

MECHANICAL SHEET INDEX

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RESPONSIBILITY MATRIX

DESCRIPTION	FURNISHED		INSTALLED		REMARKS
	GC	OWNER	GC	OWNER	
DIVISION 23: HEATING, VENTILATING, AND AIR CONDITIONING					
23.1 HVAC DUCTWORK AND PIPING IDENTIFICATION					
HVAC DUCTWORK SYSTEM IDENTIFICATION	•		•		
PIPING SYSTEM IDENTIFICATION	•		•		
UTILITY SHUT OFF IDENTIFICATION IN KITCHEN	•		•		
VALVE TAGS AND CHART	•		•		
HVAC DAMPER IDENTIFICATION	•		•		
23.2 ROOF CURBS					
23.3 HVAC DUCTWORK SYSTEM COMPONENTS					
HVAC DUCTWORK	•		•		
GREASE DUCTWORK INSIDE TENANT SPACE	•		•		
OUTSIDE AIR DUCTWORK INSIDE TENANT SPACE	•		•		
GENERAL EXHAUST AIR DUCTWORK INSIDE TENANT SPACE	•		•		
INSULATION AND FIRE WRAP	•		•		
DAMPERS	•		•		
SMOKE DETECTORS	•		•		
SUPPLY, RETURN, AND EXHAUST GRILLS AND REGISTERS	•		•		
23.4 MECHANICAL PIPING SYSTEM COMPONENTS					
WALK-IN COOLER AND FREEZER WATER COOLED CONDENSERS	•		•		1
VALVES AND ACCESSORIES (E.G. AIR VENTS)	•		•		
23.5 HVAC EQUIPMENT					
GENERAL EXHAUST FAN	•		•		
KITCHEN EXHAUST PRECIPITATOR	•		•		
DUCTED AND NON-DUCTED HEATING AND COOLING UNITS	•		•		
23.6 KITCHEN EXHAUST WITH FIRE SUPPRESSION SYSTEM					
HOOD CONTROL PANEL	•		•		
KITCHEN EXHAUST HOOD	•		•		
STRUCTURAL SUPPORT	•		•		
ELECTRICAL AND CONTROL WIRING	•		•		
ANSUL SYSTEM	•		•		2
ANSUL WIRING AND UTILITIES CONNECTION	•		•		
ANSUL GAS VALVE	•		•		
23.7 COMMISSIONING ACTIVITIES					
GREASE EXHAUST WATER LEAKAGE TEST	•		•		
TEST AND BALANCE (TAB) REPORT	•		•		
GENERAL NOTES:					
A. INFORMATION CONTAINED WITHIN IS BASED ON THE EXECUTED WORK LETTER DATED 11/01/2021.					
B. REFER TO FINAL WORK LETTER FOR ALL LANDLORD / TENANT SCOPE OF WORK RESPONSIBILITIES.					
REMARKS:					
1. WALK-IN COOLER AND FREEZER SUPPLIED BY VENDOR NO. 27. GENERAL CONTRACTOR SCOPE OF WORK TO INCLUDE PIPING INSTALLATION AND FINAL CONNECTION.					
2. GENERAL CONTRACTOR TO COORDINATE AND FACILITATE SYSTEM SIGN-OFF.					

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 THE 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 GRILLS 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.
- LOCATE AND SET THERMOSTATS AND HUMIDISTATS AT LOCATIONS SHOWN ON PLANS. VERIFY EXACT LOCATIONS WITH ARCHITECT PRIOR TO INSTALLATION. INSTALL DEVICES WITH TOP OF DEVICE AT MAXIMUM 48" AFF TO MEET ADA REQUIREMENTS UNLESS NOTED OTHERWISE 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 REIMBURSED 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 TYPE I GREASE HOOD EXHAUST DUCTWORK OF MINIMUM 16 GAUGE BLACK IRON WITH LIQUID TIGHT WELDS, WITH ACCESS PANELS FOR GREASE CLEANING AS REQUIRED BY NFPA 96 AND LOCAL CODES. SLOPE DUCT BACK TOWARDS HOOD AT MINIMUM OF 1/4" PER LINEAL FOOT MAINTAINING 18" CLEARANCE TO COMBUSTIBLE MATERIALS. INSTALL GREASE DUCTS IN AN APPROVED FIRE-RATED ENCLOSURE SEPARATED FROM THE EXHAUST DUCT BY A MINIMUM OF 6" AND MAXIMUM OF 12". VENTILATE ENCLOSURE TO THE OUTSIDE AIR IF REQUIRED BY CODE. AS AN OPTION, IF APPROVED BY LOCAL CODES, PROVIDE AN APPROVED WRAP SYSTEM IN LIEU OF THE RATED DUCT ENCLOSURE SYSTEM. DUCT WRAP SYSTEM SHALL MEET UL REQUIREMENTS FOR GREASE DUCT ENCLOSURES.
- PROVIDE A NEW SET OF AIR FILTERS IN UNITS PRIOR TO TESTING, ADJUSTING AND BALANCING AND BEFORE TURNING SYSTEM(S) OVER TO OWNER.
- FIELD VERIFY THAT THE EXISTING EQUIPMENT INCLUDING ACCESSORIES BEING REUSED FOR THIS PROJECT IS NOT DAMAGED AND IS IN GOOD WORKING ORDER. REPORT ANY DEFICIENCIES TO THE OWNER OR ARCHITECT. SUBMIT TO THE OWNER AND ARCHITECT A WRITTEN REPORT DESCRIBING TESTS PERFORMED TO VERIFY OPERATION AND RESULTS OF THE TESTS.
- CLEAN EXISTING EQUIPMENT AND EQUIPMENT COMPONENTS BEING REUSED FOR THIS PROJECT. PROVIDE NEW FILTERS FOR EXISTING AIR HANDLING EQUIPMENT PRIOR TO STARTUP OF EQUIPMENT. NEW FILTERS SHALL BE COMPATIBLE WITH THE EXISTING EQUIPMENT AND EQUAL IN PERFORMANCE TO THE EXISTING FILTERS AT NEW CONDITION UNLESS OTHERWISE NOTED. CLEAN STRAINERS IN PIPING SYSTEMS PRIOR TO STARTING PUMPS.
- 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 EGRESS 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.

V2.06

STANDARD MOUNTING HEIGHT		HVAC DUCTWORK AND ACCESSORIES		PIPING SYMBOLS																																																																																																																																																																																																																																																																																					
<p> 48" 48" </p> <p> 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 AFF TO BOTTOM OF DEVICE UNO. ALL DEVICES SHALL BE INSTALLED IN COMPLIANCE WITH CURRENT ADA AND LOCAL REQUIREMENTS. </p>	<p> LINEAR SLOT DIFFUSER INSULATED FLEXIBLE DUCT (MAX. 5'-0" LONG) BRANCH DUCT WITH 45° RECTANGLE-ROUND BRANCH FITTING AND MANUAL VOLUME DAMPER ELBOW WITH TURNING VANES BRANCH DUCT WITH BELL-MOUTH FITTING & MANUAL VOLUME CONTROL DAMPER RETURN, EXHAUST, OR OUTSIDE AIR DUCT UP RETURN, EXHAUST, OR OUTSIDE AIR DUCT DOWN SUPPLY AIR DUCT UP SUPPLY AIR DUCT DOWN EQUIPMENT WITH FLEXIBLE DUCT CONNECTION 10" (NECK SIZE) CSD-1 (TYPE) 300 CFM (CFM OF SUPPLY DIFFUSER OR REGISTER) 24x24 (NECK SIZE) CEG-1 (TYPE) 800 CFM (CFM OF EXHAUST GRILLE) MANUAL VOLUME DAMPER SQUARE TO ROUND TRANSITION DUCT MOUNTED SMOKE DETECTOR (SD-SUPPLY/RETURN) ROUND DUCT TAG INDICATING DIAMETER RECTANGULAR DUCT TAG INDICATING INTERNAL DUCT DIMENSIONS FLAT OVAL DUCT TAG INDICATING INTERNAL DUCT DIMENSIONS RISER DESIGNATION FIRE DAMPER FIRE SMOKE DAMPER SMOKE DAMPER VOLUME DAMPER MOTORIZED DAMPER BACKDRAFT DAMPER </p>	<p> DIRECTION OF FLOW CONTROL VALVE THREE-WAY CONTROL VALVE SHUTOFF VALVE CHECK VALVE BALANCING VALVE WITH PRESSURE PORTS TRIPLE DUTY VALVE WITH PRESSURE PORTS STRAINER STRAINER WITH BLOWDOWN VALVE RELIEF / SAFETY VALVE SOLENOID VALVE PRESSURE REDUCING VALVE GAS PRESSURE REGULATOR THERMOSTATIC MIXING VALVE PIPE ANCHOR EXPANSION JOINT PIPE GUIDE PIPING SUPPORT F & T TRAP BUCKET TRAP THERMOSTATIC TRAP BACKFLOW PREVENTER PRESSURE GAUGE THERMOMETER PRESSURE AND TEMPERATURE TEST PLUG UNION FLANGE CONNECTION VACUUM RELIEF VALVE AUTOMATIC AIR VENT MANUAL AIR VENT PRESSURE / VACUUM SWITCH CLEANOUT CAP ELBOW UP ELBOW DOWN TEE UP TEE DOWN ELBOW UP WITH SHUT-OFF VALVE (SOV) ELBOW DOWN WITH SHUT-OFF VALVE (SOV) TEE UP WITH SHUT-OFF VALVE (SOV) TEE DOWN WITH SHUT-OFF VALVE (SOV) REDUCER RECIRCULATION PUMP P-TRAP GAS COCK TOP BEAM CLAMP TRAPEZE HANGER FLEXIBLE CONNECTION </p>																																																																																																																																																																																																																																																																																							
<p> MECHANICAL PLAN NOTE CALLOUT MECHANICAL EQUIPMENT DESIGNATION (CONTRACTOR FURNISHED AND INSTALLED UNLESS NOTED OTHERWISE) CONNECTION POINT OF NEW WORK TO EXISTING DETAIL REFERENCE. UPPER NUMBER INDICATES DETAIL NUMBER LOWER NUMBER INDICATES SHEET NUMBER SECTION CUT DESIGNATION </p>	<p> ABBREVIATIONS </p> <table border="0"> <tr> <td>A/C</td><td>AIR CONDITIONING</td> <td>HWP</td><td>HEATING WATER PUMP</td> </tr> <tr> <td>ACC</td><td>AIR COOLED CHILLER</td> <td>IN WC</td><td>INCHES OF WATER COLUMN</td> </tr> <tr> <td>ACCU</td><td>AIR COOLED CONDENSING UNIT</td> <td>L</td><td>LEAVING AIR TEMPERATURE</td> </tr> <tr> <td>AFC</td><td>ABOVE FINISHED CEILING</td> <td>LAT</td><td>LEAVING AIR TEMPERATURE</td> </tr> <tr> <td>AFF</td><td>ABOVE FINISHED FLOOR</td> <td>LDB</td><td>LEAVING DRY BULB TEMPERATURE</td> </tr> <tr> <td>AFG</td><td>ABOVE FINISHED GRADE</td> <td>LP</td><td>LOW PRESSURE</td> </tr> <tr> <td>AHJ</td><td>AUTHORITY HAVING JURISDICTION</td> <td>LWB</td><td>LEAVING WET BULB TEMPERATURE</td> </tr> <tr> <td>AHU</td><td>AIR HANDLING UNIT</td> <td>LWT</td><td>LEAVING WATER TEMPERATURE</td> </tr> <tr> <td>AI</td><td>ANALOG INPUT</td> <td>MAU</td><td>MAKE-UP AIR UNIT</td> </tr> <tr> <td>AO</td><td>ANALOG OUTPUT</td> <td>MAX</td><td>MAXIMUM</td> </tr> <tr> <td>AP</td><td>ACCESS PANEL</td> <td>MBH</td><td>1000 BTU PER HOUR</td> </tr> <tr> <td>APD</td><td>AIR PRESSURE DROP</td> <td>MD</td><td>MOTORIZED DAMPER</td> </tr> <tr> <td>AWG</td><td>AMERICAN WIRE GAUGE</td> <td>MFR</td><td>MANUFACTURER</td> </tr> <tr> <td>B</td><td>BOLTER</td> <td>MIN</td><td>MINIMUM</td> </tr> <tr> <td>BAS</td><td>BUILDING AUTOMATION SYSTEM</td> <td>N/A</td><td>NOT APPLICABLE</td> </tr> <tr> <td>BB</td><td>BACKSLOPE</td> <td>N/C</td><td>NORMALLY CLOSED</td> </tr> <tr> <td>BD</td><td>BACKDRAFT DAMPER</td> <td>N/O</td><td>NORMALLY OPEN</td> </tr> <tr> <td>BD</td><td>BLOWDOWN</td> <td>NOM</td><td>NOMINAL</td> </tr> <tr> <td>BFC</td><td>BELOW FINISHED CEILING</td> <td>NOI</td><td>NOISE CRITERIA</td> </tr> <tr> <td>BF</td><td>BELOW FINISHED FLOOR</td> <td>NF</td><td>NON-FUSED</td> </tr> <tr> <td>BFG</td><td>BELOW FINISHED GRADE</td> <td>NIC</td><td>NOT IN CONTRACT</td> </tr> <tr> <td>BFF</td><td>BELOW FINISHED FLOOR</td> <td>CA</td><td>CONDENSING UNIT SCOPE OF WORK</td> </tr> <tr> <td>BHP</td><td>BRAKE HORSEPOWER</td> <td>PCV</td><td>PRESSURE INDEP. CONTROL VALVE</td> </tr> <tr> <td>BI</td><td>BINARY INPUT</td> <td>PROV</td><td>PROVIDE/FURNISH AND INSTALL</td> </tr> <tr> <td>BO</td><td>BINARY OUTPUT</td> <td>QTY</td><td>QUANTITY</td> </tr> <tr> <td>BOD</td><td>BOTTOM OF DUCT</td> <td>RA</td><td>RETURN AIR</td> </tr> <tr> <td>BOS</td><td>BOTTOM OF STRUCTURE</td> <td>RTU</td><td>ROOM THERMAL UNIT</td> </tr> <tr> <td>BTU</td><td>BRITISH THERMAL UNIT</td> <td>RD</td><td>RETURN DUCT</td> </tr> <tr> <td>CFM</td><td>CUBIC FEET PER MINUTE</td> <td>REA</td><td>RELIEF AIR</td> </tr> <tr> <td>CH</td><td>CHILLER</td> <td>RF</td><td>RETURN FAN</td> </tr> <tr> <td>CLG</td><td>COOLING</td> <td>RFR</td><td>REFRIGERANT</td> </tr> <tr> <td>CO</td><td>CLEANOUT</td> <td>RH</td><td>RELATIVE HUMIDITY</td> </tr> <tr> <td>CP</td><td>CONDENSATE PUMP</td> <td>RPM</td><td>REVOLUTIONS PER MINUTE</td> </tr> <tr> <td>CPT</td><td>CONTROL POWER TRANSFORMER</td> <td>RTU</td><td>ROOFTOP UNIT</td> </tr> <tr> <td>CRU</td><td>COMPUTER ROOM AIR CONDITIONING UNIT</td> <td>SA</td><td>SUPPLY AIR</td> </tr> <tr> <td>CR</td><td>COMPUTER ROOM UNIT</td> <td>SCP</td><td>STEAM CONDENSATE PUMP</td> </tr> <tr> <td>CT</td><td>COOLING TOWER</td> <td>SD</td><td>SMOKE DUCT DETECTOR</td> </tr> <tr> <td>CY</td><td>CONTROL VALVE</td> <td>SD</td><td>SUPPLY DUCT</td> </tr> <tr> <td>CWP</td><td>CONDENSER</td> <td>SF</td><td>SUPPLY FAN</td> </tr> <tr> <td>CU</td><td>WATER PUMP</td> <td>SH</td><td>SENSIBLE HEAT CAPACITY</td> </tr> <tr> <td>CHWP</td><td>CONDENSING UNIT</td> <td>SOW</td><td>SCOPE OF WORK</td> </tr> <tr> <td>DB</td><td>DECIBELS</td> <td>SP</td><td>STATIC PRESSURE</td> </tr> <tr> <td>DBA</td><td>DECIBEL AVERAGE</td> <td>ST</td><td>STEAM TRAP</td> </tr> <tr> <td>DDC</td><td>DIRECT DIGITAL CONTROL</td> <td>STM</td><td>STEAM</td> </tr> <tr> <td>DI</td><td>DIGITAL INPUT</td> <td>TBD</td><td>TO BE DETERMINED</td> </tr> <tr> <td>DISC</td><td>DISCONNECT</td> <td>TC/C</td><td>TEMPERATURE CONTROLS CONTRACTOR</td> </tr> <tr> <td>DN</td><td>DOWN</td> <td>TCF</td><td>TEMPERATURE CONTROL PANEL</td> </tr> <tr> <td>DS</td><td>DUCT SILENCER</td> <td>TF</td><td>TRANSFER FAN</td> </tr> <tr> <td>DX</td><td>DIRECT EXPANSION EXISTING</td> <td>TFA</td><td>TO FLOOR ABOVE</td> </tr> <tr> <td>EA</td><td>EXHAUST AIR</td> <td>TFB</td><td>TO FLOOR BELOW</td> </tr> <tr> <td>EAT</td><td>ENTERING AIR TEMPERATURE</td> <td>TH</td><td>TOTAL HEAT CAPACITY</td> </tr> <tr> <td>ED</td><td>EXHAUST DUCT</td> <td>TSP</td><td>TOTAL STATIC PRESSURE</td> </tr> <tr> <td>EDB</td><td>ENTERING DRY BULB EXHAUST FAN</td> <td>TT</td><td>TEMPERATURE TRANSMITTAL</td> </tr> <tr> <td>EF</td><td>EFFICIENCY</td> <td>TYP</td><td>TYPICAL</td> </tr> <tr> <td>EFF</td><td>ENERGY MANAGEMENT SYSTEM</td> <td>U/F</td><td>UNDERFLOOR</td> </tr> <tr> <td>EMS</td><td>ENERGY MANAGEMENT SYSTEM</td> <td>UG</td><td>UNDERGROUND</td> </tr> <tr> <td>ESP</td><td>EXTERNAL STATIC PRESSURE</td> <td>UIS</td><td>UNDERSLAB</td> </tr> <tr> <td>ETP</td><td>EXISTING TO REMAIN</td> <td>UH</td><td>UNIT HEATER</td> </tr> <tr> <td>EWB</td><td>ENTERING WET BULB TEMPERATURE</td> <td>UNO</td><td>UNLESS NOTED OTHERWISE</td> </tr> <tr> <td>EWT</td><td>ENTERING WATER TEMPERATURE</td> <td>VAV</td><td>VARIABLE AIR VOLUME</td> </tr> <tr> <td>FCU</td><td>FAN COIL UNIT</td> <td>VEL</td><td>VELOCITY</td> </tr> <tr> <td>FFA</td><td>FROM FLOOR ABOVE</td> <td>VFD</td><td>VARIABLE FREQUENCY DRIVE</td> </tr> <tr> <td>FFB</td><td>FROM FLOOR BELOW</td> <td>VRF</td><td>VARIABLE REFRIGERANT FLOW</td> </tr> <tr> <td>FF</td><td>FINISHED FLOOR</td> <td>VRV</td><td>VARIABLE REFRIGERANT VOLUME</td> </tr> <tr> <td>FFI</td><td>FEET PER INCH</td> <td>W</td><td>WITH</td> </tr> <tr> <td>FPM</td><td>FEET PER MINUTE</td> <td>W/O</td><td>WITHOUT</td> </tr> <tr> <td>GC</td><td>GENERAL CONTRACTOR</td> <td>WB</td><td>WET BULB</td> </tr> <tr> <td>GPM</td><td>GALLONS PER MINUTE</td> <td>WC</td><td>WATER COLUMN</td> </tr> <tr> <td>HOA</td><td>HAND-OFF-AUTOMATIC HORSEPOWER</td> <td>WPD</td><td>WATER PRESSURE DROP</td> </tr> 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CONTRACT	BFF	BELOW FINISHED FLOOR	CA	CONDENSING UNIT SCOPE OF WORK	BHP	BRAKE HORSEPOWER	PCV	PRESSURE INDEP. CONTROL VALVE	BI	BINARY INPUT	PROV	PROVIDE/FURNISH AND INSTALL	BO	BINARY OUTPUT	QTY	QUANTITY	BOD	BOTTOM OF DUCT	RA	RETURN AIR	BOS	BOTTOM OF STRUCTURE	RTU	ROOM THERMAL UNIT	BTU	BRITISH THERMAL UNIT	RD	RETURN DUCT	CFM	CUBIC FEET PER MINUTE	REA	RELIEF AIR	CH	CHILLER	RF	RETURN FAN	CLG	COOLING	RFR	REFRIGERANT	CO	CLEANOUT	RH	RELATIVE HUMIDITY	CP	CONDENSATE PUMP	RPM	REVOLUTIONS PER MINUTE	CPT	CONTROL POWER TRANSFORMER	RTU	ROOFTOP UNIT	CRU	COMPUTER ROOM AIR CONDITIONING UNIT	SA	SUPPLY AIR	CR	COMPUTER ROOM UNIT	SCP	STEAM CONDENSATE PUMP	CT	COOLING TOWER	SD	SMOKE DUCT DETECTOR	CY	CONTROL VALVE	SD	SUPPLY DUCT	CWP	CONDENSER	SF	SUPPLY FAN	CU	WATER PUMP	SH	SENSIBLE HEAT CAPACITY	CHWP	CONDENSING UNIT	SOW	SCOPE OF WORK	DB	DECIBELS	SP	STATIC PRESSURE	DBA	DECIBEL AVERAGE	ST	STEAM TRAP	DDC	DIRECT DIGITAL CONTROL	STM	STEAM	DI	DIGITAL INPUT	TBD	TO BE DETERMINED	DISC	DISCONNECT	TC/C	TEMPERATURE CONTROLS CONTRACTOR	DN	DOWN	TCF	TEMPERATURE CONTROL PANEL	DS	DUCT SILENCER	TF	TRANSFER FAN	DX	DIRECT EXPANSION EXISTING	TFA	TO FLOOR ABOVE	EA	EXHAUST AIR	TFB	TO FLOOR BELOW	EAT	ENTERING AIR TEMPERATURE	TH	TOTAL HEAT CAPACITY	ED	EXHAUST DUCT	TSP	TOTAL STATIC PRESSURE	EDB	ENTERING DRY BULB EXHAUST FAN	TT	TEMPERATURE TRANSMITTAL	EF	EFFICIENCY	TYP	TYPICAL	EFF	ENERGY MANAGEMENT SYSTEM	U/F	UNDERFLOOR	EMS	ENERGY MANAGEMENT SYSTEM	UG	UNDERGROUND	ESP	EXTERNAL STATIC PRESSURE	UIS	UNDERSLAB	ETP	EXISTING TO REMAIN	UH	UNIT HEATER	EWB	ENTERING WET BULB TEMPERATURE	UNO	UNLESS NOTED OTHERWISE	EWT	ENTERING WATER TEMPERATURE	VAV	VARIABLE AIR VOLUME	FCU	FAN COIL UNIT	VEL	VELOCITY	FFA	FROM FLOOR ABOVE	VFD	VARIABLE FREQUENCY DRIVE	FFB	FROM FLOOR BELOW	VRF	VARIABLE REFRIGERANT FLOW	FF	FINISHED FLOOR	VRV	VARIABLE REFRIGERANT VOLUME	FFI	FEET PER INCH	W	WITH	FPM	FEET PER MINUTE	W/O	WITHOUT	GC	GENERAL CONTRACTOR	WB	WET BULB	GPM	GALLONS PER MINUTE	WC	WATER COLUMN	HOA	HAND-OFF-AUTOMATIC HORSEPOWER	WPD	WATER PRESSURE DROP	HP	HEATING	XP	EXPLOSION PROOF
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800 South Figueroa St.
 Los Angeles, CA 90017
 213.337.1090
 617.542.1025

