSON ENGINEERS**  
 8345 LENEAX DRIVE, SUITE 300  
 LENEAX, KY 86214  
 TEL 913.742.2000 FAX 913.742.5001  
 WWW.HENDERSONENGINEERS.COM  
 2450004629

Seal



**DP3 ARCHITECTS**

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 www.DP3architects.com

Project

**SHAKE SHACK**  
 SHAKE SHACK #1694  
 JENKINTOWN, PA

Project Number 24204  
 Drawn By Author  
 Checked By Checker  
 Date 12 FEB 2025

Revisions  
 2-12-2025 PERMIT SET

Drawing

**MECHANICAL DETAILS**

**M-501**

NATHAN T. LOVE

## Division 23: HEATING, VENTILATING, AND AIR CONDITIONING

### 1. GENERAL INSTRUCTIONS

#### A. GENERAL REQUIREMENTS

All requirements under Division 01 and the general and supplementary conditions of these specifications apply to this section and division. Where the requirements of Division 01 and the general and division take precedence, become thoroughly familiar with all its contents as to requirements that affect this division, section, or both. Work required under this division includes all material, equipment, appliances, transportation, services, and labor necessary to complete the entire system as specified in the drawings as a guide when laying out the work and to verify that materials and equipment will fit into the designated spaces, and which when installed per manufacturers' requirements, will ensure a complete, coordinated, satisfactory, and properly operating system.

The specifications and drawings for the project are complementary, and any portion of work described in one shall be provided as if described in both. In the event of discrepancies, notify the Engineer and request clarification prior to proceeding with the work involved.

Drawings are graphic representations of the work upon which the contract is based. They show the materials and their relationship to one another, including sizes, shapes, locations, and connections. They convey the scope of work, indicating the intended general arrangement of the systems without showing all of the exact details as to elevations, offsets, control lines, and other installation requirements. Use the drawings as a guide when laying out the work and to verify that materials and equipment will fit into the designated spaces, and which when installed per manufacturers' requirements, will ensure a complete, coordinated, satisfactory, and properly operating system.

#### B. DEFINITIONS

Division: References contained in this specification follow the numbering system defined in the Construction Specifications Institute (CSI) MasterFormat 2004 Edition. Specification Divisions 01 through 13 provided with this project may reference the CSI MasterFormat 1995 Edition. The corresponding division references between the 2004 Edition and 1995 Edition are as follows:

2004 Edition	1995 Edition
1. Division 21 – Fire Suppression	Division 15
2. Division 22 – Plumbing	Division 15
3. Division 23 – HVAC	Division 15
4. Division 26 – Electrical	Division 16
5. Division 27 – Communications	Division 16
6. Division 28 – Electronic Safety and Security	Division 16

Furnish: "to supply and deliver to the project site, ready for unloading, unpacking, assembly, installation and similar operations."

Install: "to perform all operations at the project site including, but not limited to, the actual unloading, unpacking, assembling, erecting, placing, anchoring, applying, working to dimension, finishing, curing, protecting, cleaning, testing, commissioning, starting up and similar operations, complete, and ready for the intended use."

Provide: "to furnish and install."

Furnished by Owner (or Owner-Furnished) or Furnished by Others: "an item furnished by the Owner or under other divisions or contracts, and installed under the requirements of this division, complete and ready for intended use, including all items and services incidental to the work necessary for proper installation and operation. Include the installation under the warranty required by this division."

Engineer: Where referenced in this division, "Engineer" is the Engineer of Record and the Design Professional for the work under this division, and is a consultant to, and an authorized representative of the Architect, as defined in the General and/or Supplementary Conditions. When used in this division, Engineer means increased involvement by and obligations to the Engineer, in addition to involvement by and obligations to the Architect.

AHJ: The local code and/or inspection agency (Authority) Having Jurisdiction over the work.

NRTL: Nationally recognized testing laboratory, as defined and listed by OSHA in 29 CFR 1910.7 (e.g., UL, ETL, CSA), and acceptable to the AHJ over this project. Nationally recognized testing laboratories and standards listed are used only to represent the characteristics required and are not intended to restrict the use of other NRTLs that are acceptable to the AHJ and standards that meet the specified criteria.

Substitution: Changes in products, materials, equipment, and methods of construction from those required by the Contract Documents and proposed by Contractor. Substitutions include Value Engineering proposals.

1. Substitutions for Cause: Changes proposed by Contractor that are required due to changed Project conditions, such as regulatory changes, or unavailability of required materials or equipment.

2. Substitutions for Convenience: Changes proposed by Contractor or Owner that are not required in order to meet other Project requirements but may offer advantage to Contractor or Owner.

The terms "approved equal", "equivalent", or "equal" are used synonymously and shall mean "accepted by or acceptable to the Engineer as equivalent to the item or manufacturer specified." The term "approved" shall mean labeled, listed, or both, by an NRTL, and acceptable to the AHJ over this project.

#### C. CREBID SITE VISIT

Prior to submitting bid, visit the site of the proposed work and become fully informed as to the conditions under which the work is to be done. Failure to comply with this requirement shall not be considered sufficient justification to request or obtain extra compensation over and above the contract price.

#### D. MATERIAL AND WORKMANSHIP

Provide new material, equipment, and apparatus under this contract unless otherwise stated herein, of best quality normally used for the purpose of good commercial practice, and free from defects. Install material and equipment in accordance with the manufacturer's installation instructions. Model numbers listed in the specifications or shown on the drawings are not necessarily intended to designate the required trim, written descriptions of the trim govern model numbers.

Pipe, pipe fittings, pipe specialties and valves shall be manufactured in plants located in the United States or certified to meet the specified ASTM and ANSI standards.

Work performed under this contract shall provide a neat and "workmanlike" appearance when completed, to the satisfaction of the Architect and Engineer. Workmanship shall be the finest possible by experienced mechanics. Installations shall comply with applicable codes and laws.

The complete installation shall function as designed and intended with respect to efficiency, capacity, noise level, etc. Abnormal noise caused by rattling equipment, piping, ducts, air devices, and squeaks in rotating components shall not be acceptable. Materials and equipment shall be of commercial specification grade and in quality. Light duty residential grade equipment shall not be accepted unless otherwise indicated.

Remove from the premises waste material present as a result of work, including cartons, crating, paper, stickers, and/or excavation material not used in backfilling, etc. Clean equipment installed under this contract to present a neat and clean installation at the termination of the work.

Repair or replace public and private property damaged as a result of work performed under this contract to the satisfaction of authorities and regulations having jurisdiction. Provide all safety lights, guards, and warning signs required for the performance of the work and for the safety of the public.

#### E. MANUFACTURERS

In other articles where lists of manufacturers are introduced, subject to compliance with requirements, provide products by one of the manufacturers specified.

Where a list is provided, manufacturers are listed alphabetically and not in accordance with any ranking or preference.

Where manufacturers are not listed, provide products subject to compliance with requirements from manufacturers that have been actively involved in manufacturing the specified product for no less than 5 years.

#### F. COORDINATION

Coordinate work with that of other trades so that the various components of the systems are installed at the proper time, will fit the available space, and will allow proper service access to those items requiring maintenance. Components which are installed without regard to the above shall be relocated at an additional cost to the Owner.

Unless otherwise indicated, the General Contractor shall provide chases and openings in building construction required for installation of the systems specified herein. Contractor shall furnish the General Contractor with information where chases and openings are required. Contractor shall keep informed as to the work of other trades engaged in the construction of the project and shall execute work in a manner as to not interfere with or delay the work of other trades.

Figure dimensions shall be taken in preference to scale dimensions. Contractor shall take his own measurements at the building, as variations may occur. Contractor shall be held responsible for errors that could have been avoided by proper checking and inspection.

Provide materials with trim that will properly fit the types of ceiling, wall, or floor finishes actually installed. Model numbers listed in the specifications or shown on the drawings are not intended to designate the required trim.

#### G. ORDINANCES AND CODES

Work performed under this contract shall, at a minimum, be in conformance with applicable national, state and local codes having jurisdiction. Equipment furnished and associated installation work performed under this contract shall be in strict compliance with current applicable codes adopted by the local AHJ, including any amendments and standards as set forth by the following:

- National Electrical Code (NEC)
- National Fire Protection Association (NFPA)
- Underwriters Laboratories (UL)
- Occupational Safety and Health Administration (OSHA)
- American Society of Mechanical Engineers (ASME)
- American Society of Heating, Refrigerating, and Air Conditioning Engineers (ASHRAE)
- American National Standards Institute (ANSI)
- American Society of Testing and Materials (ASTM)
- Other national standards and codes where applicable.

Where the contract documents exceed the requirements of the referenced codes, standards, etc., the contract documents shall take precedence. Where conflicts between various codes, ordinances, rules, and regulations exist, comply with the most stringent.

Promptly bring all conflicts observed between codes, ordinances, rules, regulations, referenced standards, and these documents to the attention of the Architect and Engineer for final resolution. Contractor will be held responsible for any violation of the law.

Procure and pay for permits and licenses required for the accomplishment of the work herein described. Where required, obtain, pay for, and furnish certificates of inspection to Owner.

#### H. PROTECTION OF EQUIPMENT AND MATERIALS

Store and protect from damage equipment and materials delivered to job site. For materials and equipment susceptible to changing weather conditions, dryness or temperature variations, store inside in conditioned spaces. For materials and equipment not susceptible to these conditions, cover with waterproof, tear-resistant, heavy tarp or polyethylene plastics as required to protect from plaster, dust, dirt, paint, water, or physical damage. Replace insulation that has become wet at any time during construction. Drying the flow amounts on the drawings. Seal any tears or joints of internal fiberglass insulation. Equipment and material damaged by construction activities shall be rejected and Contractor shall furnish new equipment and material of a like kind at his own expense.

Keep premises broom clean of foreign material created during work performed under this contract. Piping, equipment, etc. shall have a neat and clean appearance at the termination of the work. Remove debris from coil/return air plenum, including dust. Plug, seal, or cap open ends of ductwork and piping systems while stored and installed during construction when not in use to prevent the entrance of debris into the systems. Remove temporary protection prior to starting equipment and turning the system over to the owner.

#### I. SUBSTITUTIONS

Materials, products, equipment, and systems described in the Bidding Documents establish a standard of required function, dimension, appearance and quality to be met by the proposed substitution. The base bid shall include only the products from manufacturers specifically identified in the Bidding Documents. To request a substitution, request the Substitution Request Form from the Architect or Engineer. Complete and send the Substitution Request Form for each material, product, equipment, or system that is proposed to be substituted. The burden of proof of the merit of the proposed substitution is upon the proposer.

Unless stated otherwise in writing to the Engineer by the Contractor, Contractor warrants to the Engineer, Architect, and Owner the following:

- Proposed substitution has been fully investigated and determined to meet or exceed the specified Work in all respects unless stated otherwise in the substitution request.
- Proposed substitution is consistent with the Contract Documents and will produce indicated results, including functional clearances, maintenance and operation requirements, and other details specified in the Contract Documents.
- Proposed substitution has received necessary approvals of authorities having jurisdiction.
- Same warranty will be furnished for proposed substitution as for specified Work.
- If an approved substitution as required, Contractor shall replace substitute material or system with that originally specified and bear costs incurred thereby.
- Coordination, installation and changes in the Work as necessary for accepted substitution will be complete in all respects.

No substitutions will be considered unless the Substitution Request Form is completed and attached with the appropriate substitution documentation. No substitution will be considered prior to receipt of bids unless written request for approval to bid has been received by the Engineer at least ten (10) calendar days prior to the date for receipt of bids.

If the proposed substitution is approved prior to receipt of bids, such approval will be stated in an addendum. Bidders shall not rely upon approvals made in any other way. Verbal approval will not be given. No substitutions will be considered after the contract is awarded unless specifically provided in the contract documents.

#### J. SUBMITTALS

Assemble and submit for review shop drawings, material lists, manufacturer product literature for equipment to be furnished, and items requiring coordination between contractors under this contract. Provide submittals in sufficient detail so as to demonstrate compliance with these contract documents and the design concept. Prior to transmitting submittals, verify that the equipment submitted is mutually compatible and suitable for the intended use, will fit the available space, and maintain manufacturer recommended service clearances. If the size of equipment furnished makes necessary any change in location or configuration, submit a shop drawing showing the proposed layout.

Transmit submittals as early as required to support the project schedule. Allow for two weeks Engineer review time, plus time from mailing time via the Architect, plus a duplication of this time for resubmittal, if allowed. Only resubmit those sections requiring for resubmittal.

Submittals shall contain the project name, applicable specification section, submittal date, equipment identification acronym as used on the drawings, and the Contractor's stamp. The stamp shall certify that the submittal has been checked by the Contractor, complies with the drawings and specifications, and is coordinated with other trades. Manufacturer product literature shall include shop drawings, product data, performance specifications, wiring diagrams, highlight, mark, list, or indicate the materials, performance criteria, and accessories that are being proposed. General product catalog data not specifically noted to be part of the specified product will be rejected and returned without review.

Submittals and shop drawings shall not contain the firm name, logo, seal, or signature of the Engineer. They shall not be copies of the work product of the Engineer. If the Contractor desires to use elements of such product, refer to paragraph "Electronic Drawing Files" for procedures to be used.

Separate submittals according to individual specification sections. Illegible submittals will be rejected and returned without review. Catalog data shall be properly identified, indexed and tabbed. A hard copy format or a single PDF file for each specification section is acceptable. Each item or model number shall be clearly marked and accessories indicated. Label the catalog data with the equipment identification acronym or number as used on the drawings and include performance curves, capacities, sizes, weights, materials, finishes, wiring diagrams, electrical requirements and deviations from specified equipment or materials. For equipment with motor starters or VFDs, include short circuit current ratings. Mark out inapplicable items. Shop drawings will be returned without review if the above mentioned requirements are not met.

Provide the quantity of submittals required by Division 01. If not indicated and hard-copy sets are provided, submit a minimum of six (6) copies. Refer to Division 01 for acceptance of electronic submittals for this project. For electronic submittals, Contractor shall submit the documents in accordance with the procedures specified in Division 01. Contractor shall notify the Architect and Engineer that the submittals have been posted. If electronic submittal procedures are not defined in Division 01, Contractor shall include the website, user name, and password information needed to access the submittals. For submittals sent by e-mail, Contractor shall copy the designated request, drawings, or materials to a CD-ROM and submit them to the Architect and Engineer. Contractor shall review time as specified above in the construction schedule. Contractor shall submit only the documents required to purchase the materials and/or equipment in the electronic submittal.

The checking and subsequent acceptance of submittals by the Engineer and/or Architect shall not relieve the Contractor from responsibility for deviations from the drawings and specifications, errors in dimensions, details, size of members, or quantities, omissions of components or fittings, coordination of electrical requirements; and not coordinating items with actual building conditions and adjacent work. Proceed with the procurement and installation of equipment only after receiving approved shop drawings relative to each item.

#### K. ELECTRONIC DRAWING FILES

In preparation of shop drawings or record drawings, Contractor may, at his option, obtain electronic drawing files in AutoCAD or DXF format on CD-ROM disk, DVD disk, flash drive or direct download, as desired, from the Engineer for a shipping and handling fee of \$200 for a drawing set up to 25 sheets and \$15 per sheet for each additional sheet. Contact the Architect for written authorization and Engineer for the necessary release agreement form and to specify shipping method and drawing format. In addition to payment, the written authorization from the Architect and release agreement form from the Engineer must be received before electronic drawing files will be sent.

#### L. RECORD DRAWINGS (AS-BUILT DRAWINGS)

During progress of the work in this division, Contractor shall maintain an accurate record of all changes made during the installation of the system. Upon completion of the work, accurately transfer all record information to three identical sets of the approved shop drawings. Insert one set into each copy of the manual described below.

#### M. OPERATION AND MAINTENANCE INSTRUCTIONS

During the course of construction, collect and compile a complete brochure of equipment furnished and installed on this project. Include operational and maintenance instructions, manufacturer's catalog sheets, wiring diagrams, parts lists, approved submittals and shop drawings, warranties, and descriptive literature as furnished by the equipment manufacturer. Include an inside cover sheet that lists the project name, date, Owner, General Contractor, Sub-Contractor, and an index of contents.

Submit three copies of literature bound in approved binders with index and tabs separating equipment types to the Architect, for Engineer's review, at the termination of the work. Paper clips, loose-leaf binding, and mailing envelopes are not considered approved binders. Final approval of systems installed under this contract shall be withheld until this equipment brochure is received and deemed complete by the Architect and Engineer. Instruct workmen to save required literature shipped with the equipment itself for inclusion in this brochure.

Include Record Drawings as described above.

#### N. FLAMMABLE REFRIGERANTS

Equipment with refrigeration systems using Group A2L refrigerants shall meet all requirements of ASHRAE Std 15 and this section.

#### Listing and Installation Requirements:

- Listed in accordance with UL 484 or UL 60335-2-4/CSA C22.2 No. 60335-2-40.
- The nameplate shall include a symbol indicating that a flammable refrigerant is used, as specified by the product listing.
- A label indicating a flammable refrigerant is used shall be placed adjacent to service ports and other locations where service involving components containing refrigerant is performed, as specified by the product listing.

Refrigeration systems shall have an integral refrigerant detection system that meets the following requirements as documented in ASHRAE Std 15:

- Utilize a set point, nonadjustable in the field, to generate an output signal to initiate mitigation actions.
- Field recalibration of refrigerant detection system shall not be permitted.
- Be capable of detecting the presence of a specific refrigerant corresponding to the refrigerant designation of the refrigerant contained in the refrigeration system.
- Have access for replacement of the sensing element.
- Have self-diagnostic capability to determine operational status of the sensing element.
- Energize air circulation fans of the equipment upon failure of a self-diagnostic check.
- Generate an output signal in not more than 30 seconds when exposed to a refrigerant concentration of 25% LFL (+0%, -1%).

Manufacturer's refrigeration mitigation action shall be completed in not more than 15 seconds after the initiation of the output signal and the equipment's integral refrigerant detection system and shall be maintained for at least 5 minutes after the output signal has reset.

#### O. SPARE PARTS

Furnish to Owner, with receipt, the following spare parts for the equipment furnished for this project:

- One set of spare filters of each type required for each unit. In addition to the spare set of filters, install new filters prior to testing, adjusting, and balancing work and before turning system over to Owner.
- Furnish one complete set of both gaskets and O-rings.
- Furnish three operating keys for each type of air outlet and inlet that require them.

#### P. TRAINING

At a time mutually agreed upon between the Owner and Contractor, provide the services of a factory trained and authorized representative to train Owner's designated personnel on the operation and maintenance of the equipment provided for this project.

Provide training to include, but not be limited to, an overview of the system and/or equipment as it relates to the facility as a whole; operation and maintenance procedures and schedules related to startup and shutdown, troubleshooting, servicing, preventive maintenance and appropriate operator intervention; and review of data included in the operation and maintenance manuals.

Submit a certification letter to the Architect stating that the Owner's designated representative has been trained as specified herein. Letter shall include date, time, attendees and subject of training. The Contractor and the Owner's representative shall sign the certification letter indicating agreement that the training has been provided.

Schedule training with Owner with at least 7 days advance notice.

#### Q. WARRANTIES

Warrant each system and each element thereof against all defects due to faulty workmanship, design, or material for a period of 12 months from date of Substantial Completion, unless specific items are noted to carry a longer warranty in the construction documents or manufacturer's standard warranty exceeds 12 months. Remedy all defects, occurring within the warranty period(s), as stated in the General Conditions and Division 01.

Warranties shall include labor and material, including travel expenses. Make repairs or replacements without any additional costs to the Owner, and to the satisfaction of the Owner, Architect, and Engineer.

Perform the remedial work promptly, upon written notice from the Engineer or Owner.

At the time of Substantial Completion, deliver to the Owner all warranties, in writing and properly executed, including term limits for warranties extending beyond the one year period, and any actions the Owner must take in order to maintain warranty conditions. Each warranty instrument shall be addressed to the Owner and state the commencement date and term.

#### 2. GENERAL MATERIALS AND INSTALLATION

##### A. BUILDING OPERATION

Comply with the schedule of operations as outlined in the architectural portions of this specification. Accomplish work requiring interruption of building operation at a time when the building is not in operation and only with written approval of building Owner and/or tenant. Coordinate interruption of building operation with the Owner and/or tenant a minimum of seven (7) days in advance of work.

##### B. COINCIDENTAL DAMAGE

Repair stairs, sidewalks, drives, paving, walls, finishes, and other facilities damaged in the course of the work. Repair materials shall match existing construction. Repair work shall meet all requirements of the Owner, local authorities having jurisdiction, and meet the satisfaction of the Architect.

##### C. CUTTING AND PATCHING

Conform to the requirements in Division 01. Cut walls, floors, ceilings, and other portions of the facility as required to install work under this division. Obtain permission from the Architect prior to cutting. Do not cut or disturb structural members without prior approval from the Architect and Structural Engineer. For post-tension slabs, x-ray slab and closely coordinate all core drill locations with Architect and Structural Engineer prior to performing any work. Obtain approval from Architect and Structural Engineer for all core drills and penetrations at least four days prior to performing work. Penetrations shall be made as small as possible while maintaining required clearances between the building components and the work. Patch around openings to match the adjacent construction including fire ratings, if applicable. Repair and refresh areas disturbed by work to the condition of adjoining surfaces in a manner satisfactory to the Architect.

##### D. ROUGH-IN

Coordinate without delay all roughing-in with other divisions. Conceal piping, conduit, and rough-in except in unfinished areas and where otherwise shown.

##### E. STRUCTURAL SUPPORT SYSTEMS

Structural steel used for support of equipment, ductwork and piping shall be new, clean, and conform to ASTM Designation A-36.

Support mechanical components from the building structure. Do not support mechanical components from ceilings, other mechanical or electrical components, and other non-structural elements.

##### F. PRE-ENGINEERED ROOF EQUIPMENT SUPPORTS AND CURBS

Provide prefabricated equipment support rails and roof curbs manufactured by AES Industries, Custom Curb, Inc., Pate Company, Thybar or approved equal. Provide with fully mirrored raised cant and step to match roof insulation thickness, welded, minimum 18 gauge galvanized steel shell, internally reinforced to load bearing factors of equipment being supported, minimum 1-1/2 inch thick, 3 pound rigid insulation internal to shell to maintain continuous roof insulation where required, factory installed wood nailer, and minimum 1/8 gauge jacket with counterflashing where equipment does not fully cover the equipment support. Provide sloped roof equipment supports to enable level installation of equipment. Provide multiple support rails to uniformly support the equipment. Attach to roof structure according to manufacturer's installation instructions.

Attach equipment directly to pre-engineered roof equipment support using one of the following methods:

- Rail Equipment Supports: Secure each equipment support leg to the rail with a minimum of 4 joints of connection per leg.
- Roof Curbs: Secure each corner of the equipment to the curb nailer using a minimum of 4 lag screws, located along the length of the curb. Alternatively, secure equipment to the curb using hold-down brackets. Provide minimum 6 inch long, 14 gauge galvanized steel brackets sized to wrap around top of curb and under equipment base rail with sufficient horizontal offset to cover overlap gap between the equipment rail and curb. Secure bracket to equipment and curb nailer using a minimum of 8 points of connection per bracket. Provide one bracket at each corner along the length of the curb.

##### G. ACCESS PANELS AND DOORS

Refer to Architectural documents for specification of access panels and doors.

##### H. PENETRATIONS

Provide sleeves for pipes passing through larger concrete or masonry walls, concrete floor or roof slabs. Sleeves are not required for core drilled holes in existing masonry walls, concrete floors or roofs. Provide 10 gauge galvanized steel sleeves for sleeves 6 inches and smaller. Provide galvanized sheet metal sleeves for larger than 6 inches. Schedule 40 PVC sleeves are acceptable for installation in areas without return air plenums.

Slab elevated floor, exterior wall and roof penetrations watertight and weathertight with non-shrink, non-hardening commercial sealant. Pack with mineral wool and seal both ends with minimum of 1/2 inch of sealant.

Seal around penetrations of fire rated assemblies. Coordinate fire ratings and locations with the architectural drawings. Refer to architectural specifications for fire stoppings. Provide a product schedule for UL listing, location, wall or floor rating and installation drawing for each penetration fire stop.

Extend pipe insulation for insulated pipe through floor, wall and roof penetrations, including fire rated walls and floors. The vapor barrier shall be maintained. Size sleeves for a minimum of 1 inch annular clear space between inside of sleeve and outside of insulation.

Provide prefabricated roof curbs where pipes and/or ductwork penetrate elevated slabs or the roof to the exterior. Provide cover curb of weather-resistant material and seal duct or pipe penetrations through the cover. Provide pipe collar of weather-resistant material with stainless steel pipe clamps for piping penetrations.

Provide box frames for rectangular openings welded 12 gauge galvanized steel attached to forms and of a maximum dimension established by the Architect. Notify the General Contractor or Architect before installing any box openings not shown on the Architectural or Structural drawings.

Seal concrete or masonry exterior wall penetrations below grade with "wall pipes" and mechanical sleeve seals. Provide cast iron "wall pipes" with integral watertight ring manufactured by Jay R. Smith, Josam, Wade, Watts or Zurn. Provide modular mechanical sleeve seals, manufactured by Calico, Metrolite, or Thurderline L-16 Seal.

Seal elevated concrete slab with water proof membrane penetrations with "wall pipes" and water proof sealant. Secure waterproof membrane flashing between "wall pipe" clamping flange and clamping ring. Provide cast iron "wall pipes" with integral waterproofing manufactured by Jay R. Smith, Josam, Wade, Watts or Zurn.

Provide sleeves for horizontal pipe passing through or under foundation. Sleeves shall be cast iron soil pipe two nominal pipe sizes larger than the pipe served.

Provide Schedule 40 PVC pipe sleeves for vertical pressure pipe passing through concrete slab on grade. Sleeves shall be one nominal pipe size larger than the pipe served and two pipe sizes larger than pipe served for ductile iron pipes with restraining rods. Seal water-tight with silicone caulk.

Provide 1/2 inch thick cellular foam insulation around perimeter of non-pressure pipe passing thru concrete slab on grade. Insulation shall extend to 2 inches above and below the concrete slab.

##### I. FIRESTOPPING

Sealants and accessories shall have fire-resistance ratings indicated, as established by testing identical assemblies in accordance with UL 2079 or ASTM E 814, or other NRTL acceptable to AHJ.

Manufacturers: Hill, RectorSeal, Specified Technologies Inc., United States Gypsum Company, or 3M corp.

Through and Membrane Penetration Firestopping Systems Product Schedule: Provide UL listing, location, wall or floor rating, and installation drawing for each penetration fire stop.

Where project conditions require modification to qualified testing and inspecting agency's illustrations for a particular firestopping condition, submit illustration with modifications manufacturer's approved by penetration firestopping manufacturer's fire-protection engineer as an engineering judgment or equivalent fire-resistance-rated assembly. Include qualifications data for testing agency.

##### J. ELECTRICAL WIRING

High voltage wiring is defined as 50 Volts or higher. Low voltage wiring is defined as less than 50 Volts. Line voltage wiring shall be provided by Division 26. Line voltage control and interlock wiring for mechanical systems shall also be provided by Division 26. Low voltage control wiring shall be provided by Division 23. Furnish wiring diagrams to Division 26 as required for proper equipment hookup. Coordinate with Division 26 the actual wire sizing aspects for mechanical equipment (from the equipment nameplate) to ensure proper installation.

Provide power and communication wiring with transient protection in accordance with IEEE C62.41.2. All control and interlock wiring shall comply with the NEC. Control wiring shall be sized to accommodate the voltage drop associated with the distance between the control device and the controller. Control wiring not installed in conduit shall be UL rated for plenum installation. All NEC Class 1 (line voltage) wiring shall be UL listed in approved raceway according to the NEC and Division 26 requirements. Maximum allowable voltage for control wiring shall be 120 Volts AC. All low-voltage wiring shall meet NEC Class 2 requirements. Low-voltage power circuits shall be sub-rated when required to meet Class 2 current limit.

Conduit for Control Wiring: EMT with compression fittings, cold rolled steel, zinc coated or zinc-coated rigid steel with threaded connections.

Pull and Junction Boxes: Size according to number, size, and position of entering raceways as required by National Electrical Codes. Enclosure type shall be suited to location.

Install wiring parallel to building lines wherever possible. Conceal all control wiring in finished rooms. Do not install Class 2 wiring in raceway containing Class 1 wiring. Boxes and panels containing high voltage wiring and equipment may not be used for low-voltage wiring (except for the purpose of interlocking relays, relays and time relays). All wire-to-wire and wire-to-panel connections shall be made at a terminal block or terminal strip. All runs of communication wiring shall be unspliced length when that length is commercially available. Verify the integrity of the entire run of wiring following the cable installation. Use appropriate test measures for each particular cable. Label all wiring and cabling at each end with 2 inches of termination with the controller termination number. Label control devices used in the system with permanent labels using the Identifiers that match the record documents.

##### K. EQUIPMENT FURNISHED BY OTHERS

Provide necessary equipment and accessories that are not provided by the equipment supplier or Owner to complete installation of equipment furnished by others in locations as indicated on the drawings, specified herein, or both. Equipment and accessories not provided by the equipment supplier may include, but not be limited to, filters, intakes, associated roof jacks and caps to outdoors, dampers, in-line fans, roof fans, and control interlocks, etc. as required for proper operation of the complete system in accordance with the manufacturer's instructions.

Contractor shall be responsible for correct rough-in and dimensions and shall verify them with Architect and/or equipment supplier prior to service installations.

##### L. SYSTEM TESTING, ADJUSTING, AND BALANCING

Upon completion of each phase of the installation, test each system in conformance with local code requirements and as noted below. Furnish labor and equipment required to test each system installed under this contract. Assume all costs involved in making the tests and repairing and/or replacing any damages resulting therefrom.

Final system testing, balancing and adjustments (TAB) shall be performed by a Contractor certified by the National Environmental Balancing Bureau (NEBB), Associated Air Balance Council (AABC), or Testing, Adjusting and Balancing Bureau (TAB) TAB shall be performed in accordance with the most current edition of the certified agencies procedural standard for testing, adjusting and balancing and shall comply with the strictest interpretation of that standard for execution and reporting of all TAB work.

