



**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.

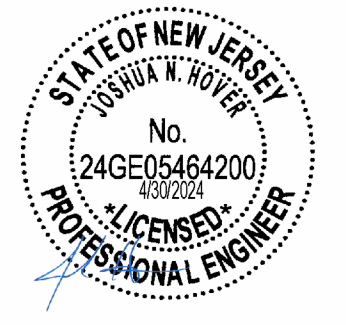
**MECHANICAL PLAN NOTES:**

- INSTALL "DUCTMATE ULTIMATE DOOR" ON DUCTS 12" OR LARGER AND INSTALL "DUCTMATE F2 SANDWICH ACCESS DOOR" FOR DUCTS LESS THAN 12" ON GREASE DUCT FOR CLEANING IN LOCATION SHOWN AT A MINIMUM AND AS REQUIRED BY NFPA 96 AND LOCAL CODES.
- 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.
- HOOD SHALL OVERHANG THE COOKING SURFACE BY AT LEAST 6" ON BOTH SIDES.
- MOUNT THERMOSTATS, HUMIDITY SENSORS, AND TEMPERATURE SENSOR(S) ON WALL. THERMOSTATS AND SENSOR(S) SHALL BE LABELED TO MATCH THE UNIT TAG AND CORRESPOND TO THE ELECTRICAL LEGEND IN THE ELECTRICAL PANELBOARD SERVING THE EQUIPMENT. COORDINATE COLOR WITH ARCHITECT.
- MOUNT TEMPERATURE SENSOR PROVIDED WITH KITCHEN EXHAUST HOODS ON WALL.
- CARBON DIOXIDE SENSOR WITH REMOTE ALARM REPEATER FURNISHED BY OWNER'S CO2 VENDOR. THE SENSOR SHALL BE EQUIPPED WITH A LOCAL AUDIBLE AND VISUAL ALARM. THE LOW-LEVEL ALARM SHALL ACTIVATE THE LOCAL AUDIBLE AND VISUAL ALARM IF THE BUILDING HAS A FIRE ALARM. PROVIDE THE APPROPRIATE FIRE ALARM INTERFACE MODULE TO INTERLOCK WITH THE BUILDING FIRE ALARM SYSTEM. THE HIGH-LEVEL CO2 ALARM SHALL SOUND BUILDING FIRE ALARM WHEN EQUIPPED.
- CARBON MONOXIDE DETECTOR FURNISHED BY OWNER. INSTALL AT 5'-0" AFF. COORDINATE FINAL LOCATION WITH OWNER REPRESENTATIVE.
- INSTALL DUCT SMOKE DETECTOR IN RETURN AIR PLENUM.
- INSTALL HOOD FIRE SUPPRESSION MANUAL PULL STATION. COORDINATE EXACT LOCATION AND REQUIREMENTS WITH FIRE SUPPRESSION SYSTEM INSTALLER AND THE AUTHORITY HAVING JURISDICTION.
- INSTALL EMERGENCY ALARM IN MANAGER'S OFFICE TO INDICATE CARBON MONOXIDE AND CARBON DIOXIDE DETECTION IN MECHANICAL ROOM. PROVIDE LIGHT IN OFFICE WITH TAG FOR EACH ALARM.
- PROVIDE COMBUSTION AIR AND EXHAUST PIPE AND ROUTE TO CONCENTRIC VENT THROUGH ROOF.
- REFRIGERANT PIPING UP TO CU-1 ON ROOF. REF 1/M150.
- CONTRACTOR TO COORDINATE 1" UNDERCUT ON DOOR FOR EXHAUST AIR PATH.
- AIR CURTAIN MOUNTED ABOVE DOOR. INSTALL PER MANUFACTURER'S RECOMMENDATIONS.
- PROVIDE EA DUCT THROUGH ROOF. FULL SIZE OF UNIT OPENING, AND CONNECT TO UNIT WITH FLEXIBLE CONNECTOR. TRANSITION 45 DEGREES THROUGH ROOF CURB.
- 10"X11" GREASE EXHAUST DUCT UP TO KEF-1 ON ROOF.
- 8"X8" GREASE EXHAUST DUCT UP TO KEF-2 ON ROOF.
- MOUNT BOTTOM OF DUCT AT 10'0" ROUTE DUCTWORK LEVEL AND COORDINATE WITH STORM DRAINAGE, STRUCTURAL, AND ELECTRICAL.
- MOUNT BOTTOM OF RETURN GRILLE AT 12'-5" AFF. DIRECT FRONT HORIZONTAL BLADES AT A 45° ANGLE TOWARDS THE FLOOR.
- PROVIDE MAKEUP AIR SUPPLY DUCT THROUGH ROOF. FULL SIZE OF UNIT OPENING, AND CONNECT TO UNIT WITH FLEXIBLE CONNECTOR.
- TRANSITION 6" OUTDOOR AIR DUCT TO 4" FLEXIBLE DUCTWORK AND CONNECT TO UNIT.
- TYPE I GREASE HOOD EXHAUST DUCTWORK SHALL BE MINIMUM 16 GAUGE STEEL OR MINIMUM 18 GAUGE STAINLESS STEEL WITH LIQUID TIGHT WELDS.
- TYPE I GREASE HOOD EXHAUST DUCTWORK SHALL BE MINIMUM SPECIFIED THICKNESS WITH LIQUID TIGHT WELDS PER NYC MECHANICAL CODE. THE MINIMUM REQUIRED THICKNESS SHALL COMPLY WITH THE FOLLOWING: DUCTS WITH A CROSS-SECTIONAL AREA UP TO AND INCLUDING 155 SQUARE INCHES SHALL BE 16 GAUGE STEEL. DUCTS WITH A CROSS-SECTIONAL AREA OVER 155 SQUARE INCHES, BUT NOT MORE THAN 200 SQUARE INCHES SHALL BE 14 GAUGE STEEL. DUCTS WITH A CROSS-SECTIONAL AREA EQUAL TO OR MORE THAN 200 SQUARE INCHES SHALL BE CONSTRUCTED OF 12 GAUGE STEEL. IF STAINLESS STEEL IS USED FOR DUCT MATERIAL, THE GAGE STEEL MAY BE INCREASED UPWARD BY 1 EVEN SIZE.
- MOUNT BOTTOM OF DUCT AT 12' 8". ROUTE DUCTWORK LEVEL AND COORDINATE WITH STORM DRAINAGE, STRUCTURAL, AND ELECTRICAL.
- MOUNT BOTTOM OF DUCT AT 10' 8". ROUTE DUCTWORK LEVEL AND COORDINATE WITH STORM DRAINAGE, STRUCTURAL, AND ELECTRICAL.
- MOUNT BOTTOM OF DUCT AT 12' 10". ROUTE DUCTWORK LEVEL AND COORDINATE WITH STORM DRAINAGE, STRUCTURAL, AND ELECTRICAL.
- MOUNT CO DETECTOR ON CEILING IN LOCATION SHOWN. REFER TO FIRE ALARM PLANS FOR ADDITIONAL INFORMATION.

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Seal

PROFESSIONAL ENGINEER  
 JOSHUA N. HOVER  
 2426564200



04/08/2024

DATE

**Margaretta L. Terry, Architect**

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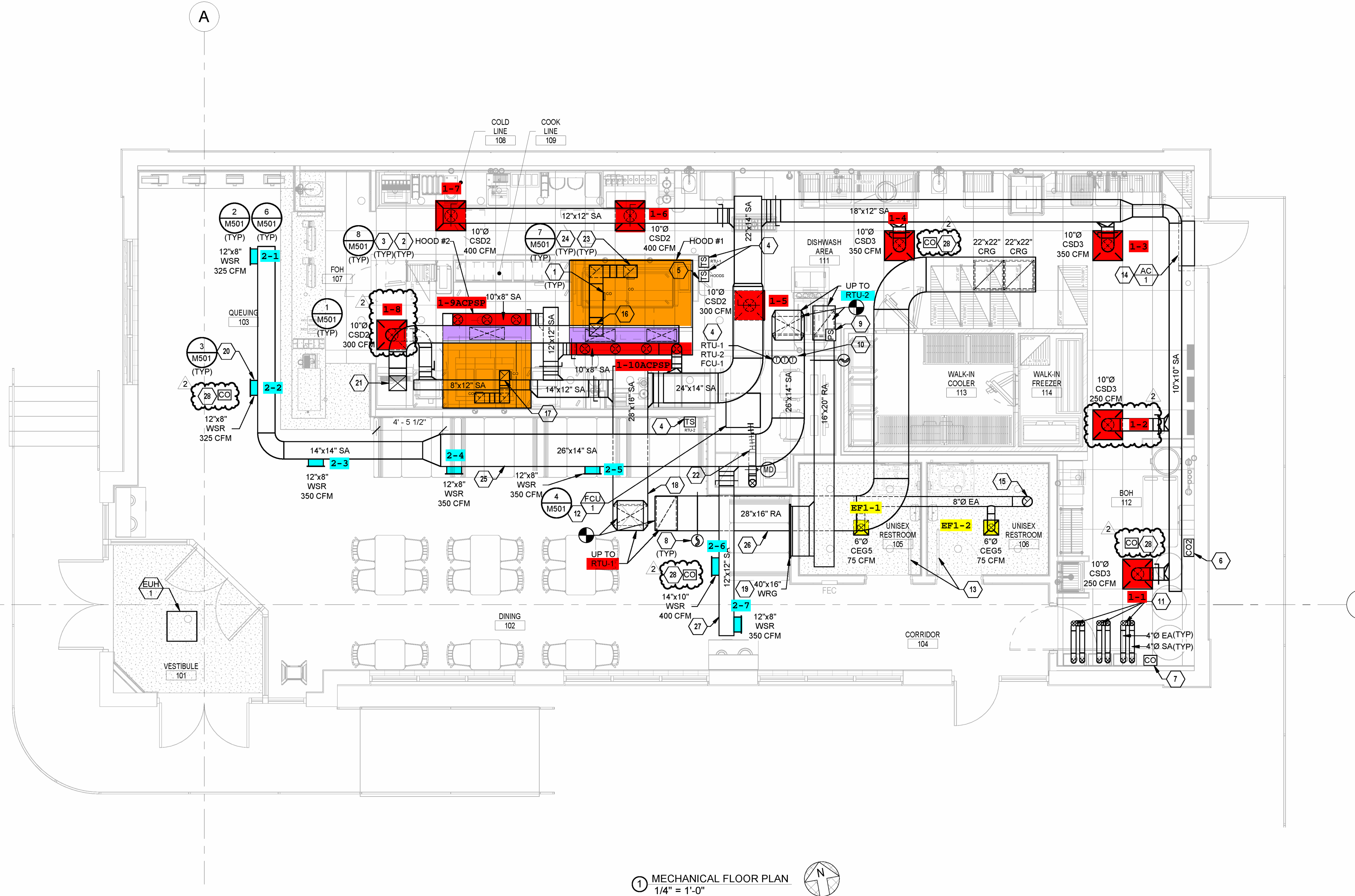
Project

**SHAKE SHACK®**  
 SHAKE SHACK #1532  
 MIDDLETOWN, NJ

Project Number 23197  
 Drawn By EGA  
 Checked By MM  
 Date 12 DEC 2023

Revisions  
 2 April 8, 2024 ISSUE FOR CONSTRUCTION

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**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@natontab.com  
 855-652-6922 ext704