CONSULTANTS:

HENDERSON ENGINEERS
 8345 LEXENA DRIVE, SUITE 300
 LEXENA, KS 66214
 TEL 913.742.5000 FAX 913.742.5001
 WWW.HENDERSONENGINEERS.COM
 215005337
 NH CORPORATE NO. 1076
 EXPIRES 12/30/2023

SEAL SIGNATURE:

06/05/2023

NO.	BY	DATE	DESCRIPTION
1		06/05/2023	ISSUED FOR CONSTRUCTION
C		05/15/2023	ADDENDUM C
B		04/20/2023	ADDENDUM B
A		10/28/2022	ADDENDUM A
		09/27/2022	PERMIT/BID SET
		08/06/2022	75% SET
		07/27/2022	DD SET



SHAKE SHACK TUSCAN VILLAGE

100 VIA TOSCANA
 BUILDING 1000
 SALEM, NEW HAMPSHIRE 03079
 SHACK #1449

ISSUED FOR CONSTRUCTION

MECHANICAL GENERAL INFORMATION

DRAWN BY: Author
 CHECKED BY: Checker
 JOB NO: 21238.00

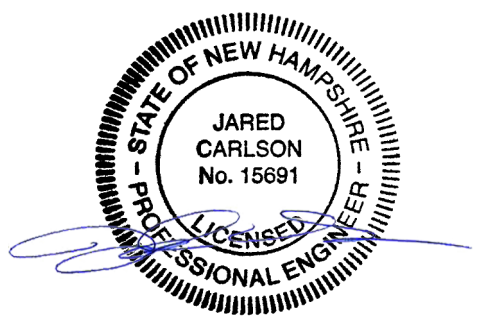
M001

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 ENGINEERS
 8345 LENEXA DRIVE, SUITE 300
 LENEXA, KS 66214
 TEL 913.742.5000 FAX 913.742.5001
 WWW.HENDERSONENGINEERS.COM

215000537
 NH CORPORATE NO. 1076
 EXPIRES 12/30/2023

SEALED SIGNATURE:



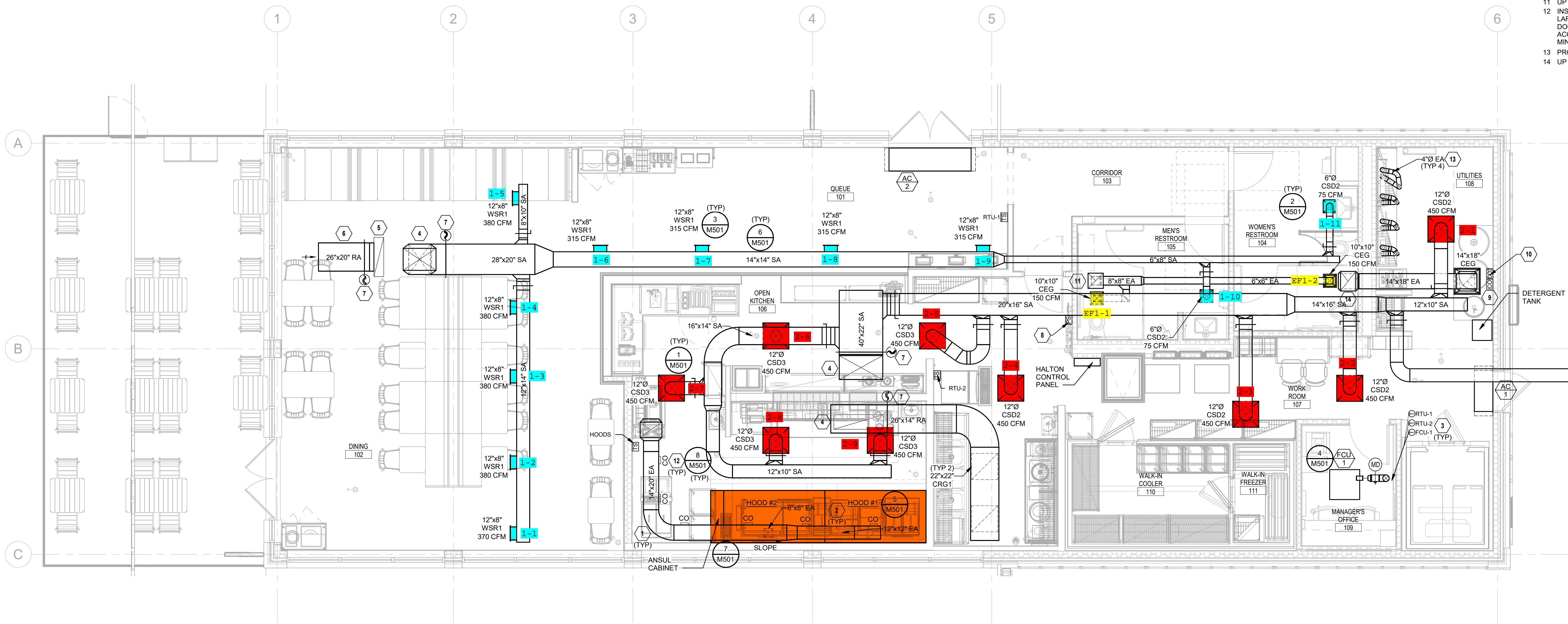
06/05/2023

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:

- TYPE I GREASE HOOD EXHAUST DUCTWORK SHALL BE MINIMUM 16 GAUGE STEEL OR MINIMUM 16 GAUGE STAINLESS STEEL WITH LIQUID TIGHT WELDS. 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.
- 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.
- MOUNT THERMOSTATS 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.
- PROVIDE SA DUCT THROUGH ROOF. FULL SIZE OF UNIT OPENING, AND CONNECT TO UNIT WITH FLEXIBLE CONNECTOR. TRANSITION 45 DEGREES THROUGH ROOF CURB.
- PROVIDE RA DUCT THROUGH ROOF. FULL SIZE OF UNIT OPENING, AND CONNECT TO UNIT WITH FLEXIBLE CONNECTOR. TRANSITION 45 DEGREES THROUGH ROOF CURB.
- 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.
- INSTALL DUCT SMOKE DETECTOR IN RETURN AND SUPPLY AIR PLENUM.
- INSTALL HOOD FIRE SUPPRESSION MANUAL PULL STATION. COORDINATE EXACT LOCATION AND REQUIREMENTS WITH FIRE SUPPRESSION SYSTEM INSTALLER AND THE AUTHORITY HAVING JURISDICTION.
- CARBON MONOXIDE DETECTOR FURNISHED BY OWNER. INSTALL AT 5'-0" AFF. COORDINATE FINAL LOCATION WITH OWNER REPRESENTATIVE.
- PROVIDE ANALOG AXSD OR APPROVED EQUAL CARBON DIOXIDE SENSOR WITH REMOTE ALARM REPEATER TO BE MOUNTED AT 12" AFF. PROVIDE CARBON DIOXIDE SENSOR WITH RELAY. RELAY SHALL BE INTERLOCKED WITH THE BUILDING FIRE ALARM SYSTEM. THE SENSOR SHALL BE EQUIPPED WITH A LOCAL AUDIBLE AND VISUAL ALARM. THE LOW LEVEL ALARM SHALL ACTIVATE THE LOCAL AUDIBLE AND VISUAL ALARM. THE HIGH LEVEL ALARM SHALL ACTIVATE RELAY. INSTALL SENSOR PER MANUFACTURER'S INSTALLATION INSTRUCTIONS.
 LOW LEVEL ALARM - 0.5% = 5,000PPM
 HIGH LEVEL ALARM - 3.0% = 30,000PPM
- UP TO REF-1
- INSTALL 'DUCTMATE ULTIMATE DOOR' ON DUCTS 12" OR LARGER AND INSTALL 'DUCTMATE F1 SANDWICH ACCESS DOOR' FOR DUCTS LESS THAN 12" ON GREASE DUCT ACCESS PANELS FOR CLEANING IN LOCATION SHOWN AT A MINIMUM AND AS REQUIRED BY NFPA 96 AND LOCAL CODES.
- PROVIDE CONCENTRIC VENT MODEL NUMBER PVC-3CT.
- UP TO REF-1.



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

ALL GREASE DUCT TO BE WATER TESTED BY ENVIROMATIC AT MECHANICAL CONTRACTOR'S EXPENSE. CONTACT OWNER'S NATIONAL ACCOUNT VENDOR.

ENVIROMATIC
 DON PFLEDERER
 1.800.325.8476
 inspections@enviromatic.com

THE BUILDINGS HVAC SYSTEMS SHALL BE BALANCED BY NATIONAL TAB (NO EXCEPTIONS) AND CONTRACTED BY THE GENERAL CONTRACTOR.

CONTACT:
 WILL TURNBOUGH
 will@nationaltab.com
 855-682-6922 ext1074

NO.	BY	DATE	DESCRIPTION
1		06/05/2023	ISSUED FOR CONSTRUCTION
B		05/15/2023	ADDENDUM C
C		04/26/2023	ADDENDUM B
A		10/28/2022	ADDENDUM A
		09/27/2022	PERMIT/BID SET
		08/06/2022	75% SET
		07/27/2022	DD SET



SHAKE SHACK TUSCAN VILLAGE

100 VIA TOSCANA
 BUILDING 1000
 SALEM, NEW HAMPSHIRE 03079
 SHACK #1449

ISSUED FOR CONSTRUCTION

MECHANICAL FLOOR PLAN

DRAWN BY: Author
 CHECKED BY: Checker
 JOB NO: 21238.00

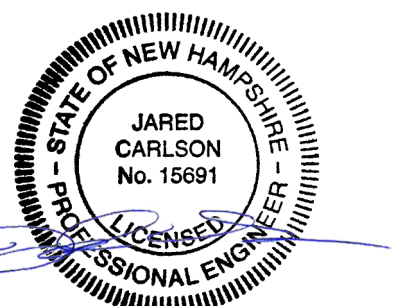
M101

CONSULTANTS:

HENDERSON ENGINEERS
8345 LENEXA DRIVE, SUITE 300
LENEXA, KS 66214
TEL 913.742.5000 FAX 913.742.5001
WWW.HENDERSONENGINEERS.COM

215005337
NH CORPORATE NO: 1076
EXPIRES 12/30/2023

SEAL SIGNATURE:



06/05/2023

NO.	BY	DATE	DESCRIPTION
1		06/05/2023	ISSUED FOR CONSTRUCTION
C		05/15/2023	ADDENDUM C
B		04/20/2023	ADDENDUM B
A		10/28/2022	ADDENDUM A
		09/27/2022	PERMIT/BID SET
		08/06/2022	75% SET
		07/27/2022	DD SET



SHAKE SHACK TUSCAN VILLAGE

100 VIA TOSCANA
BUILDING 1000
SALEM, NEW HAMPSHIRE 03079
SHACK #1449

ISSUED FOR CONSTRUCTION

MECHANICAL ROOF PLAN

DRAWN BY: Author
CHECKED BY: Checker
JOB NO: 21238.00

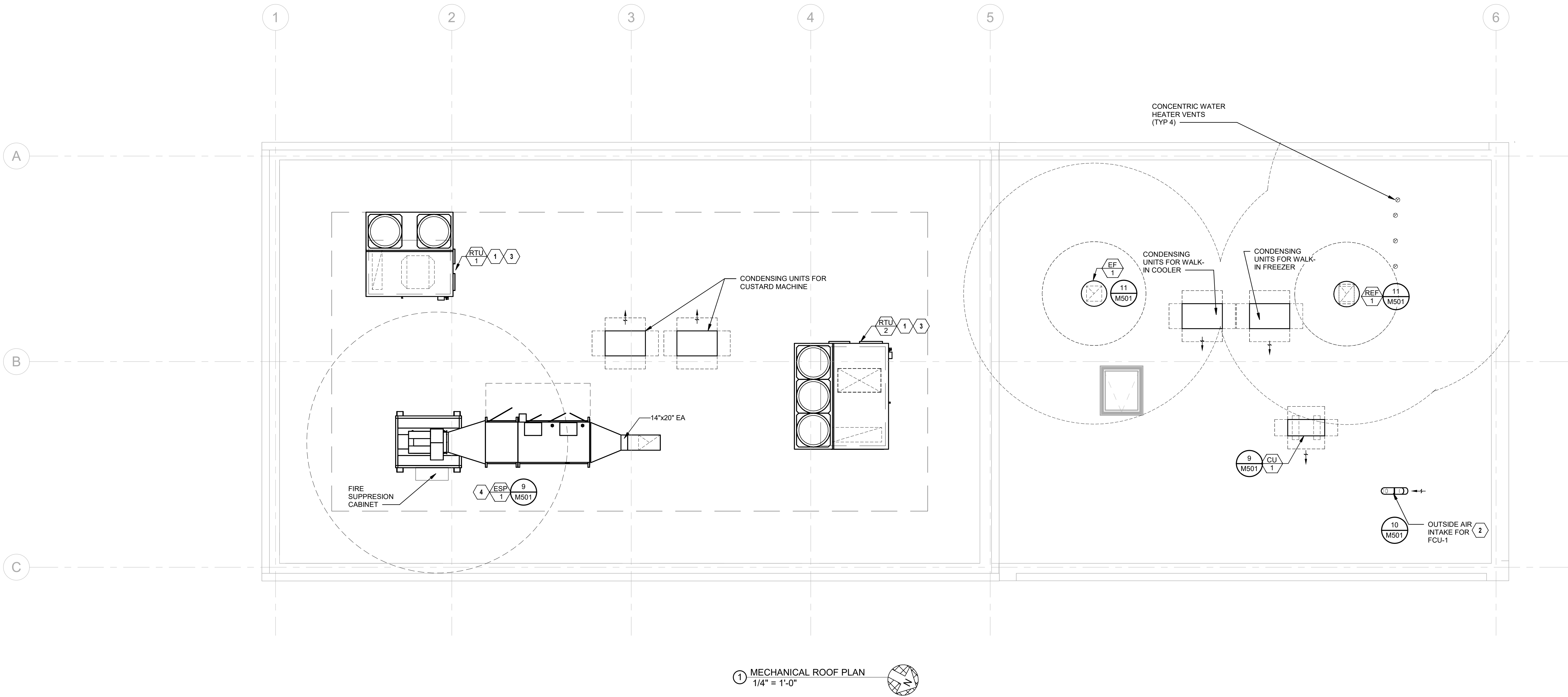
M150

MECHANICAL GENERAL NOTES:

- ALL VENT STACKS SHALL BE NO LESS THAN 12" FROM PARAPET, AT LEAST 10 FEET FROM OUTSIDE AIR INTAKES, AND ABOVE ROOF SURFACE 6" MINIMUM TO FULL HEIGHT OF PARAPET, WHICHEVER IS GREATER. CONTRACTOR SHALL PROVIDE BRACING AS SPECIFIED.
- COORDINATE EXACT EQUIPMENT LOCATIONS WITH OTHER TRADES PRIOR TO INSTALLATION.
- REFER TO SHEET M001 FOR ADDITIONAL GENERAL NOTES.
- REFER TO DETAILS AND SCHEDULES SHEETS FOR FURTHER INFORMATION.