Test, adjust, and balance equipment and systems included in the scope of work. Prepare testing and balancing report log using forms consistent with the standard forms available from the TAB certification standard being followed. Adjust equipment to deliver specified air flow amounts on the drawings. For air systems, include airflow quantities, entering and leaving temperatures, and pressures at designated design flow. Include fan and unit test readings, motor voltage and amp draws, etc., and submit six copies of the final compilation of data to the Architect for evaluation and approval before final inspection of the project.

Balance air systems to within plus or minus 10 percent for terminal devices and branch lines and plus or minus 5 percent for main ducts and air handling equipment of the amount of air shown on the drawings. TAB Contractor shall record space temperatures and make adjustments in airflow to each diffuser to obtain uniform temperature (no greater than +/- 1 F) in spaces. Document temperatures and adjustments in tab report. Adjust equipment to operate as intended by the specification. TAB report shall include a "summary/remarks" section in accordance with the procedural standard that provides both system set up and a report of deficiencies as defined by the procedural standard.

TAB Contractor shall be responsible to calibrate, set, and adjust automatic temperature control sensors, actuators and control devices. Check proper sequencing of interlock systems, and operation of safety controls, and control setpoints, limits and time based adjustment to operate in accordance with the performance requirements of the Construction Documents. Adjust fans, etc. for proper and efficient operation. Certify to Architect that adjustments have been made and that system is operating satisfactorily. Calibrate, set, and adjust automatic temperature controls. Check proper sequencing of interlock systems, and operation of safety controls.

Division 23 contractor shall align bearings and replace bearings that have dirt or foreign material in them with new bearings without additional cost to the Owner.

##### M. VIBRATION ISOLATION

Provide vibration isolation equipment and materials by a single manufacturer. If type and deflection for specific equipment is not specified within the contract documents, reference ASHRAE Handbook "HVAC Applications" or provide per manufacturer's recommendations. Approved manufacturers include Caldyn, Knott Noise Control, Mason Industries, Inc., Vibration Eliminator Co., Inc., Vibration Mounting and Controls, or Vibro-Acoustics, provided their systems are in compliance with the

Where access to dampers through a hard ceiling is required, provide a concealed, remote cable-operated, butterfly-type volume damper assembly with external worm gear operator. Damper assembly shall include duct casing with rolled bead stiffeners, reinforced blade, self-lubricating bearing, and remote operator mounting plate. External operator shall attach to damper as a single piece with no linkage adjustment required. Damper shall be adjustable through the diffuser frame with standard 1/4 inch nut/driver or flat screwdriver. Provide compatible with the controllers used, with range suitable for the systems encountered. Transmitters and transducers shall have offset and span adjustments, temperature compensation, shock and vibration immunity, and zeroing capability. Accuracy requirements shall include the combined effects of linearity, hysteresis, repeatability, and the transmitter.

Provide electric cooling, gas heating rooftop units as scheduled on the drawings, manufactured by Aeon, Carrier, Daikin, Lennox, Johnson Controls, Trane, or York, with features as noted in the RTU schedule and in the RTU Control Matrix, and complete with factory installed direct-drive hermetic compressors with internal spring vibration isolation, built-in motor thermal overload protection, crankcase heater, and low pressure switches, direct expansion cooling and condensing coils with internal installed flexible elastomeric insulation around the suction and liquid lines not directly located above a condensate drain pan and protective UV coating on any insulation exposed to sunlight, minimum SEER or EER rating (cooling) as required by the applicable energy code or greater if scheduled on the drawings, minimum SEER or EER rating (heating) as required by the applicable energy code or greater if scheduled on the drawings, AFUE rating (heating) as required by the applicable energy code or greater if scheduled on the drawings, forced combustion air blower; complete factory installed micro-processor controls including anti-short cycle timers, time delay relays and minimum "on" time controls on the drawings, direct spark ignition system; built-in thermal overload protection on motors and compressors; outdoor air damper; relief, weathertight housing constructed of zinc coated, heavy gauge, galvanized steel with weather-resistant baked enamel finish; pre-engineered roof curb with minimum height as scheduled on the drawings if unit is equipped with internal vibration isolators; thermostat; provide unit complete with manufacturer's one year guarantee on components plus an additional four year guarantee on the compressor and heat exchangers. For units equipped with an economizer assembly, the assembly shall be covered with minimum 5 year manufacturer warranty, certified to operate through 80,000 damper opening and closing cycles, and certified to meet leakage requirements specified under the section, "Control Dampers."

Provide electric unit heaters as scheduled on the drawings, manufactured by Berko, Bransch, Indecso, Markel, QMark, or Raywall, standard type propeller unit heaters with sidewall mounting brackets and hardware for horizontal airflow. Furnish heater fan motors complete with a manual motor starter with automatic thermal cutouts sized to the motor load, disconnect switch, and other code required safety devices. Provide unit mounted thermostat and manual summer/winter chnageover switch.

Provide split ductless system consisting of evaporator section for wall or ceiling mounting as indicated and remote condensing section consisting of condenser, control panel, condenser fan, condenser coils, and fan. Provide indoor unit with remote control. Provide outdoor unit with factory assembled pre-wired consisting of furnace-grade steel with baked-enamel finish, front access, with direct-drive centrifugal fans, 2-speed motor, and cleanable foam filter. Evaporator coil shall be direct-expansion cooling coil of seamless copper tubes expanded into aluminum fins, with thermal expansion valve. Air-cooled condenser shall be of corrosion-resistant cabinet containing compressor, copper-tube aluminum-fin coils, direct-drive propeller fans with internal overload protection, capacity control to 0 degrees Fahrenheit.

Provide refrigerant piping sized as recommended by equipment manufacturer with foamed plastic insulation on the suction line as specified in this section.

Control System: Unit-mounted panel with contactors, control transformer with circuit breaker, solid-state temperature- and humidity-control modules. Provide solid-state, unit-mounted control panel with start-stop switch, adjustable humidity set point, and adjustable temperature set point. Refer to sequence of operation.

Provide air curtains manufactured by Berner, Marley, Mars, or Powered Air, of sizes and capacities shown on drawings. Units shall comply with AMCA 220, ANRH 410 and NSF-37. Unit housing shall be constructed of aluminum, aluminumized steel, or galvanized steel with powder coated/enameled finish, with steel mounting brackets. Unit shall have air adjustment by way of multi-speed motors or adjustable intake louvers. Unit shall have an adjustable integral discharge nozzle. Units shall have statically and dynamically balanced fans with direct drive fan drives. Motors shall be single speed resiliently mounted, continuous duty, with permanently sealed pre-lubricated ball bearings, and internal disconnect.

Electric heating coils shall comply with UL 1995, with galvanized steel frame, resistance wires of 80 percent nickel, 20 percent chromium, die-type overtemperatue protection with automatic reset and thermal cutoff, serviceable thru terminal box with removing heater. Provide secondary protection of load-carrying, manually reset or replaceable thermal cutouts factory wired in series with each heater stage. Control panel shall be unmounted with disconnecting means and overcurrent protection and include magnetic contactor, thermal protector, solid-state pulse controller, logic switches one per step, stop controller, time-delay relay, pilot lights one per step, and airflow proving switch.

Furnish unit with washable panel filters with welded galvanized steel mounting frames, gasketed, with fasteners for bolting together built-in filter banks. Furnish unit with built-in line voltage thermostat wired to cut current junction box. Furnish with magnetic-type automatic door switch, start-stop pushbutton switch, factory-installed time-delay relay, and mounting brackets and accessories. Furnish unit with motor control panel complete with motor starter, 115V transformer with primary and secondary fuses, terminal strip, and NEMA 250 enclosure.

Provide air curtains manufactured by Berner, Marley, Mars, or Powered Air, of sizes and capacities shown on drawings. Units shall comply with AMCA 220, ANRH 410 and NSF-37. Unit housing shall be constructed of aluminum, aluminumized steel, or galvanized steel with powder coated/enameled finish, with steel mounting brackets. Unit shall have air adjustment by way of multi-speed motors or adjustable intake louvers. Unit shall have an adjustable integral discharge nozzle. Units shall have statically and dynamically balanced fans with direct drive fan drives. Motors shall be single speed resiliently mounted, continuous duty, with permanently sealed pre-lubricated ball bearings, and internal disconnect.

Electric heating coils shall comply with UL 1995, with galvanized steel frame, resistance wires of 80 percent nickel, 20 percent chromium, die-type overtemperatue protection with automatic reset and thermal cutoff, serviceable thru terminal box with removing heater. Provide secondary protection of load-carrying, manually reset or replaceable thermal cutouts factory wired in series with each heater stage. Control panel shall be unmounted with disconnecting means and overcurrent protection and include magnetic contactor, thermal protector, solid-state pulse controller, logic switches one per step, stop controller, time-delay relay, pilot lights one per step, and airflow proving switch.

Furnish unit with washable panel filters with welded galvanized steel mounting frames, gasketed, with fasteners for bolting together built-in filter banks. Furnish unit with built-in line voltage thermostat wired to cut current junction box. Furnish with magnetic-type automatic door switch, start-stop pushbutton switch, factory-installed time-delay relay, and mounting brackets and accessories. Furnish unit with motor control panel complete with motor starter, 115V transformer with primary and secondary fuses, terminal strip, and NEMA 250 enclosure.

Where plastic gas vents are installed in a return air plenum, wrap the vent with fire rated plenum insulation. Reference Article "Plenum Insulation" for plenum-rated fire wrap. Coordinate vent material compatibility with the appliance manufacturer's installation instructions prior to purchasing and installation.

Provide UL 1738 listed plastic flue gas vents, with positive or negative flue pressures complying with NFPA 211 and suitable for condensing gas appliances. Provide PVC system by IPFX "System 1738", or Polypropylene system by Centrotherm "Innoflow" or equal by Nova Flex Group "Z-DENS".

Where plastic gas vents are installed in a return air plenum, wrap the vent with fire rated plenum insulation. Reference Article "Plenum Insulation" for plenum-rated fire wrap. Coordinate vent material compatibility with the appliance manufacturer's installation instructions prior to purchasing and installation.

Submit complete shop drawings including information on noise level, pressure drop, throw, CFM for each air device, styles, borders, etc. Clearly marked with specified equipment number. Submit samples of each air device as requested by the Engineer.

Provide wall return air grilles and exhaust air registers with horizontal 35 or 45 degree angle vision-proof fans. Provide concealed fasteners for wall mounted registers and grilles. Provide floor supply air registers of aluminum heavy duty type with 0 degree deflection. Provide opposed blade dampers for supply air registers and exhaust air registers unless indicated otherwise.

Provide ceiling mounted air devices of lay-in or surface mounted type as required to be compatible with ceiling construction. Provide ceiling diffusers and grilles with white enamel finish unless noted otherwise.

Provide factory fabricated, parallel blade control dampers sized as shown on the drawings and as specified. Individual damper sections shall not be larger than 48 inches x 80 inches with maximum blade width of 6 inches. Frame construction shall be minimum 16 gauge galvanized steel for rectangular dampers, 20 gauge for round, 1/8 inch thick for aluminum, with flanges for duct mounting. Provide elastomeric or neoprene seals, mechanically attached and field replaceable. Provide a minimum of one damper actuator per section. Test damper performance in accordance with AMCA 500-D.

Provide modulating dampers with linear flow characteristics. Size modulating dampers based on the smaller of 1,500 FPM through the damper or full open air pressure drop of 0.1 inches W.G. Size two-position dampers full duct size and select to minimize pressure drop.

Provide damper operator for each automatic damper with sufficient capacity to operate the damper under all conditions and to guarantee tight close-off of dampers against system pressure encountered. Each operator shall be provided with spring-return for normally closed or normally open position for fail safe operation to account for fire, low temperatures, or power interruption as required by the control systems specified on the drawings. Damper operators shall be manufactured by Belimo, Johnson Controls or approved equal. Provide transformer for damper motors if different voltages are required.

Run refrigerant lines parallel and perpendicular to wall and floor lines and to appear straight and in good order. Pitch suction lines down slightly (1 inch in 20 feet) towards the compressor. Provide oil traps at the base of vertical suction risers over 6 feet high. Install liquid line sight glasses in liquid lines nearest the expansion valve. Factory mount expansion valves with the sensing bulbs shipped loose. Field mount expansion valve bulb after refrigerant piping is complete (damage may occur if bulbs come in contact with heat).

For systems of 5 ton capacity and smaller, the contractor shall have the option to provide copper refrigerant tubing line set sized as recommended by equipment manufacturer and of length as required for the installation. Provide quick-connect flare tubing compression fittings, solder connections, or brazed connections as recommended by the installation to match the connections of the condensing unit and evaporator coil.

Run refrigerant lines parallel and perpendicular to wall and floor lines and to appear straight and in good order. Pitch suction lines down slightly (1 inch in 20 feet) towards the compressor. Provide oil traps at the base of vertical suction risers over 6 feet high. Install liquid line sight glasses in liquid lines nearest the expansion valve. Factory mount expansion valves with the sensing bulbs shipped loose. Field mount expansion valve bulb after refrigerant piping is complete (damage may occur if bulbs come in contact with heat).

For systems of 5 ton capacity and smaller, the contractor shall have the option to provide copper refrigerant tubing line set sized as recommended by equipment manufacturer and of length as required for the installation. Provide quick-connect flare tubing compression fittings, solder connections, or brazed connections as recommended by the installation to match the connections of the condensing unit and evaporator coil.

Install kitchen grease exhaust package furnished by the owner. System includes kitchen hood and grease exhaust fans(pullout) control unit.

Provide ducts connecting Type 1 exhaust hoods to exhaust fans made of #16 gauge black iron with continuously welded joints and clean-out doors. Provide at least one opening that is minimum size of 20 inches by 20 inches for personnel entry. Where an opening of this size is not possible, provide access openings at each change in direction and at 12 foot intervals. Locate openings on sides of duct 1-1/2 inches minimum from bottom and fit with grease-tight covers of same material as duct. Support systems for ducts 24 inch and larger in any dimension shall be designed for the weight of the duct plus 800 pounds at any point in the duct system. Provide transition at connection to fan with opening size equal to or greater than the venturi opening of the fan inlet. Provide gasket at flanged connection to fan rated for 1500 degrees Fahrenheit and grease applications.

Enclose duct in fireproof enclosure per locally adopted mechanical code or, if approved by local code official, in fire rated wrap insulation. Insulation shall be minimum two-hour rated duct wrap insulation for Type 1 hood grease exhaust duct applications and shall conform to ASTM E2236 where required to comply with IMC. Insulation shall be flexible wrap enclosure rated for minimum 2000 degrees Fahrenheit and for zero resistance to combustibles. Insulation shall be clean mineral wool, passive, low bio-persistent fiber totally encapsulated on all sides with aluminum foil. Insulation shall be as manufactured by CertainTeed, Thermal Ceramics, Unifrax or 3M. Slope duct back towards hood at minimum of 1/4 inch per linear foot. Horizontal ducts that exceed 75 feet in length shall be sloped not less than 1 inch per foot. At Contractor's option, a UL listed concrete ductwork package that complies with UL 1978 standard for grease ducts may be used in lieu of the welded black iron duct for connecting hood to exhaust fan. Ductwork package shall be as manufactured by CaptipAir, Duravent, Enerex, Metal-Fab/Schaber, Seltok, or approved equal. Provide manufacturers UL listing number and verification certificate as a part of the shop drawing submittal. Install duct package in strict conformance with manufacturer's instructions and recommendations.

All portions of grease duct systems shall be tested for leakage in accordance with the "Grease Duct Test" paragraph of the IMC. Leakage tests shall be by water leakage type or equivalent test methods as approved by the local code official to determine that all joints are tight. Water leakage test shall be performed by Environmental Corporation of America or owner approved testing contractor. Tests shall be performed in the presence of the local code official. Any joints found defective shall be repaired and retested until satisfactory results are obtained. The contractor shall submit a copy of the grease duct leakage test report to the architect/engineer complete with the approved signature of the local code official.

Install owner provided exhaust hoods by Captive Aire. Conform with NFPA Bulletin 96 and UL Standard 710. Construct hood of 18 gauge stainless steel with welds polished. Hood shall contain full length stainless steel filter holder welded to hood with integral drip trap and UL classified, X-Air stainless steel filters installed at 45 degrees from horizontal. Provide vapor proof incandescent lights, and control panel with pilot lights and switches for fan and lights. Hood package shall include 3 inch filler panel at wall, and stainless steel closure panels from top of hood to finished ceiling.

Install Amexex, Ansal, Pyrochem, or approved equal wet chemical type fire extinguishing system for each hood as scheduled on drawings complete with hood nozzles, wet chemical cylinders, piping, etc. and an approved operating system. Provide manual pull station(s) at locations shown on the drawings. System shall be in full conformance with NFPA-96.

Install mechanical or electrical gas shutoff valve to shutoff fuel or power source to cooking equipment upon detection of fire. Valve shall have a clearly marked open/closed indicator.

Install a wall mounted thermostat with remote sensing element at the exhaust hood duct collar wired in parallel with the normal fan-on-off control to ensure that the hood's associated exhaust fan is energized when the cooking appliances served by the hood are activated. The thermostat set point shall be 95 degrees Fahrenheit (adjustable). The installation shall be in compliance with the International Mechanical Code.

Seven day manufacturer, occupied/unoccupied thermostats for on/off or multiple stages of heating and cooling systems shall be used. Order thermostat with multi-stage capability as required to match scheduled unit coding/labeling stages.

Remote sensors integrated with the seven-day programmable thermostat shall be Honeywell TR21/TR21-H remote sensor or equal.

#### 4. HVAC EQUIPMENT

##### A. ROOFTOP UNITS (GAS FIRED HEAT) 3-25 TONS

Provide electric cooling, gas heating rooftop units as scheduled on the drawings, manufactured by Aeon, Carrier, Daikin, Lennox, Johnson Controls, Trane, or York, with features as noted in the RTU schedule and in the RTU Control Matrix, and complete with factory installed direct-drive hermetic compressors with internal spring vibration isolation, built-in motor thermal overload protection, crankcase heater, and low pressure switches, direct expansion cooling and condensing coils with internal installed flexible elastomeric insulation around the suction and liquid lines not directly located above a condensate drain pan and protective UV coating on any insulation exposed to sunlight, minimum SEER or EER rating (cooling) as required by the applicable energy code or greater if scheduled on the drawings, minimum SEER or EER rating (heating) as required by the applicable energy code or greater if scheduled on the drawings, AFUE rating (heating) as required by the applicable energy code or greater if scheduled on the drawings, forced combustion air blower; complete factory installed micro-processor controls including anti-short cycle timers, time delay relays and minimum "on" time controls on the drawings, direct spark ignition system; built-in thermal overload protection on motors and compressors; outdoor air damper; relief, weathertight housing constructed of zinc coated, heavy gauge, galvanized steel with weather-resistant baked enamel finish; pre-engineered roof curb with minimum height as scheduled on the drawings if unit is equipped with internal vibration isolators; thermostat; provide unit complete with manufacturer's one year guarantee on components plus an additional four year guarantee on the compressor and heat exchangers. For units equipped with an economizer assembly, the assembly shall be covered with minimum 5 year manufacturer warranty, certified to operate through 80,000 damper opening and closing cycles, and certified to meet leakage requirements specified under the section, "Control Dampers."

##### B. ELECTRIC UNIT HEATERS

Provide electric unit heaters as scheduled on the drawings, manufactured by Berko, Bransch, Indecso, Markel, QMark, or Raywall, standard type propeller unit heaters with sidewall mounting brackets and hardware for horizontal airflow. Furnish heater fan motors complete with a manual motor starter with automatic thermal cutouts sized to the motor load, disconnect switch, and other code required safety devices. Provide unit mounted thermostat and manual summer/winter chnageover switch.

##### C. SPLIT DUCTLESS AIR-CONDITIONING SYSTEMS

Provide split ductless system consisting of evaporator section for wall or ceiling mounting as indicated and remote condensing section consisting of condenser, control panel, condenser fan, condenser coils, and fan. Provide indoor unit with remote control. Provide outdoor unit with factory assembled pre-wired consisting of furnace-grade steel with baked-enamel finish, front access, with direct-drive centrifugal fans, 2-speed motor, and cleanable foam filter. Evaporator coil shall be direct-expansion cooling coil of seamless copper tubes expanded into aluminum fins, with thermal expansion valve. Air-cooled condenser shall be of corrosion-resistant cabinet containing compressor, copper-tube aluminum-fin coils, direct-drive propeller fans with internal overload protection, capacity control to 0 degrees Fahrenheit.

Provide concrete bases for units located on grade. Provide pre-engineered roof equipment support rails for units located on roof. Securely attach units to rail.

Provide refrigerant piping sized as recommended by equipment manufacturer with foamed plastic insulation on the suction line as specified in this section.

Control System: Unit-mounted panel with contactors, control transformer with circuit breaker, solid-state temperature- and humidity-control modules. Provide solid-state, unit-mounted control panel with start-stop switch, adjustable humidity set point, and adjustable temperature set point. Refer to sequence of operation.

##### D. AIR CURTAINS

Provide air curtains manufactured by Berner, Marley, Mars, or Powered Air, of sizes and capacities shown on drawings. Units shall comply with AMCA 220, ANRH 410 and NSF-37. Unit housing shall be constructed of aluminum, aluminumized steel, or galvanized steel with powder coated/enameled finish, with steel mounting brackets. Unit shall have air adjustment by way of multi-speed motors or adjustable intake louvers. Unit shall have an adjustable integral discharge nozzle. Units shall have statically and dynamically balanced fans with direct drive fan drives. Motors shall be single speed resiliently mounted, continuous duty, with permanently sealed pre-lubricated ball bearings, and internal disconnect.

Electric heating coils shall comply with UL 1995, with galvanized steel frame, resistance wires of 80 percent nickel, 20 percent chromium, die-type overtemperatue protection with automatic reset and thermal cutoff, serviceable thru terminal box with removing heater. Provide secondary protection of load-carrying, manually reset or replaceable thermal cutouts factory wired in series with each heater stage. Control panel shall be unmounted with disconnecting means and overcurrent protection and include magnetic contactor, thermal protector, solid-state pulse controller, logic switches one per step, stop controller, time-delay relay, pilot lights one per step, and airflow proving switch.

Furnish unit with washable panel filters with welded galvanized steel mounting frames, gasketed, with fasteners for bolting together built-in filter banks. Furnish unit with built-in line voltage thermostat wired to cut current junction box. Furnish with magnetic-type automatic door switch, start-stop pushbutton switch, factory-installed time-delay relay, and mounting brackets and accessories. Furnish unit with motor control panel complete with motor starter, 115V transformer with primary and secondary fuses, terminal strip, and NEMA 250 enclosure.

##### 5. PIPING AND PIPING SPECIALTIES

###### A. REFRIGERANT PIPING AND INSULATION

Copper Tubing: ASTM B280, Type ACR, hard-drawn straight lengths, and soft-annealed coils, seamless copper tubing. Tubing shall be factory cleaned, ready for installation, and have ends capped to protect cleanliness of pipe interiors prior to shipping.

Bendable Copper Tubing: ASTM B280, ACR Type L with H55 temper, straight piping lengths as manufactured by Rehfric or Refrigerant Coupling Systems (RCS). Bends shall be made by factory trained personnel using tools approved by the manufacturer. Provide brazing rod, flux, and flux remover for copper tubing. Provide copper where piping is brazed. Tubing shall be factory cleaned, ready for installation, and have ends capped to protect cleanliness of pipe interiors prior to shipping. Bend tubing in accordance with manufacturer's instructions using tools that are acceptable to the manufacturer.

Refrigerant Line Kits: Soft-annealed copper tubing with pipe diameters as recommended by the manufacturer and of length as required for the installation. Tubing shall be factory or field insulated with flexible unicellular insulation with thickness as specified below.

Fittings: wrought-copper fittings: ANSI B16.22, streamlined pattern.

Solder filler metals: ASTM B32, 95-S-Tin-Antimony.

Brazing filler metals:

1. AWS A5.8, Classification BA9-5, Silver (Ag) 44.0-46.0 percent, Zinc (Z) 23.0-27.0 percent, and Copper (Cu) 29.0-31.0 percent.
2. AWS A5.8, Classification BCuP-5, Phosphorus (P) 4.8-5.2 percent, Silver (Ag) 14.5-15.5 percent, and Copper (Cu) remainder.

Brazing mechanical joints. Solder joints connecting to refrigerant valves and specialties. Continuously purge the pipe and fittings during brazing with an inert gas per manufacturer's recommendation (e.g., dry nitrogen) to prevent formation of scale. Maintain purge until the joint is cool to the touch. Provide temporary cap or cover on completed joints with open ends to prevent entry of contaminating materials.

Insulate refrigerant lines with flexible elastomeric insulation, Armaflex or equal. Insulate suction and liquid lines between the expansion valve, evaporator, and compressor with 1/2 inch thick insulation on pipes less than 1 inch in size and 1 inch thick for pipes 1 inch and larger. Insulate hot gas and liquid lines between the compressor condenser, and expansion valve with 1 inch thick insulation on pipes less than 1-1/2 inch and 1-1/2 inch thick for pipes 1-1/2 inch and larger. Piping insulation shall have a flame spread of 25 or less, and a smoke developed rating of 50 or less when tested in accordance with ASTM E84. Coat insulation that is exposed to the elements with a protective sealer. Install and support piping to keep noise and vibration to a minimum. Support and secure piping to Unistrut type supports so that no vibration passes to the building structure. Pipe attachments shall be copper-plated or have nonmetallic coating for electrolytic protection where attachments are in direct contact with copper tubing. Install a support within one foot of each change of direction. Mount pipe hangers around the outside of the insulation with saddles to prevent hangers from rupturing the insulation. Replace insulation that is cut or broken by the hangers.

Run refrigerant lines parallel and perpendicular to wall and floor lines and to appear straight and in good order. Pitch suction lines down slightly (1 inch in 20 feet) towards the compressor. Provide oil traps at the base of vertical suction risers over 6 feet high. Install liquid line sight glasses in liquid lines nearest the expansion valve. Factory mount expansion valves with the sensing bulbs shipped loose. Field mount expansion valve bulb after refrigerant piping is complete (damage may occur if bulbs come in contact with heat).

For systems of 5 ton capacity and smaller, the contractor shall have the option to provide copper refrigerant tubing line set sized as recommended by equipment manufacturer and of length as required for the installation. Provide quick-connect flare tubing compression fittings, solder connections, or brazed connections as recommended by the installation to match the connections of the condensing unit and evaporator coil.

Run refrigerant lines parallel and perpendicular to wall and floor lines and to appear straight and in good order. Pitch suction lines down slightly (1 inch in 20 feet) towards the compressor. Provide oil traps at the base of vertical suction risers over 6 feet high. Install liquid line sight glasses in liquid lines nearest the expansion valve. Factory mount expansion valves with the sensing bulbs shipped loose. Field mount expansion valve bulb after refrigerant piping is complete (damage may occur if bulbs come in contact with heat).

For systems of 5 ton capacity and smaller, the contractor shall have the option to provide copper refrigerant tubing line set sized as recommended by equipment manufacturer and of length as required for the installation. Provide quick-connect flare tubing compression fittings, solder connections, or brazed connections as recommended by the installation to match the connections of the condensing unit and evaporator coil.

###### B. SYSTEM EVACUATION AND CHARGING

Blow out refrigeration lines with dry nitrogen at a suitable pressure before making final connection at the condensing unit or coil to ensure against dirt, scale, or other foreign material being in the line. Draw a vacuum to 29 inches of mercury. Break this vacuum by charging dry refrigerant gas into the system, raising the pressure to 0 PSIG. Repeat the latter two steps for a triple evacuation before the final evacuation is started. Make final evacuation by reducing the system absolute pressure to a maximum of 0.5 millimeters (500 microns) and allowing the pump to run at this pressure for a minimum of two hours.

Repeat the proper amount of refrigerant charge per the manufacturer's recommendations. Record the amount of refrigerant by weight charged into the system for each circuit, recorded to the nearest 1/4 pound on tags and attach tags to the liquid line near the condensing unit. Refrigerant shall be supplied by the HVAC Contractor.

##### 6. TEMPERATURE CONTROLS

###### A. GENERAL REQUIREMENTS

Provide a complete temperature control system including control panels, controllers, control power transformers, thermostats, sensors, time switches, override timers, actuators, relays, and wiring as required to control the systems as specified on the drawings.

Submit shop drawings of equipment provided for temperature control. Submit operation and maintenance data, including trouble-shooting maintenance guide, step-by-step procedures indexed for each controller and thermostat function, inspection period, cleaning methods and materials, and calibration tolerances.

Provide integrated wiring diagrams showing interconnections between field-installed equipment and package wiring furnished with the HVAC equipment. Control wiring shall be sized to accommodate the voltage drop associated with the distance between the control device and the controller.

Provide supervision and on-job checkout service as required to ensure that installation and operation of the temperature control system meets requirements of the drawings, specifications, and sequences of operation. The system shall be guaranteed for a period of one year following the acceptance of the system by the Architect/Engineer. Correct defects occurring during this period at no additional cost to the Owner.

Install control devices with top of device at 48 inches AFF to meet ADA requirements unless otherwise noted on the plans.

###### B. THERMOSTAT CONTROL EQUIPMENT

Provide thermostat control equipment with sufficient communication, programming, input and output connections, and modulating or staging capability to meet the sequence of operations. Provide thermostats with the features as indicated:

1. LCD or LED display screen.
2. Button or touchscreen interface.
3. Display temperature.
4. Display temperature setpoint.
5. Adjustable temperature setpoint.
6. Limit temperature setpoint adjustment within plus or minus 3 degrees F.
7. Display operating mode.
8. Adjust operating mode.
9. Adjust schedule, minimum seven day occupied/unoccupied.
10. Security lockout.
11. At contractor's option where multiple sensors are shown, the sensors may be provided with the thermostat in a single device.