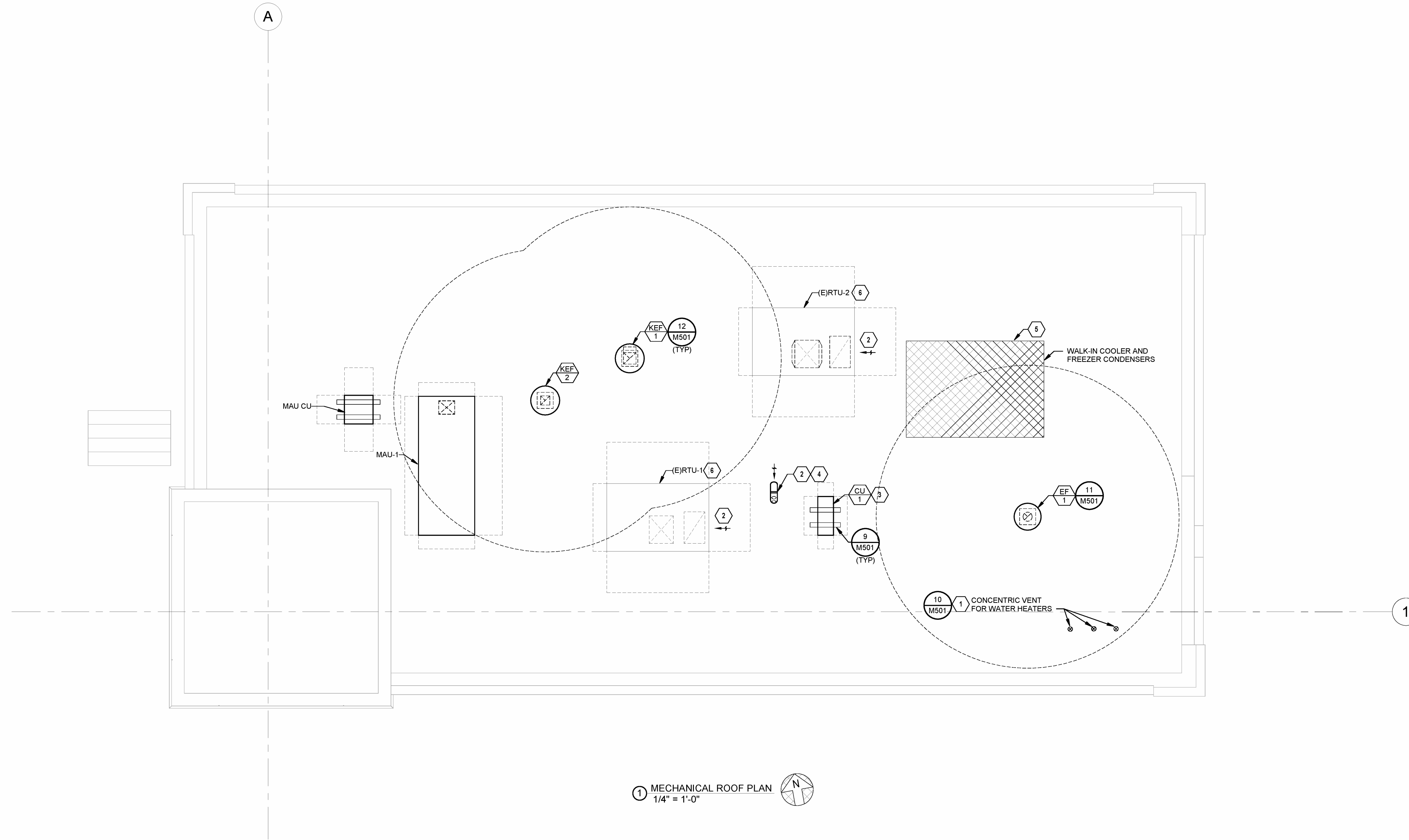
Drawing

**MECHANICAL FLOOR PLAN**

**M101**

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- MECHANICAL PLAN NOTES:**
1. PROVIDE CONCENTRIC VENT MODEL NUMBER PVC-36T.
  2. MAINTAIN ALL OUTSIDE AIR INTAKES A MINIMUM OF 10'-0" RADIUS FROM EXHAUST, TYPICAL.
  3. REFRIGERANT PIPING UP TO CU-1 ON ROOF, REF 1/1M150.
  4. TURN DOWN 6"Ø INTAKE AND END OPEN OVER ROOF (MIN. 24") WITH INSECT SCREEN.
  5. AREA RESERVED FOR REFRIGERATION CONDENSER(S) PROVIDED BY KITCHEN EQUIPMENT CONTRACTOR. COORDINATE EQUIPMENT LOCATION AND CONDENSER INSTALLATION WITH KITCHEN EQUIPMENT CONTRACTOR.
  6. REFERENCE PLUMBING DRAWINGS FOR CONDENSATE DRAIN ROUTING AND TERMINATION REQUIREMENTS.



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 DATE 04/08/2024

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 Architect

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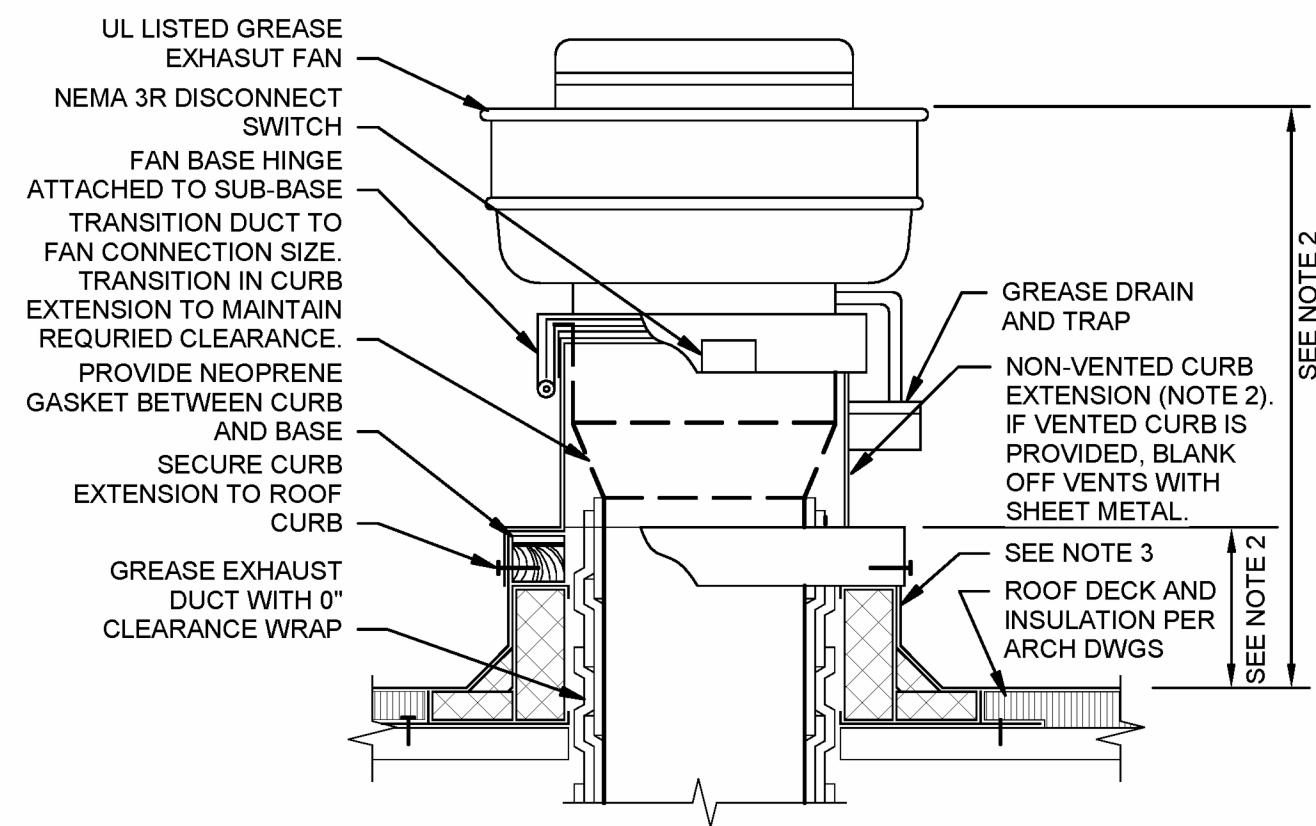
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Drawing  
 MECHANICAL  
 ROOF PLAN

M150

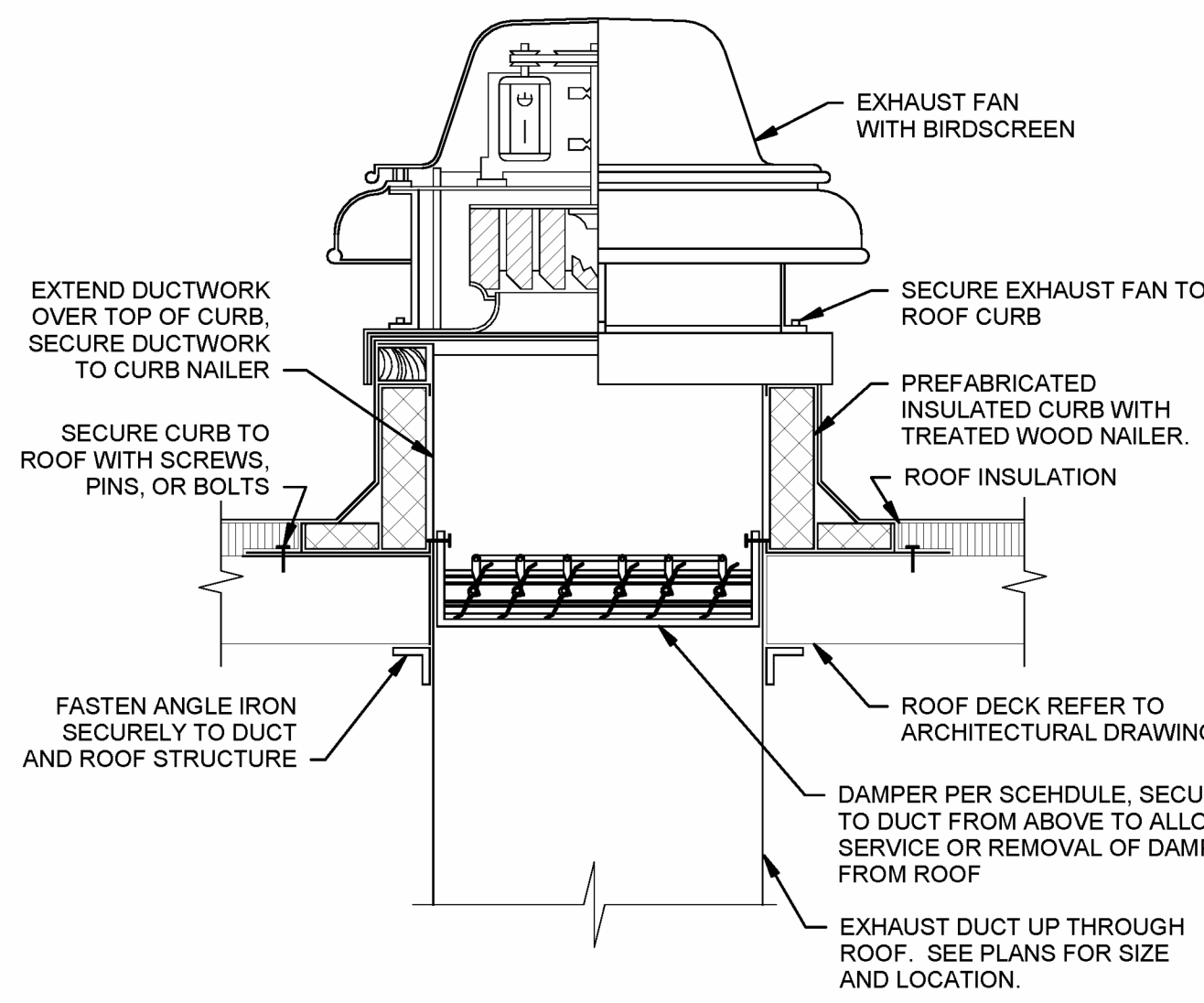
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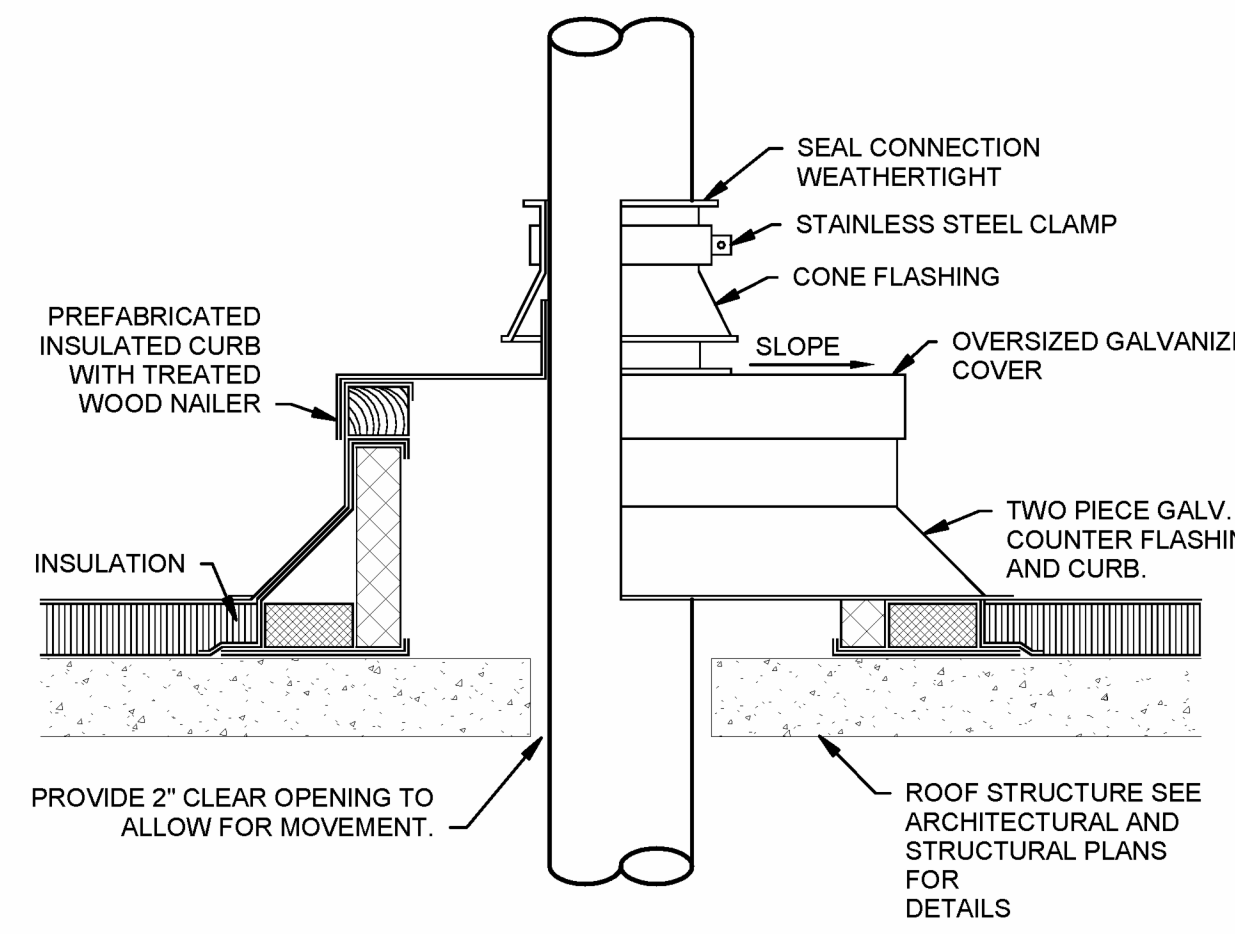