MECHANICAL PLAN NOTES:

- MAINTAIN ALL OUTSIDE AIR INTAKES A MINIMUM OF 10'-0" RADIUS FROM EXHAUST, TYPICAL.
- TURN DOWN 6"0" INTAKE AND END OPEN OVER ROOF (MIN. 24") WITH INSECT SCREEN.
- CONTRACTOR SHALL COORDINATE WITH NATIONAL TAB AND PROVIDE UV-PII INDOOR AIR PURIFICATION SYSTEM, MODEL REME-H (24V). INSTALL IN SUPPLY DUCT PER MANUFACTURER'S INSTRUCTIONS.
- REFERENCE HALTON DRAWINGS FOR MORE INFORMATION ON EXHAUST FANS.



GENERAL MECHANICAL REQUIREMENTS

1. GENERAL INSTRUCTIONS

- A. GENERAL REQUIREMENTS
B. DEFINITIONS
C. PRE-BID SITE VISIT
D. MATERIAL AND WORKMANSHIP
E. MANUFACTURERS
F. COORDINATION
G. ORDINANCES AND CODES
H. PROTECTION OF EQUIPMENT AND MATERIALS
I. SUBSTITUTIONS
J. SUBMITTALS
K. ELECTRONIC DRAWINGS FILES
L. RECORD DRAWINGS (AS-BUILT DRAWINGS)
M. OPERATION AND MAINTENANCE INSTRUCTIONS
N. SPARE PARTS
O. TRAINING
P. WARRANTIES

2. GENERAL MATERIALS AND INSTALLATION

- A. BUILDING OPERATION
B. EXISTING EQUIPMENT REUSE AND REMOVAL
C. COINCIDENTAL DAMAGE
D. CUTTING AND PATCHING
E. ROUGH-IN
F. STRUCTURAL SUPPORT SYSTEMS
G. PRE-ENGINEERED ROOF EQUIPMENT SUPPORTS AND CURBS
H. ACCESS PANELS AND DOORS
I. PENETRATIONS
J. FIRESTOPPING
K. MOTORS AND STARTERS
L. VARIABLE FREQUENCY DRIVES
M. ELECTRICAL WIRING
N. EQUIPMENT FURNISHED BY OTHERS
O. SYSTEM TESTING, ADJUSTING, AND BALANCING
P. VIBRATION ISOLATION
R. SEISMIC CONTROLS FOR MEFP SYSTEMS
S. AIR FILTERS
T. REFRIGERANT AND OIL IDENTIFICATION

3. DUCT INSULATION, DUCTWORK, ACCESSORIES, FLUES AND FANS

- A. DUCT INSULATION
B. DUCTWORK
C. FLEXIBLE DUCT
D. PLASTIC FLUE GAS VENTS
E. AIR DEVICES
F. CONTROL DAMPERS
G. EXHAUST AIR SYSTEMS
H. KITCHEN EXHAUST AIR SYSTEMS

4. HVAC EQUIPMENT

- A. ROOFTOP UNITS (GAS FIRED HEAT) 3-25 TONS
B. ELECTRIC UNIT HEATERS
C. NATURAL GAS RADIANT HEATERS
D. SPLIT DUCTLESS AIR-CONDITIONING SYSTEMS
E. AIR CURTAINS

5. PIPING AND PIPING SPECIALTIES

- A. REFRIGERANT PIPING AND INSULATION
B. SYSTEM EVACUATION AND CHARGING

6. TEMPERATURE CONTROLS

- A. GENERAL REQUIREMENTS
B. WIRING
C. THERMOSTAT CONTROL EQUIPMENT
D. SENSORS AND RELAYS

7. SEQUENCE OF OPERATION

- A. FAN COIL UNIT CONTROL
B. KITCHEN EXHAUST FAN CONTROL
C. MAKE-UP AIR UNIT CONTROL
D. ROOFTOP UNIT CONTROL
E. RESTROOM EXHAUST FAN (EF)-I CONTROL
F. AIR CURTAIN CONTROL
G. ELECTRIC UNIT HEATER CONTROL

8. ALTERNATIVES

- A. DESCRIPTION

9. COMMISSIONING OF MECHANICAL SYSTEM

- A. GENERAL
B. EXECUTION

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 this section and division exceed those of Division 01, this section 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, and labor required to complete the entire system as required by the drawings and specifications, or reasonably inferred to be necessary to facilitate the function of each system as implied by the design and the equipment specified.

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 necessary, and to verify that materials and equipment will fit into the designated spaces, and which when installed per manufacturer's 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:

Table with 2 columns: 2004 Edition and 1995 Edition. Rows include: 1. Division 21 - Fire Suppression, 2. Division 22 - Plumbing, 3. Division 23 - HVAC, 4. Division 26 - Electrical, 5. Division 27 - Communications, 6. Division 28 - Electronic Safety and Security.

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 unavailability of product, regulatory changes, or unavailability of required warranty terms.

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. PRE-BID 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 in good commercial practice, and free from defect. 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 in quality. Light duty and 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.

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.

When 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 not require service access to other trades requiring maintenance. Components which are installed without regard to the above shall be relocated at no 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:

- 1. National Electrical Code (NEC)
2. National Fire Protection Association (NFPA)
3. Underwriters Laboratories (UL)
4. Occupational Safety and Health Administration (OSHA)
5. American Society of Mechanical Engineers (ASME)
6. American Society of Heating, Refrigerating, and Air Conditioning Engineers (ASHRAE)
7. American National Standards Institute (ANSI)
8. American Society of Testing and Materials (ASTM)
9. 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, dampness, or temperature variations, store inside in conditioned spaces. For materials and equipment not susceptible to these conditions, cover with waterproof, tear-resistant, heavy-duty polyethylene plastic as required to protect from plaster, dust, dirt, paint, water, or physical damage. Replace insulation that has become wet at any time during construction. Dry the insulation it is not acceptable. 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 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 named in the drawings and specifications. To request a substitution, 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.

- 1. Unless stated otherwise in writing to the Engineer by the Contractor, Contractor warrants to the Engineer, Architect, and Owner the following:
a. 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.
b. Proposed substitution is consistent with the Contract Documents and will produce indicated results, including functional clearances, maintenance services, and sourcing of replacement parts.
c. Proposed substitution has received necessary approvals of authorities having jurisdiction.
d. Same warranty will be furnished for proposed substitution as for specified Work.

- 5. If accepted substitution fails to perform as required, Contractor shall replace substitute material or system with that originally specified and bear costs incurred thereby.
6. 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 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 requires necessary or 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 to/from mailing time via the Architect, plus a duplication of this time for resubmittal, if required. Only resubmit those sections requested for resubmittal.

Submittals shall contain the project name, applicable specification section, submittal data, equipment identification acronym as performed on the drawings, and the Contractor's stamp. The stamp shall certify that the submittal has been checked by the Contractor, compares with the drawings and specifications, and is coordinated with other trades. Manufacturer product literature shall include shop drawings, product data, performance sheets, samples and other submittals required by this division. 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 bound, identified, indexed and tabbed in a 3-ring binder. 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 applicable 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 the 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 or submittals sent by email. Contractor shall copy the designated representatives of the Architect and Engineer. Contractor shall allow for the Engineer 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 12 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.

See Division 01 and General Conditions for additional information.

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 on this project. Include an inside cover sheet that lists the project name, date, Owner, Architect, Engineer, 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 the Engineer's review, at the termination of the work. Paper clips, staples, rubber bands, 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.

Refer to Division 01 for acceptance of electronic manuals for this project. For electronic manuals, refer to paragraph "Submittals" for requirements.

N. SPARE PARTS

Furnish to Owner, with receipt, the following spare parts for the equipment furnished for this project:
1. 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.
2. Furnish one complete set of bolts for each unit.
3. Furnish three operating keys for each type of air outlet and inlet that require them.

O. 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.

P. 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 such 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 status. 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. EXISTING EQUIPMENT REUSE AND REMOVAL

Remove all unused equipment, ductwork, piping, and associated supports. Cap ductwork and piping at mains and seal air and water tight. Provide items of HVAC systems modification required because of building remodeling, as noted on the drawings or necessary for proper operation. Match existing materials and construction techniques when modifying existing systems unless specified otherwise. Coordinate additional requirements with General Contractor and Architect.

Seal airtight existing ductwork required to be abandoned in place or not in use at the termination of the work. Cap and seal weathertight existing roof curbs and roof openings to be abandoned in place as a result of equipment removal. Clean and rebalance existing ductwork, diffusers, registers, and grilles intended for reuse as required or as indicated on drawings.

Clean and refurbish existing HVAC equipment intended for reuse as required for proper operation including replacement of filters, belts, motors, remote controls, and safety interlocks.

D. COINCIDENTAL DAMAGE

Repair streets, 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.

E. 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-tensioned slabs, x-ray slabs 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 element penetrated and the system component. Patch around openings to match the adjacent construction including fire ratings, if applicable. Repair and refinish areas disturbed by work to the condition of adjoining surfaces in a manner satisfactory to the Architect.

F. 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.

G. 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.

H. 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 equipment support rails with fully milled raised cant and standard 16 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 18 gauge jacket with counterflashing where equipment does not fully cover the equipment support. Provide sloped roof equipment supports to enable level installation. Provide rigid backing material behind cant to maintain cant slope. 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:
1. Rail Equipment Supports: Secure each equipment support leg to the rail with a minimum of 4 points of connection per leg.
2. Roof Curbs: Secure each corner of the equipment to the curb nailer using a minimum of 4 leg screws, located along the length of the equipment. 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 unit.

3. Hold-Down Brackets: Coordinate with the curb manufacturer to determine the quantity and size of hold-down brackets and fasteners, with installation instructions for each unit to meet a Building Design Risk Category of III(III) or IV and a Design Wind Speed of [XXX] mph.
4. Submittal signed and sealed drawings that indicate the design and installation requirements of pre-engineered roof supports can withstand the design criteria listed. Include installation requirements for anchoring to the roof structure. The Engineer is not responsible and will not provide the seal and signature. Deliver submittal to the local AHJ for approval prior to installation of the contractor provided, pre-engineered roof supports.

5. Provide seismic restraints in accordance with Article "Seismic Controls for MEFP Systems."

I. ACCESS PANELS AND DOORS

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

Provide access doors for all concealed equipment and duct and piping accessories that require service where indicated or as required, except where above lay-in ceilings. Access doors shall be adequately sized for the devices served with a minimum size of 18 inches x 18 inches. Access doors must be of the proper construction for type of construction in which it is installed. Obtain Architect's approval of type, size, location and color before ordering. Provide factory-fabricated and assembled units, complete with attachment devices and fasteners ready for installation, concealed hinges, and a built-in screwdriver-operated cam lock, and anchor straps. Provide all access doors manufactured by Greenlock, Milcor, Titus, Turo, or equal.

J. PENETRATIONS

Provide sleeves for pipes passing through above grade 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 steel metal sleeves for larger than 6 inches. Schedule 40 PVC sleeves are acceptable for installation in areas without return air plenums.

Seal 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 assembly details. Provide a product schedule for UL listing, location, wall or floor rating and installation drawing for each penetration fire stop system.

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 sleeve for a minimum of 1 inch annular clear space between inside of sleeve and outside of insulation.

Provide prefabricated roof curbs where pipes or ductwork penetrate elevated slabs or roof to the exterior. Provide cover over 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 waterstop ring manufactured by Hilti, RectorSeal, Reliance Electric, or Yasaka. Provide modular mechanical sleeve seals, manufactured by Calpic, Mettalex, or Thundersite / Link 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 waterstop ring 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.

K. FIRESTOPPING

Sealants and accessories shall have fire-resistance ratings indicated, as established by testing identical assemblies in accordance with UL 2070 or ASTM E 814, or other NRTL acceptable to AHJ.

Manufacturers: Hilti, 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 system.

Where project conditions require modification to qualified testing and inspecting agency's illustrations for a particular firestopping condition, submit illustration, with modifications marked, 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.

L. MOTORS AND STARTERS

Provide motors and starting equipment where not furnished with the equipment package. Motors shall have copper windings, Class B insulation, and standard squirrel cage with starting torque characteristics suitable for the equipment served. Motors controlled by variable frequency drives shall be rated for voltage peaks and minimum rise times in accordance with NEMA MG1, Part 31. Motors 2 horsepower and larger controlled by variable frequency drives shall be provided with a shall grounding system equal to Aegis SCR Bearing Protection Ring, InproSeal Current Diverter Ring (CDR) or approved equal. Motors for air handling equipment shall be enclosed for quiet operation. Each motor shall be checked for proper rotation after electrical connection has been completed. Provide drip-proof enclosure for locations protected from weather and not in air stream of fan, and totally enclosed fan cooled enclosure for motors exposed to weather. Motors shall be manufactured by Century, General Electric, Louis Allis, Westinghouse, or approved equal.

Provide every motor, except fractional horsepower single phase motors with an approved type of "built-in" thermal overload protection, with a motor starter. Each starter shall be provided with overload heaters sized to the motor rating, and every three phase motor starter shall have overload heaters in each phase. Ambient compensated heaters shall be installed wherever necessary. Unless noted otherwise, motor starters shall be furnished by the Division 23 Contractor for installation and connection by the Division 26 Contractor. Starters shall be Allen-Bradley, Clark, Furnas, Square D, or approved equal.

M. VARIABLE FREQUENCY DRIVES

Provide PWM variable frequency drives (VFD) to control fan or pump

P. 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.

The final test and balance of the building HVAC systems shall be completed by National TAB (no exceptions) and contracted by the General Contractor. The representative from National TAB shall be certified by the National Environmental Balancing Bureau (NEBB), Associated Air Balance Council (AABC), or Testing, Adjusting and Balancing Bureau (TABB). 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.

Work shall include but not be limited to: Perform test readings on fans, units, coils, pumps, etc. and adjust equipment to deliver specified amounts of air. Prepare testing and balancing report log showing air supply quantities, air entering and leaving temperatures and pressures at design flow, 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 if 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 +/- 3 F) in spaces. Document temperatures and adjustments in lab report. Adjust equipment to operate as intended by the manufacturer. TAB report shall summarize the section in accordance with the procedural standard that provides both system set up and a summary 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, adjust thermostats, and control stoppages, limits and time based adjustments to operate in accordance with the performance requirements of the Construction Documents. Adjust pumps, fans, and 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.

Q. VIBRATION ISOLATION

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

General Requirements: Select vibration isolators by the weight distribution to produce uniform deflection. Vibration isolators shall have either a known un-deflection rate or a known deflection rate after adjustment. The static deflection of the spring shall operate within the linear portion of their proper range of the isolator. Isolators shall operate in the linear portion of their load versus deflection curves. Spring isolators shall have 50 percent excess capacity without becoming coil bound. Coar isolators isolators with factory-applied paint. Coar vibration isolators extend to weather and other corrosive environments with factory-applied corrosion resistance protection. Install and adjust vibration isolators in accordance with manufacturers written instructions.

Pipe connections. Provide flexible connectors for piping system connections on equipment side of shutoff valves for all pumps, mechanical equipment supported or suspended by spring isolators, and where indicated on drawings. Fabricate flexible piping connectors from stainless steel or rubber materials as suitable for system fluid. Flexible piping connectors shall be bellows, spherical or braided hose type as recommended by the manufacturer for the application.

Isolator Types:

- 1. Type WP (Waffle Pads): Provide 5/16 inch thick neoprene pads ribbed or waffled on both sides. Manufacture pads with bridge bearing quality neoprene and select for a maximum diameter of 50 and designed for 15 percent strain, with a static deflection of 0.05 inches. Incorporate steel load-spreading plates where required between the equipment and the neoprene pad to provide selected deflection. If the isolator is to be used on a concrete slab, install a neoprene mounting sleeve under the bolt head between the steel washer and the base plate to prevent metal to metal contact. Provide Mason Industries Type PV or equal.
2. Type SPNH (Spring and Neoprene Hangers): Provide a steel hanger box containing a laterally stable, double-deflecting neoprene isolator in series with a steel spring. Design springs so the ratio of the horizontal to vertical spring constant is between one and two. The spring diameter shall be not less than 3/16 inch and the diameter of the compressed height of the spring at rated load. Loaded springs shall operate within the linear portion of their load versus deflection curve over a deflection range of not less than 50 percent above design deflection. Spring diameter and hanger box hole size shall be large enough to permit the hanger rod to swing through a 30 degree arc. Include a neoprene deflector. If the isolator is to be used on a concrete slab, install a neoprene mounting sleeve under the bolt head between the steel washer and the base plate to prevent metal to metal contact. Provide Mason Industries Type 30N or equal.
3. Type NR (Neoprene Bushing): Provide neoprene, rubber-in-shear bushings for lightweight (less than 100 pounds), suspended equipment supported from structure with all thread rod and angle iron or Unistrut. Select for a maximum diameter of 50 and designed for 15 percent strain, with a static deflection of 0.15 inches. Provide Mason Industries Type HMIB or equal.

R. SEISMIC CONTROLS FOR MEPP SYSTEMS

Seismic Protection Criteria: Risk/Occupancy Category: II Contractor's Seismic Engineer to Determine. Site Soil Category: Contractor's Seismic Engineer to Determine. Seismic Design Category: Contractor's Seismic Engineer to Determine. Component Importance Factor: Determined from ASCE 7, most recent version.

The Contractor shall be responsible for determining the requirements for seismic bracing of mechanical, electrical, and plumbing systems. Seismic protection elements of all mechanical, electrical, and plumbing systems shall be determined by the applicable code adopted in the project jurisdiction. Where not otherwise determined within the contract documents, the Contractor shall be responsible for contracting a licensed professional engineer to establish building site class, seismic design category, seismic zone, or any other criteria necessary to determine the requirements for seismic bracing on mechanical, electrical, and/or plumbing systems.

Seismic bracing of fire protection systems shall be installed in strict accordance with the provisions of NFPA 13 (2010 or later edition).

The Contractor shall determine the type and location of seismic bracing required for the mechanical, electrical, and plumbing elements shown on the drawings based on the established seismic criteria, the size and weight of the supported element, and the distance from structure of the supported element.

- The Contractor shall submit the following shop drawing information to the AHJ and the Engineer for review and approval:
1. Seismic analysis listing all applicable seismic design criteria.
2. Descriptive catalog data of seismic bracing materials.
3. Shop drawings showing bracing type and location.
4. Installation details of all bracing used.
5. Calculations showing that the seismic restraints meet the seismic requirements.
Shop drawings and calculations shall be prepared and sealed by a registered professional engineer, licensed in the state of the project and employed by the manufacturer of the seismic bracing products. Calculations shall include dead loads, static seismic loads, and capacity of materials utilized for connections.