Seven day manufacturer, occupied/unoccupied thermostats for on/off or multiple stages of heating and cooling systems shall be used. Order thermostat with multi-stage capability as required to match scheduled unit coding/labeling stages.

Remote sensors integrated with the seven-day programmable thermostat shall be Honeywell TR21/TR21-H remote sensor or equal.

#### C. SENSORS AND RELAYS

Manufacturers and model numbers are listed for reference as to quality and features required for the sensors and relays. Provide general-purpose type sensing elements for use in input and output systems. Provide transmitters or transducers with sensor as required, compatible with the controllers used, with range suitable for the systems encountered. Transmitters and transducers shall have offset and span adjustments, temperature compensation, shock and vibration immunity, and zeroing capability. Accuracy requirements shall include the combined effects of linearity, hysteresis, repeatability, and the transmitter.

Provide sensors that meet the following minimum performance:

1. Dry-bulb temperature sensors at a minimum shall be accurate to +/- 2 degrees Fahrenheit over the range of 40 to 80 degrees Fahrenheit.
2. Wet-bulb temperature shall be calculated using dry-bulb-temperature and humidity and shall be accurate to +/- 2 degrees Fahrenheit.
3. Enthalpy shall be calculated using dry-bulb temperature and humidity and shall be accurate to +/- 3 BTU/lb over the range of 20 to 36 BTU/lb.
4. Humidity sensors at a minimum shall be accurate within +/- 3 percent full range between 20 and 95 percent, with drift less than 1 percent full scale per year.
5. Pressure transmitters at a minimum shall be accurate to +/- 1 percent full scale with drift less than 1 percent full scale per year.

Provide remote sensors where indicated on the drawings and integrate them with the thermostat control equipment. Remote sensors shall have the following features:

1. Wired connection.
2. Temperature sensor.
3. Humidity sensor.
4. Blank faceplate.
5. At contractor's option where multiple remote sensors are shown for a single unit, the sensors may be provided in a single device.

Smoke detectors furnished and installed as indicated in this section or as scheduled on the plans (or heat detectors, if permitted by code) shall shut down each associated unit supply fan upon activation where required by code. Provide remote visual and audible alarm device in an approved location if smoke detectors are not connected to a fire alarm panel and label device as "Air Duct Detector Trouble".

Provide 24 Volt or 120 Volt time/switches Intermatic Series FM1D20 or equal programmable time with 7-day programming with up to two "ons" and "offs" per day. Battery backup shall provide 48 hours of memory retention. Override timer switches shall be spring wound, 6-hour, normally open type. Coordinate 120 V wiring of time/switch with electrical contractor if 120 volt is programmed.

Provide relays with contact rating, configuration, and coil voltage that is suitable for the application. Relay shall be general purpose, enclosed plug-in type and protected by a heat and shock resistant duct cover. Number of contacts and operational function shall be as required. Transient suppression shall be provided as an integral part of the relay. Contactors shall be single coil, electrically operated, mechanically held, double-throw, silver-to-silver type protected by arcing contacts. Positive locking shall be obtained without the use of hooks, latches, or semi-permanent magnets. Operating and release times shall be 100 milliseconds or less.

Provide magnetic contacts for sensing open doors or windows as required per the drawings with rating and configuration that is suitable for the application by Interlogix or approved equal. Number of contacts and operational function shall be as required to meet the sequence of operation. Contacts shall be UL listed and factory tested. The magnetic contacts shall be designed for easy installation and shall be replaceable without damaging the door or window.

#### D. WIRING

Provide electrical and control wiring as specified under the section "Electrical Wiring."

#### 7. COMMISSIONING

##### A. GENERAL

###### 1. Summary

a. Section includes Cx process requirements for the following HVAC systems, assemblies, and equipment:

- i. Air handling units (Supply fans, return fan, packaged units, roof top units, specialized fans)
- ii. Exhaust fans
- iii. Fan coil units and terminal units
- iv. Condensing units
- v. Make-Up air units
- vi. Electrostatic precipitator (ESP)
- vii. Ductwork and piping
- viii. Variable Frequency Drives
- ix. Condensate Pumps

b. Related Requirements:

- i. Section 019113 "General Commissioning Requirements" for general Cx process requirement and CxA responsibilities.

###### 2. Informational Submittals

a. Construction Checklists: Draft construction checklists will be created by CxA for Contractor review.

b. Construction Checklists: Installation and Performance test checklists for systems, assemblies, subsystems, equipment, and components to be part of the Cx process and according to requirement in Section 019113 "General Commissioning Requirement."

- i. Refrigerant piping, including the following:
  - a. Refrigerant piping, fittings, and specialties.
  - b. Refrigerant charge.
  - c. General duty and specialty valves.
  - d. Meters and gauges.
- ii. Air distribution systems, including the following:
  - a. Supply, return, and exhaust systems.
  - b. Metal ducts, liners, and fittings.
  - c. Nonmetal ducts and fittings.
  - d. Air-duct accessories, including volume dampers, fire and smoke dampers, turning vanes, sound attenuators, and flexible connectors.
  - e. Duct-mounted access doors and panels.
- iii. Kitchen exhaust system, including the following:
  - a. Exhaust and makeup air systems.
  - b. Metal ducts, liners, and fittings.
  - c. Air-duct accessories, including volume dampers, fire and smoke dampers, turning vanes, sound attenuators, and flexible connectors.
  - d. Duct-mounted access doors and panels.
  - e. Exhaust fans.
  - f. Electrostatic precipitator (ESP)
- iv. Air-handling equipment, including the following:
  - a. Fans and motors.
  - b. Indoor air-handling units with and without coils, dampers, and filters.
  - c. Outdoor air-handling units with and without coils, dampers, and filters.

###### 3. Construction Checklists

a. Complete detailed construction checklists (prefunctional checklists) prepared by the CxA for HVAC systems, assemblies, subsystems, equipment, and components.

- i. Air and hydronic distribution systems, including the following:
  - a. Supply, return, outdoor-air, and exhaust-air distribution systems.
  - b. Hydronic systems.
  - c. Automatic dampers.
  - d. Variable frequency drives.
  - e. Control valves.
- ii. Heating and cooling terminal and unitary equipment, including the following:
  - a. Unit heaters.
  - b. Fan coil units.
  - c. Electric heating.
  - d. TAB verification.

###### 4. Construction Checklist Review

a. Review and provide written comments on draft construction checklists. CxA will create required draft construction checklists and provide them to Contractor.

b. Return draft construction checklist review comments within 5 days of receipt.

c. When review comments have been resolved, the CxA will provide final construction checklists marked "Approved for Use. (date)."

d. Use only construction checklists marked "Approved for Use. (date)."

###### 5. Start-Up Documentation Common to All Systems

a. Certify that HVAC systems, subsystems, and equipment have been installed, calibrated, and started and that they are operating according to the Control Documents and approved submittals.

b. Set systems, subsystems, and equipment into operating mode to be tested according to approved test procedures (for example, normal to normal, normal auto position, normal manual position, unoccupied cycle, and alarm conditions).

###### 6. Cx Testing Preparation

a. Comply with construction checklist requirements, including installation checks, startup, and performance tests requirements for HVAC systems and equipment.

b. Measure capacities and effectiveness of systems, assemblies, subsystems, equipment and components, including operational and control functions, to verify compliance with acceptance criteria.

c. Coordinate schedule with, and perform Cx activities as provided as the direction of CxA.

d. Provide technicians, instrumentation, tools, and equipment to perform and document the following:

- i. Construction checklist verification tests.
- ii. Construction checklist verification tests demonstrations
- iii. Cx test demonstrations.

###### 7. Start-Up Documentation Common to All Systems

a. The following Start-Up Documentation (Checklists and Tests) shall be considered common to all systems:

- i. Checklists that address the following: larger components to the entire system operation.
- ii. Verify labeling is affixed per specification and visible.
- iii. Verify prerequisite procedures are present.
- iv. Inspect for damage and ensure none is done.
- v. Verify system is installed per the manufacturer's recommendations.
- vi. Verify system has undergone Start-Up per the manufacturer's recommendations.
- vii. Verify that access is provided for inspection, operation and repair.
- viii. Verify that access is provided for eventual replacement of the equipment.
- ix. Verify that record drawings, submittal data and O&M documentation accurately reflect the installed systems.
- x. Verify all gauges and test ports are provided as required by control documents and manufacturer

ROOFTOP UNIT CONTROL MATRIX					
CONTROL FEATURE	UNITS	RTU-1 SETPOINT OR Y/N	RTU-2 SETPOINT OR Y/N	NOTES	
<b>SETPOINTS</b>					
COOLING - OCCUPIED SETPOINT	"F	75	75		
COOLING - UNOCCUPIED SETPOINT	"F	80	80		
DEAD BAND - MINIMUM HEATING AND COOLING TEMPERATURE SETPOINT DIFFERENCE	"F	5	5		
HEATING - OCCUPIED SETPOINT	"F	70	70		
HEATING - UNOCCUPIED SETPOINT	"F	60	60		
DEHUMIDIFICATION SETPOINT - HUMIDITY SENSOR FEEDBACK	% RH	50%	50%		B
<b>PROGRAMMED CONTROL FEATURES</b>					
HVAC SYSTEM OCCUPIED/UNOCCUPIED MODE - PROGRAMMABLE THERMOSTAT		Y	Y		B
REMOTE COMBINATION TEMPERATURE AND HUMIDITY SENSOR		Y	Y		
<b>EQUIPMENT ACCESSORIES AND CONTROL MODULES</b>					
OUTSIDE AIR DAMPER - MOTOR OPERATED (MODULATING)		Y	Y		L
OUTSIDE AIR FLOW MONITORING STATION		Y	Y		F
INTEGRATED ECONOMIZER - DIFFERENTIAL ENTHALPY ENABLE (OA ENTHALPY + RA ENTHALPY)	BTULB	Y	Y		E
ECONOMIZER FAULT DETECTION AND DIAGNOSTICS (FDD) SYSTEM		Y	Y		F, G
RELIEF - BAROMETRIC DAMPER		Y	N		H
RELIEF - VARIABLE VOLUME POWERED EXHAUST FAN	IN W.C.	N	Y		H
COOLING COIL (DX - VARIABLE SPEED)		Y	Y		M
DEHUMIDIFICATION - HOT GAS REHEAT		Y	Y		O
HEATING COIL (NATURAL GAS)		Y	Y		M
<b>SUPPLY FAN CONTROL METHODS</b>					
ON DURING OCCUPIED HOURS		Y	Y		
CYCLE WITH LOADS DURING UNOCCUPIED HOURS		Y	Y		
OPTIMUM START SEQUENCE		Y	Y		T
VARIABLE VOLUME - STAGED FAN CONTROL IN RESPONSE TO ACTIVE COOLING COIL STAGES		Y	Y		M, Q
<b>SAFETIES, INTERLOCKS, AND ALARMS</b>					
GAS VALVE SAFETY		Y	Y		F
RETURN AIR SMOKE DETECTOR - SAFETY SHUTDOWN		Y	Y		F
LOW LIMIT FREEZE/STAT - FREEZE PROTECTION SAFETY SHUTDOWN		Y	Y		F
DIFFERENTIAL PRESSURE SWITCH - FILTER CHANGE ALARM		Y	Y		F
FIRE ALARM CONTROL PANEL - SAFETY SHUTDOWN INTERLOCK		Y	Y		F
KITCHEN EXHAUST SYSTEM INTERLOCK		Y	Y		S
DIV. 23 CONTRACTOR SHALL PROVIDE CONTROL PANEL(S), WIRING, THERMOSTAT(S), TEMPERATURE SENSOR(S), HUMIDISTAT(S), AND/OR CO2 SENSOR(S) WHERE SHOWN ON THE DRAWINGS AND AS REQUIRED TO FACILITATE THE SCHEDULED SEQUENCE OF OPERATION. EACH UNIT SHALL CONTROL BASED ON ITS OWN INTERNAL SAFETIES, TIME DELAYS, AND SEQUENCES UNLESS NOTED OTHERWISE. COORDINATE WITH OWNER FINAL BUILDING AND EQUIPMENT SCHEDULES DURING STARTUP. REFERENCE DIVISION SPECIFICATIONS FOR INDIVIDUAL DEVICE REQUIREMENTS.					
<b>NOTES:</b>					
B. DIVISION 23 CONTRACTOR SHALL PROVIDE DEVICE.					
E. IF SETPOINT VALUE IS LISTED, IT INDICATES ECONOMIZER HIGH/LIMIT SHUTOFF. UNIT SHALL BE IN ECONOMIZER IF CONDITIONS ARE LESS THAN SETPOINT. THE FOLLOWING SENSORS SHALL DETERMINE ECONOMIZER ON POINT. OUTSIDE AIR TEMPERATURE, DIVISION 23 PROVIDED AS PART OF ECONOMIZER CONTROL MODULE. RETURN AIR TEMPERATURE, DIVISION 23 PROVIDED AS PART OF ECONOMIZER CONTROL MODULE. OUTSIDE AIR HUMIDITY, DIVISION 23 PROVIDED AS PART OF ECONOMIZER CONTROL MODULE. RETURN AIR HUMIDITY, DIVISION 23 PROVIDED AS PART OF ECONOMIZER CONTROL MODULE.					
F. DEVICE SHALL BE FACTORY MOUNTED AND PRE-WIRED FOR OPERATION SUBJECT TO THE ONBOARD CONTROLLER.					
G. PROVIDE UNIT WITH AN INTEGRATED SYSTEM CONSISTING OF PERMANENTLY INSTALLED OUTSIDE AIR, SUPPLY AIR, AND RETURN AIR TEMPERATURE SENSORS. THE UNIT CONTROLLER SHALL AT A MINIMUM BE CAPABLE OF PROVIDING SYSTEM STATUS OF ECONOMIZER, COMPRESSOR, HEATING, MIXED AIR LOW LIMIT ALARM, AND SENSOR VALUES. EACH OPERATING MODE SHALL BE CAPABLE OF INDEPENDENTLY OPERATING FOR TESTING. THE SYSTEM SHALL REPORT FAULTS TO AN APPLICATION ACCESSIBLE BY SERVICE PERSONNEL. THE FOLLOWING FAULTS SHALL BE DETECTED: AIR TEMPERATURE SENSOR FAILURE, ECONOMIZER ENABLED BY SERVICE PERSONNEL WHEN ECONOMIZER SHOULD BE OFF, RESPECTIVELY, DAMPER NOT MODULATING, AND EXCESS OUTSIDE AIR.					
H. POWERED EXHAUST FAN SHALL STAGE ON AND OFF ACCORDING TO DAMPER POSITION.					
L. EQUIPMENT MANUFACTURER SHALL PROVIDE MODULATING DAMPER AND CONTROLS CAPABLE OF ADJUSTING THE DAMPER POSITION TO MAINTAIN THE SCHEDULED OUTSIDE AIR ON THE DRAWINGS ACROSS ALL FAN SPEEDS. DIV. 23 CONTRACTOR SHALL PROGRAM MULTIPLE DAMPER POSITION SETPOINTS IN THE FIELD DURING TESTING AND BALANCING TO MAINTAIN MINIMUM VENTILATION WHEN NOT IN ECONOMIZER. DAMPER SHALL BE CLOSED DURING UNOCCUPIED HOURS.					
M. UNITARY CONTROLLER SHALL MODULATE AND/OR CYCLE SUPPLY FAN SPEED SETTING AND COIL CAPACITY STAGES SUBJECT TO THE INTERNAL SAFETIES AND SEQUENCES TO MAINTAIN SCHEDULED SETPOINTS.					
O. DEHUMIDIFICATION SEQUENCE SHALL BE BASED ON RETURN AIR HUMIDITY.					
S. INTERLOCK RTU WITH KITCHEN EXHAUST HOOD SYSTEM(S) TO SHUT DOWN UPON SIGNAL FROM HOOD FIRE EXTINGUISHING SYSTEM. INTERLOCK RTU WITH KITCHEN EXHAUST FAN TO ENERGIZE WHEN HOOD SYSTEM IS ENERGIZED FOR PRESSURIZATION.					

GRILLE, REGISTER AND DIFFUSER SCHEDULE										
MARK	MANUFACTURER	SERVICE	MODEL	CONSTRUCTION TYPE	FACE TYPE	MOUNTING LOCATION	FACE SIZE (IN)	MAX NC	MAX PRESS DROP (IN W.C.)	NOTES
CEG	E.H. PRICE	EXHAUST GRILLE W/ DAMPER	80D	STEEL	EGGCRATE	SURFACE	12"x12"	30	0.06	A C D G H I
CRG	E.H. PRICE	RETURN GRILLE	80	STEEL	EGGCRATE	LAY-IN	24"x24"	30	0.06	A C D G I
CS01	E.H. PRICE	SUPPLY DIFFUSER	SCD	STEEL	SQUARE CONE	SURFACE	12"x12"	30	0.08	A B C D G I J
CS02	E.H. PRICE	SUPPLY DIFFUSER	SCD	STEEL	SQUARE CONE	LAY-IN	24"x24"	30	0.08	A B C D G I
CS03	E.H. PRICE	SUPPLY DIFFUSER	PDR	STEEL	PERFORATED	LAY-IN	24"x24"	30	0.08	A C D G I
WSR	E.H. PRICE	SUPPLY REGISTER W/ DAMPER	520D	STEEL	LOUVERED FACE	WALL OR DUCT	<varies>	30	0.08	A C D E F G I

MODEL NUMBERS SHALL NOT BE CONSIDERED COMPLETE AND MATERIAL SHALL NOT BE ORDERED BY MANUFACTURER AND MODEL NUMBERS ONLY. REVIEW THE COMPLETE DESCRIPTION, NOTES AND SPECIFICATIONS TO DETERMINE THE EXACT MATERIAL AND ACCESSORIES TO BE ORDERED. THE MANUFACTURERS LISTED ARE THE BASIS FOR THE DESIGN.

**NOTES:**

- EQUIPMENT FURNISHED AND INSTALLED PER THE EQUIPMENT RESPONSIBILITY SCHEDULE.
- 4-WAY THROW PATTERN UNLESS OTHERWISE INDICATED BY FLOW ARROWS ON DRAWINGS.
- NECK SIZE SHOWN ON DRAWINGS. PROVIDE BRANCH DUCT TO MATCH NECK SIZE UNLESS OTHERWISE SHOWN ON DRAWINGS.
- BAKED ENAMEL FINISH, WHITE TO MATCH CEILING COLOR.
- FRONT BLADES PARALLEL TO LONG DIMENSION.
- DOUBLE DEFLECTION BARS SHALL BE ADJUSTABLE.
- FRAME TYPE TO MATCH CEILING WALL CONSTRUCTION. COORDINATE WITH ARCHITECTURAL REFLECTED CEILING/WALL PLAN.
- PROVIDE OPPOSED BLADE DAMPER ADJUSTABLE FROM FACE OF DEVICE.
- PROVIDE DIFFUSERS, LINEAR SLOTS, AND GRILLES WITH NO EXPOSED MOUNTING SCREWS.
- PROVIDE WITH RAPID MOUNT FRAMING OPTION FOR LAY-IN TYPE DIFFUSERS INSTALLED IN A HARD CEILING.

PROJECT DESIGN CONDITIONS																				
CLIMATE CONDITIONS					WEATHER STATION					REFERENCE										
WEATHER STATION: NORTH-EAST PHILADELPHIA, PA, USA					2021 ASHRAE					BUILDING OPERATING HOURS:										
CLIMATE ZONE: 4A					MONDAY - FRIDAY					TBD BY OWNER										
ASHRAE HEATING: 99.6%					12.8 °F DB					SATURDAY					TBD BY OWNER					
ASHRAE COOLING: 0.4%					83.3 °F DB					SUNDAY					TBD BY OWNER					
DEHUMIDIFICATION: 1.0%					73.4 °F DP					124.7 g/h					80.7 °F DB					
SPACE / UNIT DESCRIPTION	COOLING / DE-HUMIDIFICATION				SET POINTS				HUMIDIFICATION				ZONE VENTILATION RESET				NOTES			
	UNOCC		MAX		OCC		UNOCC		MIN		MAX		CONTROL		BASE			MAXIMUM		
	"F	"F	RH %	RH %	"F	"F	RH %	RH %	METHOD	PPM	PPM	METHOD	PPM	PPM	METHOD	PPM		PPM		
DINING AREAS	75	80	50%	NA	70	60	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	TBD	TBD	A-C
OFFICES	75	80	50%	NA	70	60	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	TBD	TBD	A-C
KITCHEN/BOH	75	80	50%	NA	70	60	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	TBD	TBD	A-C

**NOTES:**

- ZONE LEVEL SET POINT CONDITIONS SHALL BE AS SCHEDULED UNLESS OTHERWISE SCHEDULED OR NOTED ON THE DRAWINGS FOR ROOM SPECIFIC SPACE CONDITIONS.
- ZONE LEVEL OCCUPANCY HOUR SCHEDULE SHALL BE PER BUILDING OPERATING HOURS UNLESS OTHERWISE SCHEDULED.
- ZONE LEVEL CONTROLS SHALL BE CAPABLE OF OPERATING WITH INDEPENDENT OCCUPANCY SCHEDULES.

OUTSIDE AIR REQUIREMENTS, IMC-2018 (IP)																		
SYSTEM DESIGNATION	SYSTEM TAB NAME OR LIST 'SINGLE'	SINGLE-ZONE SYSTEMS ONLY				MULTI-ZONE SYSTEMS ONLY				FLOOR AREA SERVED BY SYSTEM [A <sub>s</sub> ] (SF)	SYSTEM AVERAGED AREA-BASED OUTDOOR AIR RATE (CFM/PSF)	SYSTEM POPULATION [P <sub>s</sub> ] (PEOPLE)	SYSTEM PEOPLE-BASED OUTDOOR AIR RATE (CFM/PP)	REQUIRED OA INTAKE FLOW [V <sub>o</sub> ] (CFM)	REQUIRED DCV OA INTAKE FLOW [V <sub>d</sub> ] (CFM)	DESIGN OA INTAKE FLOW [V <sub>d</sub> ] (CFM)	NOTES	
		SINGLE-ZONE SYSTEM ASSOCIATED VENTILATION ZONE	SINGLE-ZONE WORST CASE ZONE AIR DISTRIBUTION EFFECTIVENESS [E <sub>z</sub> ]	SYSTEM VENTILATION EFFICIENCY [E <sub>v</sub> ]	CONTROL METHOD	BASE METHOD	MAXIMUM METHOD											
RTU-1	MULTI-ZONE (RTU-1)			0.96	1.201	44	7.50	421	7.50	545	N/A	1,000					ALL	
RTU-2	SINGLE ZONE	KITCHEN + BOH	0.80	-	1.248	248	7.50	421	7.50	545	N/A	1,000					ALL	
FCU-1	SINGLE ZONE	OFFICE	0.80	-	71	0.060	2	5.00	18	N/A	40						ALL	
												TOTALS	984	0	2,640			

**GENERAL NOTES:**

- VENTILATION CALCULATIONS BASED ON IMC-2018.
- SYSTEM POPULATIONS BASED ON MAX SEATING AND/OR CODE MAXIMUM VALUES.
- SINGLE ZONE SYSTEMS (V<sub>o1</sub> + V<sub>o2</sub>): SYSTEM VENTILATION EFFICIENCY CALCULATION IS NOT REQUIRED FOR SINGLE ZONE SYSTEMS. WORST CASE AIR DISTRIBUTION EFFECTIVENESS BETWEEN HEATING AND COOLING MODES OF OPERATION IS SHOWN IN TABLE.
- 100% OA SYSTEMS (V<sub>o1</sub> + V<sub>o2</sub>): WHEN ONE AIR HANDLER SUPPLIES ONLY OUTDOOR AIR TO ONE OR MORE ZONES. EACH ZONE IS INDIVIDUALLY CALCULATED WITH ITS WORST CASE ZONE AIR DISTRIBUTION EFFECTIVENESS (HEATING/COOLING).
- MULTI-ZONE RECIRCULATING SYSTEMS: CALCULATOR USED TO DETERMINE VENTILATION AIRFLOW IN COMPLIANCE WITH IMC-2018 VPR AND ASHRAE 62-2016 APPENDIX A. VENTILATION RATE SHOWN IS ACTUAL, CALCULATED WITH CORRECTION FACTORS INCLUDED. EACH ZONE IS CALCULATED WITH ITS WORST CASE ZONE AIR DISTRIBUTION EFFECTIVENESS (HEATING/COOLING) AS PART OF CALCULATIONS TO FIND E<sub>v</sub>.

## UNIT HEATER SCHEDULE (ELECTRIC)

MARK	MANUFACTURER	MODEL	MIN OUT (MBH)	NOM (KW)	MIN NO OF STAGES	CFM	V/PH	DISC TYPE	NOTES
EUH 1	QMARK	CDF-558	17.1	5.0	1	300	208/1	NF	A C E F G

MODEL NUMBERS SHALL NOT BE CONSIDERED COMPLETE AND MATERIAL SHALL NOT BE ORDERED BY MANUFACTURER AND MODEL NUMBERS ONLY. REVIEW THE COMPLETE DESCRIPTION, NOTES AND SPECIFICATIONS TO DETERMINE THE EXACT MATERIAL AND ACCESSORIES TO BE ORDERED. THE MANUFACTURERS LISTED ARE THE BASIS FOR THE DESIGN.

- NOTES:**
- EQUIPMENT FURNISHED AND INSTALLED PER THE RESPONSIBILITY SCHEDULE IN ARCHITECTURAL SET.
  - MOUNT 8 FEET ABOVE FINISHED FLOOR WITHOUT OBSTRUCTING AIRFLOW.
  - PROVIDE WITH UNIT MOUNTED THERMOSTAT.
  - PROVIDE NECESSARY MOUNTING BRACKET AND ACCESSORIES FOR WALL MOUNTING.
  - PROVIDE FACTORY MOUNTED DISCONNECT SWITCH INSTALLED ON SERVICE SIDE OF UNIT.
  - SUPPORT UNIT AS RECOMMENDED BY UNIT MANUFACTURER.
  - FURNISH WITH RECESSED MOUNTING ENCLOSURE.
  - PROVIDE WITH WALL MOUNTED LINE VOLTAGE THERMOSTAT.

## SEQUENCE OF OPERATION

**A. FAN COIL UNIT CONTROL (FCU-1)**  
 During occupied hours, operate fan coil unit supply fan continuously and open outdoor air damper to maintain minimum ventilation. Cycle stage(s) of DX cooling and electric heating to maintain room thermostat set point (75 degrees Fahrenheit cooling, 70 degrees Fahrenheit heating). Unit shall be shutdown upon alarm signal from FACP.

During unoccupied hours, cycle the fan coil unit supply fan and cooling or heating system to maintain unoccupied setback temperature set points. Outdoor air damper shall be closed during unoccupied hours.

Connect the Outdoor air damper to the same time clock as the restroom exhaust.

## B. KITCHEN EXHAUST FAN CONTROL

Kitchen exhaust fan shall be energized through on-off switches at the associated exhaust hoods or cooking equipment or through a master kitchen ventilation control panel as indicated on the drawings. Kitchen fans shall be interlocked to operate with cooking appliances, make-up air and other air-handling equipment providing fresh air to the kitchen area as noted or scheduled on the drawings.

## C. ROOFTOP UNIT CONTROL

Refer to ROOFTOP UNIT CONTROL MATRIX on Sheet M601 for required rooftop unit control options.

## D. RESTROOM EXHAUST FAN (EF-1) CONTROL

Operate exhaust fans continuously during occupied hours and shut down during unoccupied hours. Provide a 7-day timeclock to switch each system between occupied and unoccupied operation.

## E. AIR CURTAIN CONTROL

Interlock air curtain with door limit switch to energize when the door opens.

## F. ELECTRIC UNIT HEATER CONTROL

Unit heater shall be activated by unit mounted thermostat to maintain room temperature setpoint (60 deg F).

## ROOFTOP UNIT SCHEDULE (DX COOLING, NATURAL GAS HEAT)

MARK	MANUFACTURER	MODEL	NOMINAL TONS	UNIT TYPE	SUPPLY FAN			COOLING COIL										GAS FIRED HEAT EXCHANGER										ELECTRICAL					WEIGHT (LBS)	NOTES
					CFM	ESP (IN)	NOM HP (Y/N)	TH (MBH)	SH (MBH)	EAT (°F DB)	(°F WB)	(°F WB)	REFR TYPE	MIN EFF (EER)	(IEER)	MIN NO STAGES	MIN OUT (MBH)	NOM INPUT (MBH)	MIN EFF (%)	EAT (°F DB)	LAT (°F DB)	MIN NO STAGES	MIN OA (CFM)	V/PH	MCA	MOC/P	DISC TYPE							
RTU 1	CAPTIVEAIRE	CAS-HVAC2-12 00-18-13T	13.0	SINGLE ZONE	3600	0.8	5.00	Yes	136.0	97.1	80.1	66.3	55.6	54.0	R454B	11.8	13.9	3	120.1	3	120.1	158.5	81	54.1	85.0	2	1000	208/3	86	100	FUSED	2187	A-O	
RTU 2	CAPTIVEAIRE	CAS-HVAC3-12 50-24-15T	15.0	SINGLE ZONE	4200	0.8	5.00	Yes	177.7	122.6	82.0	67.7	55.5	54.1	R454B	12	18.8	3	166.9	3	166.9	219.6	81	48.2	85.0	2	1600	208/3	75	90	FUSED	2693	A-O	

\*EQUIPMENT FURNISHED AND INSTALLED PER THE RESPONSIBILITY SCHEDULE. REF ARCHITECTURAL DRAWINGS. EQUIPMENT SHALL BE OBTAINED THROUGH SHAKE SHACK NATIONAL ACCOUNT. REFER TO T-12/ VENDOR LIST FOR MORE INFORMATION.\*  
 MODEL NUMBERS AND NOMINAL TONS LISTED SHALL NOT BE CONSIDERED COMPLETE AND MATERIAL SHALL NOT BE ORDERED BY MANUFACTURER, MODEL NUMBERS, OR NOMINAL TONS ONLY. REVIEW THE COMPLETE DESCRIPTION, NOTES AND SPECIFICATIONS TO DETERMINE THE EXACT MATERIAL AND ACCESSORIES TO BE ORDERED. THE MANUFACTURERS LISTED ARE THE BASIS FOR THE DESIGN.