**NOTES:**  
 1. ARRANGEMENT SHOWN IS SCHEMATIC, ADJUST TO SUIT FIELD CONDITIONS AND MEET LOCAL CODE.  
 2. PROVIDE CURB EXTENSION MADE FROM NON-COMBUSTIBLE MATERIAL OF HEIGHT REQUIRED TO MOUNT FAN BASE A MINIMUM 18 INCHES ABOVE COMBUSTIBLE CURB MATERIAL AND DISCHARGE GREASE OUTLET A MINIMUM OF 40 INCHES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

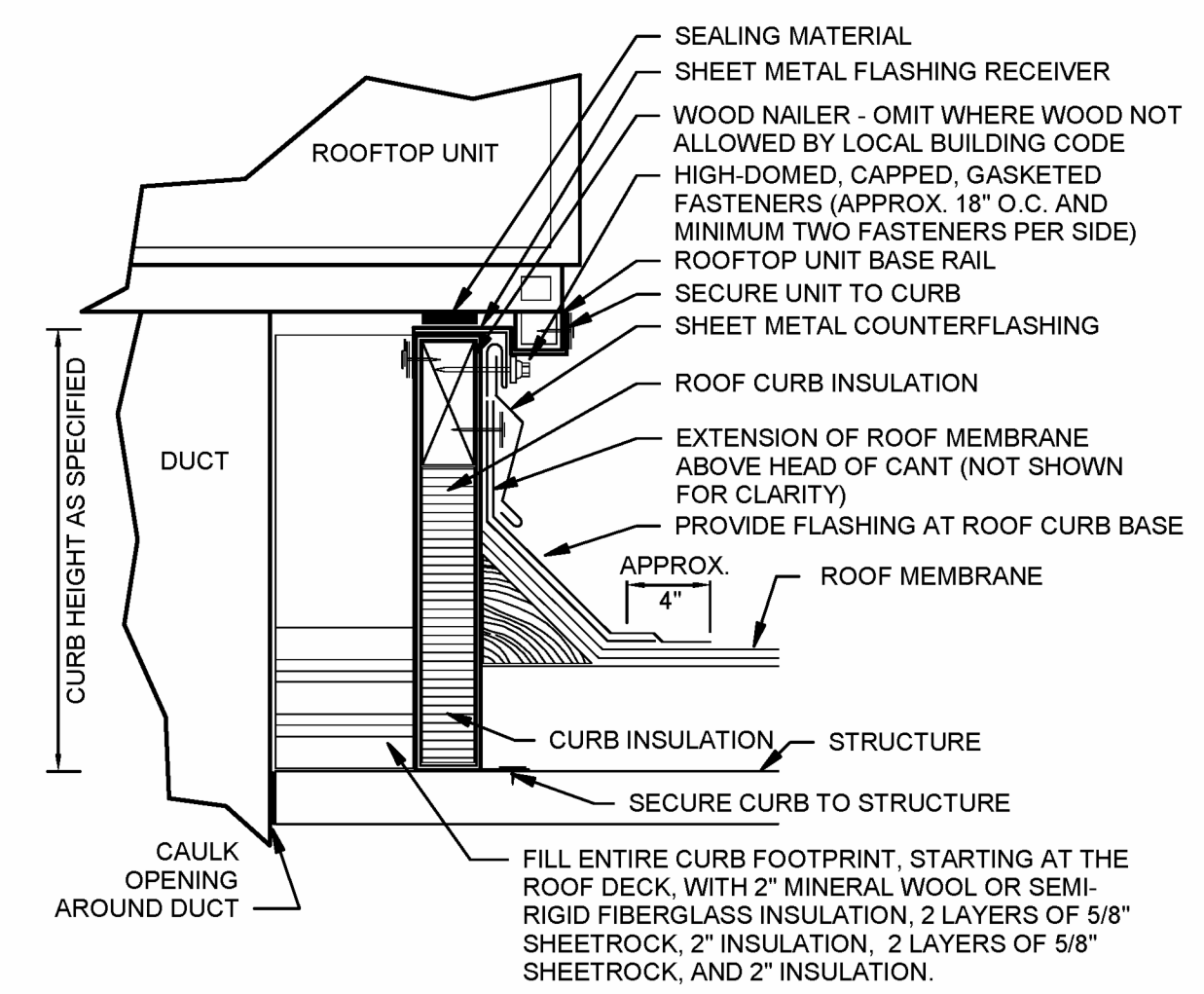
10 UL LISTED GREASE EXHAUST FAN DETAIL NTS



11 DOWNBLAST EXHAUST FAN DETAIL NTS

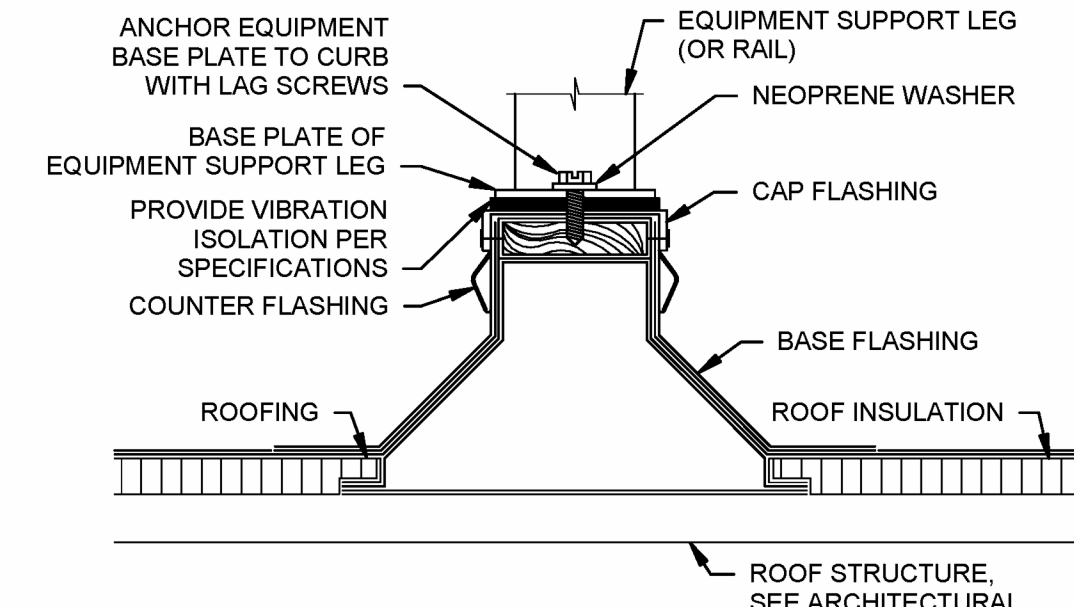


10 ROUND AIR DUCT OR PIPE PENETRATION THROUGH ROOF DETAIL NTS



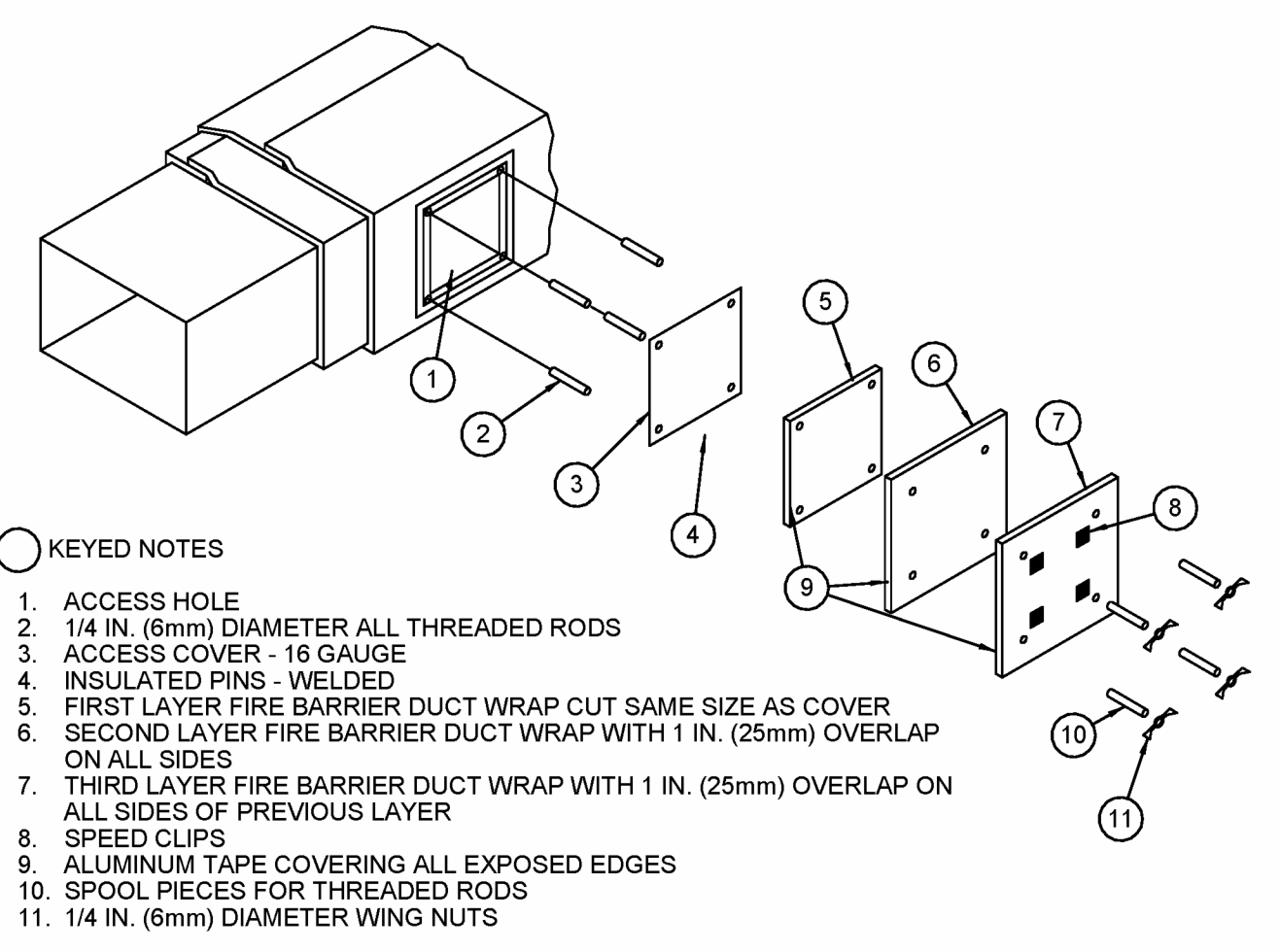
**NOTES:**  
 1. CUT METAL DECKING TO ALLOW CURB INSTALLATION ON STEEL FRAMING. AFTER CURB IS SET IN PLACE, TRIM REMAINING METAL DECKING AND INSTALL WITHIN CURB. TACK WELD DECKING TO SUPPORT STEEL. DO NOT WELD INTERIOR DECKING TO ROOF CURB. PROVIDE ADDITIONAL CROSS FRAMING TO SUPPORT INTERIOR DECKING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