Seismic bracing, restraints, isolators, and isolation materials shall be of the same manufacturer and shall be certified by the manufacturer. Approved manufacturers are: Amber/Booth Company, Inc., B-Line/Toledo, ISAT, Kinetics Noise Control, Inc., Loos & Company, Inc., Mason Industries, Inc., Uni-strut, or Vibro-Acoustics. Each device shall have a pre-approval number from California OSHPD or other recognized government agency showing maximum restraint ratings.

Seismic bracing measures to be applied to mechanical, electrical, and plumbing equipment/systems shall be installed in strict accordance with all applicable local, state, and/or federal codes as well as manufacturer's requirements. The most stringent criteria shall apply. All anchor connections to structure for support of mechanical and electrical equipment, regardless of the need for seismic restraints, shall be shown on shop drawings.

S. AIR FILTERS

Provide AAF/Flanders Perfect Pleat HC M6, Camfil Far 30/30, pleated, throwaway type filters, minimum MERV 8, or similar as manufactured by Air Filter, Inc., Bioclimatic, Columbus, Koch, or approved equal, unless otherwise indicated.

Temporary filters used to protect openings in ductwork and inside equipment when permanent HVAC equipment is used during the construction period shall be pleated, throwaway type filters, minimum MERV 8.

T. REFRIGERANT AND OIL

Provide full refrigerant and oil charge in new air conditioning refrigeration systems, and maintain it for full term of the guarantee.

U. IDENTIFICATION

Provide manufacturer's standard pre-printed, semi-rigid snap-on or permanent adhesive, pressure-sensitive vinyl pipe markers. Color code pipe markers to comply with ANSI A13.1.

Install pipe markers on each HVAC piping system and include arrows to show normal direction of flow.

Locate pipe markers and color bands wherever piping is exposed to view in occupied spaces, machine rooms, accessible maintenance spaces (shafts, tunnels, plenums) and exterior non-enclosed locations.

Provide plastic laminate or brass valve tag on every valve, cock and control device in each HVAC piping system; exclude check valves, valves within factory-fabricated equipment units, and shut-off valves at HVAC terminal devices and similar rough-in connections of end-use fixtures and units.

Provide manufacturer's standard laminated plastic, color coded equipment markers. Conform to the following color code: Green for Cooling; Yellow for Heating; Yellow/Green for combination Cooling and Heating; Brown for Energy Reclamation; Blue for other equipment types. Conform to ANSI A13.1 for Hazardous Equipment.

Provide stenciled signs for equipment identification at Contractor's option or where distance of required identification requires lettering larger than 1 inch height. Stencil paint shall be exterior type, oil-based, alkyl enamel, minimum 1-1/4 inch height or greater as required for long distance identification, white or black color for best contrast.

Provide duct markers or provide stenciled signs and arrows indicating ductwork service and flow direction in black or white lettering for best contrast with duct or insulation color. Locate markers maximum 50 feet along each duct side and within 5 feet of all control and balancing dampers or branch ducts or more than 25 feet length and within 5 feet on each side of wall, floor, and ceiling penetrations. Provide additional markers in congested areas or at multiple duct runs as required for clarity.

3. DUCT INSULATION, DUCTWORK, ACCESSORIES, FLUES AND FANS

A. DUCT INSULATION

Provide fiberglass duct liner with fibers firmly bonded together with a thermosetting resin. Liner surface shall serve as a barrier against infiltration of dust and dirt, shall meet ASTM C1338 for fungi resistance, and shall be cleanable using duct cleaning methods and equipment outlined by North American Insulation Manufacturers Association (NAIMA) duct cleaning guide. Install with liner adhesive and mechanical fasteners in accordance with manufacturer's instructions and recommendations. Ductwork sizes shown on drawings are inside clear dimensions. Increase sheet metal by liner thickness in both directions where liner is installed.

Provide rectangular liner conforming to ASTM C1071, Type I or II that is 1-1/2 inch thick, 1-1/2 pound density, minimum R-6.0 CertainTeed Corp. "ToughGuard" or equivalent, Johns Manville, Owens-Corning, or Knaflex.

Provide round liner that is 1-1/2 inch thick, 4 pound density, minimum R-6.0 Johns Manville "Spiracoustic Plus" or equivalent, CertainTeed or Owens-Corning.

Provide liner on the following interior air ducts and where specified on the drawings:

- 1. Exposed round and rectangular supply ductwork.
2. Exposed round and rectangular return ductwork.

At interface of lined and wrapped ductwork, overlap lined ductwork at least 2 feet beyond wrapped insulation.

Cover concealed, rigid ductwork with ASTM C553, Type II flexible fiberglass insulation. Installed insulation shall be 2 inch thick, 3/4 pound density, minimum R-6.0 duct wrap, CertainTeed or equivalent Johns Manville, Owens-Corning, or Knaflex with heavy-duty foil-scrim-kraft facing, and with joints taped with 3 inch wide foil tape as follows:

- 1. Round and rectangular supply and return air ductwork.
2. Unlined Round and rectangular outside air ductwork.
3. Round and rectangular exhaust and relief air ductwork within 10 feet of exterior discharge.

Cover Outdoor air, Exhaust air and Relief air plenums connected to exterior louvers with 1-1/2 inch thick, 1.5 pound density, rigid fiberglass insulation conforming to ASTM C612, Class 2.

Insulating materials, adhesives, coatings, etc., shall not exceed flame spread rating of 25 and smoke developed rating of 50 per ASTM E84. Containers for mastics and adhesives shall have U.L. Label.

For supply and return ductwork located exterior to the building, insulation shall be minimum R-8.0. Provide insulation and jacket in accordance with one of the following three options:

- 1. Exterior insulation and jacket consisting of 2 inch thickness of Armatuff flexible elastomeric insulation or equivalent meeting ASTM C534 with integral 1/2 inch thick UV resistant cladding laminated at factory. Cover all seams with Armatuff seal tape.
2. Exterior insulation consisting of 2 inch thickness of Styrofoam insulation meeting ASTM C534 with 1/2 inch density rigid fiberglass meeting ASTM C612, and jacket consisting of 20 gauge corrugated aluminum jacket with aluminum finishing flange and minimum three aluminum attachment bands per section.
3. Exterior insulation consisting of 2 inch thickness of flexible elastomeric insulation meeting ASTM C534 or 3 1/2 density rigid fiberglass meeting ASTM C612, and jacket consisting of 15.5 mils thick Venturoleuc Plus UV resistant cladding.

Install exterior ductwork with sufficient slope to ensure that water cannot pond anywhere on the duct. Drainage must be achieved by sloping ductwork -- not by varying the insulation thickness. Locate longitudinal seams of outer shell (aluminum, flexible elastomeric, or cladding as applicable) at bottom of duct. Install cladding in strict conformance with cladding manufacturer's instructions.

B. DUCTWORK

Provide galvanized steel ductwork and housings as shown on drawings. Construct ductwork including fittings and transitions in conformance with current SMACNA standards relative to gauge, bracing, joints, etc. Minimum thickness of duct shall be 26-gauge sheet metal. Reinforce housings and ductwork over 30 inches with 1-1/4 inch angles not less than 5/8" on centers, and closer if required for sufficient rigidity to prevent vibration. Support horizontal runs of duct from strip iron hangers on centers not to exceed 6'-0". Do not support ceiling grid, conduits, pipes, equipment, etc. from ductwork. Coordinate routing of ductwork with other contractors such that piping, electrical grid, and associated supports are not routed through the ductwork.

Provide pre-engineered roof duct supports supported by Cooper B-Line, Elite Components, ERICO, FNW, Miro, PHD Manufacturing, PHR Systems, Roof Top Box, Unistrut (Akroak), Zai Foster, or approved equal. Support ductwork on the roof with pre-engineered roof duct supports that rest on top of the roof membrane, not requiring any attachment to the roof structure and not penetrating the roofing assembly, with embedded support fixtures as required to seal duct. Provide steel pedestal type supports with minimum 18x18 inch thermoplastic or rubber base or 4 inch wide closed-cell polyethylene block with length as required. Maintain minimum 6 inches clearance under duct to final installation surface.

Coordinate with the pre-engineered roof duct support manufacturer to anchor the duct supports directly to the roof structure in accordance with the manufacturer's installation instructions or provide intermediate duct supports engineered to meet the wind resistance and seismic design criteria. Reference Section, "PRE-ENGINEERED ROOF EQUIPMENT SUPPORTS."

Construct non-VAV supply ducts to meet SMACNA positive pressure of 2 inches w.g. Construct Return, Outdoor and Exhaust ductwork upstream of fans to meet SMACNA negative pressure of 1 inch w.g. Construct exhaust ductwork downstream of fans to meet SMACNA positive pressure of 1 inch w.g.

Provide mill phosphatized and galvanized finish for exposed ductwork to be field painted. Shop treated sheet metal shall have galvanized metal primer applied in the shop after fabrication and prior to shipping.

Seal ductwork with heavy liquid sealant, Hardcoat Ironrip 601, Design Polymer DP 1010, Unistrut McGill duct sealer or approved SMACNA sealant according to sealant manufacturer's instructions. Seal all longitudinal and transverse ductwork joints airtight to meet SMACNA Seal Class A. Tapes and mastics shall be listed and labeled in accordance with UL 181A.

Provide radius elbows, turns, and offsets with a minimum centerline radius of 1-1/2 times the duct width. Where space does not permit full radius elbows, provide short radius elbows with a minimum of two continuous splitter vanes. Vanes shall be the entire length of the bend. Provide mirrored elbows where space does not permit radius elbows, where shown on the drawings, or at the option of the contractor with the engineer's approval. Mirrored elbows less than 45 degrees shall not require turning vanes. Mirrored elbows 45 degrees and greater shall have angle thickness turning vanes of same gauge as ductwork, rigidly fastened with guide strips in ductwork. Vanes for mirrored elbows shall be provided in all supply and exhaust ductwork and in return and outdoor air ductwork that has an air velocity exceeding 1000 fpm. Do not install vanes in gas pressure ductwork. The use of square throat, radius edge elbows is prohibited. Remove and replace all installed elbows of this type with an approved elbow at no additional cost to the owner.

Connect ducts to vibrating equipment and when transitioning between two different metallic duct materials (e.g., aluminum to galvanized steel) use a variety of flexible connectors. Flexible connectors shall be neoprene reinforced glass cloth canvas connections, Duro-Dyne, Eigen, Ventairic, or equal. Flexible connectors shall have a flame spread of 25 or less and smoke developed rating not higher than 50. Make ventairic joints and install with minimum 1-1/2 inches slack.

Provide balancing dampers, manufactured by Cesco, Greenheck, Louvers & Compairs, Nalor Industries, Potluff, Ruskin, Tamco, or approved equal, where shown on drawings and wherever necessary for complete control of air flow. Splitter dampers shall be controlled by existing ductwork and bearings for the damper rod. Rectangular volume dampers shall be opposed blade interlocking type. Round volume dampers shall be single-blade type consisting of circular blade mounted to a shaft. Provide Flexmaster model STO or equal 45 degree rectangular-round blade latching fitting model B03 damper with locking quadrant and system specified on drawings. Provide rectangular dampers by Metropolitan Air Technology model RT-200, Young's Regulator model 820-1200, or approved equal. Provide rectangular dampers by Metropolitan Air Technology model RT-200, Young's Regulator model 820-1200, or approved equal. Provide remote cable control by Metropolitan Air Technology model RT-WGA, Young's Regulator model 270-275, or approved equal.

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 actuate with a single piece with no linkage adjustment required. Damper shall be adjustable through the diffuser frame with standard 1/4 inch rudditor or flat screwdriver. Provide positive, direct, two-way damper control with no sleeves, springs or screw adjustments to come loose after installation. Provide cable length to span the distance from the damper to the remote operator location. Install damper in branch duct. Do not install in diffusers. If the isolator is to be used on a concrete slab, install a neoprene mounting sleeve under the bolt head between the steel washer and the base plate to prevent metal to metal contact. Provide Mason Industries Type 30N or equal.

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 actuate with a single piece with no linkage adjustment required. Damper shall be adjustable through the diffuser frame with standard 1/4 inch rudditor or flat screwdriver. Provide positive, direct, two-way damper control with no sleeves, springs or screw adjustments to come loose after installation. Provide cable length to span the distance from the damper to the remote operator location. Install damper in branch duct. Do not install in diffusers. If the isolator is to be used on a concrete slab, install a neoprene mounting sleeve under the bolt head between the steel washer and the base plate to prevent metal to metal contact. Provide Mason Industries Type 30N or equal.

Round or oval ductwork shall be FlakGroup Semco, United, Hercules Industries or equal, sheetmetal, with smooth interior surface, with low pressure (duct pressure class up to and including 2 inches w.g.) or medium pressure (duct pressure class 2.1 inch to 6 inches w.g.) flexible duct that shall be Flexmaster type BB, Thermaxflex type G-KM, M-KE, JPL, type Silver Jacket, or equal (fire retardant polymer) protective sleeve per manufacturer's instructions. Ductwork shall be protected with R-6.0 fiberglass insulation. Provide CPE liner with steel wire helix mechanically bonded or permanently bonded to the liner.

Flexible duct runs shall not exceed 5 feet in length, and shall be installed fully extended and straight as possible avoiding tight turns. Install flexible duct in accordance with manufacturer's instructions. Support flexible duct at maximum 5 feet of center and within 6 inches of bends. Bends shall not exceed a centerline radius of one duct diameter. Duct sag shall not exceed 1/2 inch. Supporting material in direct contact with the duct shall not be less than 1-1/2 inches in width.

Connect flexible duct to rigid metal duct or air devices as recommended by the manufacturer. At a minimum, install two wraps of duct tape around the inner circumference and a metallic or metal wrap of duct tape and two wraps of duct tape or a clamp over the outer jacket. Duct clamps shall be labeled in accordance with UL 181B and marked 181B-C. Duct tape shall be labeled in accordance with UL 181B and marked 181B-FX.

G. PLASTIC FLUE GAS VENTS

Provide UL 1788 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 IPEX "System 1738", or Polypropylene system by Centertrom "Infolux" or equal by Nova Flex Group "2-DENS."

Vents and combustion air ducts for condensing type appliances shall be Schedule 40 PVC pipe and socket fittings meeting ASTM D2865 and UL 1738, manufactured by IPEX. Use solvent cement meeting ASTM D2864 and make joints in accordance with ASTM D2865.

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.

H. AIR DEVICES

Provide air devices as scheduled on drawings, manufactured by Corneal, Kluger, Metataire, Nalor Industries, Price, Tish, or Tuttle & Bailey. Select air devices to limit noise level to no higher than NC-30 unless otherwise shown. Provide devices with a soft plastic gasket to make an airtight seal against the mounting surface. Coordinate final location, frame, and mounting type of air devices with Architectural reflected ceiling plans.

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 bars. 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 linear slot diffusers of standard one-piece lengths up to 6-feet and furnish in multiple sections greater than 6-feet. Join multiple sections together end-to-end with alignment pins to form a continuous airway appearance. For installations in a ceiling, use pressure plates per manufacturer's installation instructions prior to installation of drywall. Contractor shall use manufacturer's hard ceiling clips for mounting to ceiling framing. Screws through face of linear slot diffuser are not acceptable. Provide alignment components by the manufacturer. Provide plenums by the slot diffuser manufacturer. Plenums shall be internally insulated by the manufacturer with minimum 1/4 inch thick, fiberglass insulation.

I. CONTROL DAMPERS

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 60 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 actuated and field replaceable. Provide a minimum of one damper actuator per section. Test damper performance in accordance with AMCA 500-D.

Provide multi-opening 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.C. Size positioning dampers full duct size and select to minimize pressure drop. Motorized dampers used for ventilation air intake, exhaust air, or relief air shall have leakage rates not to exceed 4.0 CFM/square foot in full closed position at 1 inch W.G. pressure differential across the damper.

Provide dampers as manufactured by Greenheck, CESCO, Potluff, Nalor, or Ruskin. Reference manufacturer's manual with model number for outside air dampers is Manufacturer CD-50 constructed of aluminum, and all other applications is Ruskin CD-35 constructed of galvanized steel.

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 encouped. Each operator shall be provided with spring-return 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 Control or approved equal. Provide transformer for damper motors if different voltages are required.

J. EXHAUST AIR SYSTEMS

Provide roof mounted exhaust fans as scheduled on the drawings, or equal ACME, Carnes, Cook, Greenheck, Pennbary, or Twin City Fans complete with aluminum housing, aluminum centrifugal wheel, motor with integral thermal overload protection, disconnect switch mounted inside the housing, birdscreen, backdraft damper, and pats prefabricated roof curb. Three phase fans shall be furnished with magnetic starters with push button station.

Provide roof mounted upblast exhaust fans as scheduled on the drawings. Accurec, ACME, Carnes, Cook, Greenheck, Pennbary, or Twin City Fans complete with aluminum housing, aluminum centrifugal wheel, motor with integral thermal overload protection, disconnect switch mounted inside the housing, drain trough, birdscreen and pats prefabricated roof curb with minimum height of 12 inches for roofs with no insulation, 14 inches for roofs with insulation or schedule on the drawings. Exhaust fans serving Type I kitchen exhaust hoods shall discharge a minimum of 40 inches above the roof surface, shall have hinged access including access for blade inspection and cleaning per NFPA 96, grease drain trough filled with replaceable, absorbent material or replaceable cup and cap with absorbent material which absorbs grease and rejects water, and insulated curb, and shall be installed in accordance with NFPA 96 and local codes.

K. KITCHEN EXHAUST AIR SYSTEMS

Install kitchen grease exhaust package furnished by the owner. System includes kitchen hood, grease exhaust fan/pollution control unit, filtered makeup air unit and a mechanical or electrical gas shutoff valve provided with the kitchen exhaust system to shutoff fuel or power source to cooking equipment upon detection of fire. Valve shall have a clearly marked open/closed indicator.

Provide ducts connecting Type I exhaust hoods to exhaust fans made of #16 gauge black iron with continuously welded joints and clean-out doors. 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 I hood grease exhaust duct applications and shall conform to ASTM E2336 where required to comply with IMC. Insulation shall be flexible wrap enclosure rated for minimum 2000 degrees Fahrenheit and for zero clearance to combustibles. Insulation shall be non-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. At Contractor's option, a UL listed non-combustible ductwork package that complies with UL 1978 standards 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 Metal-Fab, Schreiber, Selkirk, or approved equal. Provide manufacturers UL listing number and verification certificate as a part of the shop drawing submital. 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 test methods as approved by the local code official to determine that all joints are airtight. Water leakage test shall be performed by Enviromatic 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.