## NOTES:

- REFER TO ROOFTOP UNIT CONTROL MATRIX FOR ADDITIONAL UNIT FEATURES, COMPONENTS, MODULES, ACCESSORIES, AND CONTROLS THAT SHALL BE PROVIDED WITH THE EQUIPMENT.
- EQUIPMENT SIZED FOR 100°F AMBIENT TEMPERATURE.
- PROVIDE 2" MERV 13, EFFICIENT PLEATED THROWAWAY AIR FILTERS.
- PROVIDE FACTORY MOUNTED DISCONNECT INSTALLED ON SERVICE SIDE OF UNIT.
- STARTERS FOR ALL MOTORS SHALL BE FURNISHED INTEGRAL WITH UNIT.
- PROVIDE FACTORY MOUNTED VARIABLE FREQUENCY DRIVE TO FACILITATE MODULATING FAN SPEED CONTROL.
- COORDINATE SIZE OF CONDUCTOR TERMINATION LUGS WITH CONDUCTOR SIZES SHOWN ON ELECTRICAL DRAWINGS.
- PROVIDE 125 VAC, 20 AMP DUPLEX CONVENIENCE RECEPTACLE MOUNTED TO UNIT READY FOR FIELD WIRING WITH A COVER UL LISTED FOR WET AND DAMPER LOCATIONS WHEN IN USE.
- SPECIFIED FAN ESP ACCOUNTS FOR DUCT LOSSES EXTERNAL TO UNIT.
- PROVIDE MOTOR HORSEPOWER TO OVERCOME INTERNAL UNIT STATIC PRESSURE DROP PLUS SPECIFIED EXTERNAL STATIC PRESSURE DROP. NOMINAL MOTOR HP SHALL BE NO LARGER THAN THE FIRST AVAILABLE NOMINAL MOTOR SIZE GREATER THAN THE REQUIRED BHP.
- PROVIDE INSULATED ROOF CURB WITH MINIMUM HEIGHT REQUIRED TO MAINTAIN BOTTOM OF EQUIPMENT A MINIMUM OF 16 INCHES ABOVE FINISHED ROOF SURFACE. PROVIDE SLOPED CURB IF NEEDED TO MATCH ROOF SLOPE. COORDINATE WITH ROOF INSULATION THICKNESS AND ROOF TAPER AT INSTALLED LOCATION. COORDINATE CURB TYPE WITH DRAWINGS.
- SCHEDULED WEIGHT IS THE MAXIMUM ALLOWABLE OPERATING WEIGHT OF THE EQUIPMENT AND CURB.
- COOLING COIL LAT IS LEAVING AIR TEMPERATURE OF COIL.
- PROVIDE GUARDS TO PROTECT CONDENSER COIL FROM HAIL OR OTHER DAMAGE.
- PROVIDE HEATER TO MEET OR EXCEED SCHEDULED MINIMUM MBH OUTPUT. NOMINAL KW IS BASED ON LISTED MANUFACTURER'S STANDARD PRODUCT. COORDINATE EQUIPMENT POWER SUPPLY WITH ELECTRICAL CONTRACTOR IF DIFFERENT FROM THAT SCHEDULED.

## FAN COIL UNIT SCHEDULE (HEAT PUMP)

MARK	MANUFACTURER	MODEL	SUPPLY FAN				COOLING COIL					HEAT PUMP HEATING COIL				ELECTRICAL					WEIGHT (LBS)	NOTES					
			CFM	ESP (IN)	NOM HP (Y/N)	TH (MBH)	SH (MBH)	EAT (°F DB)	(°F WB)	(°F WB)	REFR TYPE	MIN EFF (EER)	(IEER)	MIN NO STAGES	MIN OUT (MBH)	AMBIENT (°F DB)	EAT (°F DB)	LAT (°F DB)	MIN OA (CFM)	V/PH			MCA	MOC/P	DISC TYPE	STARTER TYPE	
FCU 1	CARRIER	40MCCQ18	420	0.03	0.66	11.0	9.5	76.5	63.7	55.9	55.0	R410A	9.3	9.3	13	65	85	40	208/1	0	0	NF	N/A	N/A	45		A-G

\*EQUIPMENT SHALL BE OBTAINED THROUGH SHAKE SHACK NATIONAL ACCOUNT. REFER TO T002 / VENDOR LIST FOR MORE INFORMATION.\*  
 MODEL NUMBERS SHALL NOT BE CONSIDERED COMPLETE AND MATERIAL SHALL NOT BE ORDERED BY MANUFACTURER AND MODEL NUMBERS ONLY. REVIEW THE COMPLETE DESCRIPTION, NOTES AND SPECIFICATIONS TO DETERMINE THE EXACT MATERIAL AND ACCESSORIES TO BE ORDERED. THE MANUFACTURERS LISTED ARE THE BASIS FOR THE DESIGN.

## NOTES:

- EQUIPMENT FURNISHED AND INSTALLED PER THE RESPONSIBILITY SCHEDULE. REF ARCHITECTURAL DRAWINGS.
- ASSOCIATED CONDENSING UNIT SHALL BE BY THE SAME MANUFACTURER.
- FOR COOLING, EQUIPMENT SIZED FOR 100°F AMBIENT TEMPERATURE. HEAT PUMP HEATING CAPACITY BASED ON AMBIENT TEMPERATURE LISTED.
- PROVIDE UNIT WITH CLEANABLE AIR FILTERS.
- PROVIDE WITH 7-DAY PROGRAMMABLE THERMOSTAT WITH STAGED HEATING AND COOLING CAPABILITY AS REQUIRED FOR OPERATION OF AUXILIARY HEATING AND COOLING CONTROLS.
- DISCONNECT SWITCH PROVIDED BY DIVISION 26 CONTRACTOR.
- COORDINATE SIZE OF CONDUCTOR TERMINATION LUGS WITH CONDUCTOR SIZES SHOWN ON ELECTRICAL DRAWINGS.
- PROVIDE SINGLE POINT POWER CONNECTION.

## CONDENSING UNIT SCHEDULE (HEAT PUMP)

MARK	SERVICE	MANUFACTURER	MODEL	COOLING CAPACITY				HEATING CAPACITY				ELECTRICAL					WEIGHT (LBS)	NOTES				
				REFR TYPE	TH (MBH)	SH (MBH)	EAT (°F DB)	(°F WB)	(°F WB)	REFR TYPE	MIN EFF (EER)	(SEER)	CAP (MBH)	AMBIENT (°F DB)	COP (HSPF)	MCA			MOC/P	V/PH	DISC TYPE	
CU 1	FCU 1	CARRIER	38MARQ18AA3	R410A	11.0	12.5	20	9.3	9.3	13	65	85	40	208/1	0	0	NF	N/A	N/A	45		A-I

\*EQUIPMENT SHALL BE OBTAINED THROUGH SHAKE SHACK NATIONAL ACCOUNT. REFER TO T002 / VENDOR LIST FOR MORE INFORMATION.\*  
 MODEL NUMBERS SHALL NOT BE CONSIDERED COMPLETE AND MATERIAL SHALL NOT BE ORDERED BY MANUFACTURER AND MODEL NUMBERS ONLY. REVIEW THE COMPLETE DESCRIPTION, NOTES AND SPECIFICATIONS TO DETERMINE THE EXACT MATERIAL AND ACCESSORIES TO BE ORDERED. THE MANUFACTURERS LISTED ARE THE BASIS FOR THE DESIGN.

## NOTES:

- EQUIPMENT FURNISHED AND INSTALLED PER THE RESPONSIBILITY SCHEDULE. REF ARCHITECTURAL DRAWINGS.
- EQUIPMENT CAPACITY SCHEDULED IS MINIMUM CAPACITY THAT MUST BE PROVIDED AT AMBIENT TEMPERATURE INDICATED.
- CONTRACTOR SHALL VERIFY WITH EQUIPMENT SUPPLIER EXACT QUANTITY AND SIZE OF REFRIGERANT PIPING.
- PROVIDE LIQUID LINE FILTER DRYER AND SIGHT GLASS.
- PROVIDE PRE-ENGINEERED ROOF EQUIPMENT SUPPORTS WITH MINIMUM HEIGHT REQUIRED TO MAINTAIN BOTTOM OF EQUIPMENT A MINIMUM OF 16 INCHES ABOVE FINISHED ROOF SURFACE. COORDINATE WITH ROOF INSULATION THICKNESS AND ROOF TAPER AT INSTALLED LOCATION.
- DISCONNECT SWITCH PROVIDED BY DIVISION 26 CONTRACTOR.
- START

COMcheck Software Version COMcheckWeb  
**Mechanical Compliance Certificate**

**Project Information**

Energy Code: 2018 IECC  
 Project Title: Shake Shack - Jenkintown  
 Location: Jenkintown, Pennsylvania  
 Climate Zone: 4a  
 Project Type: New Construction

Construction Site: 901 Old York Road, Suite 4  
 Owner/Agent: DP3 Architects  
 Designer/Contractor: Henderson Engineers, Inc.  
 15 South Main Street, Suite 400  
 Greenville, South Carolina 8200  
 864-232-8200  
 8345 Lenexa Dr #300  
 Lenexa, Kansas 66214  
 913-742-5000

Additional Efficiency Packages)  
 Credits: 1.0 Required, 1.0 Proposed  
 High Performance SWH, 1.0 credit

**Mechanical Systems List**

**Quantity System Type & Description**

- RTU-1 (Single Zone):  
 Heating: 1 each - Central Furnace, Gas, Capacity = 128 kBtu/h  
 Proposed Efficiency = 81.00% Et, Required Efficiency: 80.00 % Et or 80% AFUE  
 Cooling: 1 each - Single Package DX Unit, Capacity = 155 kBtu/h, Air-Cooled Condenser, Air Economizer  
 Proposed Efficiency = 11.00 EER, Required Efficiency = 10.80 EER  
 Proposed Part Load Efficiency = 13.90 IEER, Required Part Load Efficiency = 12.20 IEER  
 Fan System: RTU-1 Fan | Dining - Compliance (Motor nameplate HP and fan efficiency method) : Passes  
 Fans:  
 FAN 1 Supply, Single-Zone VAV, 2600 CFM, 5.0 motor nameplate hp, 0.0 fan efficiency grade, 0.0 total fan efficiency, 0.0 design fan efficiency , fan exception: Single fan <= SHF
- RTU-2 (Single Zone):  
 Heating: 1 each - Central Furnace, Gas, Capacity = 177 kBtu/h  
 Proposed Efficiency = 81.00% Et, Required Efficiency: 80.00 % Et or 80% AFUE  
 Cooling: 1 each - Single Package DX Unit, Capacity = 203 kBtu/h, Air-Cooled Condenser, Air Economizer  
 Proposed Efficiency = 12.00 EER, Required Efficiency = 10.80 EER  
 Proposed Part Load Efficiency = 18.80 IEER, Required Part Load Efficiency = 12.20 IEER  
 Fan System: RTU-2 Fan | Kitchen - Compliance (Motor nameplate HP and fan efficiency method) : Passes  
 Fans:  
 Fan 2 Supply, Single-Zone VAV, 4200 CFM, 5.0 motor nameplate hp, 0.0 fan efficiency grade, 0.0 total fan efficiency, 0.0 design fan efficiency , fan exception: Single fan <= SHF
- CU-1 (Single Zone):  
 Split System Heat Pump  
 Heating Mode: Capacity = 18 kBtu/h  
 Proposed Efficiency = 10.50 HSPF, Required Efficiency = 8.20 HSPF  
 Cooling Mode: Capacity = 14 kBtu/h  
 Proposed Efficiency = 20.00 SEER, Required Efficiency = 14.00 SEER  
 Proposed Part Load Efficiency = 0.00, Required Part Load Efficiency = 0.00  
 Fan System: CU-1 Fan | Office - Compliance (Motor nameplate HP and fan efficiency method) : Passes  
 Fans:  
 FAN 3 Supply, Constant Volume, 420 CFM, 0.1 motor nameplate hp, 0.0 fan efficiency grade, 0.0 total fan efficiency, 0.0 design fan efficiency , fan exception: Single fan <= SHF
- WH-1, WH-2, WH-3:  
 Gas Instantaneous Water Heater, Capacity: 0 gallons, Input Rating: 199 kBtu/h w/ Circulation Pump  
 No minimum efficiency requirement applies

Project Title: Shake Shack - Jenkintown Report date: 02/11/25  
 Data filename: Page 1 of 11

**Mechanical Compliance Statement**

Compliance Statement: The proposed mechanical design represented in this document is consistent with the building plans, specifications, and other calculations submitted with this permit application. The proposed mechanical systems have been designed to meet the 2018 IECC requirements in COMcheck Software Version COMcheckWeb and to comply with any applicable mandatory requirements listed in the Inspection Checklist.

Eion Hindsman-Curry  
 Name - Title Signature Date 02/11/2025

COMcheck Software Version COMcheckWeb  
**Inspection Checklist**  
 Energy Code: 2018 IECC

Requirements: 100.0% were addressed directly in the COMcheck software  
 Text in the "Comments/Assumptions" column is provided by the user in the COMcheck Requirements screen. For each requirement, the user certifies that a code requirement will be met and how that is documented, or that an exception is being claimed. Where compliance is itemized in a separate table, a reference to that table is provided.

Section # & Req.ID	Plan Review	Complies?	Comments/Assumptions
C103.2 (PR2)	Plans, specifications, and/or calculations provide all information with which compliance can be determined for the mechanical systems and equipment and document where exceptions to the standard are claimed. Load calculations per acceptable engineering standards and handbooks.	<input type="checkbox"/> Complies <input type="checkbox"/> Does Not <input type="checkbox"/> Not Observable <input type="checkbox"/> Not Applicable	Requirement will be met.
C103.2 (PR3)	Plans, specifications, and/or calculations provide all information with which compliance can be determined for the service water heating systems and equipment and document where exceptions to the standard are claimed. Hot water system sized per manufacturer's sizing guide.	<input type="checkbox"/> Complies <input type="checkbox"/> Does Not <input type="checkbox"/> Not Observable <input type="checkbox"/> Not Applicable	Requirement will be met.
C406 (PR9)	Plans, specifications, and/or calculations provide all information with which compliance can be determined for the additional energy efficiency package options.	<input type="checkbox"/> Complies <input type="checkbox"/> Does Not <input type="checkbox"/> Not Observable <input type="checkbox"/> Not Applicable	Requirement will be met.

**Additional Comments/Assumptions:**

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

Project Title: Shake Shack - Jenkintown Report date: 02/11/25  
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Section # & Req.ID	Footing / Foundation Inspection	Complies?	Comments/Assumptions
C403.12.2 (FG3)	Snowice mating system and freeze protection systems have sensors and controls configured to limit service for pavement temperature and outdoor temperature, future connection to controls.	<input type="checkbox"/> Complies <input type="checkbox"/> Does Not <input type="checkbox"/> Not Observable <input type="checkbox"/> Not Applicable	Requirement will be met.

**Additional Comments/Assumptions:**

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

Project Title: Shake Shack - Jenkintown Report date: 02/11/25  
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Section # & Req.ID	Plumbing Rough-In Inspection	Complies?	Comments/Assumptions
C404.5, C404.5.1, C404.5.2 (PL6)	Heated water supply piping conforms to pipe length and volume requirements. Refer to section details.	<input type="checkbox"/> Complies <input type="checkbox"/> Does Not <input type="checkbox"/> Not Observable <input type="checkbox"/> Not Applicable	Requirement will be met.
C404.6.1, C404.6.2 (PL3)	Automatic time switches installed to automatically switch off the recirculating hot-water system or heat trace.	<input type="checkbox"/> Complies <input type="checkbox"/> Does Not <input type="checkbox"/> Not Observable <input type="checkbox"/> Not Applicable	Requirement will be met.
C404.6.3 (PL7)	Pumps that circulate water between a heater and storage tank have controls that limit operation from startup to <= 5 minutes after end of heating cycle.	<input type="checkbox"/> Complies <input type="checkbox"/> Does Not <input type="checkbox"/> Not Observable <input type="checkbox"/> Not Applicable	Requirement will be met.
C404.7 (PL8)	Demand recirculation water systems have controls that start the pump upon receiving a signal from the action of a user of a fixture or appliance and limits the temperature of the water entering the cold-water piping to 104°F.	<input type="checkbox"/> Complies <input type="checkbox"/> Does Not <input type="checkbox"/> Not Observable <input type="checkbox"/> Not Applicable	Requirement will be met.

**Additional Comments/Assumptions:**

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

Project Title: Shake Shack - Jenkintown Report date: 02/11/25  
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Section # & Req.ID	Mechanical Rough-In Inspection	Complies?	Comments/Assumptions
C402.2.6 (ME14)	Thermally ineffective panel surfaces of insulation >= R-5.	<input type="checkbox"/> Complies <input type="checkbox"/> Does Not <input type="checkbox"/> Not Observable <input type="checkbox"/> Not Applicable	Requirement will be met.
C403.11.3 (ME61)	HVAC piping insulation insulated in accordance with Table C403.11.3. Insulation exposed to weather is protected from damage and is provided with shielding from solar radiation.	<input type="checkbox"/> Complies <input type="checkbox"/> Does Not <input type="checkbox"/> Not Observable <input type="checkbox"/> Not Applicable	Requirement will be met.
C403.8.4 (ME142)	Motors for fans that are not less than 1/12 hp and less than 1 hp are electronically commutated motors or have a minimum motor efficiency of 70 percent. These motors have the means to adjust motor speed.	<input type="checkbox"/> Complies <input type="checkbox"/> Does Not <input type="checkbox"/> Not Observable <input type="checkbox"/> Not Applicable	Requirement will be met.
C403.8.5 (ME143)	Each DX cooling system > 65 kBtu and chiller water/evaporative cooling system with fans > 1/4 hp are designed to vary the indoor fan airflow as a function of load and comply with detailed requirements of this section.	<input type="checkbox"/> Complies <input type="checkbox"/> Does Not <input type="checkbox"/> Not Observable <input type="checkbox"/> Not Applicable	Requirement will be met.
C403.12 (ME17)	Systems that heat outside the building envelope are radiant heat systems controlled by an occupancy sensing device or timer switch.	<input type="checkbox"/> Complies <input type="checkbox"/> Does Not <input type="checkbox"/> Not Observable <input type="checkbox"/> Not Applicable	Requirement will be met.
C403.5.5 (ME113)	Fault detection and diagnostics installed with aircooled unitary DX units having economizers.	<input type="checkbox"/> Complies <input type="checkbox"/> Does Not <input type="checkbox"/> Not Observable <input type="checkbox"/> Not Applicable	Requirement will be met.
C403.2.2 (ME59)	Natural or mechanical ventilation is provided in accordance with International Mechanical Code Chapter 4. Mechanical ventilation has capability to reduce outdoor air supply to minimum per IMC Chapter 4.	<input type="checkbox"/> Complies <input type="checkbox"/> Does Not <input type="checkbox"/> Not Observable <input type="checkbox"/> Not Applicable	Requirement will be met.
C403.7.1 (ME59)	Demand control ventilation provided for spaces >500 ft <sup>2</sup> and >25 people/1000 ft <sup>2</sup> occupant density and served by systems with air side economizer, auto modulating outside air damper control, or design airflow >= 3,000 cfm.	<input type="checkbox"/> Complies <input type="checkbox"/> Does Not <input type="checkbox"/> Not Observable <input type="checkbox"/> Not Applicable	<b>Exception:</b> Spaces where the supply airflow rate minus makeup air and minus outgoing transfer air is less than 1200 cfm.
C403.7.2 (ME115)	Enclosed parking garage ventilation has automatic contaminant detection and capacity to stage or modulate fans to 50% or less of design capacity.	<input type="checkbox"/> Complies <input type="checkbox"/> Does Not <input type="checkbox"/> Not Observable <input type="checkbox"/> Not Applicable	<b>Exception:</b> Requirement does not apply.
C403.7.6 (ME141)	HVAC systems serving guestrooms in Group R-1 buildings with > 50 guestrooms. Each guestroom is provided with controls that automatically manage temperature setpoint and ventilation (see sections C403.7.6.1 and C403.7.6.2).	<input type="checkbox"/> Complies <input type="checkbox"/> Does Not <input type="checkbox"/> Not Observable <input type="checkbox"/> Not Applicable	Requirement will be met.
C403.7.4 (ME57)	Exhaust air energy recovery on systems meeting Table C403.7.4(1) and C403.7.4(2).	<input type="checkbox"/> Complies <input type="checkbox"/> Does Not <input type="checkbox"/> Not Observable <input type="checkbox"/> Not Applicable	<b>Exception:</b> Where the largest exhaust source is less than 75% of the design outdoor airflow.

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

Project Title: Shake Shack - Jenkintown Report date: 02/11/25  
 Data filename: Page 6 of 11

Section # & Req.ID	Mechanical Rough-In Inspection	Complies?	Comments/Assumptions
C403.7.5 (ME116)	Kitchen exhaust systems comply with replacement air and conditioned supply air limitations, and satisfy hood requirements and maximum exhaust rate criteria.	<input type="checkbox"/> Complies <input type="checkbox"/> Does Not <input type="checkbox"/> Not Observable <input type="checkbox"/> Not Applicable	Requirement will be met.
C403.11.1, C403.11.2 (ME60)	HVAC ducts and plenums insulated in accordance with C403.11.1 and constructed in accordance with C403.11.2, verification may need to occur during Foundation Inspection.	<input type="checkbox"/> Complies <input type="checkbox"/> Does Not <input type="checkbox"/> Not Observable <input type="checkbox"/> Not Applicable	Requirement will be met.
C403.5 (ME62)	Air economizers provided where required, meet the requirements for design capacity, control signal, ventilation controls, high-limit shut-off, integrated economizer control, and provide a means to relieve excess outside air during operation.	<input type="checkbox"/> Complies <input type="checkbox"/> Does Not <input type="checkbox"/> Not Observable <input type="checkbox"/> Not Applicable	Requirement will be met.
C403.5.3 (ME124)	An economizer automatically reduce minimum outdoor air quantity when outdoor air intake will not reduce cooling energy usage. See Table C403.5.3.3 for applicable device types and climate zones.	<input type="checkbox"/> Complies <input type="checkbox"/> Does Not <input type="checkbox"/> Not Observable <input type="checkbox"/> Not Applicable	Requirement will be met.
C403.5.3 (ME125)	System capable of relieving excess outdoor air during air economizer operation to prevent overpressurizing the building. The relief air outlet located to avoid recirculation into the building.	<input type="checkbox"/> Complies <input type="checkbox"/> Does Not <input type="checkbox"/> Not Observable <input type="checkbox"/> Not Applicable	Requirement will be met.
C403.5.3 (ME126)	Return, exhaust/relief and outdoor air dampers used in economizers have motorized dampers that automatically shut when not in use and meet maximum leakage rates. Reference section C403.7.7 for details.	<input type="checkbox"/> Complies <input type="checkbox"/> Does Not <input type="checkbox"/> Not Observable <input type="checkbox"/> Not Applicable	Requirement will be met.
C403.4.3 (ME121)	Closed-circuit cooling tower within heat pump loop have either automatic bypass valve or lower leakage positive closure dampers. Open-circuit tower within heat pump loop have automatic valve to bypass all heat pump water flow around the tower. Open or closed-circuit cooling towers used in conjunction with a separate heat exchanger have heat loss by shutting down the circulation pump on the cooling tower loop. Open or closed circuit cooling towers have a separate heat exchanger to isolate the cooling tower from the heat pump loop, and heat loss is controlled by shutting down the circulation pump on the cooling tower loop.	<input type="checkbox"/> Complies <input type="checkbox"/> Does Not <input type="checkbox"/> Not Observable <input type="checkbox"/> Not Applicable	<b>Exception:</b> Requirement does not apply.
C403.4.1 (ME63)	Heating for vestibules and air curtains with integral heating include automatic controls that shut off the heating system when outdoor air temperatures > 45F. Vestibule heating and cooling systems controlled by a thermostat in the vestibule with heating setpoint <= 60F and cooling setpoint >= 80F.	<input type="checkbox"/> Complies <input type="checkbox"/> Does Not <input type="checkbox"/> Not Observable <input type="checkbox"/> Not Applicable	Requirement will be met.

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

Project Title: Shake Shack - Jenkintown Report date: 02/11/25  
 Data filename: Page 7 of 11

Section # & Req.ID	Mechanical Rough-In Inspection	Complies?	Comments/Assumptions
C403.3.3 (ME35)	Hot gas bypass limited to: <=240 kBtu/h - 50% >240 kBtu/h - 25%	<input type="checkbox"/> Complies <input type="checkbox"/> Does Not <input type="checkbox"/> Not Observable <input type="checkbox"/> Not Applicable	Requirement will be met.
C408.2.2 (ME53)	Air outlets and zone terminal devices have means for air-balancing.	<input type="checkbox"/> Complies <input type="checkbox"/> Does Not <input type="checkbox"/> Not Observable <input type="checkbox"/> Not Applicable	<b>Exception:</b> Fans with fan motors of 1 hp (0.74 kW) or less.
C403.5 (ME123)	Refrigerated display cases, walk-in coolers or walk-in freezers served by remote compressors and remote condensers not located in a condensing unit, have fan-powered condensers that comply with Sections C403.5.1 and refrigeration compressor systems that comply with C403.5.2.	<input type="checkbox"/> Complies <input type="checkbox"/> Does Not <input type="checkbox"/> Not Observable <input type="checkbox"/> Not Applicable	Requirement will be met.

**Additional Comments/Assumptions:**

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

Project Title: Shake Shack - Jenkintown Report date: 02/11/25  
 Data filename: Page 8 of 11



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 Greenville, SC 29601  
 864.232.8200  
 www.DP3architects.com

**Project**

SHAKE SHACK  
 SHAKE SHACK #1694  
 JENKINTOWN, PA

Project Number: 24204  
 Drawn By: Author  
 Checked By: Checker  
 Date: 12 FEB 2025

Revisions  
 2-12-2025 PERMIT SET

**Drawing**

MECHANICAL  
 ENERGY CODE  
 COMPLIANCE

M-630

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NATHAN T. LOVE

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Section # & Req. ID	Rough-In Electrical Inspection	Complies?	Comments/Assumptions
C405.6 [EL26]†	Low voltage dry-type distribution electric transformers meet the minimum efficiency requirements of Table C405.6.	<input type="checkbox"/> Complies <input type="checkbox"/> Does Not <input type="checkbox"/> Not Observable <input type="checkbox"/> Not Applicable	<b>Exception:</b> Requirement does not apply.
C405.7 [EL27]†	Electric motors meet the minimum efficiency requirements of Tables C405.7(1) through C405.7(4). Efficiency verified through certification under an approved certification program or the equipment efficiency ratings shall be provided by motor manufacturer (where certification programs do not exist).	<input type="checkbox"/> Complies <input type="checkbox"/> Does Not <input type="checkbox"/> Not Observable <input type="checkbox"/> Not Applicable	Requirement will be met.
C405.8.2.1 [EL28]†	Escalators and moving walks comply with ASME A17.1/CSA B44 and have automatic controls configured to reduce speed to the minimum permitted speed in accordance with ASME A17.1/CSA B44 or applicable local code when not conveying passengers.	<input type="checkbox"/> Complies <input type="checkbox"/> Does Not <input type="checkbox"/> Not Observable <input type="checkbox"/> Not Applicable	<b>Exception:</b> Requirement does not apply.
C405.9 [EL29]†	Total voltage drop across the combination of feeders and branch circuits <= 5%.	<input type="checkbox"/> Complies <input type="checkbox"/> Does Not <input type="checkbox"/> Not Observable <input type="checkbox"/> Not Applicable	Requirement will be met.

**Additional Comments/Assumptions:**

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

Project Title: Shake Shack - Jenkintown Report date: 02/11/25  
Data filename: Page 9 of 11

Section # & Req. ID	Final Inspection	Complies?	Comments/Assumptions
C403.3, C408.2.5 [F18]†	Furnished OEM manuals for HVAC systems within 90 days of system acceptance.	<input type="checkbox"/> Complies <input type="checkbox"/> Does Not <input type="checkbox"/> Not Observable <input type="checkbox"/> Not Applicable	Requirement will be met.
C403.2.2 [F127]†	HVAC systems and equipment capacity does not exceed calculated loads.	<input type="checkbox"/> Complies <input type="checkbox"/> Does Not <input type="checkbox"/> Not Observable <input type="checkbox"/> Not Applicable	Requirement will be met.
C403.2.4.1 [F147]†	Heating and cooling to each zone is controlled by a thermostat control. Minimum one humidity control device per installed humidification/dehumidification system.	<input type="checkbox"/> Complies <input type="checkbox"/> Does Not <input type="checkbox"/> Not Observable <input type="checkbox"/> Not Applicable	Requirement will be met.
C403.2.4.1.1 [F142]†	Heat pump controls prevent supplemental electric resistance heat from coming on when not needed.	<input type="checkbox"/> Complies <input type="checkbox"/> Does Not <input type="checkbox"/> Not Observable <input type="checkbox"/> Not Applicable	Requirement will be met.
C403.4.1.2 [F138]†	Thermostatic controls have a 5 °F deadband.	<input type="checkbox"/> Complies <input type="checkbox"/> Does Not <input type="checkbox"/> Not Observable <input type="checkbox"/> Not Applicable	Requirement will be met.
C403.2.4.1.3 [F120]†	Temperature controls have setpoint overlap restrictions.	<input type="checkbox"/> Complies <input type="checkbox"/> Does Not <input type="checkbox"/> Not Observable <input type="checkbox"/> Not Applicable	Requirement will be met.
C403.2.4.2 [F139]†	Each zone equipped with setback controls using automatic time clock or programmable control system.	<input type="checkbox"/> Complies <input type="checkbox"/> Does Not <input type="checkbox"/> Not Observable <input type="checkbox"/> Not Applicable	Requirement will be met.
C403.2.4.2.1 [F140]†	Automatic Controls: Setback to 55°F (heat) and 85°F (cool); 7-day clock, 2-hour occupant override, 10-hour backup.	<input type="checkbox"/> Complies <input type="checkbox"/> Does Not <input type="checkbox"/> Not Observable <input type="checkbox"/> Not Applicable	Requirement will be met.
C403.2.4.2.2 [F141]†	Systems include optimum start controls.	<input type="checkbox"/> Complies <input type="checkbox"/> Does Not <input type="checkbox"/> Not Observable <input type="checkbox"/> Not Applicable	Requirement will be met.
C404.3 [F111]†	Heat traps installed on supply and discharge piping of non-circulating systems.	<input type="checkbox"/> Complies <input type="checkbox"/> Does Not <input type="checkbox"/> Not Observable <input type="checkbox"/> Not Applicable	Requirement will be met.
C404.4 [F125]†	All piping insulated in accordance with section details and Table C403.11.3.	<input type="checkbox"/> Complies <input type="checkbox"/> Does Not <input type="checkbox"/> Not Observable <input type="checkbox"/> Not Applicable	Requirement will be met.
C404.6.1 [F123]†	Controls are installed that limit the operation of a recirculation pump installed to maintain temperature of a storage tank; system return pipe is a dedicated return pipe or a cold water supply pipe.	<input type="checkbox"/> Complies <input type="checkbox"/> Does Not <input type="checkbox"/> Not Observable <input type="checkbox"/> Not Applicable	Requirement will be met.