13 ROOF CURB DETAIL NTS



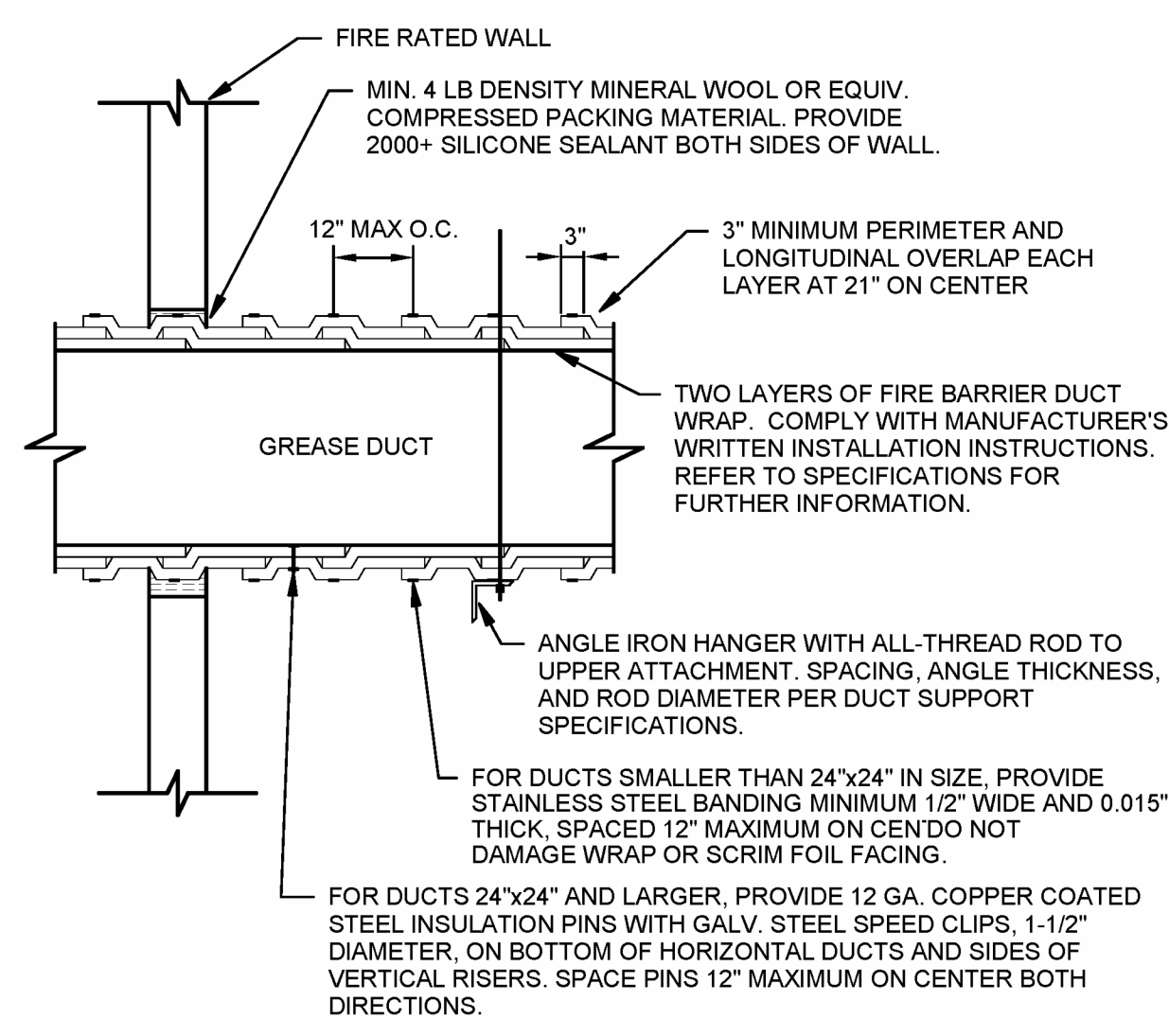
**NOTES:**  
 1. REFER TO SPECIFICATIONS FOR ADDITIONAL REQUIREMENTS FOR EQUIPMENT SUPPORTS, ANCHORING AND SEISMIC/WIND RESISTANCE.

9 ROOF EQUIPMENT SUPPORT RAIL DETAIL NTS



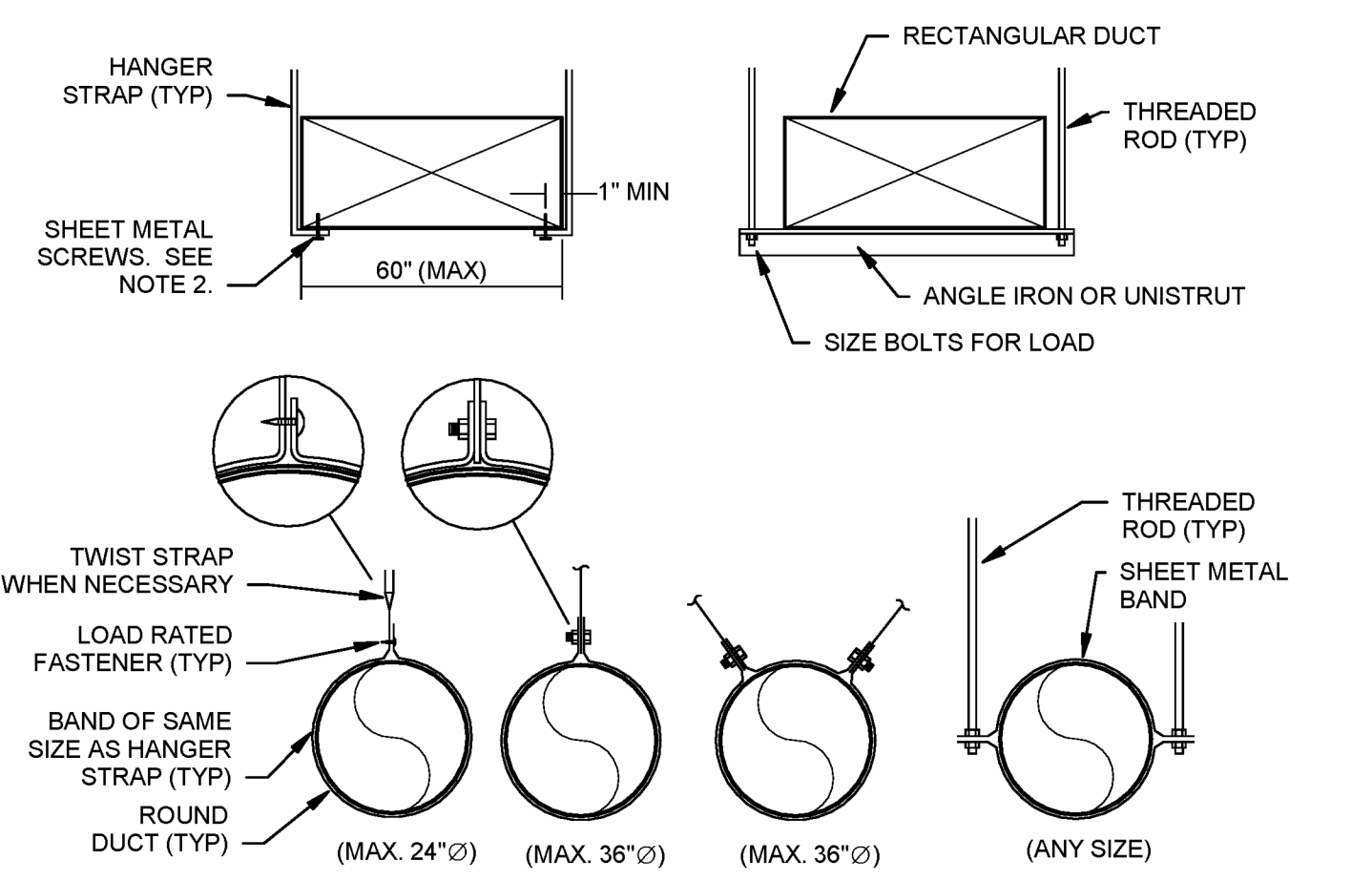
**NOTES:**  
 1. FOR REFERENCE ONLY. INSTALL PER MANUFACTURER'S RECOMMENDATIONS.  
 2. AT CONTRACTOR'S OPTION, A LISTED UL 1978 GREASE ACCESS DOOR PRODUCT MAY BE SUBSTITUTED FOR THE ACCESS DOOR PICTURED IN THIS DETAIL. DOOR SHALL BE RATED FOR UP TO 2,000F AND MEET NFPA STANDARDS. BOLTS SHALL BE LONG ENOUGH FOR DUCT WRAP SYSTEM (WHEN USED). INSTALL IN ACCORDANCE WITH MANUFACTURER'S LITERATURE.

8 GREASE DUCT CLEANOUT ACCESS DOOR DETAIL NTS



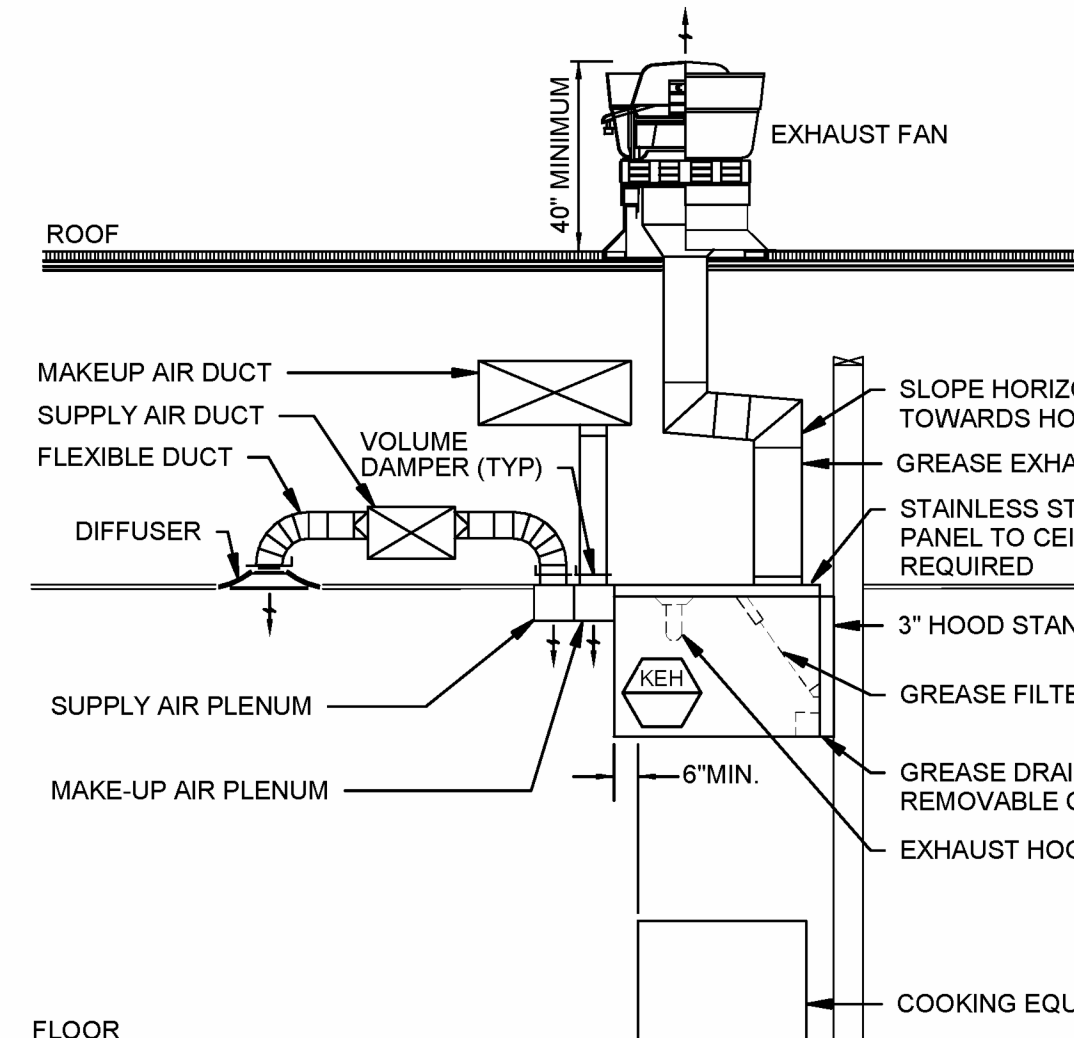
**NOTES:**  
 1. INSTALL GREASE EXHAUST AND FIRE RATED DUCT WRAP IN ACCORDANCE WITH THE MANUFACTURER'S APPROVED INSTRUCTIONS AND UL LISTED INSTALLATION DETAILS. TECHNIQUES THAT DIFFER FROM THE ABOVE METHOD ARE ACCEPTABLE IF THEY ARE UL TESTED AND APPROVED.