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 Acon, Carrier, Dakin, 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 cooling as required by the applicable energy code or greater. Provide electric heater, and low pressure switches; direct expansion cooling and condensing coils shall 1/2 inch factory 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 as required by the applicable energy code or greater. If scheduled on the drawings, centrifugal evaporator blower; air filter rack, propeller type condenser fan; aluminumized steel heat exchanger; minimum 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 100 "on" time controls, 100 percent safety gas shutoff, direct spark ignition system; built-in thermal overload protection on motors and compressors; outdoor air purifier; relief; weatherlight 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 shipped with internal ventilators; Type CMB unit is not equipped with internal ventilator isolators; single point electrical power connection. Provide guards or louvers panels to protect the condenser coil from hail or other damage. Provide a 125 VAC, 20 amp duplex electrical receptacle mounted on the unit for electrical power connections. Provide a single point electrical power connection. Provide electronic programmable type thermostat. Provide unit complete with manufacturer's one year guarantee on components plus an additional four year guarantee on the compressors and heat exchangers. For units equipped with an economizer assembly, the assembly shall be covered with minimum 1/2 inch insulation. Provide control dampers by Metropolitan Air Technology model RT-200, Young's Regulator model 820-1200, or approved equal. Provide remote cable control by Metropolitan Air Technology model RT-WGA, Young's Regulator model 270-275, or approved equal.

F. SPLIT DUCTLESS AIR-CONDITIONING SYSTEMS

Provide split ductless system consisting of evaporator section for wall or ceiling mounting as indicated and remote condensing section similar to Carrier, Comfort Star, Dakin, Friedrich, Fujitsu, Lennox, U.S. Mitsubishi, Samsung, Sanyo, Trane, or York. Evaporator cabinet shall be 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 blower filter. Evaporator coil shall be direct-expansion cooling coil of seamless copper tubes expanded into aluminum fins, with thermal-expansion valve with external equalizer. Air-cooled condenser shall be of corrosion-resistant cabinet containing compressor, copper-tube-aluminum-fin coils, direct-drive propeller fans with motors 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 controls, 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.

G. 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, AHRI 410 and NSF 37. Unit housing shall be constructed of aluminum, aluminumized steel, or galvanized steel with powder coated finish. Units shall be equipped with remote control by infrared remote control or remote control by adjustable inlet louvers. Unit shall have an adjustable inertial discharge nozzle. Units shall have statically and dynamically balanced fans with direct drive fan drives. Motors shall be single speed/insulation mounted, continuous duty, with permanently sealed pre-lubricated ball bearings, and internal discharge.

Furnish unit with washable panel filters with welded galvanized steel mounting frames, gasketed, with fasteners for bolting together build-up filter banks. Furnish unit with built-in line voltage thermostat wired to air curtain junction box. Furnish with plunger-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.

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, 95.5-Tin-Antimony.

Brazing filler metals: AWS A5.8, Classification BAq-5: Silver (Ag) 44.0-46.0 percent, Zinc (Zn) 23.0-27.0 percent, and Copper (Cu) 29.3-31.0 percent.

2. AWS A5.8, Classification BCu-P-S: 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.

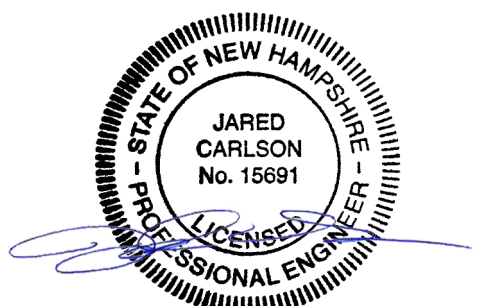
Insulate refrigerant lines with flexible elastomeric insulation, Armetflex or equal. Insulate suction and liquid lines between the expansion valve/evaporator and compressor with rigid mineral wool insulation with a minimum of 1/2 inch in size and 1 inch thick for pipes 1 inch and larger. Insulate hot 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 without melting or charring on the surface of the insulation. Provide insulation with a protective sleeve. 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 vibration stop at each change of direction. Mount pipe hangers around the outside of the insulation with saddles to prevent hangers from rubbing 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).

CONSULTANTS:

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 EXPIRES 12/30/2023

SEAL/ SIGNATURE:



06/05/2023

NO.	BY	DATE	DESCRIPTION
1		06/05/2023	ISSUED FOR CONSTRUCTION
C		05/15/2023	ADDENDUM C
B		04/29/2023	ADDENDUM B
A		10/28/2022	ADDENDUM A
		09/27/2022	PERMIT/BID SET
		08/06/2022	75% SET
		07/27/2022	DD SET



SHAKE SHACK TUSCAN VILLAGE

100 VIA TOSCANA
 BUILDING 1000
 SALEM, NEW HAMPSHIRE 03079
 SHACK #1449

ISSUED FOR CONSTRUCTION

MECHANICAL SPECIFICATIONS

DRAWN BY:	Author
CHECKED BY:	Checker
JOB NO:	21238.00

M592

9. COMMISSIONING OF MECHANICAL SYSTEMS
 Commissioning of HVAC System

A. PART 1 GENERAL

1.1 SUMMARY

- a. Section includes Cx process requirements for the following HVAC systems, assemblies, and equipment:
 1. Air-handling units (Supply fans, return fan, packaged units, roof top units, specialized fans)
 2. Exhaust fans
 3. Fan coil units and terminal units
 4. Condensing units
 5. Make-Up air units
 6. Ductwork and piping
- b. Related Requirements:
 1. Section 019113 "General Commissioning Requirements" for general Cx process requirement and CxA responsibilities.

1.2 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."
- 1. Refrigerant piping, including the following:
 - a. Refrigerant piping, fittings, and specialties.
 - b. Refrigerant charge.
 - c. General duty and specialty valves.
 - d. Meters and gages.
- 2. 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.
- 3. Kitchen exhaust system, including the following:
 - a. Exhaust and makeup air system.
 - 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. Make-Up air unit.
- 4. 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.

B. PART 3 EXECUTION

3.1 CONSTRUCTION CHECKLISTS

- a. Complete detailed construction checklists (prefunctional checklists) prepared by the CxA for HVAC systems, assemblies, subsystems, equipment, and components.
 1. Air and hydronic distribution systems, including the following:
 - a. Supply, return, outdoor-air, and exhaust-air distribution systems.
 - b. Automatic dampers.
 - c. Control valves.
 2. Heating and cooling terminal and unitary equipment, including the following:
 - a. Unit heaters.
 - b. Fan coil units.
 - c. Electric heating.
 3. TAB verification.

3.2 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)."

3.3 Cx TESTING PREPARATION

- a. Certify that HVAC systems, subsystems, and equipment have been installed, calibrated, and started and that they are operating according to the Contract Documents and approved submittals.
- b. Set systems, subsystems, and equipment into operating mode to be tested according to approved test procedures (for example, normal shutdown, normal auto position, normal manual position, unoccupied cycle, and alarm conditions).

3.4 Cx TESTS COMMON TO HVAC SYSTEMS

- 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 at the direction of CxA.
- d. Provide technicians, instrumentation, tools, and equipment to perform and document the following:
 1. Construction checklist verification tests.
 2. Construction checklist verification tests demonstrations.
 3. Cx test demonstrations.

3.5 START-UP DOCUMENTATION COMMON TO ALL SYSTEMS

- a. The following Start-Up Documentation (Checklists and Tests) shall be considered common to all systems:
 1. Checkout shall proceed from lower level devices to larger components to the entire system operation.
 2. Verify labeling is affixed per specification and visible.
 3. Verify prerequisite procedures are done.
 4. Inspect for damage and ensure none is present.
 5. Verify system is installed per the manufacturer's recommendations.
 6. Verify system has undergone Start-Up per the manufacturer's recommendations.
 7. Verify that access is provided for inspection, operation and repair.
 8. Verify that access is provided for eventual replacement of the equipment.
 9. Verify that record drawings, submittal data and O&M documentation accurately reflect the installed systems.
 10. Verify all gauges and test ports are provided as required by contract documents and manufacturer's recommendations.
 11. Verify all recorded nameplate data is accurate.
 12. Verify that the installation ensures safe operation and maintenance.
 13. Verify all rotating and moving parts are properly lubricated.
 14. Verify specified replacement material/stock has been provided as required by the Contract Documents.
 15. Verify all monitoring and ensure all alarms are active and set per requirements.

3.6 MECHANICAL IDENTIFICATION

- a. Include all applicable "Start-Up Checks Common to All Systems".
- b. Start-Up Checks: Perform the following checks:
 1. Verify all valve tags, piping, duct, and equipment labeling corresponds with drawings and indexes and meets requirements specified. Correct any deficiencies for all piping and duct system.
 2. Adjusting: Relocate any mechanical identification device which has become visually blocked by work of this division or other divisions.
 3. Cleaning: Clean face of identification devices, and glass frames of valve charts.

3.7 MECHANICAL INSULATION

- a. Include all applicable "Start-Up Checks Common to All Systems".
- b. Start-Up Checks: Examine all piping, systems and equipment specified to be insulated.
 1. Ensure quality of insulation. Patch and repair all insulation damaged after installation.
 2. Ensure the integrity of vapor barrier around all cold surfaces.

3.8 PIPING GENERAL

- a. Include all applicable "Start-Up Checks Common to All Systems".
- b. Start-Up Checks: These procedures apply to all installed piping systems, including underground site utilities.
 1. Inspect all piping for proper installation, adequate support (with appropriate vibration isolation where applicable) and adequate isolation valves for required service.
 2. Provide notifications of pipe cleaning and flushing activities.
 3. Flush and clean all piping and clean all strainers. Provide documentation of all related procedures.
 4. Ensure adequate drainage is provided at low points and venting is provided at high points.
 5. Ensure facilities to effectively drain and fill the system are in place.
 6. Ensure air is thoroughly removed from the system as applicable.
 7. Provide notification of pressure testing.
 8. Pressure and/or leak test all applicable systems in accordance with the requirements in the applicable Division 23 specification.
 9. Sterilize applicable piping systems as specified in the individual sections and as required by regulatory authorities.
 10. Submit pressure test reports that document the pressure testing results with certification of the results. Include drawings/diagrams indicating sections of pipe that are tested with the corresponding report.
 11. Set and adjust fill, pressure, or level controls to the required setting.

3.9 AC MOTORS

- a. Include all applicable "Start-Up Checks Common to All Systems".
- b. Start-Up Checks: Perform the following checks during start-up and as specified in manufacturer's instructions:
 1. Verify proper alignment, installation, and rotation.
 2. Verify properly sized overloads are in place.
- c. Start-Up Tests: Perform the following tests, measurements, or procedures during start-up and as specified in the manufacturer's instruction:
 1. Measure voltage available to all phases. Measure amps and RPM after motor has been placed in operation and is under load.
 2. Record all motor nameplate data.

3.10 PACKAGED HEATING AND COOLING UNITS

- a. Include all applicable "Start-Up Checks Common to All Systems".
- b. Refer to AC Motors in this section.
- c. General: Provide the services of a factory-authorized service representative to test and inspect unit installation, provide startup service, and to demonstrate and train Owner's maintenance personnel is required by the Owner.
- b. Start-Up Checks: Perform the following inspections/checks during start-up:
 1. Test controls and demonstrate compliance with requirements. Replace damaged or malfunctioning controls and equipment.
 2. Install new filters after start-up.

3.11 TERMINAL UNITS

- a. Include all applicable "Start-Up Checks Common to All Systems".
- b. Start-Up Checks: Perform the following inspections/checks during start-up:
 1. After construction is completed, including painting if applicable, clean unit exposed surfaces.
 2. Clean factory-finished surfaces. Repair any marred or scratches surfaces with manufacturer's touch-up paint.
 3. Verify adequate access for maintenance.
 4. Check power and control voltages.
 5. Check rotation of fan where applicable.
 6. Check operation of water leak sensors.
 7. Check calibration and operation of the controlling elements.
 8. Check control valves for required close-off and fail position.
 9. Install new filter units for terminals requiring same.

3.12 FANS

- a. Include all applicable "Start-Up Checks Common to All Systems".
- b. General: Provide the services of a factory-authorized service representative to test and inspect exhaust fan installation, provide startup service, and to demonstrate and train Owner's maintenance personnel is required by the Owner.
- c. Start-Up Checks: Perform the following inspections/checks during start-up:
 1. Inspect the field assembly of components and installation of the units, piping, ductwork, and electrical connections.
 2. Clean unit cabinet interiors to remove foreign material and construction dirt and dust. Vacuum clean fan wheel, fan cabinet, coils entering air face. Ensure volatile irritants are contained and kept out of occupied spaces.
 3. Adjust and lubricate dampers and linkages for proper damper operation.
 4. Verify the unit is secure on mountings and supporting devices and connections for ductwork, and electrical are complete. Verify proper thermal overload protection is installed in motors, starters, and disconnects.
 5. Ensure vibration isolation integrity is maintained with the fan installation and associated connections.
 6. Lubricate bearings, pulleys, belts, and other moving parts with factory-recommended lubricants.
 7. Stroke all dampers to ensure free and full travel.

3.13 DUCTWORK ACCESSORIES

- a. Include all applicable "Start-Up Checks Common to All Systems".
- b. Start-Up Checks: Perform the following checks during start-up and as specified:
 1. Cleaning: Clean factory-finished surfaces. Repair any marred or scratches surfaces with manufacturer's touch-up paint.
- c. Start-Up Tests: In addition to specifications, perform the following as a minimum:
 1. Operate installed ductwork accessories to demonstrate compliance with requirements. Test for air leakage while system is operating. Repair or replace faulty accessories, as required to obtain proper operation and leak proof performance.
 2. Label access doors in accordance with Division 21 Section "Mechanical Identification"
 3. Adjusting: Adjust ductwork accessories for proper settings, install fusible links in-fire dampers and adjust for proper action.

END OF SECTION 23

CONTROL FEATURE	UNITS	RTU-1		RTU-2		NOTES
		DINING SETPOINT OR Y/N	KITCHEN SETPOINT OR Y/N	DINING SETPOINT OR Y/N	KITCHEN SETPOINT OR Y/N	
COOLING - OCCUPIED SETPOINT	"F	75	75			
COOLING - UNOCCUPIED SETPOINT	"F	80	80			
HEATING - OCCUPIED SETPOINT	"F	70	68			
HEATING - UNOCCUPIED SETPOINT	"F	60	60			
DEHUMIDIFICATION SETPOINT - HUMIDITY SENSOR FEEDBACK	% RH	50%	50%			B
PROGRAMMED CONTROL FEATURES						
HVAC SYSTEM OCCUPIED/UNOCCUPIED MODE - PROGRAMMABLE THERMOSTAT		Y	Y	Y		B
REMOTE TEMPERATURE AND HUMIDITY SENSOR		Y	Y	Y		B
EQUIPMENT ACCESSORIES AND CONTROL MODULES						
OUTSIDE AIR DAMPER - MOTOR OPERATED (MODULATING)		Y	Y	Y		L
INTEGRATED ECONOMIZER - DIFFERENTIAL ENTHALPY ENABLE (OA ENTHALPY < RA ENTHALPY)	BTULB	Y	Y	Y		E
ECONOMIZER FAULT DETECTION AND DIAGNOSTICS (FDD) SYSTEM		Y	Y	Y		F, G
RELIEF - BAROMETRIC DAMPER		Y	Y	Y		
COOLING COIL (DX - STAGED)		Y	Y	Y		M
DEHUMIDIFICATION - HOT GAS REHEAT		Y	Y	Y		O
HEATING COIL (NATURAL GAS)		Y	Y	Y		M
SUPPLY FAN CONTROL METHODS						
ON DURING OCCUPIED HOURS		Y	Y			
CYCLE WITH LOADS DURING UNOCCUPIED HOURS		Y	Y			
SAFETIES, INTERLOCKS, AND ALARMS						
GAS VALVE SAFETY		Y	Y	Y		F
SUPPLY RETURN AIR SMOKE DETECTOR - SAFETY SHUTDOWN		Y	Y	Y		U
FIRE ALARM CONTROL PANEL - SAFETY SHUTDOWN INTERLOCK		Y	Y	Y		
KITCHEN EXHAUST SYSTEM INTERLOCK		Y	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 CONTROL MODES AND SEQUENCES 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.

- NOTES:
- 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 FDD 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 ENABLE/DISABLED 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 AIR FAN SPEED SETTING AND COIL CAPACITY STAGES SUBJECT TO THE INTERNAL SAFETIES AND SEQUENCES TO MAINTAIN SCHEDULED SETPOINTS.
 - O. PROGRAM DEHUMIDIFICATION SEQUENCE BASED ON ZONE 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.
 - U. DIVISION 26 CONTRACTOR SHALL PROVIDE DEVICE.

DEDICATED OUTDOOR AIR UNIT SCHEDULE (DX COOLING, NATURAL GAS HEAT)																									
PART OF CAPTIVE AIRE KITCHEN PACKAGE																									
MARK	MANUFACTURER	MODEL	UNIT TYPE	SUPPLY FAN						DX COOLING COIL						GAS HEAT EXCHANGER				ELECTRICAL				WEIGHT (LBS)	NOTES
				CFM	ESP (IN)	HP	OA (CFM)	TH (MBH)	SH (MBH)	EAT (°F DB) (°F WB)	LAT (°F DB) (°F WB)	REFR TYPE	MIN OUT (MBH)	NOM INPUT (MBH)	MIN EFF (%)	LAT (°F DB)	V/PH	MCA	MCOCP	DISC TYPE	STARTER TYPE				
RTU-1	CAPTIVEAIRE	CASRTU2-1200-18-10T-DOAS	DOAS	3300	0.5	3	730	144.3	98.3	70.4	65.0	52.1	50.5	R410A	160.5	198.3	81	99.5	480/3	28.7	30	FUSED	COMBINATION	2003	A-R
RTU-2	CAPTIVEAIRE	CASRTU3-1300-24-20T-DOAS	DOAS	4500	0.5	5	2500	259.1	171.0	63.8	68.7	55.5	53.9	R410A	274.0	338.3	81	99.8	480/3	43.3	50	FUSED	COMBINATION	2722	A-R

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:

- A. EQUIPMENT FURNISHED AND INSTALLED PER THE EQUIPMENT RESPONSIBILITY SCHEDULE.
- B. PROVIDE INLET WITH 2" MERV 8, EFFICIENT PLEATED THROWAWAY AIR FILTERS.
- C. PROVIDE FACTORY MOUNTED DISCONNECT INSTALLED ON SERVICE SIDE OF UNIT.
- D. STARTERS FOR ALL MOTORS SHALL BE FURNISHED INTEGRAL WITH UNIT.
- E. PROVIDE UNIT WITH SINGLE POINT ELECTRICAL CONNECTION.
- F. SPECIFIED FAN ESP ACCOUNTS FOR DUCT LOSSES EXTERNAL TO UNIT. FILTER LOSS IS AT A MAXIMUM OF 400 FPM FACE VELOCITY.
- G. 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.
- H. DIVISION 28 CONTRACTOR SHALL PROVIDE SMOKE DETECTORS IN RETURN AIR DUCT.
- K. SCHEDULED WEIGHT IS THE MAXIMUM ALLOWABLE OPERATING WEIGHT OF THE EQUIPMENT AND CURB.
- L. PROVIDE WITH STAINLESS STEEL HEAT EXCHANGER.
- N. PROVIDE HEATER TO MEET OR EXCEED SCHEDULED MINIMUM MBH OUTPUT. NOMINAL INPUT IS BASED ON LISTED MANUFACTURER'S STANDARD PRODUCT. COORDINATE EQUIPMENT GAS LOAD WITH PLUMBING CONTRACTOR IF DIFFERENT FROM THAT SCHEDULED. MEET MINIMUM EFFICIENCY SCHEDULED.
- P. PROVIDE UNIT WITH VERTICAL SUPPLY AIR DUCT DISCHARGE THROUGH UNIT CURB.
- R. PROVIDE FREEZE STAT IN THE SUPPLY AIR DUCT TO SHUT DOWN THE SUPPLY FAN AND CLOSE THE OUTDOOR AIR DAMPER IF TEMPERATURE IN THE SUPPLY DUCT DROPS BELOW 40 DEGREES FAHRENHEIT.