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

Project Title: Shake Shack - Jenkintown Report date: 02/11/25  
Data filename: Page 10 of 11

Section # & Req. ID	Final Inspection	Complies?	Comments/Assumptions
C408.7, C405.7.1 [F153]†	Enhanced Service Water Heat System efficiency package. One of the following SWH system enhancements must satisfy 60 percent of buildings annual hot water requirements, or 100 percent if the building requirements otherwise comply with heat recovery per Section C403.9.5. Waste heat recovery (from SWH, process equipment, OR on-site renewable water-heating.	<input type="checkbox"/> Complies <input type="checkbox"/> Does Not <input type="checkbox"/> Not Observable <input type="checkbox"/> Not Applicable	Requirement will be met.
C408.1.1 [F157]†	Building operations and maintenance documents will be provided to the owner. Documents will cover manufacturers' information, specifications, programming procedures and means of illustrating to owner how building, equipment and systems are intended to be installed, maintained, and operated.	<input type="checkbox"/> Complies <input type="checkbox"/> Does Not <input type="checkbox"/> Not Observable <input type="checkbox"/> Not Applicable	Requirement will be met.
C408.2.1 [F128]†	Commissioning plan developed by registered design professional or approved agency.	<input type="checkbox"/> Complies <input type="checkbox"/> Does Not <input type="checkbox"/> Not Observable <input type="checkbox"/> Not Applicable	Requirement will be met.
C408.2.3.1 [F131]†	HVAC equipment has been tested to ensure proper operation.	<input type="checkbox"/> Complies <input type="checkbox"/> Does Not <input type="checkbox"/> Not Observable <input type="checkbox"/> Not Applicable	Requirement will be met.
C408.2.3.2 [F110]†	HVAC control systems have been tested to ensure proper operation; calibration and adjustment of controls.	<input type="checkbox"/> Complies <input type="checkbox"/> Does Not <input type="checkbox"/> Not Observable <input type="checkbox"/> Not Applicable	Requirement will be met.
C408.2.3.3 [F132]†	Economizers have been tested to ensure proper operation.	<input type="checkbox"/> Complies <input type="checkbox"/> Does Not <input type="checkbox"/> Not Observable <input type="checkbox"/> Not Applicable	Requirement will be met.
C408.2.4 [F129]†	Preliminary commissioning report completed and certified by registered design professional or approved agency.	<input type="checkbox"/> Complies <input type="checkbox"/> Does Not <input type="checkbox"/> Not Observable <input type="checkbox"/> Not Applicable	Requirement will be met.
C408.2.5 [F17]†	Furnished HVAC as-built drawings submitted within 90 days of system acceptance.	<input type="checkbox"/> Complies <input type="checkbox"/> Does Not <input type="checkbox"/> Not Observable <input type="checkbox"/> Not Applicable	Requirement will be met.
C408.2.5.3 [F143]†	An air and/or hydronic system balancing report is provided for HVAC systems.	<input type="checkbox"/> Complies <input type="checkbox"/> Does Not <input type="checkbox"/> Not Observable <input type="checkbox"/> Not Applicable	Requirement will be met.
C408.2.5.4 [F130]†	Final commissioning report due to building owner within 90 days of receipt of certificate of occupancy.	<input type="checkbox"/> Complies <input type="checkbox"/> Does Not <input type="checkbox"/> Not Observable <input type="checkbox"/> Not Applicable	Requirement will be met.

**Additional Comments/Assumptions:**

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

Project Title: Shake Shack - Jenkintown Report date: 02/11/25  
Data filename: Page 11 of 11

**HENDERSON**  
ENGINEERS  
8345 LENEZA DRIVE, SUITE 300  
LENEZA, KS 66214  
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02/20/2025

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Project

**SHAKE SHACK**  
SHAKE SHACK #1694  
JENKINTOWN, PA

Project Number: 24204  
Drawn By: Author  
Checked By: Checker  
Date: 12 FEB 2025

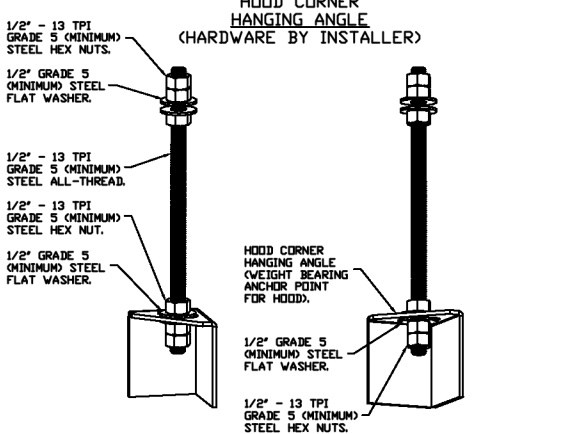
Revisions  
2-12-2025 PERMIT SET

Drawing

MECHANICAL  
ENERGY CODE  
COMPLIANCE

**M-631**

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**HANGING ANGLE DETAILS**

HOOD STYLE / MODEL	450 DEGREES cfm/ft.	600 DEGREES cfm/ft.	700 DEGREES cfm/ft.
CANOPY ND-2	150	200	250
CANOPY ND-2 W/ END PANELS	105	140	175
SLOPED SND-2	228	294	-
ISLAND ND-2W	269	300	350
ISLAND ND-2I	346	422	475

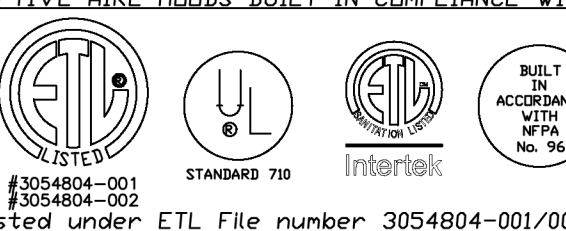
**ETL HOOD LISTING DETAIL**

EXHAUST CFM = LENGTH OF HOOD X CFM/ALFT. (LOAD)  
 SUPPLY CFM = EXHAUST CFM X PERCENTAGE REQUIRED  
 TOTAL DUCT AREA (sq. in.) = 144 X CFM  
 DUCT LENGTH = TOTAL DUCT AREA / DUCT WIDTH

WARRANTY: VENTILATOR DUCT SIZES ARE CALCULATED USING AN EXHAUST VELOCITY OF 1500-1800 FPM AND A SUPPLY VELOCITY OF 1000 FPM.

**CALCULATIONS UTILIZED**

CAPTIVE-AIRE HOODS BUILT IN COMPLIANCE WITH:



**BUILDING CODES**

CAPTIVE-AIRE HOODS HAVE OPTIONAL CLEARANCE REDUCTION SYSTEMS AVAILABLE AS FOLLOWS:

MATERIAL	CLEARANCE	REDUCTION SYSTEM
NON-COMBUSTIBLE	NONE REQUIRED	
LIMITED-COMBUSTIBLE	3" UNINSULATED STANDOFF	
COMBUSTIBLE	1" INSULATED STANDOFF	

**CLEARANCE TO COMBUSTIBLES**

**INSTALLATION**

- ALL ELECTRICAL "TIE-OUT" CONNECTIONS AND RELATED INTERCONNECTIONS BY ELECTRICAL CONTRACTORS.
- ALL PLUMBING "TIE-OUT" CONNECTIONS AND RELATED INTERCONNECTIONS BY PLUMBING CONTRACTORS.
- HANGING BRACKETS LOCATED AND WELDED AS SHOWN ON PLANS. ALL OTHER HANGER MATERIALS PROVIDED BY INSTALLING CONTRACTORS.
- ALL CONNECTIONS FROM CAPTIVEAIRE HOOD PER MECHANICAL CONTRACTOR'S PLANS.
- COOKING EQUIPMENT TO SHUT OFF IN EVENT OF FIRE.
- EXHAUST FANS TO TURN ON IN EVENT OF FIRE.
- ALL LIGHT FIXTURES SHOWN INSTALLED BY CAPTIVEAIRE ARE FACTORY PREWIRED. INTERCONNECTIONS BETWEEN HOODS AND TO SWITCHES ARE BY ELECTRICAL CONTRACTOR.
- LAMPS FOR LIGHT FIXTURES BY INSTALLING CONTRACTORS.
- SEMI-RESTRICTS ARE RESPONSIBILITY OF INSTALLING CONTRACTOR.
- INSTALLING CONTRACTORS ASSUME ALL RELATED RESPONSIBILITY FOR VERIFICATION OF DIMENSIONAL DATA LISTED IN THESE DOCUMENTS FOR ACCURACY, INTEGRATION AND ADMINISTRATION OF CODE REQUIREMENTS IN EFFECT PRIOR TO ANY RELEASE FOR PRODUCTION OF EQUIPMENT SHOWN.

**BALANCE**

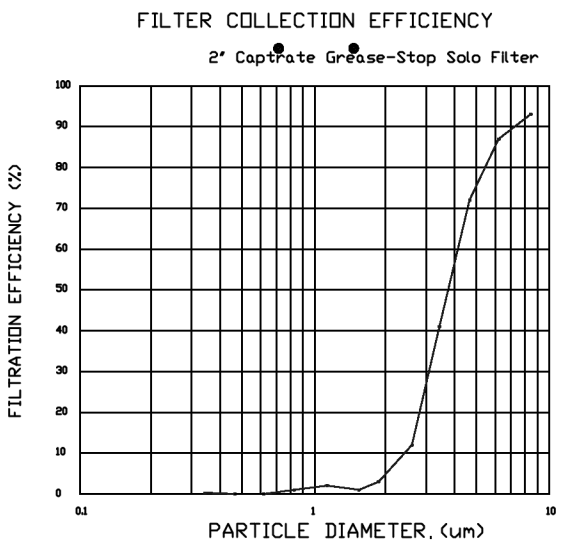
- KITCHEN HOODS MUST BE BALANCED WITH KITCHEN.
- KITCHEN SHALL BE NEGATIVE WITH RESPECT TO DRIVING AREA.
- RESTAURANT SHALL BE POSITIVE WITH RESPECT TO AMBIENT PRESSURE.

**ADDITIONAL**

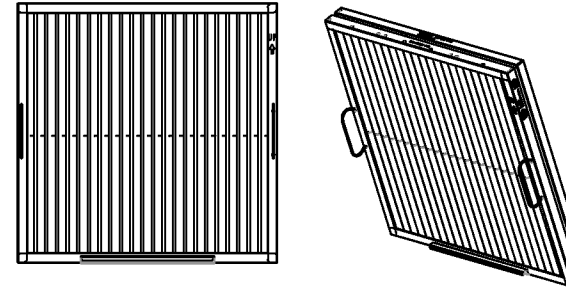
- WRITTEN HOOD DIMENSIONS HAVE PRECEDENCE OVER SCALE.
- SIKED AND "APPROVED" COPIES OF THIS DOCUMENT COMMENCEMENT OF FABRICATION.

**GENERAL NOTES**

1. FILTER COLLECTION EFFICIENCY



2. CaptiveAir Grease-Stop Solo Filter



CaptiveAir Grease-Stop Solo Filter  
 ETL Listed Grease Extracting Filters  
 Made From 430 Stainless Steel

**FILTER DETAIL**

FOR QUESTIONS, CALL THE  
 Eastern PA Mechanical  
 REGION 103  
 PHONE: (267) 504 - 4126  
 EMAIL: regi08@captiveaire.com

**HOOD INFORMATION - JOB#7240964**

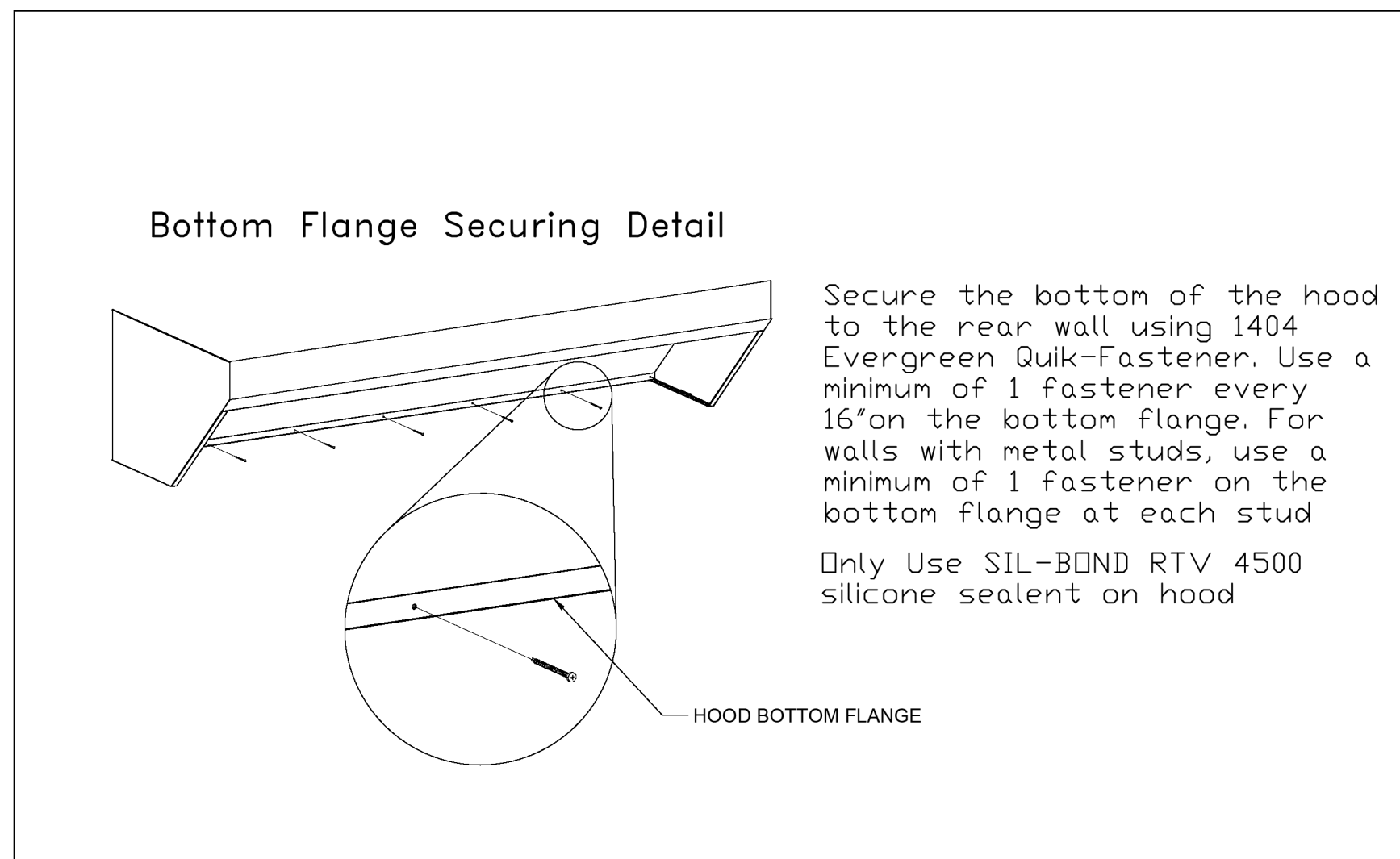
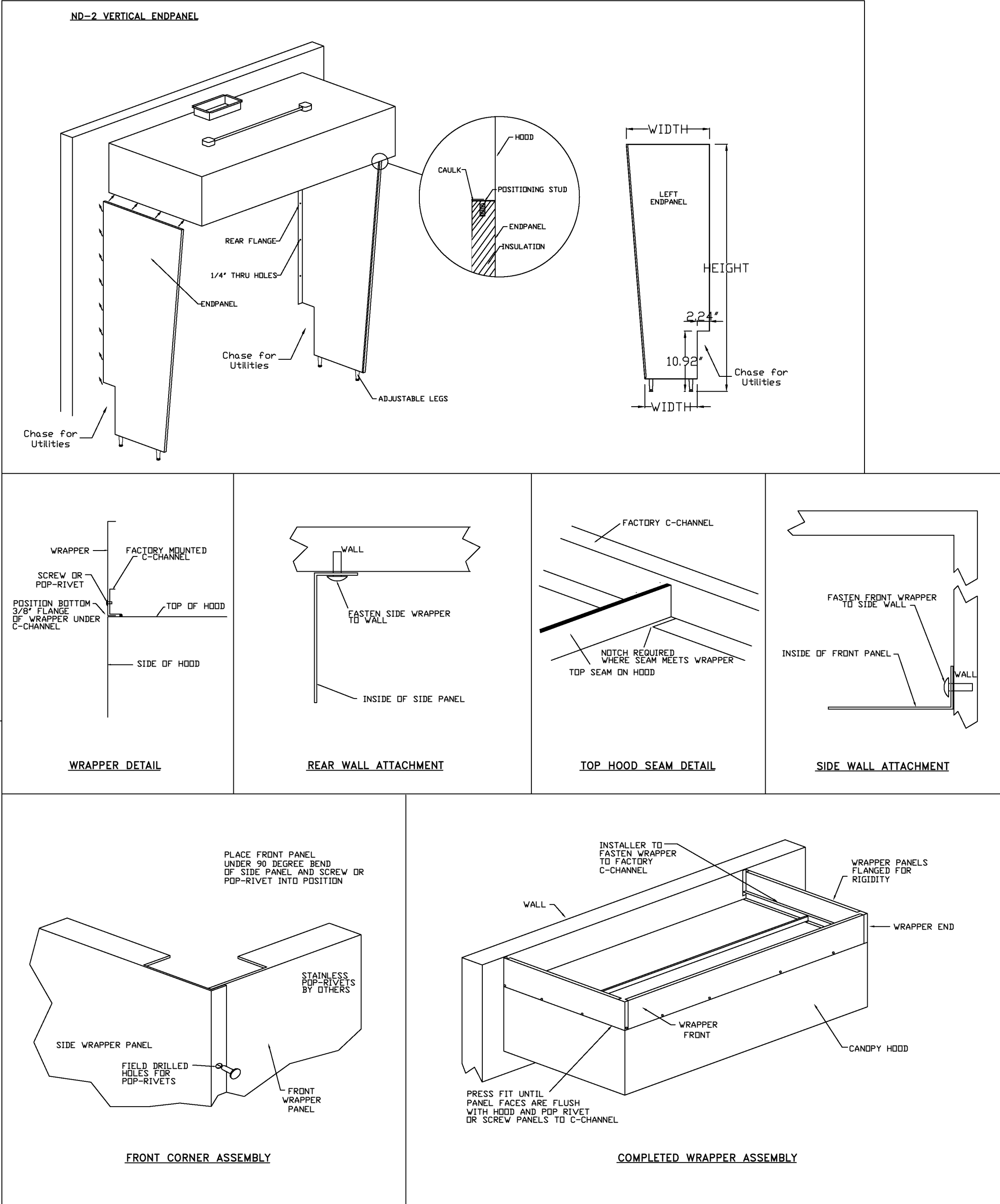
HOOD NO	TAG	MODEL	MANUFACTURER	LENGTH	MAX COOKING TEMP	TYPE	APPLIANCE DUTY	DESIGN CFM/FT	TOTAL EXH CFM	EXHAUST PLENUM RISER(S)				HOOD CONSTRUCTION	HOOD CONFIG			
										WIDTH	LENG	HEIGHT	DIA		CFM	VEL	SP	END TO END
1	Hood (Grill)	5430 ND-2	CAPTIVEAIRE	7' 11"	450 DEG	I	MEDIUM	150	1188	10'	11'	4'	1188	1555	-0.462'	430 SS WHERE EXPOSED	ALONE	ALONE
2	Hood (Fryer)	5430 ND-2	CAPTIVEAIRE	4' 11"	600 DEG	I	HEAVY	175	860	9'	9'	4'	860	1929	-0.494'	430 SS WHERE EXPOSED	ALONE	ALONE

**HOOD INFORMATION**

HOOD NO	TAG	TYPE	QTY	FILTER(S)		EFFICIENCY @ 7 MICRONS	QTY	LIGHT(S)		WIRE GUARD	LOCATION	SIZE	UTILITY CABINETS(S)		FIRE SYSTEM	ELECTRICAL	SWITCHES	FIRE SYSTEM PIPING	HOOD WEIGHT
				HEIGHT	LENGTH			TYPE	SIZE				TYPE	SIZE					
1	Hood (Grill)	CAPTRATE SLDL FILTER	5	20"	16"	85% SEE FILTER SPEC	2	RECESSED ROUND	NO									YES	484 LBS
2	Hood (Fryer)	CAPTRATE SLDL FILTER	3	20"	16"	85% SEE FILTER SPEC	2	RECESSED ROUND	NO	LEFT	12"x54"x30"	TANK FS	4.0/4.0/4.0	SC-320110MA	1 LIGHT 1 FAN		YES	748 LBS	

**HOOD OPTIONS**

HOOD NO	TAG	OPTION
1	Hood (Grill)	FIELD WRAPPER 18.00" HIGH FRONT, LEFT, RIGHT.
		RIGHT END STANDOFF (FINISHED) 1" WIDE 54" LONG INSULATED.
		INSULATION FOR BACK OF HOOD.
		RISER SENSOR INSTALL 6IN PLEN.
2	Hood (Fryer)	GFCI DUPLEX OUTLET, 20A 125V - HOOD FRONT LEFT - HORIZONTAL - DIST FROM END: 3.50 DIST FROM BOTTOM: 4.00.
		RIGHT WALL AS END PANEL.
		FIELD WRAPPER 12.00" HIGH FRONT, LEFT, RIGHT.
		RIGHT QUARTER END PANEL 23" TOP WIDTH, 0" BOTTOM WIDTH, 23" HIGH 430 SS.



**REVISIONS**

NO	DESCRIPTION	DATE

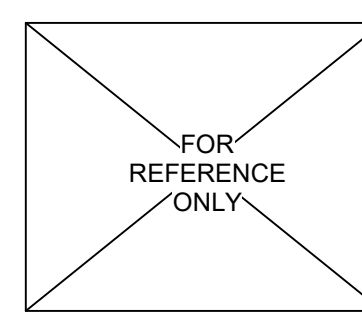
**CAPTIVEAIRE**  
 Eastern PA Mechanical  
 www.captiveaire.com  
 225 E. Coby Lane, Avenue, Suite #103, Bala Cynwyd, PA, 19004 PHONE: (267) 504 - 4126 EMAIL: regi108@captiveaire.com

**SHAKE SHACK #1694 - JENKINTOWN, PA(KITCHEN)**

**DATE:** 12/23/2024  
**DWG.#:** 7240964  
**DRAWN BY:** Joe.shilba  
**SCALE:** 3/4" = 1'-0"  
**MASTER DRAWING**

**SHEET NO.**  
 1

Seal



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**DP3 ARCHITECTS**

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Project

**SHAKE SHACK**  
 SHAKE SHACK #1694  
 JENKINTOWN, PA

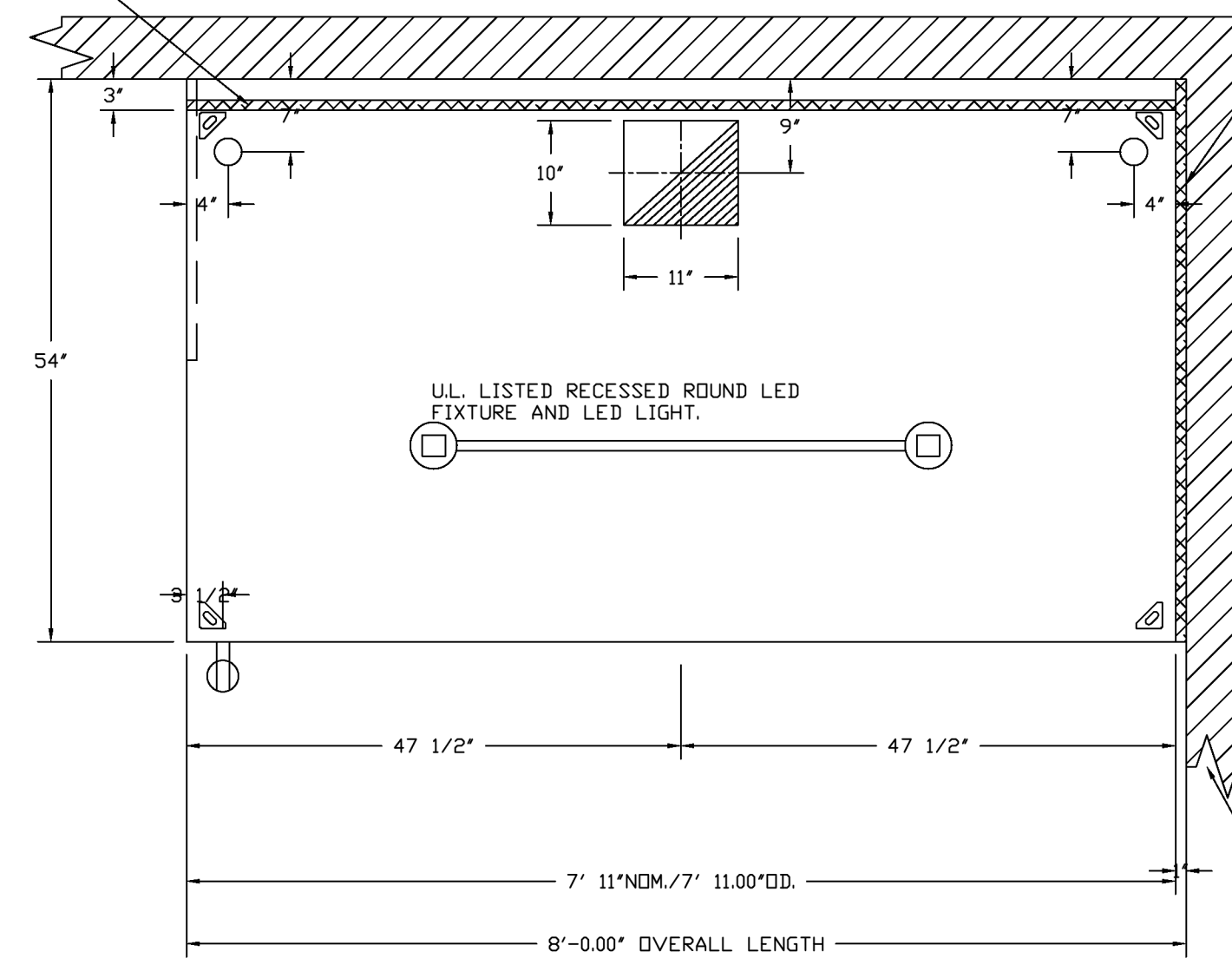
Project Number: 24204  
 Drawn By: Author  
 Checked By: Checker  
 Date: 12 FEB 2025

Revisions  
 2-12-2025 PERMIT SET

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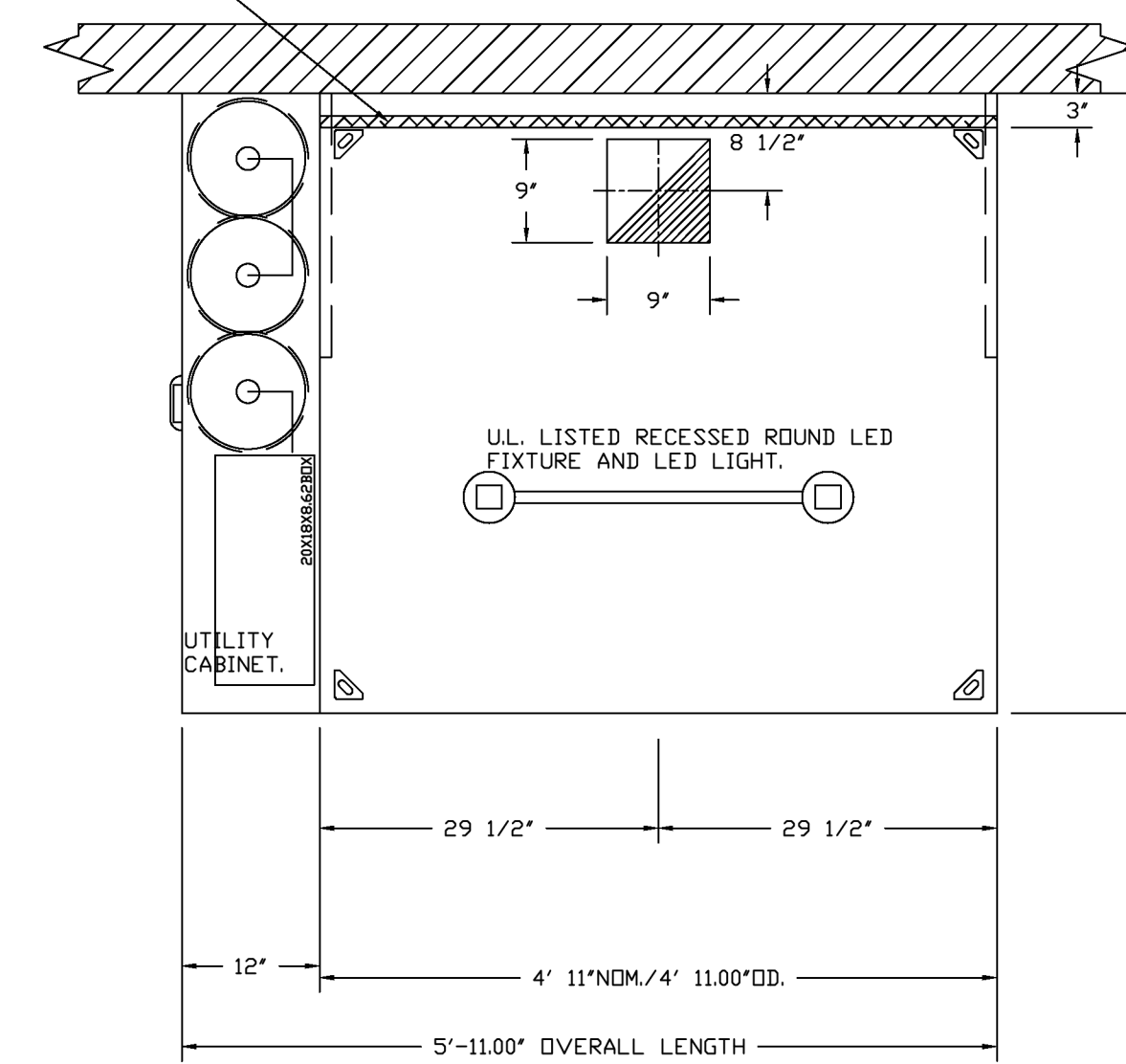
1" LAYER OF INSULATION FACTORY  
INSTALLED IN INTERNAL BACK STANDOFF.  
MEETS 0 INCH REQUIREMENTS FOR  
CLEARANCE TO COMBUSTIBLE SURFACES.