7 GREASE DUCT FIRE WRAP INSULATION INSTALLATION DETAIL NTS



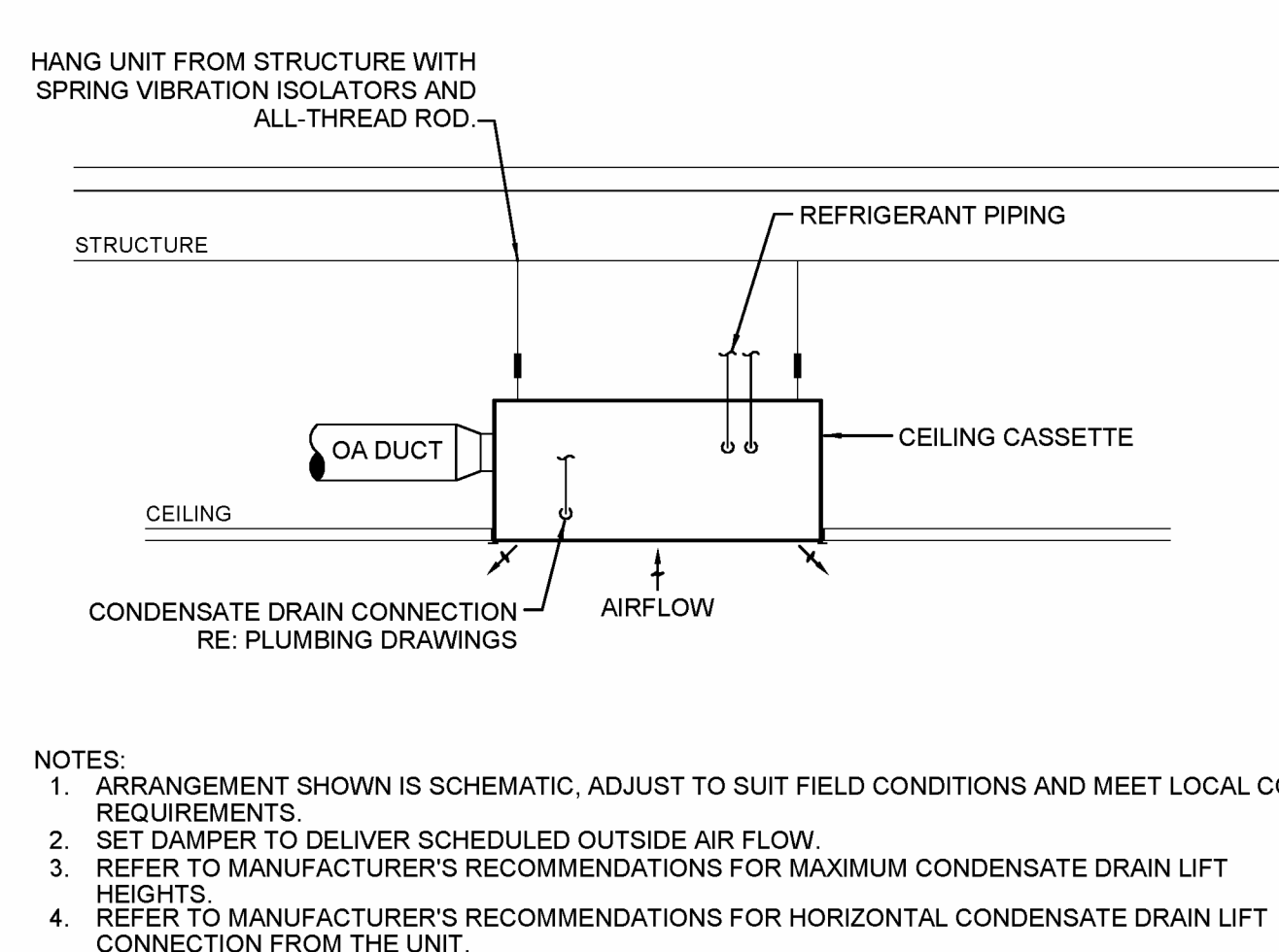
**NOTES:**  
 1. USE THREADED ROD FOR RECTANGULAR DUCTS LARGER THAN 60\"/>

6 DUCT HANGER LOWER ATTACHMENT DETAILS NTS



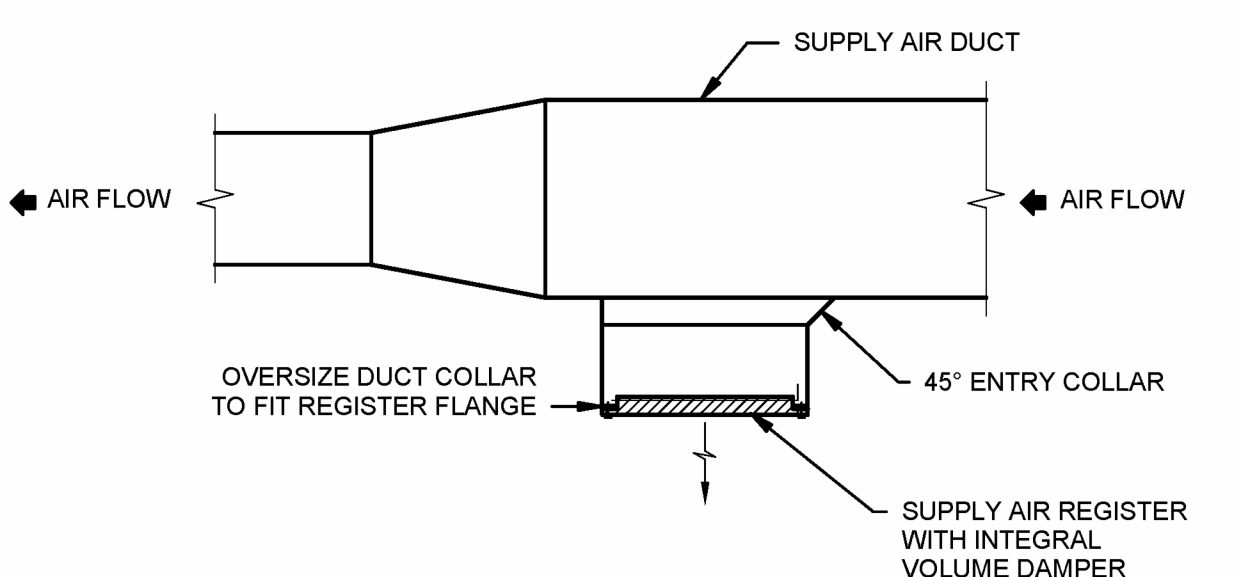
**NOTES:**  
 1. SUBMIT SHOP DRAWINGS OF ALL HOOD SYSTEMS TO CITY FOR APPROVAL PRIOR TO INSTALLATION. TOTAL HOOD SYSTEM TO BE IN COMPLETE CONFORMANCE WITH NFPA, AND ALL LOCAL CODES AND REGULATIONS.  
 2. COORDINATE ALL FIRE PROTECTION SYSTEMS WITH FIRE PROTECTION CONTRACTOR WHO SHALL ALSO BE RESPONSIBLE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

5 KITCHEN EXHAUST HOOD ELEVATION DETAIL NTS

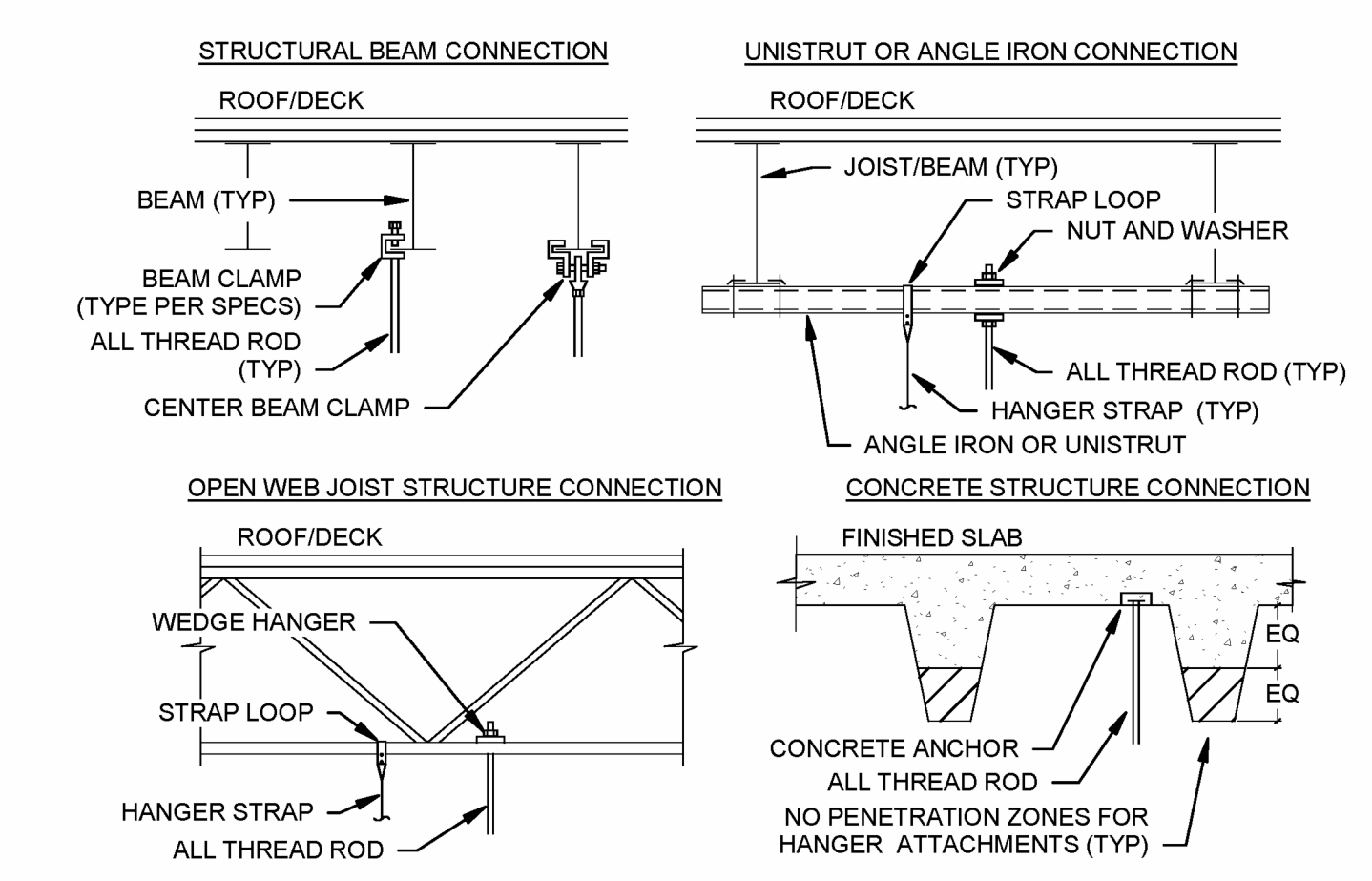


**NOTES:**  
 1. ARRANGEMENT SHOWN IS SCHEMATIC, ADJUST TO SUIT FIELD CONDITIONS AND MEET LOCAL CODE REQUIREMENTS.  
 2. SET DAMPER TO DELIVER SCHEDULED OUTSIDE AIR FLOW.  
 3. REFER TO MANUFACTURER'S RECOMMENDATIONS FOR MAXIMUM CONDENSATE DRAIN LIFT HEIGHTS.  
 4. REFER TO MANUFACTURER'S RECOMMENDATIONS FOR HORIZONTAL CONDENSATE DRAIN LIFT CONNECTION FROM THE UNIT.

4 CEILING CASSETTE DETAIL NTS

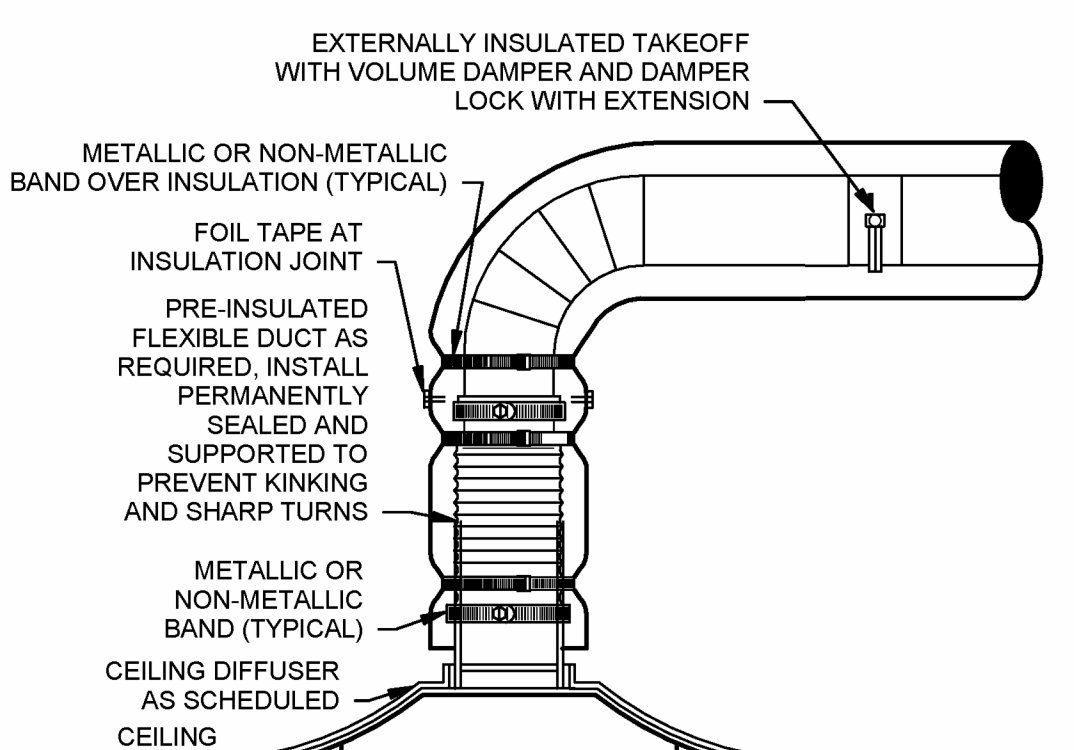


3 DUCT MOUNTED REGISTER DETAIL NTS



**NOTES:**  
 1. ALL ATTACHMENTS SHALL BE INSTALLED PER MANUFACTURER'S REQUIREMENTS AND SHALL BE APPROVED FOR THE SPECIFIC APPLICATION.  
 2. COORDINATE ALL ATTACHMENTS WITH ARCHITECT AND STRUCTURAL ENGINEER.  
 3. REFER TO SPECIFICATIONS FOR MORE INFORMATION ON APPROVED ATTACHMENT METHODS.  
 4. REFER TO SPECIFICATIONS FOR REQUIREMENTS RELATING TO SEISMIC INSTALLATIONS.  
 5. FOR OPEN WEB JOIST STRUCTURE, CONTRACTOR MAY HANG FROM TOP CHORD AND RUN DUCT AND PIPING THROUGH WEB JOIST WHEN APPROPRIATE. ANY CONCENTRATED LOADS NOT OCCURRING AT JOIST PANEL POINTS MUST BE REVIEWED BY A STRUCTURAL ENGINEER FOR FIELD INSTALLED PANEL BRACE REQUIREMENTS.