AIR CURTAIN SCHEDULE									
MARK	SERVICE AREA	MANUFACTURER	MODEL	UNIT SPECS				V/PH/Hz	NOTES
				LENGTH (IN)	MAX AIRFLOW	HEATING CAPACITY (KW)	MOTOR (HP)		
AC-1	SERVICE ENTRY	MARS	STD2	36	1379	N/A	1/2	115/1	A-E
AC-2	CARRY-OUT ENTRY	MARS	STD2	72	1442	24	(2)1/2	480/3	A-F

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NOTES:

- A. EQUIPMENT FURNISHED AND INSTALLED PER THE RESPONSIBILITY SCHEDULE. REF ARCHITECTURAL DRAWINGS.
- B. MOUNT UNIT PER MANUFACTURER'S RECOMMENDATIONS TO FACE OF WALL AND SUPPORT VERTICALLY.
- C. PROVIDE INTEGRAL STARTER AND DISCONNECT SWITCH.
- D. PROVIDE AIR CURTAIN WITH NORMALLY CLOSED DOOR LIMIT SWITCH FOR INSTALLATION ON DOOR. THE AIR CURTAIN SHALL ENERGIZE WHEN DOOR OPENS.
- E. PROVIDE WITH DELAY MICROSWITCH WITH ADJUSTABLE DELAY TIMERS PRE MOUNTED IN THE AIR CURTAIN CONTROL PANEL.
- F. PROVIDE UNIT WITH INTERNAL THERMOSTAT.

GRILLE, REGISTER, AND DIFFUSER SCHEDULE										
MARK	MANUFACTURER	SERVICE	MODEL	CONSTRUCTION MATERIAL	FACE TYPE	MOUNTING LOCATION	FACE SIZE (IN)	MAX. NC	NOTES	
CEG	E.H. PRICE	EXHAUST GRILLE W/ DAMPER	80D	STEEL	EGGCRATE SURFACE	LAY-IN	12x12	30	A B C	F G H
CRG1	E.H. PRICE	RETURN GRILLE	80	STEEL	EGGCRATE SURFACE	LAY-IN	24x24	30	A B C	F H
CRD1	E.H. PRICE	SUPPLY DIFFUSER	SCD	STEEL	SQUARE CONE SURFACE	LAY-IN	12x12	30	A B C	F H J K L
CRD2	E.H. PRICE	SUPPLY DIFFUSER	SCD	STEEL	SQUARE CONE SURFACE	LAY-IN	24x24	30	A B C	F H K
CRD3	E.H. PRICE	SUPPLY DIFFUSER	PCDR	STEEL	PERFORATED SURFACE	LAY-IN	24x24	30	A B C	F H
WSR1	E.H. PRICE	SUPPLY REGISTER W/ DAMPER	520D	STEEL	LOUVERED FACE	WALL OR DUCT	(SEE PLANS)	30	A B C D E F G H	

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NOTES:

- A. EQUIPMENT FURNISHED AND INSTALLED PER THE EQUIPMENT RESPONSIBILITY SCHEDULE.
- B. NECK SIZE SHOWN ON DRAWINGS. PROVIDE BRANCH DUCT TO MATCH NECK SIZE UNLESS OTHERWISE SHOWN ON DRAWINGS.
- C. DIFFUSERS SHALL BE PREFINISHED TO MATCH CEILING/WALL EXPOSED DUCT COLOR (COORDINATE WITH ARCHITECT).
- D. FRONT BLADES PARALLEL TO LONG DIMENSION.
- E. DOUBLE DEFLECTION BARS SHALL BE ADJUSTABLE.
- F. FRAME TYPE TO MATCH CEILING/WALL CONSTRUCTION. COORDINATE WITH ARCHITECTURAL REFLECTED CEILING/WALL PLAN.
- G. PROVIDE OPPOSED BLADE DAMPER ADJUSTABLE FROM FACE OF DEVICE.
- H. PROVIDE DIFFUSERS, LINEAR SLOTS, AND GRILLES WITH NO EXPOSED MOUNTING SCREWS.
- J. CONTRACTOR SHALL PROVIDE REMOTE CABLE-OPERATED VOLUME DAMPER BY METROPOLITAN AIR TECHNOLOGIES MODEL RT-250 WITH EXTERNAL WORM GEAR OPERATOR OR EQUIVALENT YOUNG REGULATOR BUTTERFLY DAMPER WITH 270-275 CONTROLLER. OPERATOR SHALL HAVE A SQUARE DRIVE FOR 1/4" NUT DRIVER. DAMPER ASSEMBLY SHALL INCLUDE GALVANIZED STEEL DUCT WITH ROLLED BEAD STIFFENERS, REINFORCED BLADE, SELF LUBRICATING BEARING AND WORM GEAR MOUNTING PLATE. DAMPER SHALL BE INSTALLED IN BRANCH DUCT NOT INLET OF PLENUM DIFFUSER. (RE: 2M501)
- K. 4-WAY THROW PATTERN UNLESS OTHERWISE INDICATED BY FLOW ARROWS ON DRAWINGS.
- L. PROVIDE RAPID MOUNT FRAME FOR INSTALLATION IN HARD CEILING.

BUILDING AIR BALANCE SUMMARY NORMAL OPERATION				
UNIT NO.	SUPPLY (CFM)	OUTDOOR (CFM)	EXHAUST (CFM)	PERCENT OA/SA
RTU-1	3,400	730	--	21%
RTU-2	4,500	2,500	--	56%
FCU-1	420	40	--	10%
ESP-1	--	--	2,538	--
EF-1	--	--	300	--
TOTAL	8,320	3,270	2,838	--
DESIGN BUILDING PRESSURIZATION AIRFLOW (CFM)				432
PRESSURIZATION CHECK				13%

FAN SCHEDULE															
MARK	SERVICE DESCRIPTION	MANUFACTURER	MOUNTING	MODEL	CFM	ESP (IN)	MIN HP	FAN RPM	DRIVE (BELT/DIRECT)	VFD (Y/N)	ELECTRICAL			WEIGHT (LBS)	NOTES
											V/PH	DISC TYPE	STARTER TYPE		
EF-1	TOILETS	GREENHECK	ROOF	G-095-D	300	0.5	1/8	1550	DIRECT	N	120/1	NON-FUSED	N/A	30	A - E
REF-1	RELIEF	GREENHECK	ROOF	GB-160	2600	0.5	1/2	1016	DIRECT	N	120/1	NON-FUSED	N/A	76	A, C, E, F

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NOTES:

- A. EQUIPMENT FURNISHED AND INSTALLED PER THE RESPONSIBILITY SCHEDULE. REF ARCHITECTURAL DRAWINGS.
- B. PROVIDE WITH MINIMUM 24" HIGH ROOF CURB, BIRDSCREEN AND BACKDRAFT DAMPER.
- C. PROVIDE FACTORY MOUNTED DISCONNECT SWITCH.
- D. INTERLOCK FAN OPERATION WITH TIME CLOCK.
- E. PROVIDE WITH MANUFACTURER'S FAN SPEED CONTROLLER FOR BALANCING PURPOSES.
- F. INTERLOCK FAN OPERATION WITH RTU-2 ECONOMIZER CONTROLLER.

PROJECT DESIGN CONDITIONS															
CLIMATE CONDITIONS					BUILDING OPERATING HOURS:										
WEATHER STATION: LAWRENCE, MA, USA					MONDAY - FRIDAY: TBD BY OWNER										
CLIMATE ZONE: 5					SATURDAY: TBD BY OWNER										
HEATING (DB): 99.6% 4.6 "F					SUNDAY: TBD BY OWNER										
COOLING (DB/MCBW): 0.4% 90.8 "F/ 73.1 "F					HOLIDAY: TBD BY OWNER										
SPACE / UNIT DESCRIPTION	SET POINTS				SPACE OPERATING HOURS OCCUPIED / UNOCCUPIED				NOTES						
	COOLING / DEHUMIDIFICATION		HEATING		HUMIDIFICATION		ZONE VENTILATION RESET								
	OCC	UNOCC	MAX	MIN	OCC	UNOCC	MIN	MAX	CONTROL	BASE	MAXIMUM	M-F	SAT	SUN	
DINING AREAS	"F	"F	RH %	RH %	"F	"F	RH %	RH %	METHOD	PPM	PPM	TBD	TBD	TBD	A, B, C
OFFICES	75	80	50%	NA	70	60	NA	NA	NA	NA	NA	TBD	TBD	TBD	A, B, C
STOCKROOM/STORAGE	75	80	NA	NA	70	60	NA	NA	NA	NA	NA	TBD	TBD	TBD	A, B, C
FOOD PREP AREAS	75	80	NA	NA	70	60	NA	NA	NA	NA	NA	TBD	TBD	TBD	A, B, C

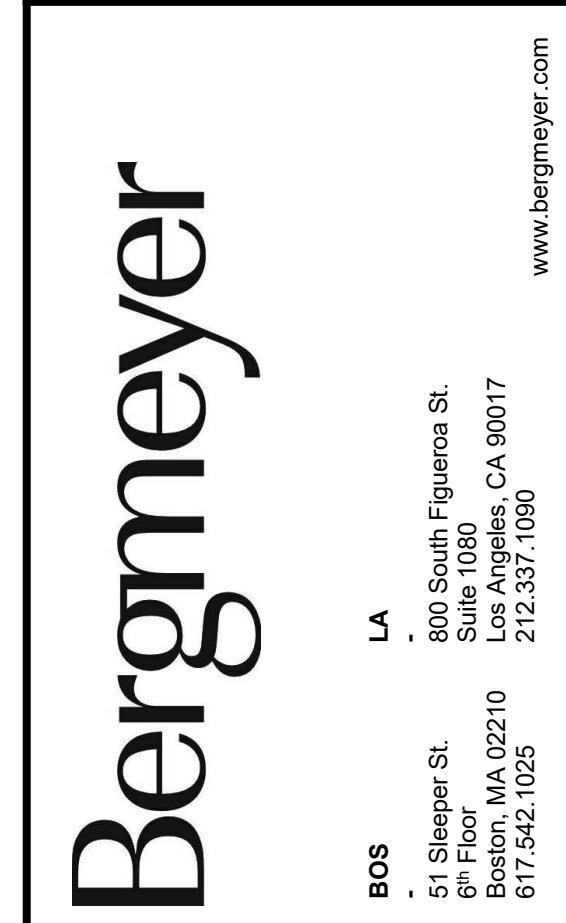
NOTES:

- A. ZONE LEVEL SET POINT CONDITIONS SHALL BE AS SCHEDULED UNLESS OTHERWISE SCHEDULED OR NOTED ON THE DRAWINGS FOR ROOM SPECIFIC SPACE CONDITIONS.
- B. ZONE LEVEL OCCUPANCY HOUR SCHEDULE SHALL BE PER BUILDING OPERATING HOURS UNLESS OTHERWISE SCHEDULED.
- C. 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 _s) (SF)	SYSTEM AVERAGED AREA-BASED OUTDOOR AIR RATE (CFM/SF)	SYSTEM POPULATION (P _s) (PEOPLE)	SYSTEM AVERAGED PEOPLE-BASED OUTDOOR AIR RATE (CFM/P)	REQUIRED OA INTAKE FLOW (V _o) (CFM)	REQUIRED DCV OA INTAKE FLOW (V _o) (CFM)	DESIGN OA INTAKE FLOW (V _o) (CFM)	NOTES
		SINGLE-ZONE SYSTEM ASSOCIATED VENTILATION ZONE	SINGLE-ZONE WORST CASE ZONE AIR DISTRIBUTION EFFECTIVENESS (E _Z)	SYSTEM VENTILATION EFFICIENCY (E _V)	SYSTEM EFFICIENCY (E _S)										
RTU-1	MULTIZONE (RTU-1)	-	-	0.90	1,404	62.91	7.50	699	N/A	730	-	-	-	-	
RTU-2	MULTIZONE (RTU-2)	-	-	1.00	1,040	20.8	7.50	281	N/A	2,500	-	-	-	-	
FCU-1	SINGLE ZONE OFFICE	0.80	-	-	65	0.060	0.325	5.00	7	40	-	-	-	-	
TOTALS											986	0	3,270		

GENERAL NOTES:

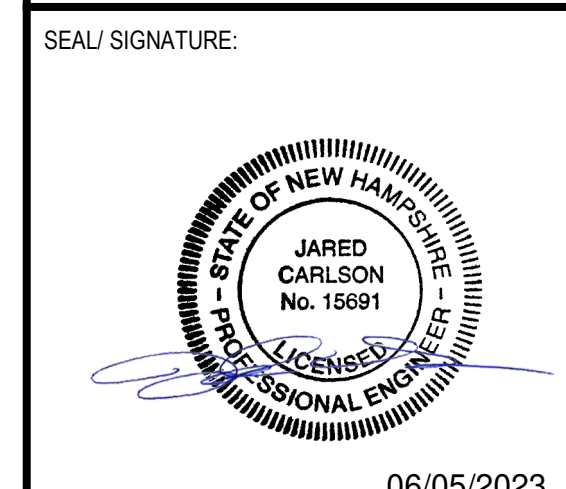
- VENTILATION CALCULATIONS BASED ON IMC-2018.
- SYSTEM POPULATIONS BASED ON MAX SEATINGS AND/OR CODE MAXIMUM VALUES.
- SINGLE ZONE SYSTEMS (V_o ≠ V_z): SYSTEM VENTILATION EFFICIENCY CALCULATION IS NOT REQUIRED FOR SINGLE ZONE SYSTEMS. WORST CASE AIR DISTRIBUTION EFFECTIVENESS BETWEEN HEATING AND COOLING MODES OF OPERATION IS SHOWN IN TABLE.
- 100% OA SYSTEMS (V_o = V_z = zones V_o): 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 V_o AND ASHRAE 62-1.2016 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_V.



CONSULTANTS:

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215005337
 NH CORPORATE NO. 1076
 EXPIRES 12/30/2023



SEA / SIGNATURE: 06/05/2023

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 JARED P. CARLSON

NO.	BY	DATE	DESCRIPTION
1		06/05/2023	ISSUED FOR CONSTRUCTION
B		05/15/2023	ADDENDUM C
C		04/20/2023	ADDENDUM B
A		10/28/2022	ADDENDUM A
		09/27/2022	PERMIT/BID SET
		08/06/2022	75% SET
		07/27/2022	DD SET



SHAKE SHACK TUSCAN VILLAGE

100 VIA TOSCANA
 BUILDING 1000
 SALEM, NEW HAMPSHIRE 03079
 SHACK #1449

ISSUED FOR CONSTRUCTION

MECHANICAL SCHEDULES

DRAWN BY: Author

CHECKED BY: Checker

JOB NO: 2123.00

M601

COMcheck Software Version 4.1.5.1
Mechanical Compliance Certificate

Project Information
 Energy Code: 2018 IECC
 Project Title: Shake Shack
 Location: Nashua, New Hampshire
 Climate Zone: 5a
 Project Type: New Construction
 Construction Site: Salem, NH
 Owner/Agent: Shake Shack
 Designer/Contractor: Henderson Engineers Lenexa, KS

Additional Efficiency Package(s)
 Unspecified
Mechanical Systems List
Quantity System Type & Description
 1 RTU-1 (Single Zone)
 Heating: 1 each - Other, Gas, Capacity = 160 kBtu/h
 No minimum efficiency requirement applies
 Cooling: 1 each - Single Package DX Unit, Capacity = 115 kBtu/h, Air-Cooled Condenser, Air Economizer
 Proposed Efficiency = 13.00 EER, Required Efficiency: 11.00 EER + 12.6 IEER
 Fan System: RTU-1 | DINING -- Compliance (Motor nameplate HP method) - Passes
 Fans:
 FAN 1 Supply, Constant Volume, 3400 CFM, 3.0 motor nameplate hp, 0.0 fan efficiency grade
 1 RTU-2 (Single Zone)
 Heating: 1 each - Other, Gas, Capacity = 274 kBtu/h
 No minimum efficiency requirement applies
 Cooling: 1 each - Single Package DX Unit, Capacity = 243 kBtu/h, Air-Cooled Condenser, Air Economizer
 Proposed Efficiency = 12.72 EER, Required Efficiency: 9.80 EER + 11.4 IEER
 Fan System: RTU-2 | KITCHEN -- Compliance (Motor nameplate HP method) - Passes
 Fans:
 FAN 11 Supply, Constant Volume, 4500 CFM, 5.0 motor nameplate hp, 0.0 fan efficiency grade

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 Version 4.1.5.1 and to comply with any applicable mandatory requirements listed in the Inspection Checklist.
 Andrew Pettus - Mechanical Designer
 Name - Title: Andrew Pettus Signature: [Signature] Date: 09/26/2022

Project Title: Shake Shack Report date: 09/26/22
 Data filename: J:\Lenexa\Programs\P-T\Shake Shack\2150005337 Shake Shack 1449 - (Tuscan Village) Salem, Page 1 of 11
 NH0000EnergyComCheck

Section # & Req.ID	Mechanical Rough-In Inspection	Complies?	Comments/Assumptions
C402.2.6 [ME42]	Thermally ineffective panel surfaces of serviceable heating panels have insulation >= R-3.5	<input type="checkbox"/> Complies <input type="checkbox"/> Does Not <input type="checkbox"/> Not Observable <input type="checkbox"/> Not Applicable	Exception: Requirement does not apply.
C403.8.4 [ME142]	Motors for fans that are not less than 1/2 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	Exception: Requirement does not apply.
C403.8.4 [ME142]	Motors for fans that are not less than 1/2 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.
C403.8.5 [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.
C403.12.3 [ME71]	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	Exception: Requirement does not apply.
C403.2.3 [ME55]	HVAC equipment efficiency verified.	<input type="checkbox"/> Complies <input type="checkbox"/> Does Not <input type="checkbox"/> Not Observable <input type="checkbox"/> Not Applicable	See the Mechanical Systems list for values.
C403.5.5 [ME113]	Fault detection and diagnostics installed with air-cooled 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.
C403.5.5 [ME113]	Fault detection and diagnostics installed with air-cooled 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	Exception: Requirement does not apply.
C403.7.1 [ME39]	Demand control ventilation provided for spaces >500 ft ² and >25 people/1000 ft ² 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	Exception: Requirement does not apply.