PLAN VIEW - HOOD #1 (Hood (Grill))  
7' 11.00" LONG 5430ND-2

1" LAYER OF INSULATION  
FACTORY INSTALLED IN  
1.00' END STANDOFF MEETS  
0" REQUIREMENTS CLEARANCE  
TO COMBUSTIBLE SURFACES.

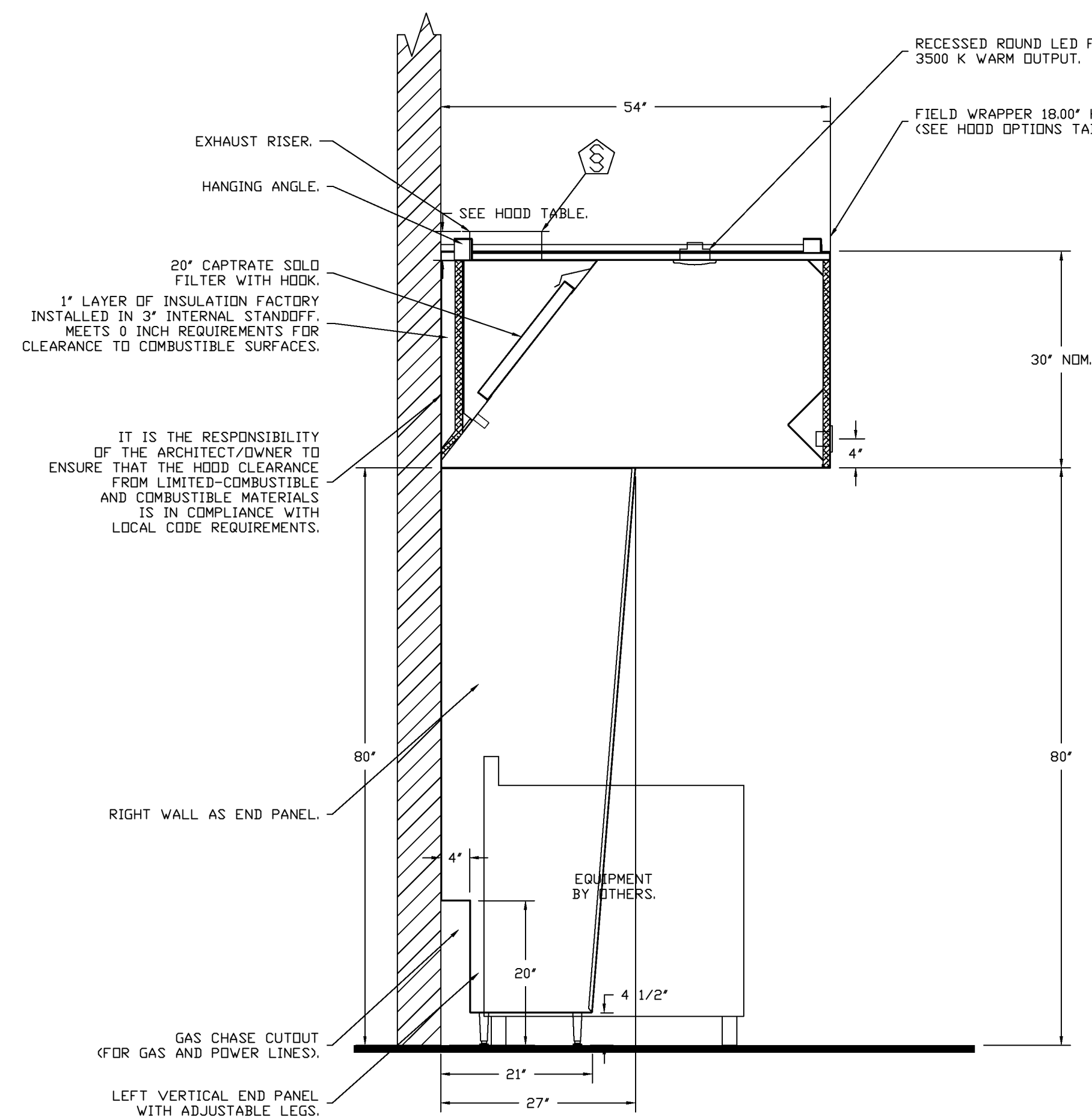
1" LAYER OF INSULATION FACTORY  
INSTALLED IN INTERNAL BACK STANDOFF.  
MEETS 0 INCH REQUIREMENTS FOR  
CLEARANCE TO COMBUSTIBLE SURFACES.



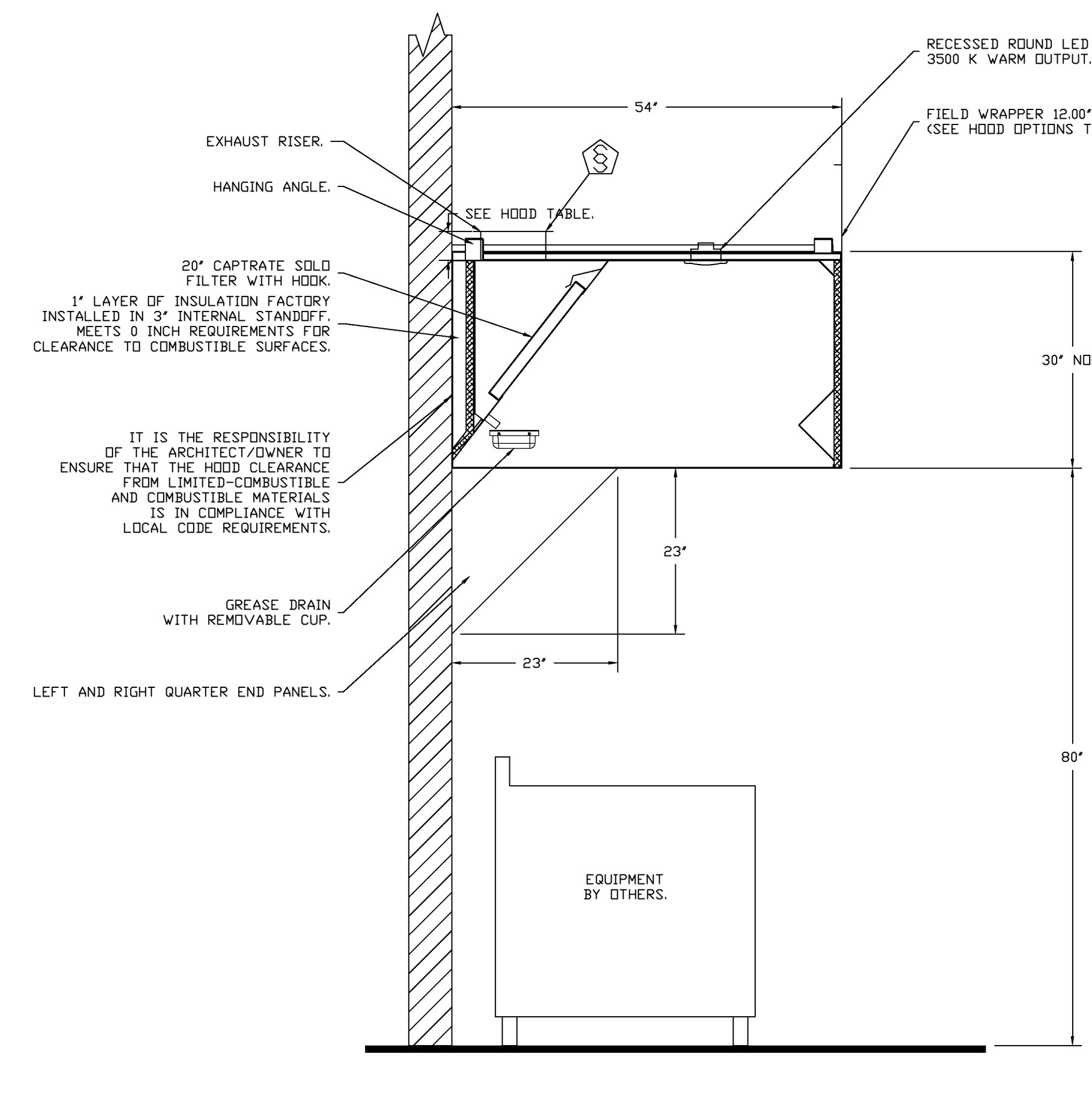
PLAN VIEW - HOOD #2 (Hood (Fryer))  
4' 11.00" LONG 5430ND-2

INSTALLER MUST CONFIRM HOOD IS INSTALLED SUCH  
THAT THE SPECIFIED WALL, ACTING AS AN END PANEL,  
IS MATED TIGHT TO THE CORRECT END OF HOOD TO  
ACHIEVE A REDUCED MINIMUM EXHAUST CFM LISTING.  
NON-COMPLIANCE WILL NULLIFY THE ETL LISTING.  
VOID THE MANUFACTURER'S WARRANTY, AND HOLD THE  
CONTRACTOR LIABLE FOR ANY AND ALL LOSSES, COSTS,  
AND EXPENSES RELATED TO THE NON-COMFORMANCE OF  
THE MANUFACTURER'S SPECIFIED INSTRUCTION THE  
WALL ACTING AS AN END PANEL MUST EXTEND NO LESS  
THAN 20" FROM THE INTERSECTING WALL ON WHICH HOOD  
IS MOUNTED AND MUST EXTEND NO LESS THAN 20" UNDER  
BOTTOM OF HOOD TO BE ELIGIBLE FOR REDUCED  
MINIMUM EXHAUST CFM LISTING.

Ⓛ Ⓜ DUPLEX OUTLET



SECTION VIEW - MODEL 5430ND-2  
HOOD - #1 (Hood (Grill))



SECTION VIEW - MODEL 5430ND-2  
HOOD - #2 (Hood (Fryer))

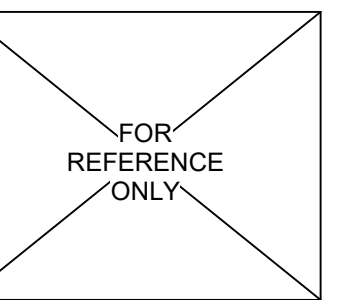
REVISIONS	
DESCRIPTION	DATE

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Shake Shack-1694 - Jenkintown, PA (Kitchen)

<b>DATE:</b> 12/23/2024
<b>DWG.#:</b> 7240964
<b>DRAWN BY:</b> Joe.shilba
<b>SCALE:</b> 3/4" = 1'-0"
<b>MASTER DRAWING</b>
<b>SHEET NO.</b> 2

Seal



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Project

**SHAKE SHACK**  
SHAKE SHACK #1694  
JENKINTOWN, PA

Project Number 24204  
Drawn By Author  
Checked By Checker  
Date 12 FEB 2025

Revisions  
2-12-2025 PERMIT SET

Drawing

CAPTIVEAIRE  
DRAWINGS

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**M-702**

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**FIRE SYSTEM INFORMATION - JOB#7240964**

FIRE SYSTEM NO	TAG	TYPE	SIZE	MAX FP	DESIGN FP	INSTALLATION	
						SYSTEM	LOCATION ON HOOD
1		TANK FS	4.0/4.0/4.0	60	46	FIRE CABINET LEFT	LEFT, HOOD 2

**GAS VALVE(S)**

FIRE SYSTEM NO	TAG	TYPE	SIZE	SUPPLIED BY
1		SC ELECTRICAL	1.000	CAPTIVEAIRE SYSTEMS

**NOTES**

- FIELD PIPE DROPS AS SHOWN
- PIPING, ELBOWS, TEES, AND NOZZLES SUPPLIED BY CAS.
- FIELD INSTALLED DROP: FACTORY WILL PROVIDE QTY 2 60IN LONG PIECES OF CHROME PLATED PIPING SHIPPED LOOSE TO BE FIELD-INSTALLED.
- SHIP LOOSE DROP: FACTORY WILL PROVIDE THE EXACT CHROME PIPE LENGTH NEEDED SHIPPED LOOSE TO BE FIELD-INSTALLED.
- RELOCATE NOZZLES IF FLOW PATTERN IS BLOCKED BY SHELVING, SALAMANDERS, ETC.
- OVERLAPPING COVERAGE SHALL NOT BE USED ON ANY APPLIANCE WITH AN OBSTRUCTION.
- IF APPLICABLE, EXTENDED PRE-PIPED DROPS ARE SHIPPED LOOSE.
- FACTORY PIPING EXTENDS A MAXIMUM OF 6' ABOVE THE TOP OF THE HOOD.

- APPLIANCE DIMENSIONS LISTED REPRESENT THE COOKING SURFACE SIZE, NOT THE OVERALL APPLIANCE SIZE.
- THIS FIRE SYSTEM COMPLIES WITH U.L. 300 REQUIREMENTS.
- QL-F NOZZLE PART NUMBER REPLACES 3070-3/8H-10-SS

JOB #: 7240964.  
JOB NAME: SHAKE SHACK-1694-JENKINTOWN,PA(KITCHEN).

SYSTEM SIZE: TANK-SP-3 DESIGN FP: 46, MAXIMUM FP: 60.  
HOOD # 1 7' 11.00" LONG x 54" WIDE x 30" HIGH.  
RISER # 1 SIZE: 10" x 11".  
HOOD # 1 METAL BLOW-OFF CAPS INCLUDED.  
HOOD # 2 4' 11.00" LONG x 54" WIDE x 30" HIGH.  
RISER # 1 SIZE: 9" x 9".  
HOOD # 2 METAL BLOW-OFF CAPS INCLUDED.

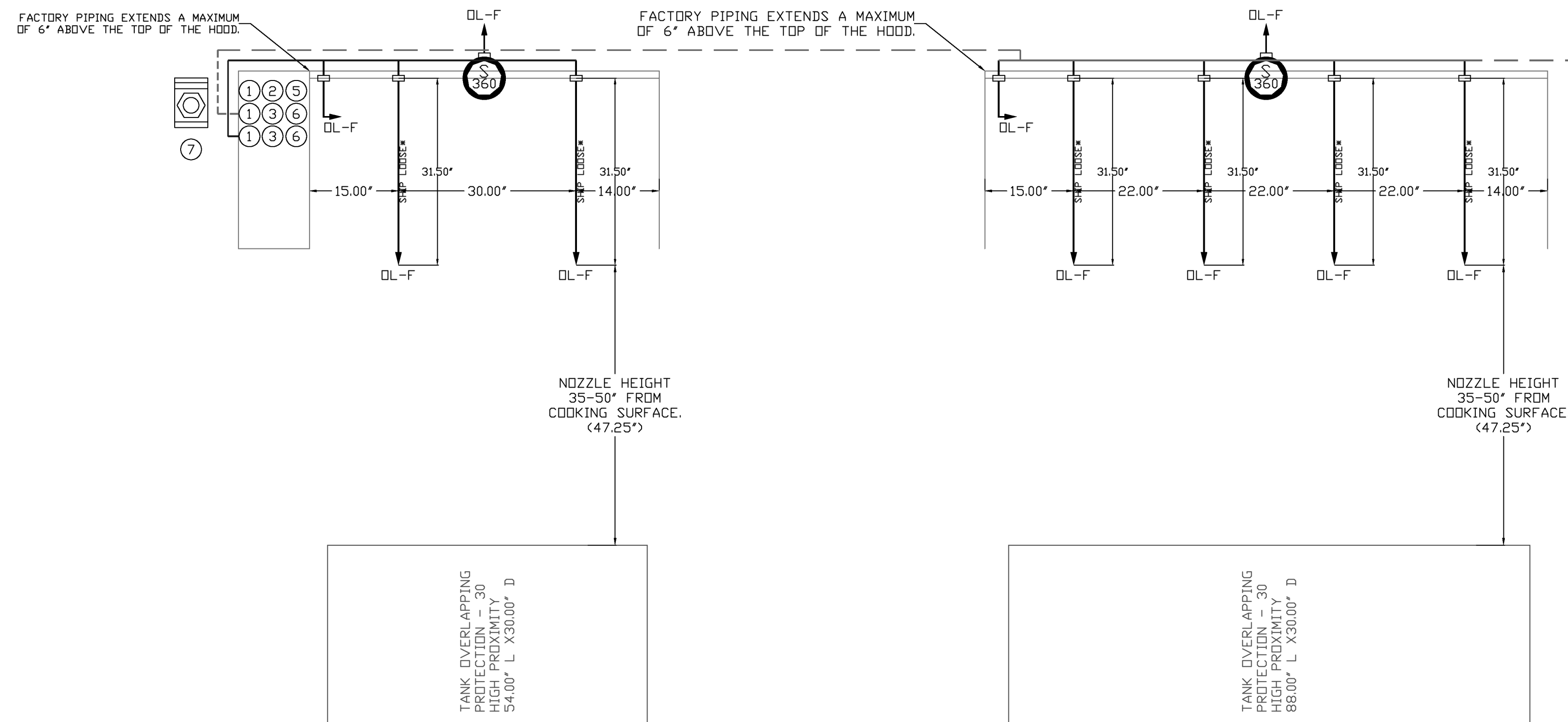
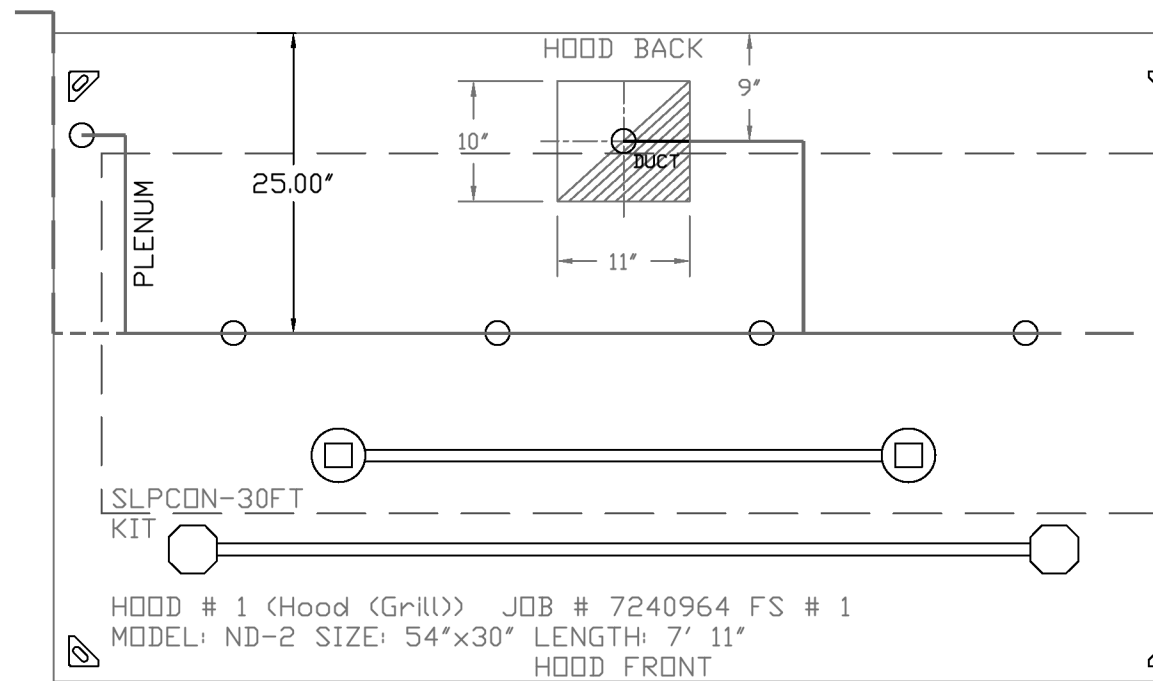
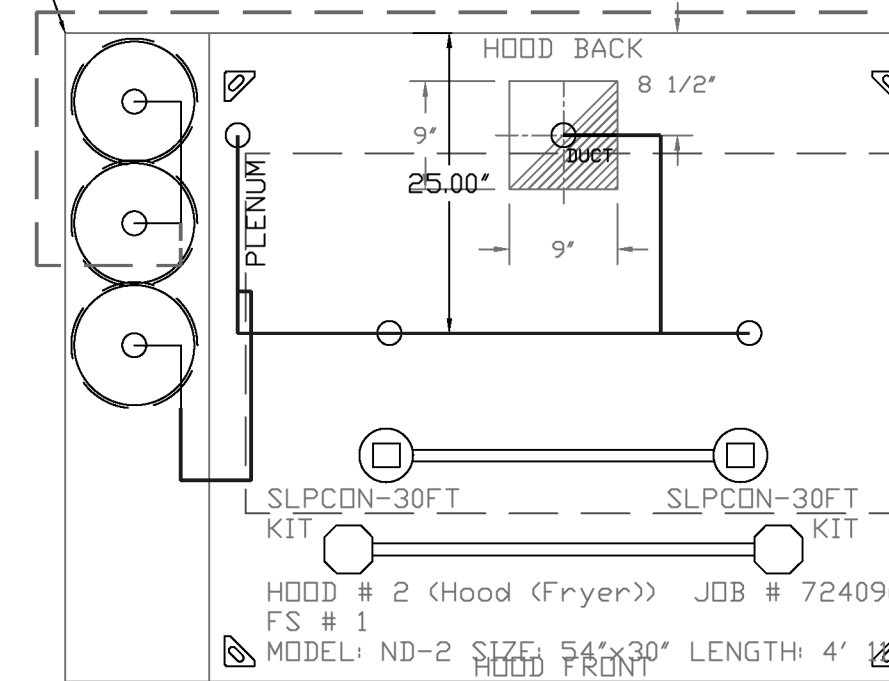
- HEAVY-DUTY APPLIANCES (RATED 600°F) WILL REQUIRE AN ADDITIONAL DOWNSTREAM FIRESTAT IN THE EVENT THAT THE DUCTWORK CONTAINS ANY HORIZONTAL RUNS OVER 25 FT IN LENGTH.
- MEDIUM TO LIGHT-DUTY APPLIANCES (RATED 450°F) WILL NOT REQUIRE ANY ADDITIONAL DOWNSTREAM DETECTION.

AGENT DISTRIBUTION PIPING LIMITATIONS	
PIPE SECTION	MAX PIPE LENGTH (FT)
MAX SUPPLY LINE TO FIRST OVERLAPPING NOZZLE	42
OVERLAPPING NOZZLE APPLIANCE BRANCH	10
DEDICATED NOZZLE APPLIANCE BRANCH	10

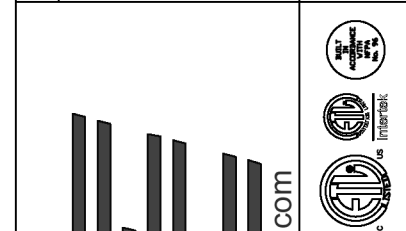
**LEGEND - FIRE CABINET TANK SYSTEM**

- 4 GALLON TANK.
- PRIMARY ACTUATOR RELEASE.
- SECONDARY ACTUATOR RELEASE.
- PRESSURE SUPERVISION SWITCH.
- PRIMARY HOSE ASSEMBLY.
- SECONDARY HOSE ASSEMBLY.
- REMOTE MANUAL ACTUATION DEVICE.

- SYSTEM REQUIRES A MINIMUM OF 7 FT OF EQUIVALENT PIPE LENGTH BETWEEN TANK AND NEAREST APPLIANCE NOZZLE FOR MOST APPLIANCES. EACH 90 DEGREE ELBOW ADDS 1.3 FT OF EQUIVALENT LENGTH. SEE MANUAL FOR DETAILS



REVISIONS	
DESCRIPTION	DATE

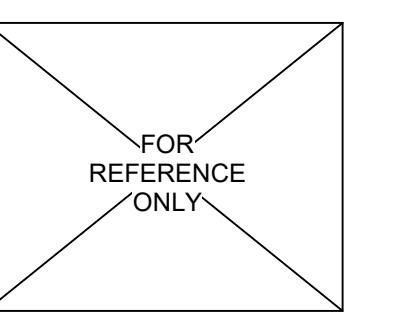


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<b>SHEET NO.</b> 3

Seal



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Project

**SHAKE SHACK**

SHAKE SHACK #1694  
JENKINTOWN, PA

Project Number 24204  
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**EXHAUST FAN INFORMATION - JOB#7240964**

FAN UNIT NO	TAG	QTY	FAN UNIT MODEL #	MANUFACTURER	CFM	ESP	RPM	MOTOR ENCL	HP	BHP	PHASE	VOLT	FLA	DISCHARGE VELOCITY	WEIGHT (LBS)	SDNES
1	KEF<GRILL>	1	DUBSHFA	CAPTIVEAIRE	1188	1.500	1424	TEAD-ECM	0.750	0.4970	1	208	5.2	376 FPM	90	12.7
2	KEF<FRYER>	1	DUBSHFA	CAPTIVEAIRE	860	1.500	1354	TEAD-ECM	0.750	0.4270	1	208	5.2	272 FPM	90	11.4

**FAN OPTIONS**

FAN UNIT NO	TAG	QTY	DESCRIPTION
1	KEF<GRILL>	1	GREASE BOX
		1	FAN BASE CERAMIC SEAL - DU/DRB5HFA - INSTALLED AT PLANT - FOR GREASE DUCTS
		1	ECM WIRING PACKAGE - EXHAUST - MODBUS CONTROL -MSC- (TELCD), CCW ROTATION
		1	2 YEAR PARTS WARRANTY
2	KEF<FRYER>	1	GREASE BOX
		1	ECM WIRING PACKAGE - EXHAUST - MODBUS CONTROL -MSC- (TELCD), CCW ROTATION
		1	FAN BASE CERAMIC SEAL - DU/DRB5HFA - INSTALLED AT PLANT - FOR GREASE DUCTS
		1	2 YEAR PARTS WARRANTY

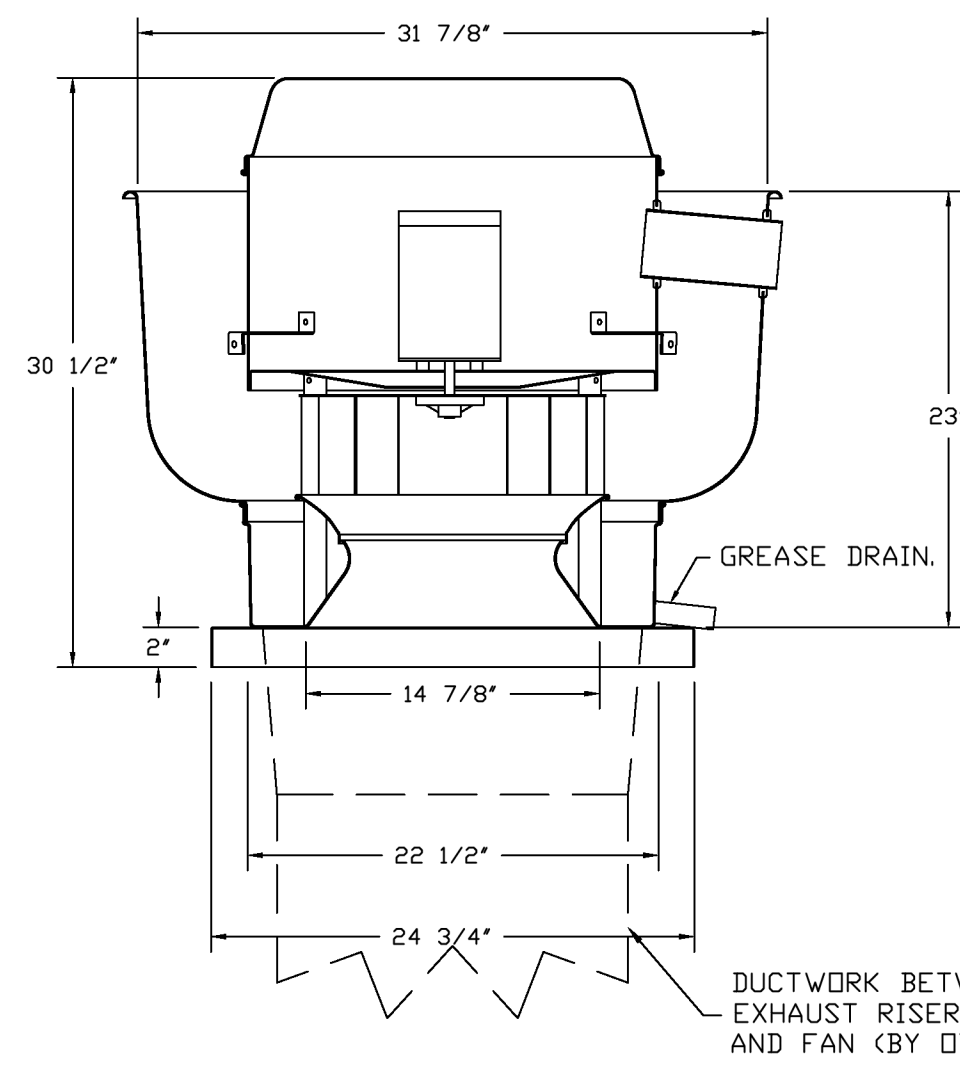
**FAN ACCESSORIES**

FAN UNIT NO	TAG	EXHAUST				SUPPLY		
		GREASE CUP	GRAVITY DAMPER	WALL MOUNT	SIDE DISCHARGE	GRAVITY DAMPER	MOTORIZED DAMPER	WALL MOUNT
1	KEF<GRILL>	YES						
2	KEF<FRYER>	YES						

**CURB ASSEMBLIES**

NO	ON FAN	TAG	WEIGHT	ITEM	SIZE
1	# 1	KEF-1	36 LBS	CURB	23.000"W X 23.000"L X 20.000"H HINGED.
2	# 2	KEF<FRYER>	36 LBS	CURB	23.000"W X 23.000"L X 20.000"H HINGED.