2 HANGER UPPER ATTACHMENT DETAILS NTS



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

1 LAY-IN CEILING DIFFUSER DETAIL NTS

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DATE: 04/08/2024

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Revisions  
 2 April 8, 2024 ISSUE FOR CONSTRUCTION

Drawing  
**MECHANICAL DETAILS**

**M501**

JOSHUA N. HOVER

**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. SUBMITTALS
- J. ELECTRONIC DRAWINGS FILES
- K. RECORD DRAWINGS (AS-BUILT DRAWINGS)
- L. OPERATION AND MAINTENANCE INSTRUCTIONS
- M. SPARE PARTS
- N. TRAINING
- O. WARRANTIES

**2. GENERAL MATERIALS AND INSTALLATION**

- A. BUILDING OPERATION
- B. EXISTING EQUIPMENT REUSE AND REMOVAL
- C. EXCAVATION AND BACKFILLING
- D. COINCIDENTAL DAMAGE
- E. CUTTING AND PATCHING
- F. ROUGH-IN
- G. STRUCTURAL SUPPORT SYSTEMS
- H. PRE-ENGINEERED ROOF EQUIPMENT SUPPORTS AND CURBS
- I. ACCESS PANELS AND DOORS
- J. PENETRATIONS
- K. FIRESTOPPING
- L. MOTORS AND STARTERS
- M. VARIABLE FREQUENCY DRIVES
- N. ELECTRICAL WIRING
- O. EQUIPMENT FURNISHED BY OTHERS
- P. SYSTEM TESTING, ADJUSTING, AND BALANCING
- Q. VIBRATION ISOLATION
- R. AIR FILTERS
- S. REFRIGERANT AND OIL
- T. 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. ELECTRIC UNIT HEATERS
- B. SPLIT DUCTLESS AIR-CONDITIONING SYSTEMS
- C. 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-1) 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, services, 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, offset, control lines, and other installation requirements. Use the drawings as a guide when laying out the work and to verify that materials and equipment will fit into the designated spaces, and which when installed per manufacturers' requirements, will ensure a complete, coordinated, satisfactory, and properly operating system.

**B. DEFINITIONS**

Division: References contained in this specification follow the numbering system defined in the Construction Specifications Institute (CSI) MasterFormat 2004 Edition. This 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:

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

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

Install: "to perform all operations at the project site including, but not limited to, the actual unloading, unpacking, assembling, erecting, connecting, 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 the 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 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 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. PREBID 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 defects. Install material and equipment in accordance with the manufacturer's installation instructions. Model numbers listed in the specifications or shown on the drawings are not necessarily intended to designate the required trim, written descriptions of the trim govern model numbers.

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

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

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

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

**E. MANUFACTURERS**

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

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

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

**F. COORDINATION**

Coordinate work with that of other trades so that the various components of the systems are installed at the proper time, will fit the available space, and will allow proper service access to those items requiring maintenance. Components which are installed without regard to the above shall be relocated at 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 and equipment specified. The General Contractor shall coordinate with other trades to ensure that all necessary clearances 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.

Figured 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 tarp or 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. Drying the insulation 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 ceiling/return air plenum, including dust.

**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, request the Substitution Request Form from the Architect or Engineer. Complete and send the Substitution Request Form for each material, product, equipment, or system that is proposed to be substituted. The burden of proof of the merit of the proposed substitution is upon the proposer.

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

- 1. 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.
- 2. Proposed substitution is consistent with the Contract Documents and will provide indicated results, including functional clearances, maintenance service, and sourcing of replacement parts.
- 3. Proposed substitution has received necessary approvals of authorities having jurisdiction.
- 4. Same warranty as provided 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 to complete the entire system as required.
- 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 of receipt of bids.

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

**J. SUBMITTALS**

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

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

Submittals shall contain the project name, applicable specification section, submittal date, equipment identification acronym as used on the drawings, and the Contractor's stamp. The stamp shall certify that the submittal has been checked by the Contractor, complies with the drawings and specifications, and is coordinated with other trades. Manufacturer product literature shall include shop drawings, product data, performance 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 illegible items. Shop drawings returned without review if the above mentioned requirements are not met.

Provide the quantity of submittals required by Division 01. If not indicated and hard-copy sets are provided, submit a minimum of six (6) copies. Refer to Division 01 for acceptance of electronic submittals for this project. For electronic submittals, Contractor shall submit the documents in accordance with the procedures specified in Division 01. Contractor shall notify the Architect and Engineer that the submittals have been posted. If electronic submittal procedures are not defined in Division 01, Contractor shall include the website, user name, and password information needed to access the submittals. For submittals sent by e-mail, Contractor shall copy the designated 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 solid 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.

**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 by the equipment manufacturer. 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 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.

**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 balls for each fan.
- 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.

**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 specific items are noted to carry a longer warranty in the construction documents or manufacturer's standard warranty exceeds 12 months. Remedy all defects, occurring within the warranty period(s), as stated in the General Conditions and Division 01.

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

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

At the time of Substantial Completion, deliver to the Owner all warranties, in writing and properly executed, including term limits for warranties extending beyond the one year period and any actions the Owner must take in order to maintain warranty 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 relubricate existing HVAC equipment, diffusers, registers, and grilles intended for reuse as required or as indicated on drawings.

**C. EXCAVATION AND BACKFILLING**

Perform excavation and backfill required for installation of underground work under this contract. Trenches shall be of sufficient width. Crib or brace trenches to prevent cave-in or settlement. Do not excavate trenches close to columns and walls of new building without prior consultation with the Architect. Use pumping equipment if required to keep trenches free of water. Backfill trenches in maximum 6 inch layers of well-tamped dry earth in a manner to prevent future settlement.

Excavation as specified herein shall be classified as common excavation. Common excavation shall comprise the satisfactory removal and disposition of material of whatever substances and of every description encountered, including rock, if any within the limits of the work as specified and shown on the drawings. Excavation shall be performed to the lines and grades indicated on the drawings. Dispose of excavated materials that are considered unsuitable for backfill and surplus of excavated material which is not required for backfill to the satisfaction of the Architect.

**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-tension slabs, x-ray slab and closely coordinate all core drill locations with Architect and Structural Engineer prior to performing any work. Obtain approval from Architect and Structural Engineer for all core drills and penetrations at least four days prior to start of any 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 rough-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 with fully milled raised cant and step to match roof insulation thickness, welded, minimum 18 gauge galvanized steel sheet, 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 16 gauge jacket with counterflashing where equipment does not fully cover the equipment support. Provide sloped roof equipment supports to enable level installation. Provide one bracket at each corner along the length of the unit.

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 lag 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] or [IV] and a Design Wind Speed of [XXX] mph.
- 4. Submit 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 submittals 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 MEPF 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, flush screwdriver-operated cam lock, and anchor straps. Provide access doors manufactured by Greenheck, Milcor, Titus, Zum, 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 waterproof and weathertight with non-shrink, non-hardening commercial sealant. Pack with mineral wool and seal both ends with minimum of 1/2 inch of sealant.

Seal around penetrations of fire rated assemblies. Coordinate fire ratings and locations with the architectural drawings. Refer to architectural specifications for fire stoppings. Provide a product schedule for UL listing, location, wall or floor rating and installation drawing for each penetration fire stop 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 and/or ductwork penetrate elevated slabs or the 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 weathertight ring manufactured by Jay

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

#### O. EQUIPMENT FURNISHED BY OTHERS

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

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

#### 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 of 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 (not 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 of the amount of air shown on the drawings. TAB Contractor shall record space temperatures and make adjustments in airflow to each diffuser to obtain uniform temperature (no greater than +/- 3 F) in spaces. Document temperatures and adjustments in tab report. Adjust equipment to operate as intended by the specification. TAB report shall include a "report summary/notebook" 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 setpoints, limits and time based adjustment to operate in accordance with the performance requirements of the Construction Documents. Adjust pumps, fans, etc. for proper and efficient operation. Notify 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 deflection for specific equipment is not specified within the contract documents, reference ASHRAE Handbook "HVAC Applications" or provide per manufacturer's recommendations. Approved manufacturers include Caldyn, Kinetics Noise Control, Mason Industries, Inc., Vibration Eliminator Co., Inc., Vibration Mounting and Isolators, Inc. Control, 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 known un-deflected heights or calibration markings so that, after adjustment, the static deflection can be verified, thus determining that the load is within the proper range of the isolator. Isolators shall operate in the linear portion of their load versus deflection curves. Spring isolators shall have 50 percent excessive capacity without becoming overloaded. Coat handling equipment with factory-applied paint. Coat vibration isolators exposed to weather and other corrosive environments with factory-applied corrosion resistance protection. Install and adjust vibration isolators in accordance with manufacturer's 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 service 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 bolted to the structure, 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 W or equal.

2. Type SPNH (Spring and Neoprene Hangers): Provide a steel hanger box containing a laterally stable, double deflection 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 90 percent 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 bushing to prevent contact between the lower hanger rod and hanger box and short-circuiting the isolating function. The neoprene element shall have a maximum diameter of 50 and designed for 15 percent strain, with a static deflection of not less than 0.4 inches. Unless otherwise specified, the static deflection of SPNH hangers shall be 2 inches. Provide SPNH hangers with 1 inch static deflection for water source heat pumps and fan-powered VAV terminal units. When installed, do not coat the spring element and do not allow the hanger box to rotate through a full 360 degree arc without encountering obstructions. 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 1MB8 or equal.

#### R. AIR FILTERS

Provide AAF/Flanders Perfect Pleat HC M8, Camfil FR 30/30, pleated, throwaway type filters, minimum MERV 8, or similar as manufactured by Air Filter, Inc., Biocimate, 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 6.

#### S. REFRIGERANT AND OIL

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

#### T. 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-concealed 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 combined Heating and Cooling; 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 more than 25 feet length and within 25 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 materials commercially available. Verify the integrity of the entire network following the cable installation. Use appropriate test measures 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 Krauf.

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:

- Exposed round and rectangular supply ductwork.
- 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-6.0duct wrap, Certainteed or equivalent Johns Manville, Owens-Corning, or Krauf with heavy-duty foil-scrim-kraft facing, and with joints taped with 3 inch wide foil tape as follows:

- Round and rectangular supply and return air ductwork.
- Unlined Round and rectangular outside air ductwork.
- Round and rectangular exhaust and relief air plenums connected to outdoor air 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 UL Label.

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

- Exterior insulation and jacket consisting of 2 inch thickness of Armauff flexible elastomeric insulation or equivalent meeting ASTM C534 with integral 1/2 mil thick UV resistant cladding laminated at factory. Cover all seams with Armauff seal tape.
- Exterior insulation consisting of 2 inch thickness of flexible elastomeric insulation meeting ASTM C534 or 3 B density rigid fiberglass meeting ASTM C612, and jacket consisting of 20 gauge conugated aluminum jacket with aluminum fitting covers and minimum three aluminum attachment bands per section.
- Exterior insulation consisting of 2 inch thickness of flexible elastomeric insulation meeting ASTM C534 or 3 B density rigid fiberglass meeting ASTM C612, and jacket consisting of 15.5 mils thick Venturacted 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" x 5" on centers, and closer if required for sufficient rigidity to prevent vibration. Support horizontal runs of duct from strap iron hangers on centers not to exceed 8'-0". Do not support ceiling grid, conduits, pipes, equipment, etc. from ductwork. Coordinate routing of ductwork with other contractors such that piping, electrical, conduit, and associated supports are not routed through the ductwork.

Provide pre-engineered roof duct supports supports by Cooper B-Line, Elite Components, ERICO, FNW, Mikro, PHD Manufacturing, PHP Systems, Roof Top Box, Unistrut (Akrux), Zai Foster, or approved equal. Support ductwork on the roof with pre-engineered roof duct supports that rest on top of the roofing membrane, not requiring any attachment to the roof structure and not penetrating the roofing assembly but with embedded support features as required to support the duct. Provide steel pedestal type supports with minimum 1/2 inch diameter and aluminum attachment bands per section. Provide 1/2 inch diameter closed-cell polyethylene block with length as required. Maintain minimum 6 inches clearance under duct to finished roof 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 or 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 Itrongip DP 1010 - United McGill duct sealer or approved equal, minimum two-hour rated duct wrap insulation for Type I hood grease exhaust duct applications and shall conform to ASTM E2336 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 spliter vanes. Vanes shall be the entire length of the bend. Provide mitered 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. Mitered elbows less than 45 degrees shall not require turning vanes. Mitered elbows 45 degrees and greater shall have single thickness turning vanes of same gauge as ductwork, rigidly fastened with guide strips in ductwork. Vanes for mitered elbows shall be provided in all supply and exhaust ductwork and in return and outside air ductwork that has an air velocity exceeding 1000 fpm. Do not install 90 degree elbows in grease ductwork. The use of square throat, radius head 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) by means of flexible connectors. Flexible connectors shall be neoprene coated glass cloth canvas connections, Duro-Dyne, Elgen, Ventiflor or equal. Flexible connectors shall have a flame spread of 25 or less and smoke developed rating not higher than 50. Make airtight joints and install with minimum 1-1/2 inches slack.

Provide balancing dampers, manufactured by Cooper, Greenheck, Louvers & Dampers, Nalor Industries, Pottorff, Ruskin, Tamco, or approved equal, where shown on drawings and wherever necessary for complete control of air flow. Splitter dampers shall be controlled by locking quadrants; provide Young Regulator or Venlok end 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 570 or equal 45 degree rectangular side takeoff fitting with model B03 damper with locking quadrant and insulation build out for round ductwork branch takeoffs to individual air devices. Omit damper at takeoff fitting when damper is located downstream of takeoff.