Project Title: Shake Shack Report date: 09/26/22
 Data filename: J:\Lenexa\Programs\P-T\Shake Shack\2150005337 Shake Shack 1449 - (Tuscan Village) Salem, Page 5 of 11
 NH0000EnergyComCheck

COMcheck Software Version 4.1.5.1
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.
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:

Project Title: Shake Shack Report date: 09/26/22
 Data filename: J:\Lenexa\Programs\P-T\Shake Shack\2150005337 Shake Shack 1449 - (Tuscan Village) Salem, Page 2 of 11
 NH0000EnergyComCheck

Section # & Req.ID	Mechanical Rough-In Inspection	Complies?	Comments/Assumptions
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	Exception: 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	Exception: Requirement does not apply.
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	Exception: Requirement does not apply.
C403.7.5 [ME116]	Kitchen exhaust systems comply with replacement air and conditioned supply air limitations, and safety hood rating 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 [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.
C403.5.1 [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.
C403.5.1 [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]	Air economizers automatically reduce outdoor air intake to the design 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 [ME124]	Air economizers automatically reduce outdoor air intake to the design 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.

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Section # & Req.ID	Footing / Foundation Inspection	Complies?	Comments/Assumptions
C403.12.3 [FO9]	Snow/ice melting 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	Exception: Requirement does not apply.

Additional Comments/Assumptions:

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Section # & Req.ID	Mechanical Rough-In Inspection	Complies?	Comments/Assumptions
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	Exception: Requirement does not apply.
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	Exception: 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 > 45°F. Vestibule heating and cooling systems controlled by a thermostat in the vestibule with heating setpoint <= 60°F and cooling setpoint >= 80°F.	<input type="checkbox"/> Complies <input type="checkbox"/> Does Not <input type="checkbox"/> Not Observable <input type="checkbox"/> Not Applicable	Exception: Requirement does not apply.
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.
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	Requirement will be met.
C403.5.1 [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.

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Section # & Req.ID	Plumbing Rough-In Inspection	Complies?	Comments/Assumptions
C404.5.1 [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	Exception: Requirement does not apply.
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	Exception: Requirement does not apply.
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	Exception: Requirement does not apply.
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	Exception: Requirement does not apply.
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	Exception: Requirement does not apply.
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	Exception: Requirement does not apply.


Additional Comments/Assumptions:

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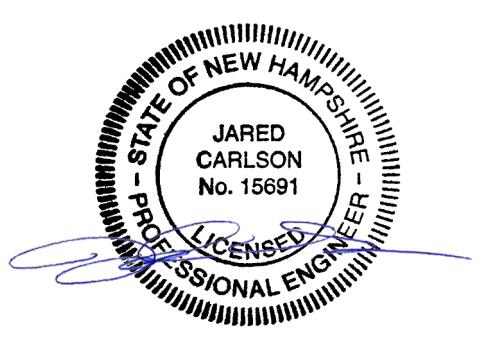
Section # & Req.ID	Rough-In Electrical Inspection	Complies?	Comments/Assumptions
C405.6 [EL26]	Low-voltage dry-type distribution electric transformers meet the minimum efficiency requirements of Table C405.6.	<input type="checkbox"/> Complies <input type="checkbox"/> Does Not <input type="checkbox"/> Not Observable <input type="checkbox"/> Not Applicable	Exception: 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 [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	Exception: 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	Exception: Requirement does not apply.

Additional Comments/Assumptions:

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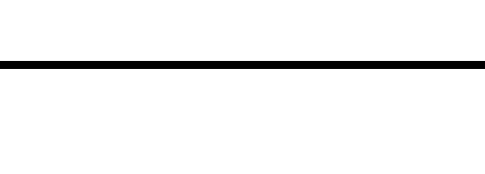


CONSULTANTS:
HENDERSON ENGINEERS
 8345 LENEXA DRIVE, SUITE 300
 LENEXA, KS 66214
 TEL 913.742.5000 FAX 913.742.5001
 WWW.HENDERSONENGINEERS.COM
 2150005337
 NH CORPORATE NO: 1076
 EXPRES 12/20/2022



06/05/2023

SEAU SIGNATURE:



1 | 06/05/2023 | ISSUED FOR CONSTRUCTION
 C | 05/15/2023 | ADDENDUM C
 B | 04/20/2023 | ADDENDUM B
 A | 10/26/2022 | ADDENDUM A
 09/27/2022 PERMIT/BID SET
 08/06/2022 75% SET
 07/27/2022 DD SET

NO.	BY	DATE	DESCRIPTION
1		06/05/2023	ISSUED FOR CONSTRUCTION
C		05/15/2023	ADDENDUM C
B		04/20/2023	ADDENDUM B
A		10/26/2022	ADDENDUM A
		09/27/2022	PERMIT/BID SET
		08/06/2022	75% SET
		07/27/2022	DD SET

SHAKE SHACK

SHAKE SHACK TUSCAN VILLAGE

100 VIA TOSCANA BUILDING 1000 SALEM, NEW HAMPSHIRE 03079 SHACK #1449

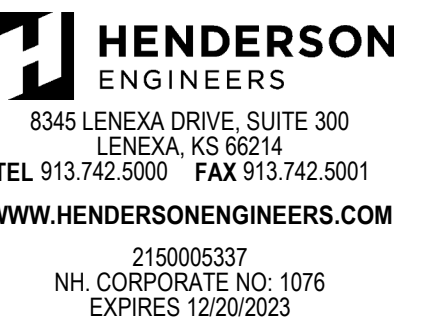
ISSUED FOR CONSTRUCTION

MECHANICAL ENERGY CODE COMPLIANCE

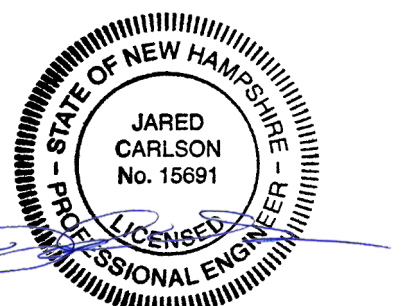
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 CHECKED BY: Checker
 JOB NO: 21238.00

M630

CONSULTANTS:



SEAU SIGNATURE:



06/05/2023

Section # & Req ID	Final Inspection	Complies?	Comments/Assumptions
C303.3. C408.2.5 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 [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.
C403.1.1 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. C403.2.4 2,2 [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 2,3 [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.
C403.2.4 2,3 [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.
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.

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

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Section # & Req ID	Final Inspection	Complies?	Comments/Assumptions
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. 1 [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)

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NO.	BY	DATE	DESCRIPTION
1		06/05/2023	ISSUED FOR CONSTRUCTION
C		05/15/2023	ADDENDUM C
B		04/20/2023	ADDENDUM B
A		10/28/2022	ADDENDUM A
		09/27/2022	PERMIT/BID SET
		08/06/2022	75% SET
		07/27/2022	DD SET



SHAKE SHACK TUSCAN VILLAGE

100 VIA TOSCANA
BUILDING 1000
SALEM, NEW HAMPSHIRE 03079
SHACK #1449

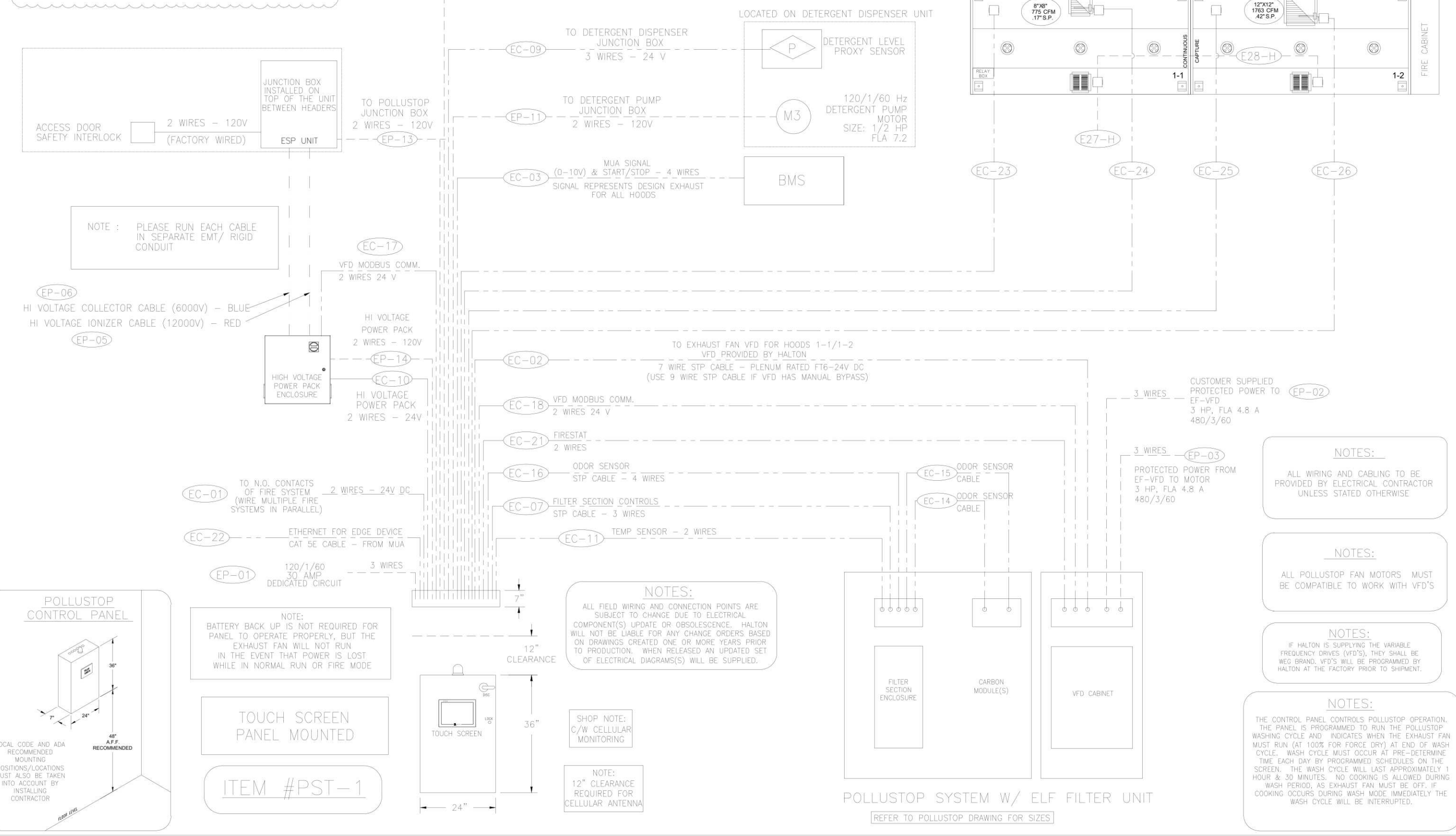
ISSUED FOR CONSTRUCTION

MECHANICAL ENERGY CODE COMPLIANCE

DRAWN BY: Author
CHECKED BY: Checker
JOB NO: 21238.00

M631

HALTON TO SUPPLY 100 FEET OF COLLECTOR CABLING OF EACH TYPE.



POWER CONNECTIONS

EP-01	120V, 30 AMP - POLLUSTOP CONTROL PANEL POWER - 3 WIRES
EP-02	HIGH VOLTAGE POWER FROM BUILDING SOURCE TO VFD
EP-03	HIGH VOLTAGE POWER FROM VFD TO MOTOR STARTER
EP-04	NOT USED
EP-05	HIGH VOLTAGE (RED) CABLE - PROVIDED BY HALTON
EP-06	HIGH VOLTAGE COLLECTOR CABLE (BLUE) - PROVIDED BY HALTON
EP-07	NOT USED
EP-08	NOT USED
EP-09	NOT USED
EP-10	NOT USED
EP-11	TO DETERGENT PUMP - 2 WIRES @ 120 V
EP-12	TO MAIN WATER VALVE - 2 WIRES 120 V
EP-13	TO POLLUSTOP CONTROL PANEL JUNCTION BOX - 2 WIRES 120 V
EP-14	HIGH VOLTAGE POWER PACK - 2 WIRES @ 120V
EP-15	NOT USED
EP-16	NOT USED
EP-17	NOT USED
EP-18	NOT USED
EP-19	NOT USED
EP-20	NOT USED
EP-21	NOT USED
EP-22	NOT USED

CONTROLS CONNECTIONS

EC-01	2 WIRES - TO N.O. CONTACT OF FIRE SYSTEM MICROSWITCH
EC-02	7 WIRE STP CABLE - PLenum RATED FT6 - TO EF VFD
EC-03	4 WIRES - MAIN INTERLOCK TO WEG OR DOD
EC-04	NOT USED
EC-05	MAN SHUT OFF - 3 WIRES (OPTIONAL)
EC-06	NOT USED
EC-07	3 WIRE STP CABLE - FT6 RATED - TO FILTER SECTION
EC-08	SPRING TEMP SENSOR (OPTIONAL)
EC-09	TO DETERGENT DISPENSER (FRISTAT SWITCH) - 3 WIRES 24 V
EC-10	HIGH VOLTAGE POWER PACK - 2 WIRES @ 24 V
EC-11	TEMP SENSOR - 2 WIRES
EC-12	NOT USED
EC-13	NOT USED
EC-14	3 WIRE CM MAIN SENSOR 1 (BEFORE CARBON FILTER)
EC-15	NOT USED
EC-16	4 WIRES FOR DOOR MONITOR
EC-17	VFD MODBUS COMMUNICATION
EC-18	VFD MODBUS COMMUNICATION
EC-19	3 WIRE CM MAIN SENSOR 2 (AFTER CARBON FILTER)
EC-20	4 WIRES FOR DOOR MONITOR
EC-21	2 WIRES - FRISTAT SIGNAL
EC-22	CABLE CABLE - ETHERNET CONNECTION FOR EDGE DEVICE

SEQUENCE OF OPERATION:

- TOUCH SCREEN ON/OFF BUTTON - "ON" POSITION (RUN MODE)
- EXHAUST FAN ON (SET POINT) (LOW RATE)
- ORV CONTACT FOR MAKE UP AIR WILL CLOSE
- EXHAUST FAN WILL MAINTAIN CONSTANT AIRFLOW THROUGH VFD SPEED CHANGE RELATED TO STATIC PRESSURE CHANGE
- EXHAUST FAN WILL SHUT DOWN IN CASE OF MISSING FILTERS)
- ERIE MODE
- EXHAUST FAN IS ON AT 100% IN A FIRE MODE
- MAIN FAN IS OFF

TOUCH SCREEN ALARM CONDITIONS:

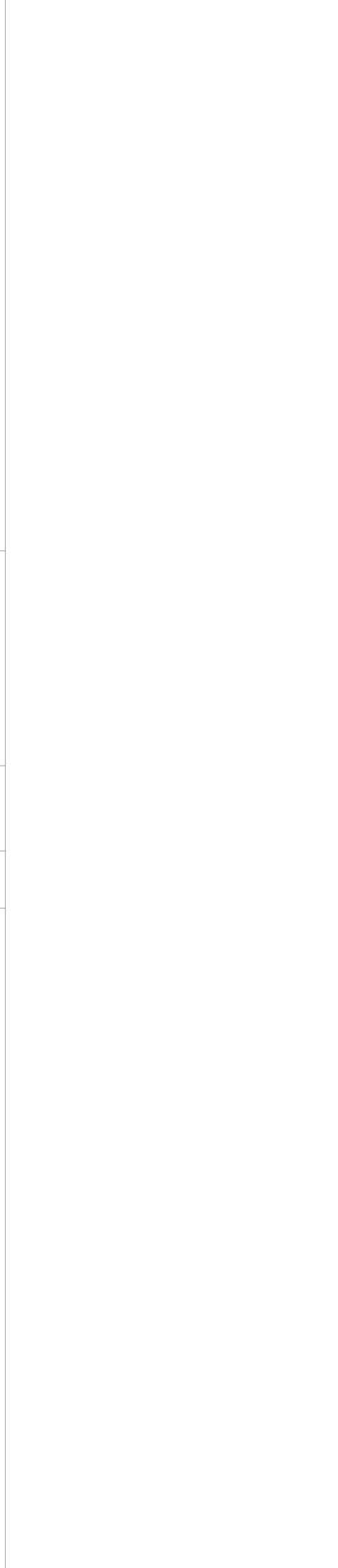
- ELF BAG FILTER CLOGGED
- ELF BAG FILTER MISSING
- FINAL FILTER CLOGGED
- FINAL FILTER MISSING
- FIRE
- CHANGE FILTERS
- LOW DOOR CONTROL LEVEL
- FAN FAILED

TOUCH SCREEN DISPLAY SCREENS APPLICATIONS:

- FAN SPEED
- ELF FILTER LIFE REMAINING
- FINAL FILTER LIFE REMAINING
- DOOR CONTROL
- ON/OFF (CONTINUOUS)
- ON THE SETTINGS
- OFF THE SETTINGS
- TECH SUPPORT

POLLUSTOP - SYSTEM SCOPE OF WORK

- RESPONSIBILITY TO BE SELECTED BY GENERAL CONTRACTOR (REVISIONS FOR REFERENCE):
- APPLICABLE CONTRACTOR TO SUPPLY AND INSTALL THREE PHASE OR SINGLE PHASE POWER FEED FROM CIRCUIT BREAKER(S) TO VFD'S. APPLICABLE CONTRACTOR TO SUPPLY AND INSTALL THREE PHASE OR SINGLE PHASE POWER FROM VFD(S) TO EXHAUST / WIA OF APPLICABLE MOTOR. POLLUSTOP 2 EXHAUST FAN.
 - APPLICABLE CONTRACTOR TO SUPPLY AND INSTALL 120V (240) DEDICATED CIRCUIT AT POLLUSTOP CONTROL PANEL.
 - APPLICABLE CONTRACTOR TO SUPPLY AND INSTALL BARE CABLE CABLE CONNECTION AT POLLUSTOP CONTROL PANEL FOR SYSTEMS FOR UP ADDRESS IF APPLICABLE.
 - APPLICABLE CONTRACTOR TO SUPPLY AND INSTALL 120V (240V) DEDICATED CIRCUIT AT DOOR CONTROL PANEL.
 - APPLICABLE CONTRACTOR TO SUPPLY AND INSTALL 120V (240V) DEDICATED CIRCUIT AT VFD CABINET FOR COOLING FAN POWER FEED.
 - APPLICABLE CONTRACTOR TO SUPPLY AND INSTALL THREE PHASE OR SINGLE PHASE POWER FEED FROM CIRCUIT BREAKER(S) TO VFD'S. APPLICABLE CONTRACTOR TO SUPPLY AND INSTALL THREE PHASE OR SINGLE PHASE POWER FROM VFD(S) TO EXHAUST / WIA OF APPLICABLE MOTOR. POLLUSTOP 2 EXHAUST FAN.
 - APPLICABLE CONTRACTOR TO SUPPLY AND RUN 2 WIRE 3 V DC WIRING FROM WEGAL FIRE SYSTEM TO POLLUSTOP CONTROL PANEL.
 - APPLICABLE CONTRACTOR TO SUPPLY AND RUN 4 WIRE STP PLenum RATED CABLE FOR WIA. SIGNAL, START/STOP FROM CONTROL PANEL TO WEG OR DOD PANEL.
 - APPLICABLE CONTRACTOR TO SUPPLY AND RUN 8 WIRE STP PLenum RATED CABLE (OR TWO CABLES 4 WIRE STP PLenum RATED CABLE) FROM POLLUSTOP CONTROL PANEL TO EXHAUST FAN VFD UNIT AND CABINET SUPPLIED BY HALTON UNLESS OTHERWISE NOTED.
 - APPLICABLE CONTRACTOR TO BE RESPONSIBLE FOR THE INSTALLATION OF THE VFD CABINET, ONLY IF POLLUSTOP EXHAUST FAN. LOCATION TO BE DETERMINED BY GC AND SHALL BE WITHIN 50 FEET MAX DISTANCE FROM EXHAUST FAN. IF VOLTAGE IS 308 V, MAX. DISTANCE SHALL BE 150 FT.
 - APPLICABLE CONTRACTOR TO SUPPLY AND RUN 4 WIRE 240V AC WIRING FROM POLLUSTOP CONTROL PANEL TO VFD CABINET. TWO WIRES ARE FOR COOLING FAN OPERATION CONTROL AND TWO WIRES ARE FOR FREESTAT CONNECTION.
 - APPLICABLE CONTRACTOR TO SUPPLY AND RUN 6 WIRE STP PLenum RATED CABLE FROM POLLUSTOP CONTROL PANEL TO ELECTRICAL ENCLOSURE OF THE FILTER SECTION LOCATED AT POLLUSTOP UNIT.
 - APPLICABLE CONTRACTOR TO SUPPLY AND RUN 3 WIRE 240V AC WIRING FROM POLLUSTOP CONTROL PANEL IN ORDER TO SHUT OFF POWER SUPPLY AND GAS IN CASE OF MISSING FILTER AT POLLUSTOP (APPLIES FOR CANADA ONLY).
 - APPLICABLE CONTRACTOR TO SUPPLY AND RUN 4 WIRE 240V AC & DC WIRING FROM POLLUSTOP CONTROL PANEL TO POLLUSTOP DOOR CONTROL CABINET.
 - APPLICABLE CONTRACTOR TO SUPPLY AND RUN TWO WIRES 24 VDC ARE FOR COMPRESSOR OPERATION AND TWO WIRES 24 VDC ARE FOR LOW SLOUGH LEVEL ALARM.
 - HALTON REPRESENTATIVE TO PROVIDE FINAL FIELD COMMISSIONING ONCE ALL RESPONSIBILITIES ARE COMPLETED ABOVE.