**FANS #1 (KEF<GRILL>), #2 (KEF<FRYER>) - DUBSHFA EXHAUST FAN**



TOP VIEW

**FEATURES:**

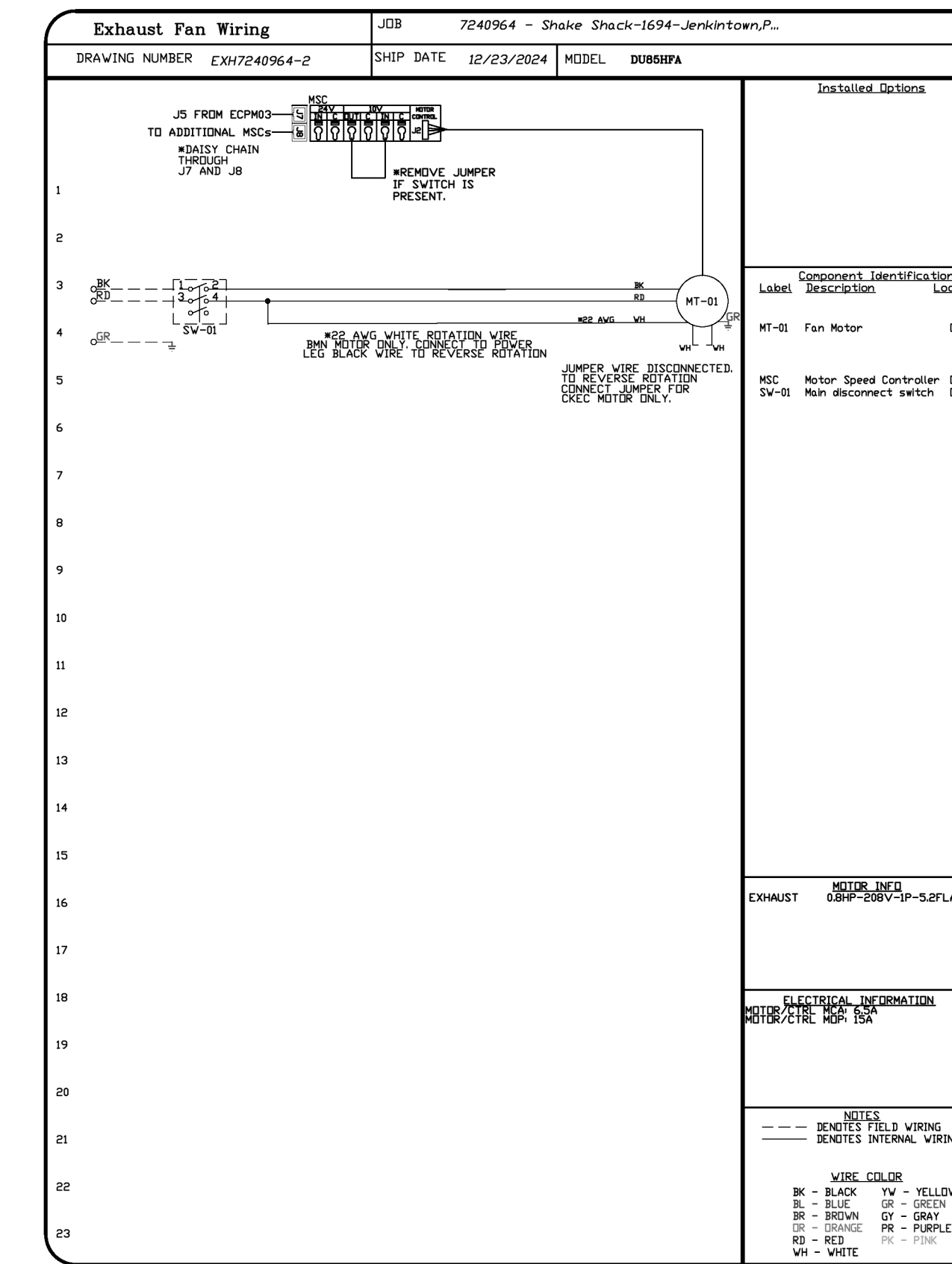
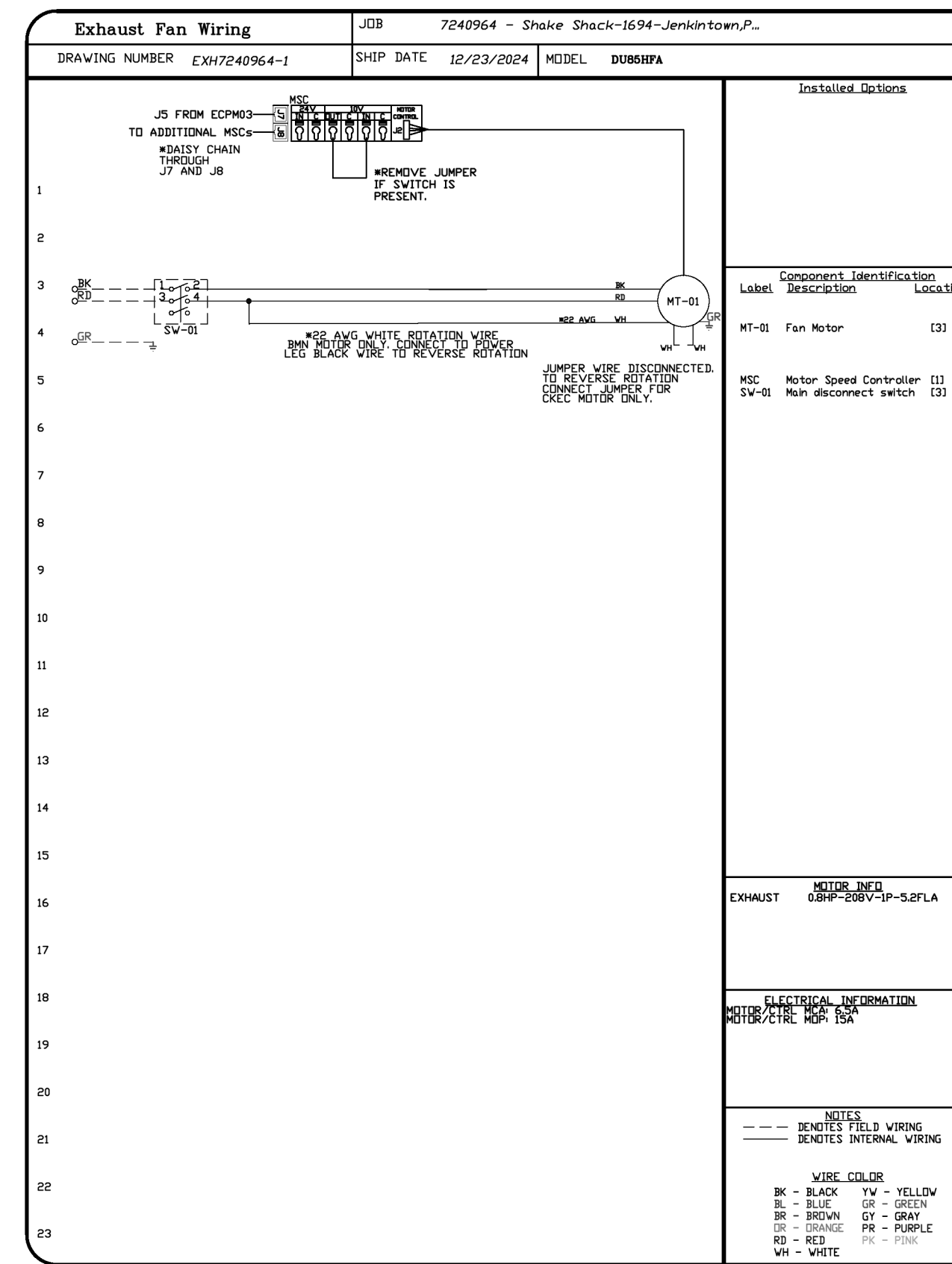
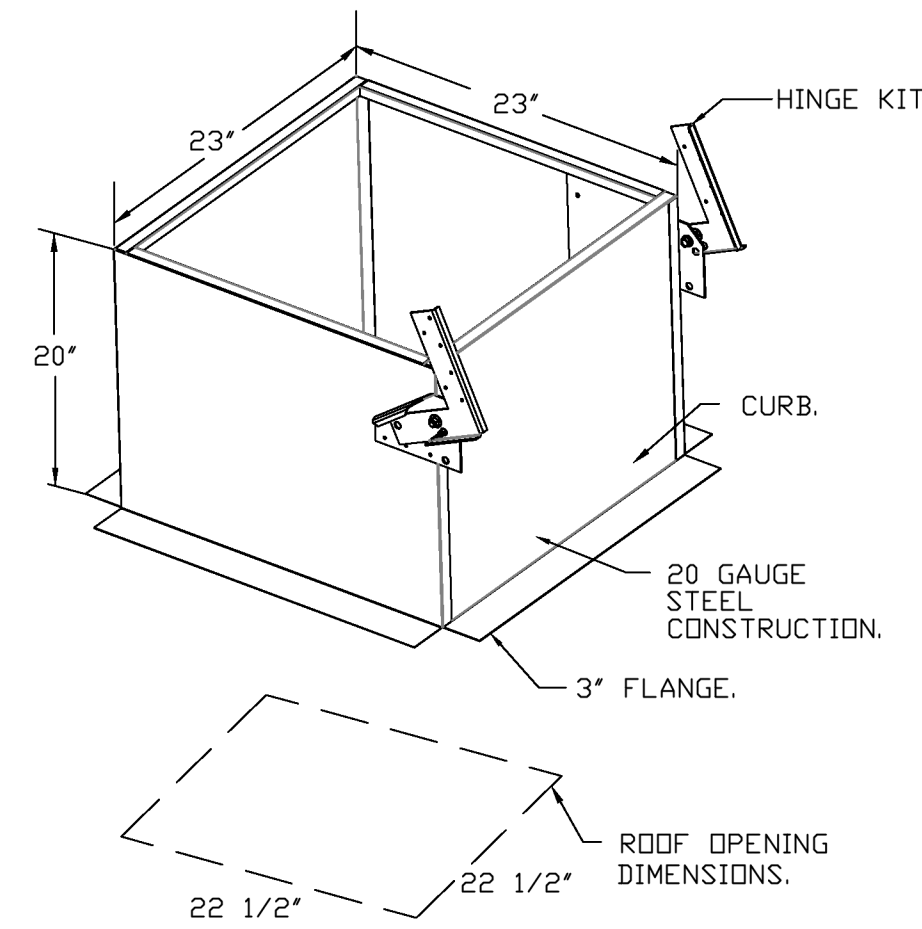
- DIRECT DRIVE CONSTRUCTION (NO BELTS/PULLEYS).
- ROOF MOUNTED FANS.
- RESTAURANT MODEL.
- UL705 AND UL762 AND ULC-S645
- VARIABLE SPEED CONTROL.
- INTERNAL WIRING.
- THERMAL OVERLOAD PROTECTION (SINGLE PHASE).
- HIGH HEAT OPERATION 300°F (149°C).
- GREASE CLASSIFICATION TESTING.
- NEMA 3R SAFETY DISCONNECT SWITCH.

**NORMAL TEMPERATURE TEST**  
EXHAUST FAN MUST OPERATE CONTINUOUSLY WHILE EXHAUSTING AIR AT 300°F (149°C) UNTIL ALL FAN PARTS HAVE REACHED THERMAL EQUILIBRIUM, AND WITHOUT ANY DETERIORATING EFFECTS TO THE FAN WHICH WOULD CAUSE UNSAFE OPERATION.

**ABNORMAL FLARE-UP TEST**  
EXHAUST FAN MUST OPERATE CONTINUOUSLY WHILE EXHAUSTING BURNING GREASE VAPORS AT 600°F (316°C) FOR A PERIOD OF 15 MINUTES WITHOUT THE FAN BECOMING DAMAGED TO ANY EXTENT THAT COULD CAUSE AN UNSAFE CONDITION.

**OPTIONS**

- GREASE BOX.
- FAN BASE CERAMIC SEAL - DU/DRB5HFA - INSTALLED AT PLANT - FOR GREASE DUCTS.
- ECM WIRING PACKAGE - EXHAUST - MODBUS CONTROL -MSC- (TELCD), CCW ROTATION.
- 2 YEAR PARTS WARRANTY.

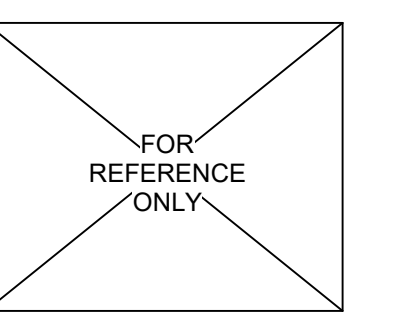


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DESCRIPTION	DATE

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<b>SHEET NO.</b> 4

Seal



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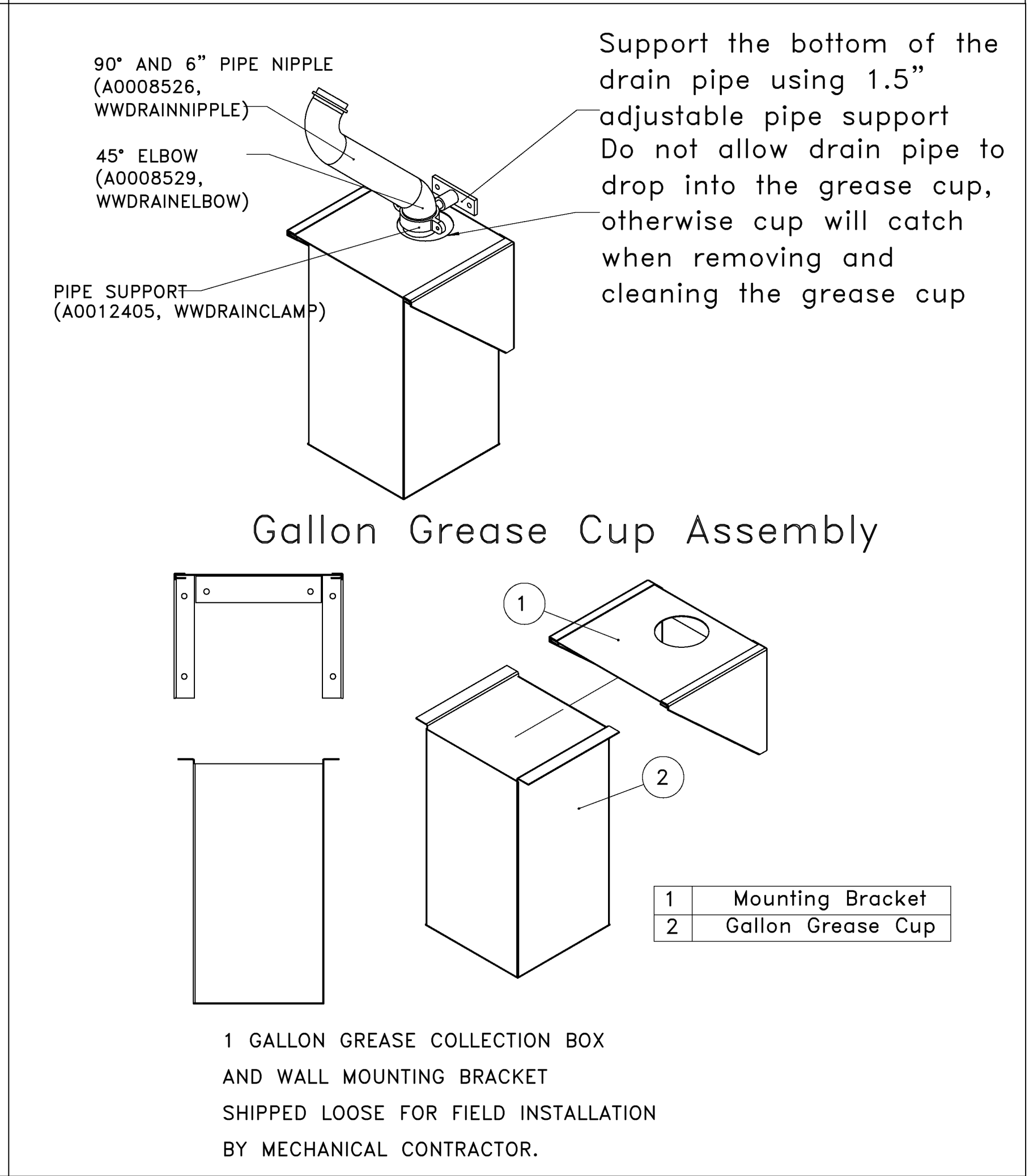
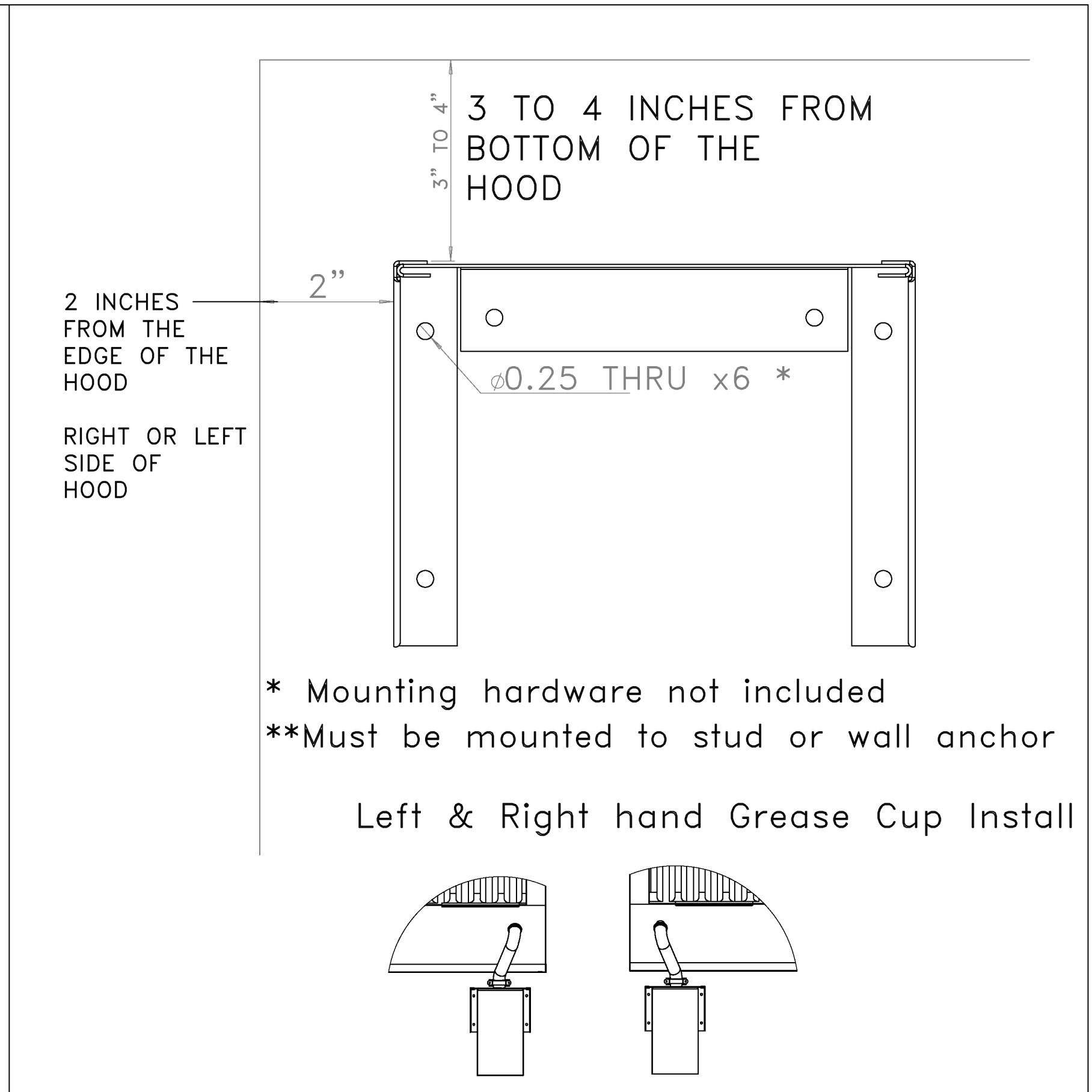
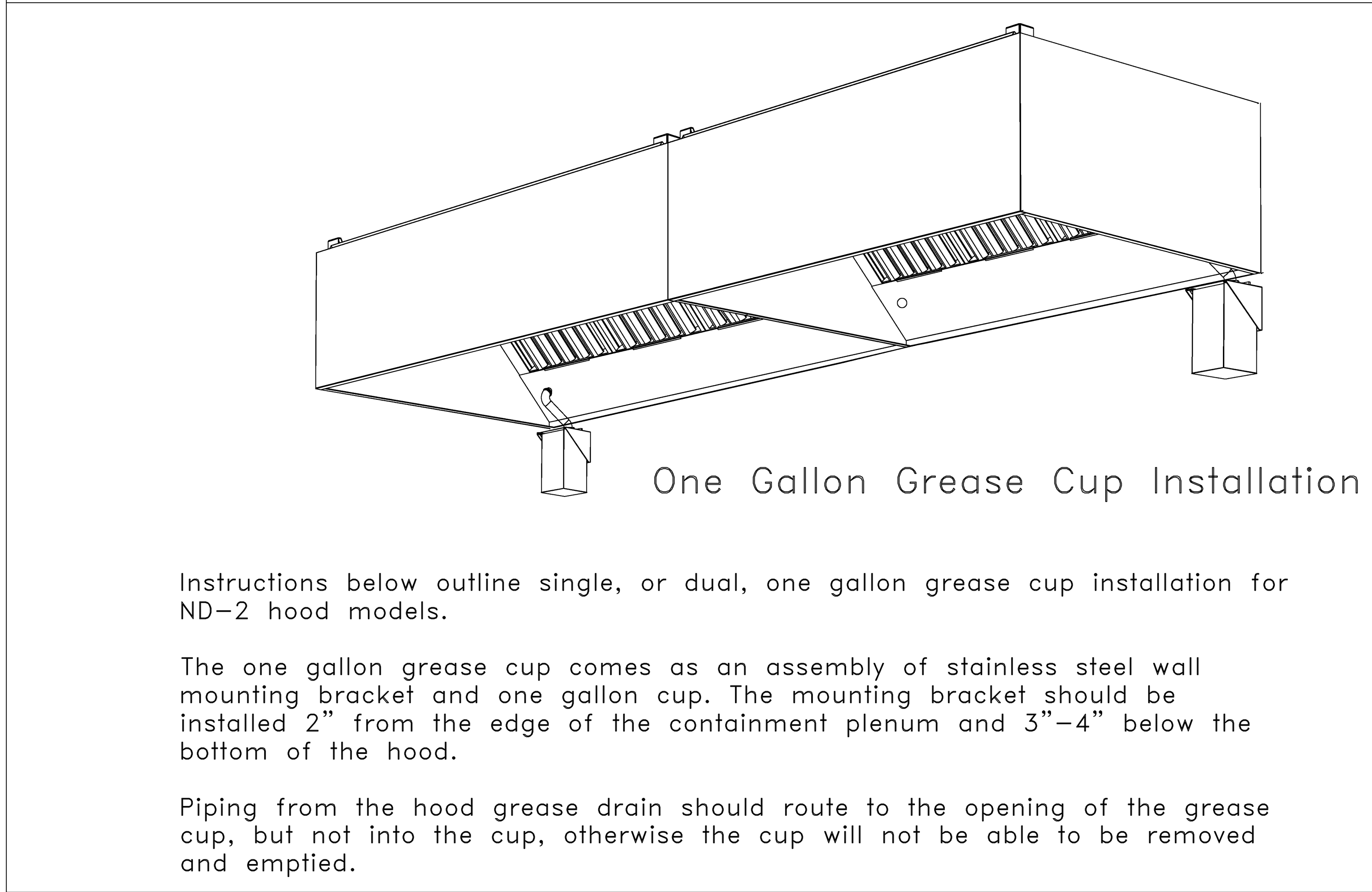
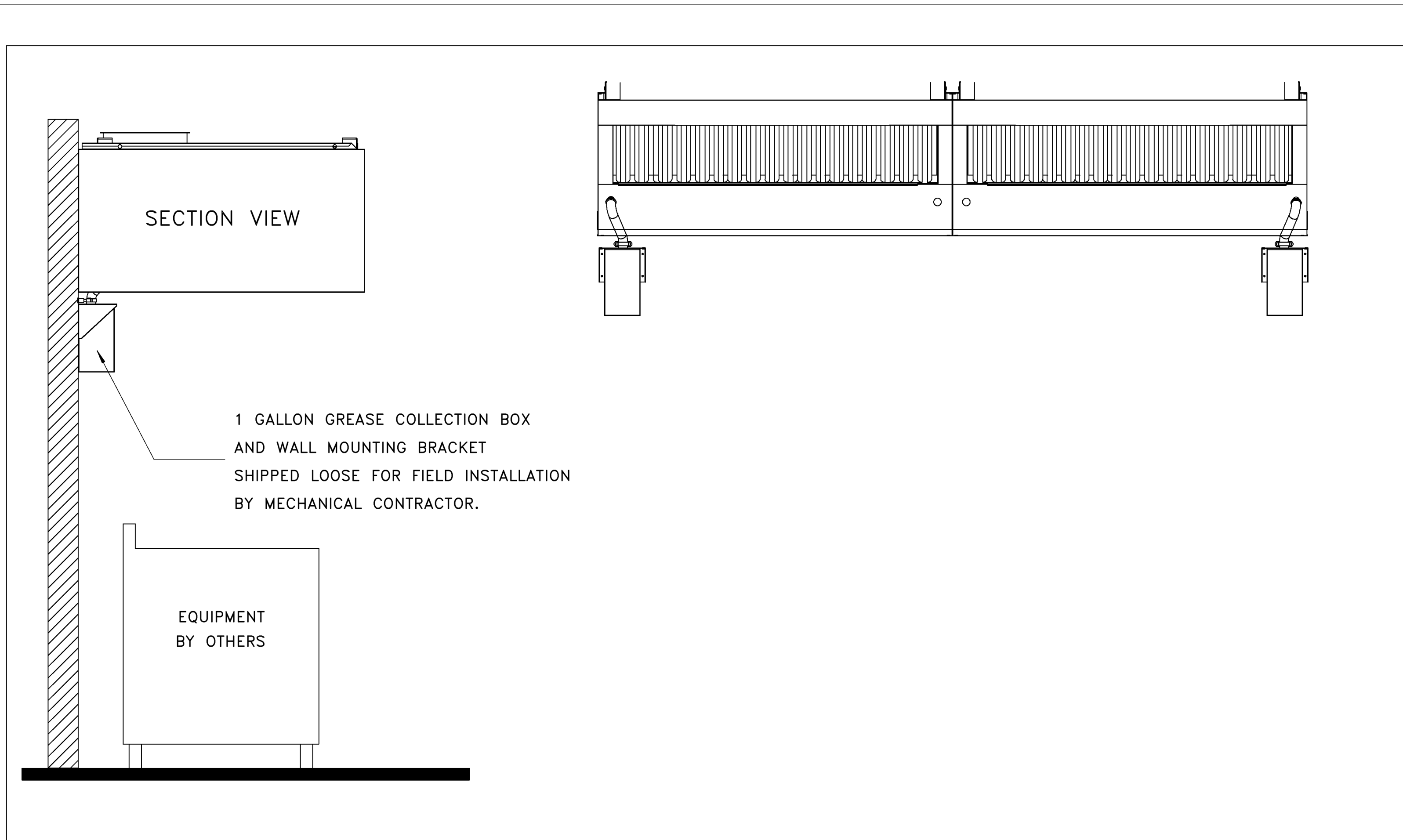
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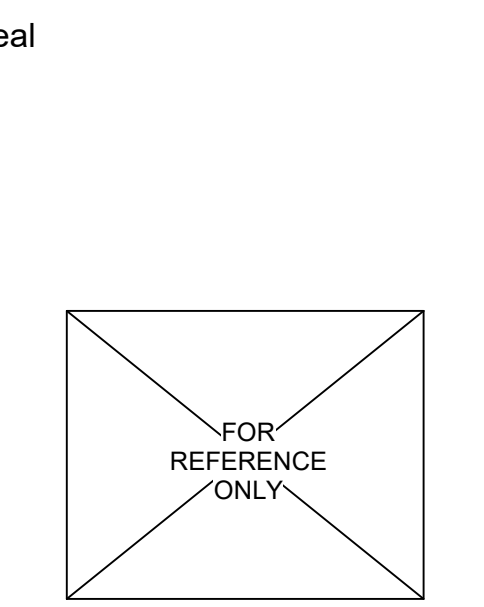