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/or operator mounting plate. External operator shall attach to damper as a single piece with no linkage adjustment required. Damper shall be adjustable through the diffuser frame with standard 1/4 inch nutdriver 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 diffuser neck. Install remote operator on the back of the diffuser frame or side of a slot diffuser plenum. Support cable assembly to avoid bends and kinks in cable at manufacturer recommended intervals. Where approved by architect, a celloping cup with cover plate may be used for access to cable operator. Provide round dampers by Metropolitan Air Technology model RT-200, Young's Regulator model 5020-1200, or approved equal. Provide rectangular dampers by Metropolitan Air Technology model RT-WGA, Young's Regulator model 27D-275, or approved 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.) Round ductwork gauges per the following table (reference SMACNA HVAC duct construction standards for gauges when pressures exceed 2 inches w.g.):

Size	Duct Gauge	Fitting Gauge
14" & under	26	24
15" thru 20"	24	22
20" thru 24"	22	20
38" thru 50"	20	20
52" thru 60"	18	18

Lewis & Lambert, Linx Industries Lindab Safe, or approved equal factory-manufactured round ductwork and fittings may be substituted for specified round branch ductwork, at Contractors option. Heavy liquid sealant shall be omitted on factory-manufactured round ductwork.

Low pressure (duct pressure class up to and including 2 inches w.g.) Fittings 24 inches in diameter and less shall be prefabricated, spot-welded and internally sealed. Continuously wet fittings larger than 24 inches in diameter. Fitting gauge shall be 22 gauge for 36 inch fittings and under, 20 gauge for larger sizes, 90 degree tees shall be conical type. Seal longitudinal and transverse ductwork joints airtight with heavy liquid sealant applied according to manufacturer's instructions. Provide gauge thickness in medium pressure (duct pressure class 3 inches to 6 inches w.g.) ductwork as recommended by SMACNA.

##### C. FLEXIBLE DUCT

Low pressure (duct pressure class up to and including 2 inches w.g.) and medium pressure (duct pressure class 2.1 inch to 6 inches w.g.) flexible duct shall be Flexmaster type 8B, Thermalex type G-KM, M-KE, iPL type Silver Jacket, or equal (fire retardant polyethylene) protective vapor barrier, UL-181 Class 1, acoustical insulated duct, P-6.0 fiberglass insulation. Provide CPE liner with wire helix mechanically locked 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 on 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 corner of the duct connection and a metallic or non-metallic clamp over the 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.

##### D. PLASTIC FLUE GAS VENTS

Provide UL 1738 listed plastic flue gas vents, with positive or negative flue pressures complying with NFPA 211 and suitable for condensing gas appliances. Provide PVC system by IPEX "System 1738", or Polypropylene system by Centrotherm "Inotline" 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 D2565 and UL 1738, manufactured by IPEX. Use solvent cement meeting ASTM D2564 and make joints in accordance with ASTM D2855.

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.

##### E. AIR DEVICES

Provide air devices as scheduled on drawings, manufactured by Carnes, Krueger, Metallaire, Nalor Industries, Price, Titus, or Tuttle & Bailey. Select air devices to limit room 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 plan.

Submit complete shop drawings including information on noise level, pressure drop, throw, CFM for each air device, styles, borders, etc. Clearly mark 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 aluminum or stainless steel registers 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 slot apparatus. For installations in a hard ceiling, install diffuser per manufacturer 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.

##### F. 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 ranges for duct mounting. Provide elastomeric or neoprene seals, mechanically attached and field replaceable. Provide a minimum of one damper actuator per section. Test damper performance in accordance with AMCA 500-D.

Provide modulating dampers with linear flow characteristics. Size modulating dampers based on the smaller of 1,500 FPM through the damper or full open air pressure drop of 0.1 inches W.C. Size two-position 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, Pottorff, Nalor, or other Ruskin. Reference manufacturer with model number for outside air dampers is Ruskin CD-50 constructed of aluminum, and all 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 encountered. Each operator shall be provided with spring return for normally closed or normally open position for fail safe operation to account for fire, low temperatures, or power interruption as required by the control systems specified on the drawings. Damper operators shall be manufactured by Belimo, Johnson Controls or approved equal. Provide transformer for damper motors if different voltages are required.

##### G. EXHAUST AIR SYSTEMS

Provide roof mounted exhaust fans as scheduled on the drawings, or equal ACME, Carnes, Cook, Greenheck, Penrithair, 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 pale prefabricated roof curb. Three phase fans shall be furnished with magnetic starters with push button station.

##### H. 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 1 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 IBC. 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-permeable 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 concentric ductwork package that complies with UL 1978 standard for grease ducts may be used in lieu of the welded black iron duct for connecting hood to exhaust fan. Ductwork package shall be as manufactured by Metal-Fab, Schebler, Sellirk, or approved equal. Provide manufacturer's UL listing number and verification certificate as a part of the shop drawing submittal. Install duct package in strict conformance with manufacturer's instructions and recommendations.

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

##### A. HVAC EQUIPMENT

##### 4. ELECTRIC UNIT HEATERS

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

##### B. 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 Start, Daikin, Friedrich, Lennox, Lennox Pro, Mitsubishi, Rheem, Samsung, Sanyo, Trane, or York. Evaporator cabinet shall be factory assembled pre-wired consisting of furniture-grade steel with baked-enamel finish, front access, with direct-drive centrifugal fans, 2-speed motor, and cleanable foam filter. Evaporator coil shall be direct-expansion cooling coil of seamless copper tubes expanded into aluminum fins, with thermal expansion valve with external equalizer. Air-cooled condenser shall be a 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 roof. Provide pre-engineered roof equipment support rails for units located on roof. Securely attach units to rail.

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

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

##### C. 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, AHRF 410 and NSF-37. Unit housing shall be constructed of aluminum, aluminum-stel, or galvanized steel with powder coated/enamel finish, with steel mounting brackets. Unit shall have air adjustment by way of multi-speed motors or adjustable intake louvers. Unit shall have an adjustable integral discharge nozzle. Units shall have statically and dynamically balanced fans with direct-drive fan drives. Motors shall be single speed/efficiently mounted, continuous duty, with permanently sealed pre-lubricated ball bearings and internal disconnect.

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

##### A. PIPING AND PIPING SPECIALTIES

##### 5. REFRIGERANT RIGGING 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: 1. AWS A5.8, Classification Bag-5: Silver (Ag) 44.0-46.0 percent, Zinc (Zn) 23.0-27.0 percent, and Copper (Cu) 29.0-31.0 percent.

2. AWS A5.8, Classification BCuP-5: Phosphorus (P) 4.8-5.2 percent, Silver (Ag) 14.5-15.5 percent, and Copper (Cu) remainder.

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

Rin 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 lines over 6 feet high. Install liquid line sight glasses in liquid lines nearest the expansion valve. Factory mount expansion valves with the sensing bulbs shipped loose. Field mount expansion valve bulb after refrigerant piping is complete (damage may occur if bulbs come in contact with heat).

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

##### B. SYSTEM EVACUATION AND CHARGING

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

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

##### 6. TEMPERATURE CONTROLS

##### A. GENERAL REQUIREMENTS

Provide a complete system of temperature controls including

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

1. Wired connection.
2. Temperature sensor.
3. Humidity sensor.
4. Blank faceplate.
5. Where multiple remote sensors are shown for a single unit, the sensors shall be provided in a single device.

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

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

Provide 24 Volt or 120 Volt timeswitches Intermatic Series FMD20 or equal programmable type with 7-day programming with up to two "ons" and "offs" per day. Battery backup shall provide 48 hours of memory retention. Override timer switches shall be spring wound, 6-hour, normally open type. Coordinate 120 V wiring of timeswitch with electrical contractor if 120 V model is provided.

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

7. SEQUENCE OF OPERATION

A. FAN COIL UNIT CONTROL

During occupied hours, operate fan coil unit supply fan continuously and open outdoor air damper to maintain minimum ventilation. Cycle stage(s) of DX cooling and electric heating to maintain room thermostat set point (75 degrees Fahrenheit cooling, 70 degrees Fahrenheit heating). Duct mounted smoke detectors shall shutdown unit upon alarm.

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

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

B. KITCHEN EXHAUST FAN CONTROL

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

C. MAKE-UP AIR UNIT CONTROL

Make-up air unit supply air fan shall be energized and the outside air damper shall open 100% when exhaust fans are energized. Exhaust fans and make-up air units shall modulate thru the hood control panel. Refer to installation, operation, and maintenance manual.

D. ROOFTOP UNIT CONTROL

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

E. RESTROOM EXHAUST FAN (EF-1) CONTROL

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

F. AIR CURTAIN CONTROL

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

G. ELECTRIC UNIT HEATER CONTROL

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

8. ALTERNATES

A. DESCRIPTION

Refer to the architectural portion of the specification for list of alternates. Applicable sections of the base specifications shall apply to all work required by the alternate unless otherwise specified. Determine whether or not and how each alternate affects work. Include labor, materials, equipment, and transportation services necessary for and incidental to the completion of work under each particular alternate. Furnish separate bid for each alternate applicable to work, stating the amount to be added or deducted from the base bid.

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 gauges.
- 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.
  - e. Duct-mounted access doors and panels.
- 3. Kitchen exhaust system, including the following:
  - a. Exhaust and make-up 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 item 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 materialstock 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 proper 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.
  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 end full 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 flexible links in fire dampers and adjust for proper action.

END OF SECTION 23

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Seal

PROFESSIONAL ENGINEER  
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DATE 04/08/2024

DATE

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Project



SHAKE SHACK #1532  
MIDDLETOWN, NJ

Project Number 23197  
Drawn By EGA  
Checked By MM  
Date 12 DEC 2023

Revisions  
2 April 8, 2024 ISSUE FOR CONSTRUCTION

Drawing

MECHANICAL  
SPECIFICATIONS

M592

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ROOFTOP UNIT CONTROL MATRIX. Table with columns: CONTROL FEATURE, UNITS, RTU-1 DINING SETPOINT OR Y/N, RTU-2 KITCHEN SETPOINT OR Y/N, NOTES. Includes sections for SETPOINTS, PROGRAMMED CONTROL FEATURES, SAFETIES, INTERLOCKS, AND ALARMS, and various notes regarding contractor responsibilities.

AIR CURTAIN SCHEDULE. Table with columns: MARK, SERVICE AREA, MANUFACTURER, MODEL, LENGTH (IN), MAX. AIRFLOW, HEATING CAPACITY (KW), MOTOR, VPHHZ, NOTES. Includes notes on equipment furnished and installation requirements.

FAN SCHEDULE. Table with columns: MARK, SERVICE, MANUFACTURER, MOUNTING, MODEL, CFM, ESP (IN), DRIVE (BELT/DIRECT), MIN. HP, FAN RPM, VFD (Y/N), ELECTRICAL (VPH, DISC, TYPE), STARTER TYPE, NOTES. Includes notes on equipment furnished and installation requirements.

OUTSIDE AIR REQUIREMENTS, IMC-2021 (IP). Table with columns: SYSTEM DESIGNATION, SYSTEM TAB NAME OR LIST 'SINGLE', SINGLE-ZONE SYSTEMS ONLY, MULTI-ZONE SYSTEMS ONLY, SYSTEM AVERAGED AREA-BASED OUTDOOR AIR RATE, SYSTEM AVERAGED PEOPLE-BASED OUTDOOR AIR RATE, REQUIRED OA INTAKE FLOW [Vq], DESIGN OA INTAKE FLOW [Vq], NOTES. Includes general notes on calculations and system requirements.

EXISTING ROOFTOP UNIT SCHEDULE (FOR REFERENCE ONLY). Table with columns: MARK, MANUFACTURER, MODEL, NOMINAL TONS, UNIT TYPE, SUPPLY FAN, COOLING COIL, GAS FIRED HEAT EXCHANGER, MIN, ELECTRICAL, WEIGHT (LBS), NOTES. Includes notes on model numbers and manufacturer information.

UNIT HEATER SCHEDULE (ELECTRIC). Table with columns: MARK, MANUFACTURER, MODEL, OUTPUT (KW), MIN. NO. OF STAGES, CFM, VPH, NOTES. Includes notes on equipment furnished and installation requirements.

BUILDING AIR BALANCE SUMMARY NORMAL OPERATION. Table with columns: UNIT NO., SUPPLY (CFM), OUTDOOR (CFM), EXHAUST (CFM), PERCENT O.A.S.A. Includes a note on total airflow available for pressurization (416 CFM) and percent positive pressurization (14.8%).

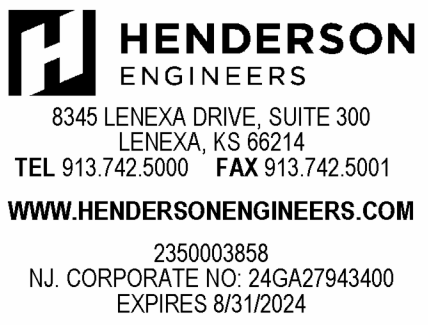
FAN COIL UNIT SCHEDULE (HEAT PUMP). Table with columns: MARK, MANUFACTURER, MODEL, SUPPLY FAN, COOLING COIL, TOTAL, HEAT PUMP HEATING COIL, MIN, ELECTRICAL, WEIGHT (LBS), NOTES. Includes notes on equipment furnished and installation requirements.

HEAT PUMP CONDENSING UNIT SCHEDULE. Table with columns: MARK, SERVICE, MANUFACTURER, MODEL, REFR. TYPE, COOLING CAPACITY, HEATING CAPACITY, MIN, ELECTRICAL, WEIGHT (LBS), NOTES. Includes notes on equipment furnished and installation requirements.

GRILLE, REGISTER, AND DIFFUSER SCHEDULE. Table with columns: MARK, MANUFACTURER, SERVICE, MODEL, CONSTRUCTION MATERIAL, FACE TYPE, MOUNTING LOCATION, FACE SIZE (IN), MAX. NC, NOTES. Includes notes on equipment furnished and installation requirements.