NOTES:

- ALL WIRING AND CABLING TO BE PROVIDED BY ELECTRICAL CONTRACTOR UNLESS SPECIFIC OTHERWISE.
- ALL POLLUSTOP FAN MOTORS MUST BE COMPATIBLE TO WORK WITH VFD'S.
- IF A FAN IS SUPPLIED BY THE WIRABLE PROVIDER, THE WIRABLE PROVIDER SHALL VERIFY THAT THE WIRABLE PROVIDER'S WIRING IS AS SPECIFIED BY THE ELECTRICAL ENGINEER.
- THE CONTROL PANEL COMPLETES POLLUSTOP OPERATIONS. APPROXIMATELY 2 WIRE MODBUS COMMUNICATION FROM VFD TO MOTOR. APPROXIMATELY 2 WIRE MODBUS COMMUNICATION FROM VFD TO MOTOR. APPROXIMATELY 2 WIRE MODBUS COMMUNICATION FROM VFD TO MOTOR. APPROXIMATELY 2 WIRE MODBUS COMMUNICATION FROM VFD TO MOTOR.

ELECTRICAL CONNECTION SCHEDULE

NO.	DESCRIPTION	NO.	DESCRIPTION
EP-01	120V, 30 AMP - POLLUSTOP CONTROL PANEL POWER - 3 WIRES	EC-23	FIELD CONNECTION FOR PRESSURE TRANSDUCER - 2 WIRES - HOOD 1-1
EP-02	HIGH VOLTAGE POWER FROM BUILDING SOURCE TO VFD	EC-24	FIELD CONNECTION FOR TEMP SENSOR - 2 WIRES - TO HOOD 1-1
EP-03	HIGH VOLTAGE POWER FROM VFD TO MOTOR STARTER	EC-25	FIELD CONNECTION FOR PRESSURE TRANSDUCER - 2 WIRES - HOOD 1-2
EP-04	NOT USED	EC-26	FIELD CONNECTION FOR TEMP SENSOR - 2 WIRES - TO HOOD 1-2
EP-05	HIGH VOLTAGE (RED) CABLE - PROVIDED BY HALTON	EC-27	120V TAMP - HOOD LIGHT POWER - 3 WIRES - TO HOOD 1-1
EP-06	HIGH VOLTAGE COLLECTOR CABLE (BLUE) - PROVIDED BY HALTON	EC-28	FIELD CONNECTION FOR HOOD LIGHTS - FROM HOOD 1-1 TO 1-2
EP-07	NOT USED		
EP-08	NOT USED		
EP-09	NOT USED		
EP-10	NOT USED		
EP-11	TO DETERGENT PUMP - 2 WIRES @ 120 V		
EP-12	TO MAIN WATER VALVE - 2 WIRES 120 V		
EP-13	TO POLLUSTOP CONTROL PANEL JUNCTION BOX - 2 WIRES 120 V		
EP-14	HIGH VOLTAGE POWER PACK - 2 WIRES @ 120V		
EP-15	NOT USED		
EP-16	NOT USED		
EP-17	NOT USED		
EP-18	NOT USED		
EP-19	NOT USED		
EP-20	NOT USED		
EP-21	NOT USED		
EP-22	NOT USED		

REVISIONS

NO.	DATE	DESCRIPTION
1	06/05/2023	ISSUED FOR CONSTRUCTION
B	05/15/2023	ADDENDUM C
C	04/20/2023	ADDENDUM B
A	10/28/2022	ADDENDUM A
	09/27/2022	PERMIT/BID SET
	08/06/2022	75% SET
	07/27/2022	DD SET

DRAWING TITLE: POLLUSTOP DETAILS

DRAWING NO.: U22-609

REV. NO. 3

DATE: 08/04/22

SCALE: NOT TO SCALE

CONVENTIONS:

SHAKE SHACK TUSCAN VILLAGE

100 VIA TOSCANA
BUILDING 1000
SALEM, NEW HAMPSHIRE 03079
SHACK #1449

ISSUED FOR CONSTRUCTION

HALTON DRAWINGS

DRAWN BY: Author
CHECKED BY: Checker
JOB NO: 21238.00

M704

CONSULTANTS:

SEAL SIGNATURE:

FOR REFERENCE ONLY

RESPONSIBILITY TO BE SELECTED BY GENERAL CONTRACTOR (REVISIONS FOR REFERENCE):

- APPLICABLE CONTRACTOR TO SUPPLY AND INSTALL 120V (240) DEDICATED CIRCUIT AT POLLUSTOP CONTROL PANEL.
- APPLICABLE CONTRACTOR TO SUPPLY AND INSTALL BARE CABLE CABLE CONNECTION AT POLLUSTOP CONTROL PANEL FOR SYSTEMS FOR UP ADDRESS IF APPLICABLE.
- APPLICABLE CONTRACTOR TO SUPPLY AND INSTALL 120V (240V) DEDICATED CIRCUIT AT DOOR CONTROL PANEL.
- APPLICABLE CONTRACTOR TO SUPPLY AND INSTALL 120V (240V) DEDICATED CIRCUIT AT VFD CABINET FOR COOLING FAN POWER FEED.
- APPLICABLE CONTRACTOR TO SUPPLY AND INSTALL THREE PHASE OR SINGLE PHASE POWER FEED FROM CIRCUIT BREAKER(S) TO VFD'S. APPLICABLE CONTRACTOR TO SUPPLY AND INSTALL THREE PHASE OR SINGLE PHASE POWER FROM VFD(S) TO EXHAUST / WIA OF APPLICABLE MOTOR. POLLUSTOP 2 EXHAUST FAN.
- APPLICABLE CONTRACTOR TO SUPPLY AND RUN 2 WIRE 3 V DC WIRING FROM WEGAL FIRE SYSTEM TO POLLUSTOP CONTROL PANEL.
- APPLICABLE CONTRACTOR TO SUPPLY AND RUN 4 WIRE STP PLenum RATED CABLE FOR WIA. SIGNAL, START/STOP FROM CONTROL PANEL TO WEG OR DOD PANEL.
- APPLICABLE CONTRACTOR TO SUPPLY AND RUN 8 WIRE STP PLenum RATED CABLE (OR TWO CABLES 4 WIRE STP PLenum RATED CABLE) FROM POLLUSTOP CONTROL PANEL TO EXHAUST FAN VFD UNIT AND CABINET SUPPLIED BY HALTON UNLESS OTHERWISE NOTED.
- APPLICABLE CONTRACTOR TO BE RESPONSIBLE FOR THE INSTALLATION OF THE VFD CABINET, ONLY IF POLLUSTOP EXHAUST FAN. LOCATION TO BE DETERMINED BY GC AND SHALL BE WITHIN 50 FEET MAX DISTANCE FROM EXHAUST FAN. IF VOLTAGE IS 308 V, MAX. DISTANCE SHALL BE 150 FT.
- APPLICABLE CONTRACTOR TO SUPPLY AND RUN 4 WIRE 240V AC WIRING FROM POLLUSTOP CONTROL PANEL TO VFD CABINET. TWO WIRES ARE FOR COOLING FAN OPERATION CONTROL AND TWO WIRES ARE FOR FREESTAT CONNECTION.
- APPLICABLE CONTRACTOR TO SUPPLY AND RUN 6 WIRE STP PLenum RATED CABLE FROM POLLUSTOP CONTROL PANEL TO ELECTRICAL ENCLOSURE OF THE FILTER SECTION LOCATED AT POLLUSTOP UNIT.
- APPLICABLE CONTRACTOR TO SUPPLY AND RUN 3 WIRE 240V AC WIRING FROM POLLUSTOP CONTROL PANEL IN ORDER TO SHUT OFF POWER SUPPLY AND GAS IN CASE OF MISSING FILTER AT POLLUSTOP (APPLIES FOR CANADA ONLY).
- APPLICABLE CONTRACTOR TO SUPPLY AND RUN 4 WIRE 240V AC & DC WIRING FROM POLLUSTOP CONTROL PANEL TO POLLUSTOP DOOR CONTROL CABINET.
- APPLICABLE CONTRACTOR TO SUPPLY AND RUN TWO WIRES 24 VDC ARE FOR COMPRESSOR OPERATION AND TWO WIRES 24 VDC ARE FOR LOW SLOUGH LEVEL ALARM.
- HALTON REPRESENTATIVE TO PROVIDE FINAL FIELD COMMISSIONING ONCE ALL RESPONSIBILITIES ARE COMPLETED ABOVE.

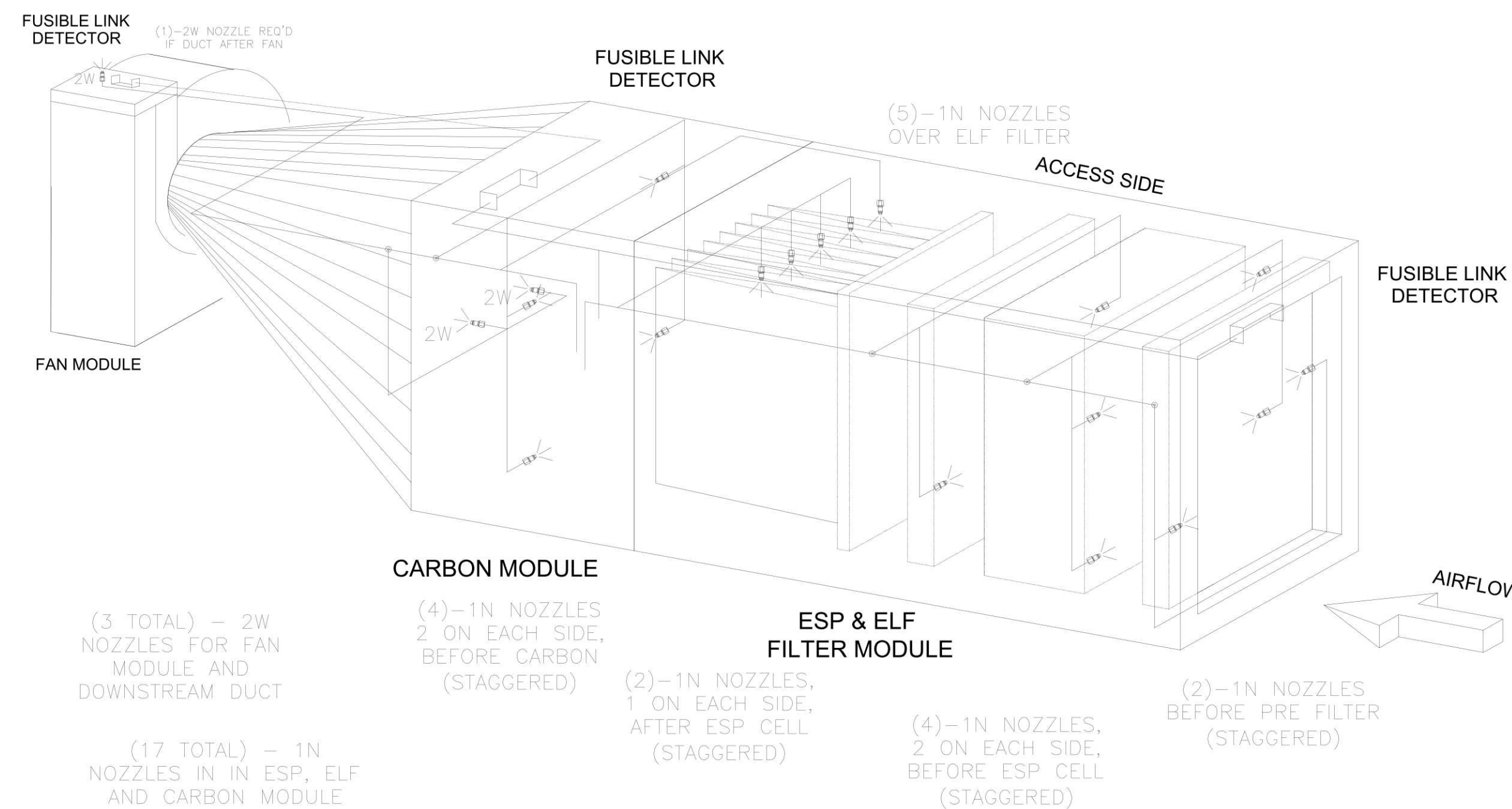
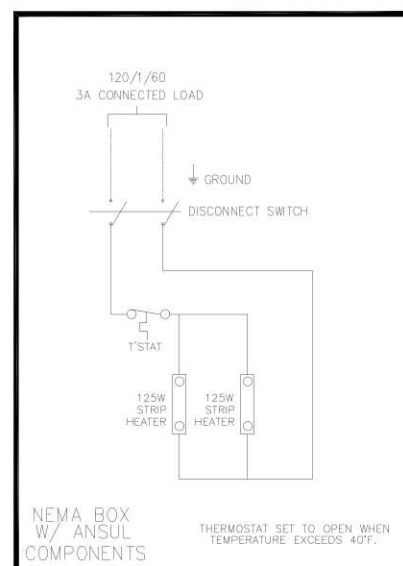
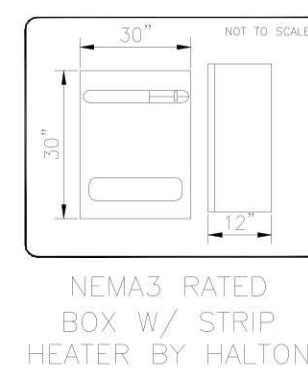
NOTE:

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FLOW POINT CHART

ANSUL R-102 FLOW POINT CALCULATION			
NOZZLE TYPE	NOZZLE FLOW PT.	NOZZLE QUANTITY	TOTAL FLOW PT.
2W	2	3	6
1N	1	17	17
TOTAL FLOW POINTS USED			23
MAX. SYSTEM FLOW POINTS:			24 (6 GALLON)

ITEM #PST-1



ANSUL NOTES

- GENERAL NOTES:**
- THIS INSTALLATION IS TO BE MADE IN ACCORDANCE WITH THE R-102 INSTALLATION MANUAL AND IN ACCORDANCE WITH ALL STATE AND LOCAL CODES.
 - THE WIRE ROPE FOR THE DETECTOR IS TO BE INSTALLED BY AN AUTHORIZED AND FACTORY TRAINED DISTRIBUTOR OR SERVICE REPRESENTATIVE.
 - THIS INSTALLATION IS TO BE INSPECTED, PUT INTO OPERATION AND CERTIFIED BY AN AUTHORIZED AND FACTORY TRAINED DISTRIBUTOR OR SERVICE REPRESENTATIVE.
 - ELECTRICAL CONTACTS AND WIRING FOR APPLIANCE SHUT OFF TO BE PROVIDED BY THE ELECTRICAL CONTRACTOR.
 - ANSUL R-102 RESTAURANT FIRE SUPPRESSION SYSTEMS HAVE BEEN TESTED AND ARE LISTED BY UNDERWRITERS' LABORATORIES INC. AS FIRE-ENGINEERED SYSTEMS, AND WHEN INSTALLED AS SHOWN ON THIS DRAWING SHALL COMPLY WITH ALL RELEVANT ANSUL INSTALLATION RECHARGE INSPECTION AND MAINTENANCE MANUALS AND SHALL COMPLY WITH NFPA 96 WHEN INSTALLED AND CERTIFIED BY AUTHORIZED TRAINED ANSUL DISTRIBUTORS IN ACCORDANCE WITH THE MANUAL.
 - ALL AGENT DISTRIBUTION PIPING AND DETECTION CONDUIT HOOD PENETRATIONS MUST BE PROPERLY SEALED IN ACCORDANCE WITH NFPA 96.
- DISTRIBUTION PIPING REQUIREMENT NOTES:**
- PIPE SHALL BE 3/8" SCHEDULE 40 BLACK IRON FOR INDOOR APPLICATIONS, AND WILL BE PAINTED FOR OUTDOOR APPLICATIONS UNLESS OTHERWISE NOTED.
 - FINAL NOZZLE LOCATION MAY NOT VARY FROM LOCATION SHOWN.

MAIL APPROVED DRAWINGS TO APPROPRIATE FACTORY BELOW

WEBSITE: www.halton.com

HALTON CO. (USA)
100 INDUSTRIAL PARK DRIVE
MERRIMACK, NH 03041
TEL: 603-882-3500 FAX: 603-882-3501

SHAKE SHACK TUSCAN VILLAGE
100 VIA TOSCANA
SALEM, NH 03079
SCALE: NOT TO SCALE DATE: 08/09/22
DRAWN BY: SPJ
CHECKED BY: JLD
CONSULTANT:

ANSUL SYSTEM
U22-609
No. 3 of 5

Halton

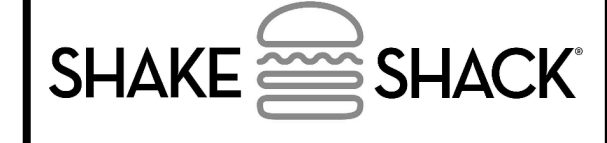
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CONSULTANTS:

SEALED SIGNATURE:

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SHAKE SHACK TUSCAN VILLAGE

100 VIA TOSCANA
BUILDING 1000
SALEM, NEW HAMPSHIRE 03079
SHACK #1449

ISSUED FOR CONSTRUCTION

HALTON DRAWINGS

DRAWN BY: Author
CHECKED BY: Checker
JOB NO: 21238.00

M705