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**SCALE:** 3/4" = 1'-0"  
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**SHAKE SHACK**  
SHAKE SHACK #1694  
JENKINTOWN, PA

Project Number: 24204  
 Drawn By: Author  
 Checked By: Checker  
 Date: 12 FEB 2025

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**CAPTIVEAIRE DRAWINGS**

**M-706**

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DOAS/RTU FAN SCHEDULE - JOB#7240959										ELECTRICAL INFORMATION										COOLING INFORMATION										REHEAT INFORMATION										GAS HEAT INFORMATION										ABL MINIMUM ROOM VOLUME			NOTES
FAN UNIT NO	TAG	QTY	DOAS/RTU MODEL #	MANUFACTURER	BLOWER	RETURN AIR CFM	MAX OUTSIDE AIR CFM	TOTAL CFM	WEIGHT (LBS)	ESP	HP	PHASE	VOLT	MCA	MICP	OUTSIDE AIR DB	MIXED AIR WB	LEAVING AIR DB	WB	DP	TOTAL CAPACITY	SENS.	IEER	ISHRE	DISCHARGE DB	WB	DESIRED	CAPACITY MAX	MOISTURE REMOVAL RATE	GAS TYPE	INPUT BTUs	OUTPUT BTUs	TEMP RISE	REQUIRED INPUT GAS PRESSURE	ROOM AREA (FT <sup>2</sup> )	AIRFLOW (CFM)	HEIGHT (FT)																
1	RTU-1	1	CAS-HVAC2-1200-1B-13T	CAPTIVEAIRE	18MF-2-RTU	2600	1000	3600	2197	0.800	5.00	3	208	85.7A	100A	93.3°F	75.0°F	80.1°F	66.3°F	52.2°F	51.6°F	51.2°F	155.5 MBH	109.4 MBH	13.9	5.5	75.0°F	62.5°F	92.5 MBH	103.2 MBH	41.6 LBS/HR	NATURAL	158462	128354	32°F	7 IN. W.C. - 14 IN. V.C.	440.6	793	7.2	1,2,3,4,5,6,7,8,9,10,11,12,13,14,15,16,17,18,19													
2	RTU-2	1	CAS-HVAC3-1250-24-15T	CAPTIVEAIRE	24MF-3-RTU	2600	1600	4200	2693	0.800	5.00	3	208	75.2A	90A	93.3°F	75.0°F	82.0°F	67.7°F	51.6°F	51.5°F	203.8 MBH	138.8 MBH	18.8	5.7	75.0°F	62.5°F	109.7 MBH	129.6 MBH	57.5 LBS/HR	NATURAL	219560	177844	38°F	7 IN. W.C. - 14 IN. V.C.	587.4	1057	7.2	1,2,3,4,5,6,7,8,9,10,11,12,13,14,15,16,17,18,19														

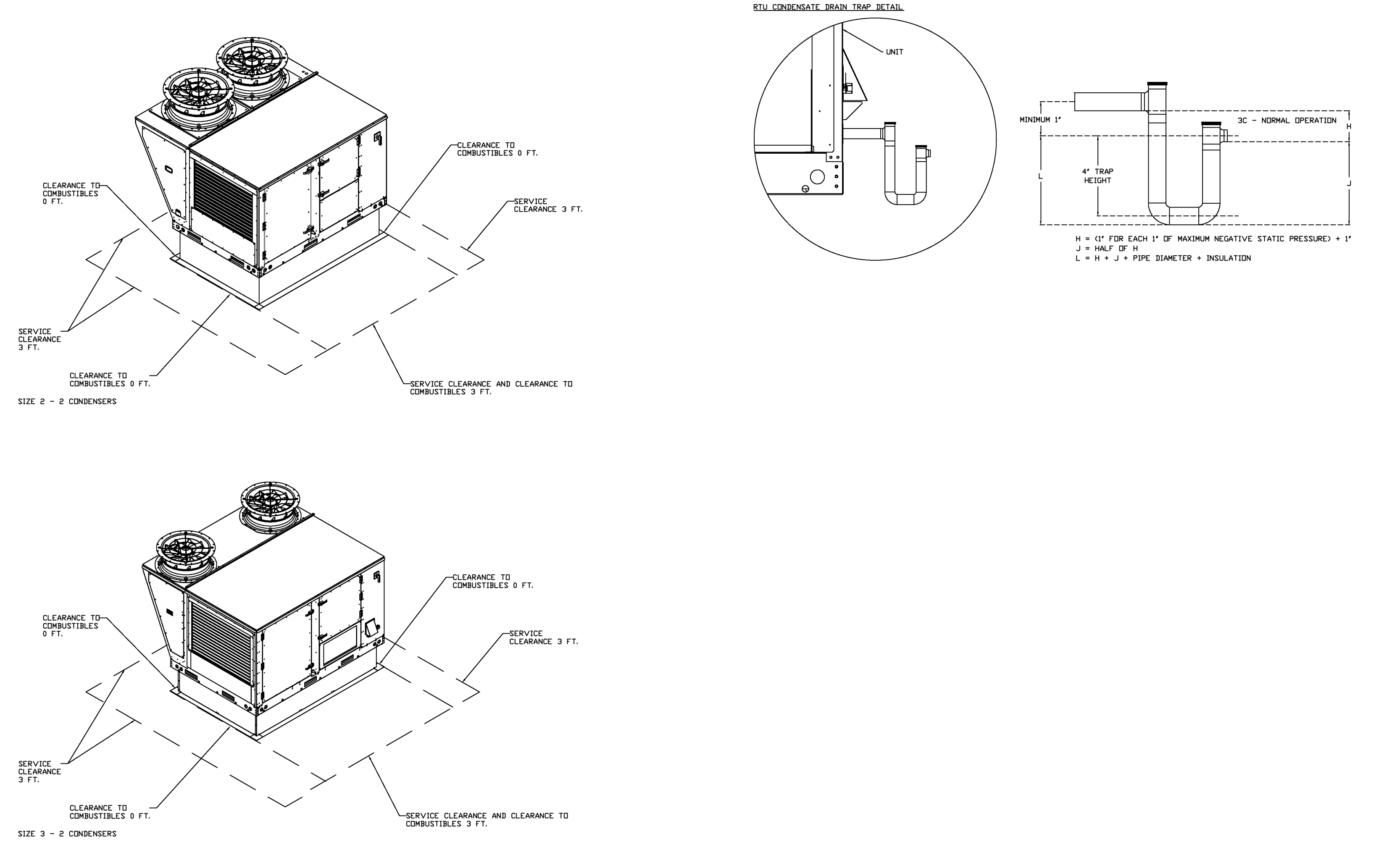
**NOTES:**  
 1. INVERTER SCROLL COMPRESSOR WITH INTEGRATED OIL SENSOR. DIGITAL OR STAGED SCROLL NOT AN APPROVED EQUAL.  
 2. DIRECT DRIVE, FLUXM BLUVER. BELT DRIVEN BLOWERS ARE NOT ACCEPTABLE.  
 3. INTEGRATED MONITORING VIA CELLULAR CONNECTION BY MANUFACTURER.  
 4. REFRIGERATION PRESSURE MONITORING ON HIGH AND LOW PRESSURE SIDE OF SYSTEM INCLUDED THROUGH DIGITAL INTERFACE.  
 5. ECM MOTOR CONDENSING FANS.  
 6. ELECTRONIC EXPANSION VALVE. TXV NOT ACCEPTABLE.  
 7. SUCTION LINE ACCUMULATOR.  
 8. FACTORY COMMISSIONING WITH 5 YEAR PARTS WARRANTY, 25 YEAR WARRANTY ON STAINLESS STEEL HEAT EXCHANGER.  
 9. AVERAGING INTAKE, EVAP AND DISCHARGE TEMPERATURE SENSORS. DISCHARGE SENSOR TO BE FACTORY MOUNTED WITHIN UNIT.  
 10. 6" EXTERIOR DUAL-WALL CONSTRUCTION W/ R-13 INSULATION-MINIMUM 60GA EXTERIOR W/ 1/4" ADA BASE.  
 11. SIX EFFICIENT FURNACE, WITH MODULATING INDUCER TO MAINTAIN CONSTANT COMBUSTION EFFICIENCY ACROSS FIRING RANGE. 61 TURNDOWN WITH NG AND 5:1 TURNDOWN WITH LP.  
 12. SUPPLY CFM MONITORING INTEGRAL TO UNIT WITH CFM MEASUREMENT INCLUDED THROUGH DIGITAL INTERFACE.  
 13. FULLY MODULATING HDT GAS REHEAT.  
 14. IS SEQUENCE LOW AMBIENT DAMPER.  
 15. HAIL GUARD FOR CONDENSING COIL.  
 16. RTU CONDENSER WITH DIFFERENTIAL ENTHALPY CONTROL.  
 17. BAROMETRIC RELIEF DAMPER.  
 18. DOWN DISCHARGE/DOWN RETURN.  
 19. MINIMUM ROOM AREA ASSUMED 7.2'. SUPPLY DIFFUSER HEIGHT AND IS CALCULATED PER UL60335-2-40 4TH ED. VALUES BASED ON FACTORY CHARGE. ACTUAL SITE CHARGE MAY DIFFER.

FOR QUESTIONS, CALL THE Eastern PA Mechanical REGION 108  
 PHONE: (610) 304 - 4126  
 EMAIL: regi108@captiveaire.com

FAN UNIT NO	TAG	QTY	DESCRIPTION
1	RTU-1	1	INLET PRESSURE GAUGE, 0-35"
		1	MANIFOLD PRESSURE GAUGE, 0 TO 10" WC, 1 FURNACE
		1	SHIP LODGE GAS STRAINER 3/4"
		1	SINGLE POINT ELECTRICAL CONNECTION FOR RTU, 750VA TRANSFORMER USED. IF A NON-DCV PREVIRE CONTROLS THIS UNIT, THE BOB #47, "MAY" OR "CEP" PREVIRE OPTION MUST BE SELECTED. DOES NOT PROVIDE SUPPLY STARTER IN PREVIRE.
		1	CASLINK BUILDING MONITORING SYSTEM - INTERNET OR CELLULAR CONNECTION REQUIRED
		1	RTU BLOWER DOOR SWITCH
		1	RTU2 DOWN DISCHARGE
		1	2" MERV 13 FILTERS FOR RTU2 (QTY. 4)
		1	2" MERV 8 FILTERS FOR RTU2 (QTY. 4)
		1	OVERHEAT STAT
		1	TOTAL CFM MONITORING
		1	VFD FACTORY MOUNTED AND WIRED IN RTU COMMERCIAL CONTROL VESTIBULE
		1	15 TON MODULATING COOLING OPTION, 208/230V, R454B REFRIGERANT, VARIABLE SPEED COMPRESSOR, ECM CONDENSING FANS
		1	R454B LEAK DETECTOR OPTION FOR RTUS
		1	OCCUPIED SCHEDULING
2	RTU-2	1	INLET PRESSURE GAUGE, 0-35"
		1	MANIFOLD PRESSURE GAUGE, 0 TO 10" WC, 1 FURNACE
		1	SHIP LODGE GAS STRAINER 1"
		1	SINGLE POINT ELECTRICAL CONNECTION FOR RTU, 750VA TRANSFORMER USED. IF A NON-DCV PREVIRE CONTROLS THIS UNIT, THE BOB #47, "MAY" OR "CEP" PREVIRE OPTION MUST BE SELECTED. DOES NOT PROVIDE SUPPLY STARTER IN PREVIRE.
		1	CASLINK BUILDING MONITORING SYSTEM - INTERNET OR CELLULAR CONNECTION REQUIRED
		1	CONSTRUCTION MODE - MODIFIES START-UP SETTINGS TO ALLOW TEMPERING A BUILDING STILL UNDER CONSTRUCTION
		1	RTU BLOWER DOOR SWITCH
		1	RTU2 DOWN DISCHARGE
		1	2" MERV 13 FILTERS FOR RTU2 (QTY. 4)
		1	2" MERV 8 FILTERS FOR RTU2 (QTY. 4)
		1	OVERHEAT STAT
		1	TOTAL CFM MONITORING
		1	VFD FACTORY MOUNTED AND WIRED IN RTU COMMERCIAL CONTROL VESTIBULE
		1	15 TON MODULATING COOLING OPTION, 208/230V, R454B REFRIGERANT, VARIABLE SPEED COMPRESSOR, ECM CONDENSING FANS
		1	R454B LEAK DETECTOR OPTION FOR RTUS
1	OCCUPIED SCHEDULING		
1	INLET FIRESTAT SET TO 135°F		
1	FREEZE STAT		
1	DISCHARGE FIRESTAT SET TO 240°F		
1	15 TON MODULATING REHEAT OPTION - SPACE DEWPOINT CONTROL - R454B		
1	RTU3 CURB DUCT HANGER		
1	120V FIRE INPUT		
1	LOW AMBIENT COOLING OPERATION - DOWN TO OF AMBIENT		
1	CLOGGED FILTER SWITCH - NOTIFICATION ON HMI		
1	RTU3 CONVENIENCE OUTLET (GFCI), 15 AMP - REQUIRES SEPARATE 120V CONNECTION. INCLUDES RECEPTACLE, COVER AND J-BOX		
1	RTU3 ECONOMIZER - DIFFERENTIAL ENTHALPY CONTROL		
1	RTU3 ECONOMIZER BAROMETRIC RELIEF		
1	RTU INTAKE/RETURN DAMPER - MANUAL CONTROL, VIA HMI		
1	RTU3 HAIL GUARD		
1	RTU3 DOWN RETURN		
1	VAV PACKAGE W/ MANUAL/DDC CONTROL (S71 VFD INCLUDED)		
1	LOAD REACTOR MOUNTED IN FAN		
1	5 YEAR ENTIRE UNIT PARTS WARRANTY, 10 YEAR ENTIRE UNIT PARTS WARRANTY WITH REMOTE MONITORING AND CAPTIVEAIRE SERVICE CONTRACT, 25 YEAR STAINLESS STEEL FURNACE PARTS WARRANTY (SEE ADDITIONAL DETAILS)		
1	EXTERIOR GAS CONNECTION PROVIDED BY FACTORY WITH QUICK SEAL AND ANTI-ROTATION BRACKET		

NO	DN	TAG	WEIGHT	ITEM	SIZE
1	# 1	RTU-1	90 LBS	CURB	49.500"W X 75.000"L X 14.000"H INSULATED
2	# 2	RTU-2	173 LBS	CURB	59.500"W X 91.000"L X 14.000"H INSULATED 16 GAUGE

UNIT NUMBER	HMI #	HMI LOCATION	TEMP AVERAGING	MODBUS ADDRESS
FAN #1	HMI #1 - UNIT	IN UNIT	NOT AVERAGED	55
FAN #1	HMI #2 - SPACE	DINING ROOM	AVERAGED	56
FAN #1	HMI #3 - SPACE	MANAGERS OFFICE	NOT AVERAGED	57
FAN #2	HMI #1 - UNIT	IN UNIT	NOT AVERAGED	55
FAN #2	HMI #2 - SPACE	KITCHEN	AVERAGED	56
FAN #2	HMI #3 - SPACE	MANAGERS OFFICE	NOT AVERAGED	57



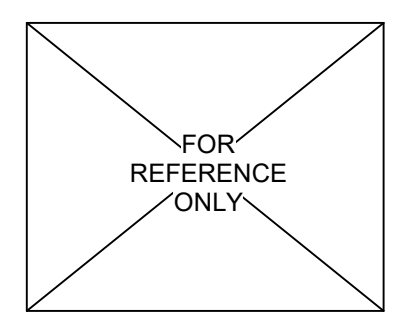
REVISIONS	DESCRIPTION	DATE

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 Eastern PA Mechanical  
 225 E. City Line Avenue, Suite #103, Blue Bell, PA, 19004  
 PHONE: (610) 304-4126  
 EMAIL: regi108@captiveaire.com

Snake Shack-1694-Jenkintown, PA(HVAC)  
 JENKINTOWN, PA, 19046

<b>DATE:</b>	12/23/2024
<b>DWG.#:</b>	7240959
<b>DRAWN BY:</b>	Joe Shilka
<b>SCALE:</b>	1/2" = 1'-0"
<b>MASTER DRAWING</b>	
<b>SHEET NO.</b>	1

Seal



**DP3 ARCHITECTS**  
 DP3 Architects, Ltd.  
 15 South Main Street, Suite 400  
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 www.DP3architects.com

Project

**SHAKE SHACK**  
 SHAKE SHACK #1694  
 JENKINTOWN, PA

Project Number	24204
Drawn By	Author
Checked By	Checker
Date	12 FEB 2025

Revisions	2-12-2025	PERMIT SET
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Drawing

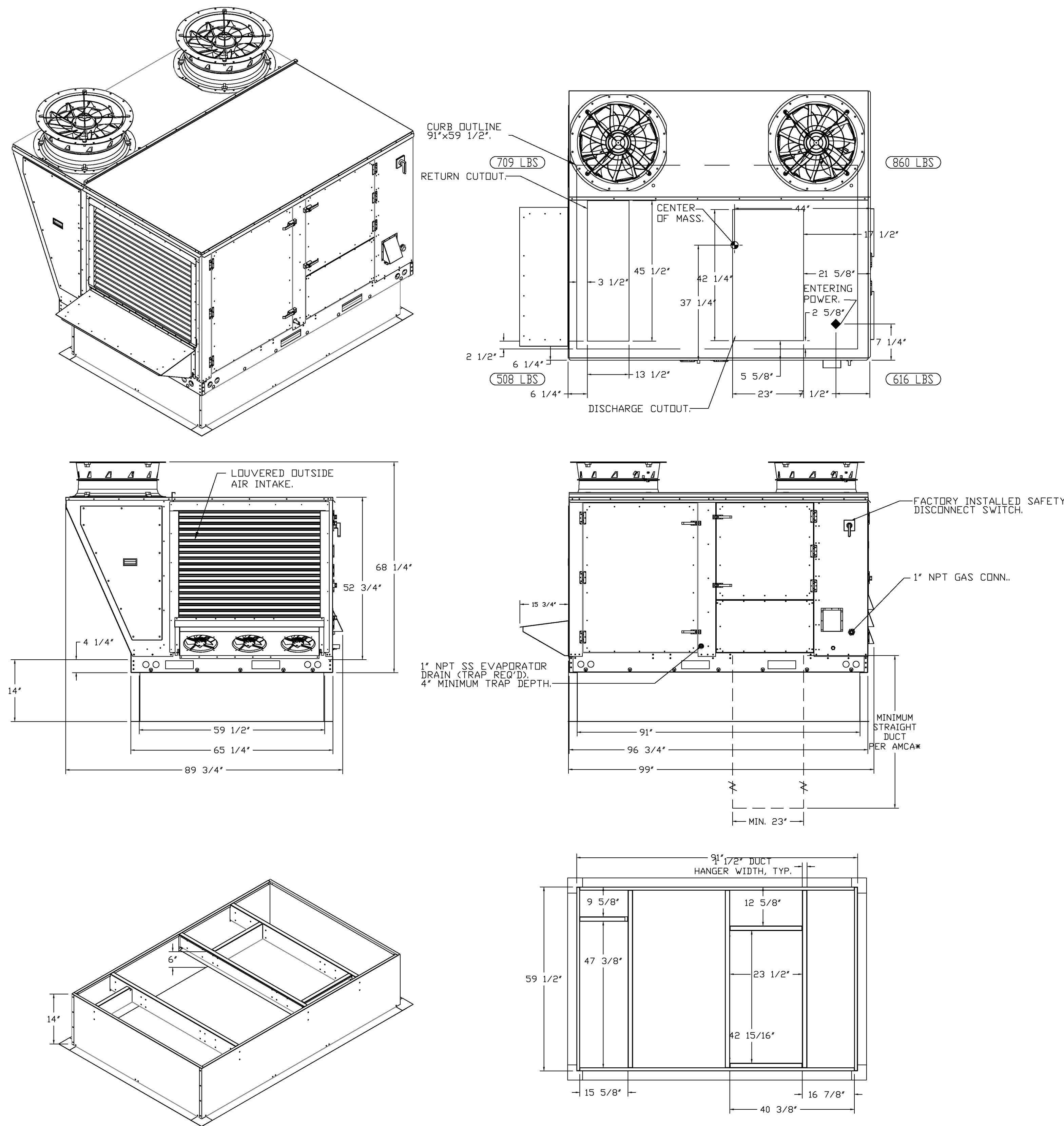
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M-707

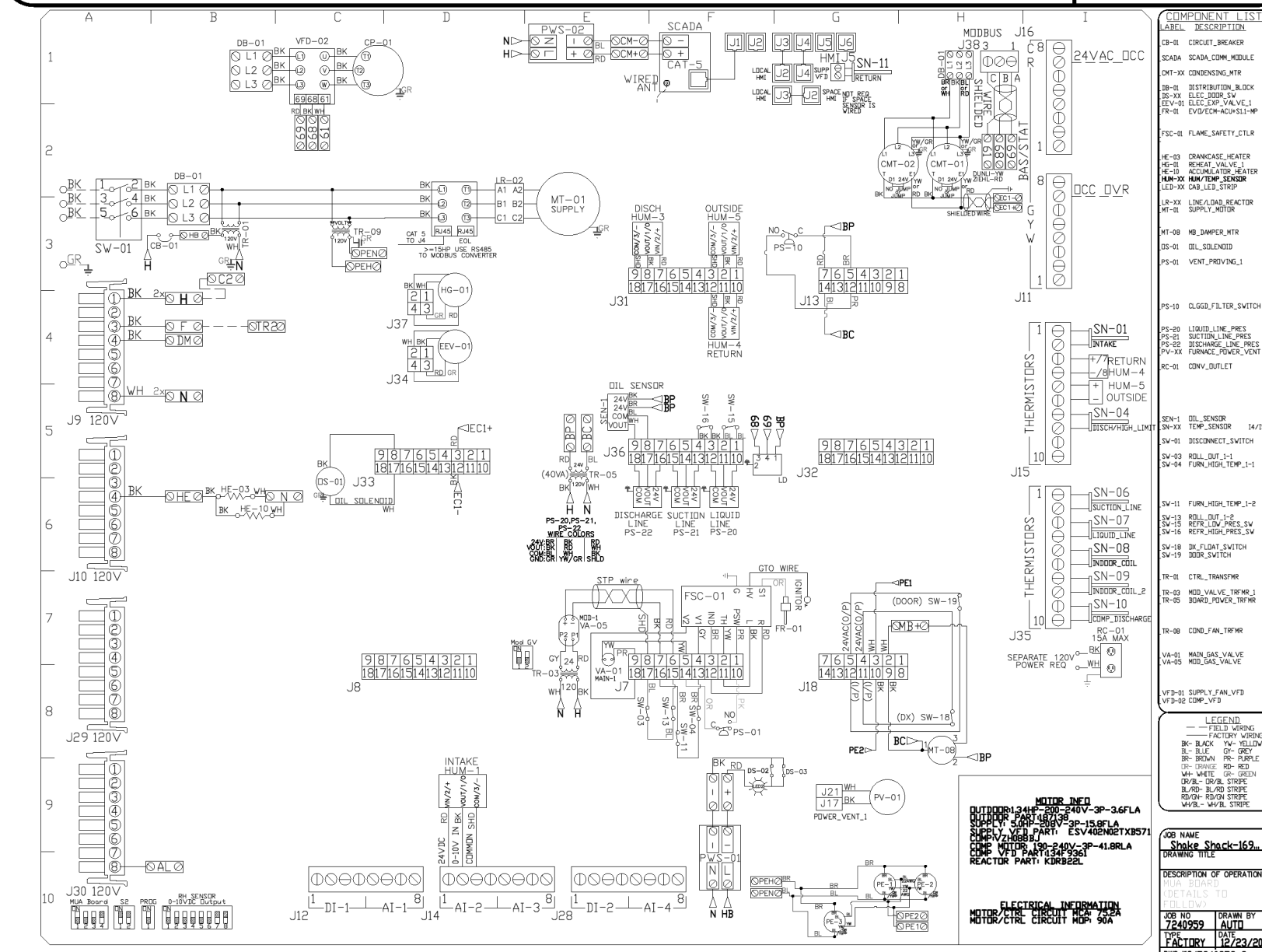
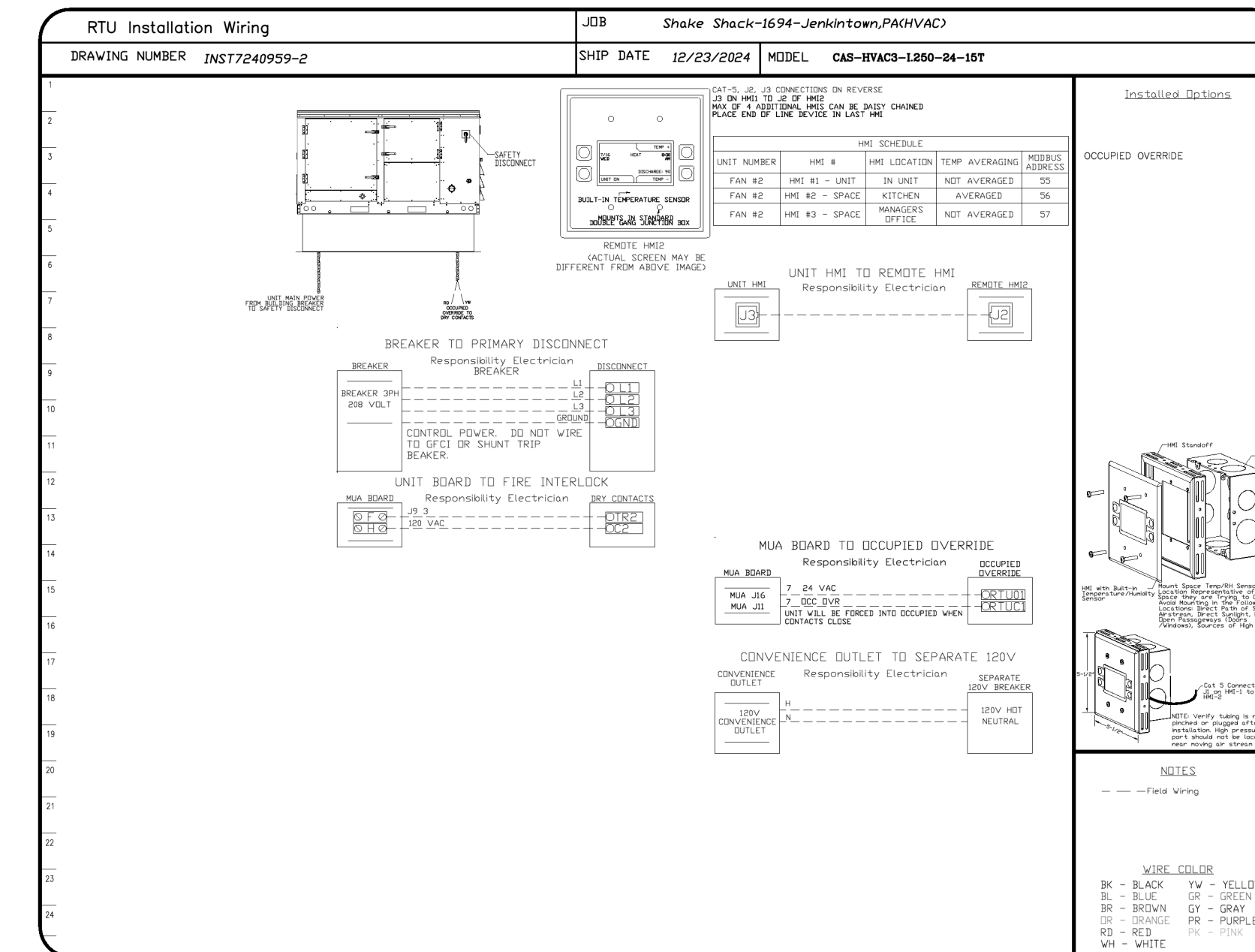


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FAN #2 CAS-HVAC3-1.250-24MF-15T - HEATER (RTU-2)

- NOTES:
- DO NOT OBSTRUCT OUTSIDE AIR INLET, OUTSIDE AIR COIL OR OUTSIDE AIR FAN.
  - DENOTES CORNER WEIGHT.
  - ROOF OPENING MUST BE 2" SMALLER THAN CURB DIMENSIONS IN BOTH DIRECTIONS.
  - CONNECTION FROM BREAKER TO UNITS SAFETY DISCONNECT SWITCH TO BE COPPER WIRE ONLY.
  - EXTERIOR GAS CONNECTION PROVIDED BY FACTORY WITH QUICK SEAL AND ANTI-ROTATION BRACKET.



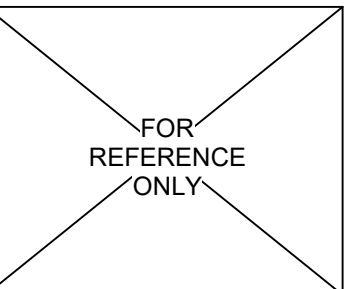
REVISIONS	
DESCRIPTION	DATE

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Snake Shack-1694-Jenkintown,PA(HVAC)  
 JENKINTOWN, PA, 19046

<b>DATE:</b> 12/23/2024
<b>DWG.#:</b> 7240959
<b>DRAWN BY:</b> Joe.shilka
<b>SCALE:</b> 1/2" = 1'-0"
<b>MASTER DRAWING</b>
<b>SHEET NO.</b> 3

Seal



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Project

**SHAKE SHACK**  
 SHAKE SHACK #1694  
 JENKINTOWN, PA

Project Number: 24204  
 Drawn By: Author  
 Checked By: Checker  
 Date: 12 FEB 2025

Revisions  
 2-12-2025 PERMIT SET

Drawing

CAPTIVEAIR  
 DRAWINGS

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**M-709**