FAN COIL UNIT SCHEDULE (HEAT PUMP). Table with columns: MARK, MANUFACTURER, MODEL, SUPPLY FAN, COOLING COIL, TOTAL, HEAT PUMP HEATING COIL, MIN, ELECTRICAL, WEIGHT (LBS), NOTES. Includes notes on equipment furnished and installation requirements.

PROJECT DESIGN CONDITIONS. Table with columns: CLIMATE CONDITIONS, WEATHER STATION, BUILDING OPERATING HOURS, SPACE / UNIT DESCRIPTION, SETPOINTS, HEATING, HUMIDIFICATION, ZONE VENTILATION RESET, SPACE OPERATING HOURS OCCUPIED / UNOCCUPIED, NOTES. Includes notes on climate conditions and operating hours.



Seal

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JOSHUA N. HOVER  
2426364200



04/08/2024  
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Project

SHAKE SHACK®  
SHAKE SHACK #1532  
MIDDLETOWN, NJ

Project Number 23197  
Drawn By EGA  
Checked By MM  
Date 12 DEC 2023

Revisions  
2 April 8, 2024 ISSUE FOR CONSTRUCTION

Drawing

MECHANICAL  
SCHEDULES

M601

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Table with 5 columns: Section # & Req. ID, Mechanical Rough-In Inspection, Plans Verified Value, Field Verified Value, Complies?, Comments/Assumptions. Rows include 6.5.8.1, 7.4.2, 6.4.3.9, and 6.5.10.

Additional Comments/Assumptions:

Table with 5 columns: Section # & Req. ID, Mechanical Rough-In Inspection, Plans Verified Value, Field Verified Value, Complies?, Comments/Assumptions. Rows include 6.5.1.4 and 6.5.3.7.

Additional Comments/Assumptions:

Table with 5 columns: Section # & Req. ID, Mechanical Rough-In Inspection, Plans Verified Value, Field Verified Value, Complies?, Comments/Assumptions. Rows include 6.4.1.4, 6.4.4.2.1, 6.8.1-15, 6.8.1-16, 6.4.4.2.2, 6.5.2.3, 6.5.2.4.1, 6.5.2.4.2, 6.5.2.5, 6.5.2.6, 6.5.3.6.

Additional Comments/Assumptions:

Table with 5 columns: Section # & Req. ID, Mechanical Rough-In Inspection, Plans Verified Value, Field Verified Value, Complies?, Comments/Assumptions. Rows include 6.4.1.4, 6.4.1.5, 6.4.3.4.1, 6.4.3.4.2, 6.4.3.4.3, 6.4.3.4.5, 6.4.3.4.4, 6.4.3.8, 6.5.3.2.1, 6.4.4.1.1, 6.4.4.1.2, 6.4.4.1.3.

Additional Comments/Assumptions:

Impact Legend: 1 High Impact (Tier 1), 2 Medium Impact (Tier 2), 3 Low Impact (Tier 3). Project Title: SS Middletown. Report date: 12/07/23. Page 11 of 13.

Impact Legend: 1 High Impact (Tier 1), 2 Medium Impact (Tier 2), 3 Low Impact (Tier 3). Project Title: SS Middletown. Report date: 12/07/23. Page 10 of 13.

Impact Legend: 1 High Impact (Tier 1), 2 Medium Impact (Tier 2), 3 Low Impact (Tier 3). Project Title: SS Middletown. Report date: 12/07/23. Page 9 of 13.

Impact Legend: 1 High Impact (Tier 1), 2 Medium Impact (Tier 2), 3 Low Impact (Tier 3). Project Title: SS Middletown. Report date: 12/07/23. Page 8 of 13.

Table with 4 columns: Section # & Req. ID, Plumbing Rough-In Inspection, Complies?, Comments/Assumptions. Row includes 7.4.4.2.

Additional Comments/Assumptions:

Table with 4 columns: Section # & Req. ID, Footing / Foundation Inspection, Complies?, Comments/Assumptions. Row includes 6.4.3.7.

Additional Comments/Assumptions:

Impact Legend: 1 High Impact (Tier 1), 2 Medium Impact (Tier 2), 3 Low Impact (Tier 3). Project Title: SS Middletown. Report date: 12/07/23. Page 7 of 13.

Impact Legend: 1 High Impact (Tier 1), 2 Medium Impact (Tier 2), 3 Low Impact (Tier 3). Project Title: SS Middletown. Report date: 12/07/23. Page 6 of 13.

Impact Legend: 1 High Impact (Tier 1), 2 Medium Impact (Tier 2), 3 Low Impact (Tier 3). Project Title: SS Middletown. Report date: 12/07/23. Page 5 of 13.

Impact Legend: 1 High Impact (Tier 1), 2 Medium Impact (Tier 2), 3 Low Impact (Tier 3). Project Title: SS Middletown. Report date: 12/07/23. Page 4 of 13.

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Project

SHAKE SHACK logo and address: SHAKE SHACK #1532, MIDDLETOWN, NJ

Project Number: 23197, Drawn By: EGA, Checked By: MM, Date: 12 DEC 2023

Revisions: 2 April 8, 2024 ISSUE FOR CONSTRUCTION

COMcheck Software Version COMcheckWeb Inspection Checklist Energy Code: 90.1 (2019) Standard

Requirements: 97.0% were addressed directly in the COMcheck software. Text in the 'Comments/Assumptions' column is provided by the user in the COMcheck Requirements screen.

Table with 4 columns: Section # & Req. ID, Plan Review, Complies?, Comments/Assumptions. Rows include 4.2.2, 6.7.2, 4.2.2, 7.7.1, 10.4.2, 4.2.2, 8.4.1.1, 8.4.1.2, 6.7, 4.2.5.2.

Additional Comments/Assumptions:

Impact Legend: 1 High Impact (Tier 1), 2 Medium Impact (Tier 2), 3 Low Impact (Tier 3). Project Title: SS Middletown. Report date: 12/07/23. Page 5 of 13.

COMcheck Software Version COMcheckWeb Mechanical Compliance Certificate

Project Information: Energy Code: 90.1 (2019) Standard, Project Title: SS Middletown, Location: Long Branch, New Jersey, Climate Zone: 4a, Project Type: Alteration.

Table with 3 columns: Mechanical Systems List, Quantity System Type & Description, Details. Includes HVAC System, Split System Heat Pump, Heating Mode Capacity = 11 kBtu/h, Proposed Efficiency = 9.00 HSPF2, Required Efficiency = 7.50 HSPF2.

Mechanical Compliance Statement: Compliance Statement: The proposed mechanical alteration project represented in this document is consistent with the building plans, specifications, and other calculations submitted with this permit application.

Signature: Emma Allred, Date: 12/7/2023

Impact Legend: 1 High Impact (Tier 1), 2 Medium Impact (Tier 2), 3 Low Impact (Tier 3). Project Title: SS Middletown. Report date: 12/07/23. Page 4 of 13.

Drawing MECHANICAL ENERGY CODE COMPLIANCE

M630

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04/08/2024

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Project

**SHAKE SHACK**  
SHAKE SHACK #1532  
MIDDLETOWN, NJ

Project Number 23197  
Drawn By EGA  
Checked By MM  
Date 12 DEC 2023

Revisions

2 April 8, 2024 ISSUE FOR CONSTRUCTION

Drawing

MECHANICAL  
ENERGY CODE  
COMPLIANCE

**M631**

Section # & Req.ID	Final Inspection	Complies?	Comments/Assumptions
6.4.3.1.2 [F13]	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.
6.4.3.2 [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.
6.4.3.3.1 [F121]	HVAC systems equipped with at least one automatic shutdown control.	<input type="checkbox"/> Complies <input type="checkbox"/> Does Not <input type="checkbox"/> Not Observable <input type="checkbox"/> Not Applicable	Requirement will be met.
6.4.3.3.2 [F122]	Setback controls allow automatic restart and temporary operation as required for maintenance.	<input type="checkbox"/> Complies <input type="checkbox"/> Does Not <input type="checkbox"/> Not Observable <input type="checkbox"/> Not Applicable	Requirement will be met.
6.4.3.5 [F15]	Heat pump controls prevent supplemental electric resistance heat from coming on when not needed.	<input type="checkbox"/> Complies <input type="checkbox"/> Does Not <input type="checkbox"/> Not Observable <input type="checkbox"/> Not Applicable	Requirement will be met.
6.4.3.6 [F16]	When humidification and dehumidification are provided to a zone, simultaneous operation is prohibited. Humidity control prohibits the use of fossil fuel or electricity to produce RH > 30% in the warmest zone humidified and RH < 60% in the coldest zone dehumidified.	<input type="checkbox"/> Complies <input type="checkbox"/> Does Not <input type="checkbox"/> Not Observable <input type="checkbox"/> Not Applicable	Requirement will be met.
6.7.2.1 [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.
6.7.2.2 [F18]	Furnished O&M manuals for HVAC systems within 90 days of system acceptance.	<input type="checkbox"/> Complies <input type="checkbox"/> Does Not <input type="checkbox"/> Not Observable <input type="checkbox"/> Not Applicable	Requirement will be met.
6.7.2.3 [F19]	An air and/or hydronic system balancing report is provided for HVAC systems serving zones >5,000 ft <sup>2</sup> of conditioned area.	<input type="checkbox"/> Complies <input type="checkbox"/> Does Not <input type="checkbox"/> Not Observable <input type="checkbox"/> Not Applicable	<b>Exception:</b> Requirement does not apply.
7.4.4.3 [F111]	Public lavatory faucet water temperature <=110°F.	<input type="checkbox"/> Complies <input type="checkbox"/> Does Not <input type="checkbox"/> Not Observable <input type="checkbox"/> Not Applicable	Requirement will be met.
7.4.4.4 [F112]	Controls are installed that limit the operation of a recirculation pump installed to maintain temperature of a storage tank.	<input type="checkbox"/> Complies <input type="checkbox"/> Does Not <input type="checkbox"/> Not Observable <input type="checkbox"/> Not Applicable	Requirement will be met.
10.4.3 [F124]	Elevators are designed with the proper lighting, ventilation power, and standby mode.	<input type="checkbox"/> Complies <input type="checkbox"/> Does Not <input type="checkbox"/> Not Observable <input type="checkbox"/> Not Applicable	<b>Exception:</b> Requirement does not apply.

Additional Comments/Assumptions:

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

Project Title: SS Middletown Report date: 12/07/23  
Data filename: Page 13 of 13

Section # & Req.ID	Rough-In Electrical Inspection	Complies?	Comments/Assumptions
8.4.2 [EL10]	At least 50% of all 125 volt 15- and 20-Amp receptacles are controlled by an automatic control device.	<input type="checkbox"/> Complies <input type="checkbox"/> Does Not <input type="checkbox"/> Not Observable <input type="checkbox"/> Not Applicable	
8.4.3 [EL11]	New buildings have electrical energy use measurement devices installed. Where tenant spaces exist, each tenant is monitored separately. In buildings with a digital control system the energy use is transmitted to a control system and displayed graphically.	<input type="checkbox"/> Complies <input type="checkbox"/> Does Not <input type="checkbox"/> Not Observable <input type="checkbox"/> Not Applicable	
10.4.1 [EL9]	Electric motors meet requirements where applicable.	<input type="checkbox"/> Complies <input type="checkbox"/> Does Not <input type="checkbox"/> Not Observable <input type="checkbox"/> Not Applicable	Requirement will be met.

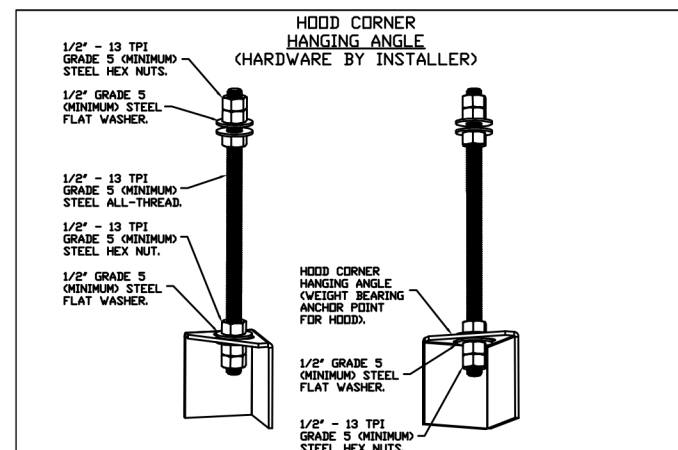
Additional Comments/Assumptions:

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

Project Title: SS Middletown Report date: 12/07/23  
Data filename: Page 12 of 13

JOSHUA N. HOVER

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

ETL HOOD LISTING DETAIL	
EXHAUST CFM = LENGTH OF HOOD X CFM/LA.F.T. (L/60)	
SUPPLY CFM = EXHAUST CFM X PERCENTAGE REQUIRED	
TOTAL DUCT AREA (sq. in.) = 144 X (CFM) <sup>2</sup>	
DUCT LENGTH = TOTAL DUCT AREA	
DUCT WIDTH	
CAPTIVEAIRE VENTILATOR BUILT INTO HOODS ARE CALCULATED USING AN EXHAUST VELOCITY OF 1500-1800 FPM AND A SUPPLY VELOCITY OF 1000 FPM	

**CALCULATIONS UTILIZED**  
 CAPTIVE-AIRE HOODS BUILT IN COMPLIANCE WITH:

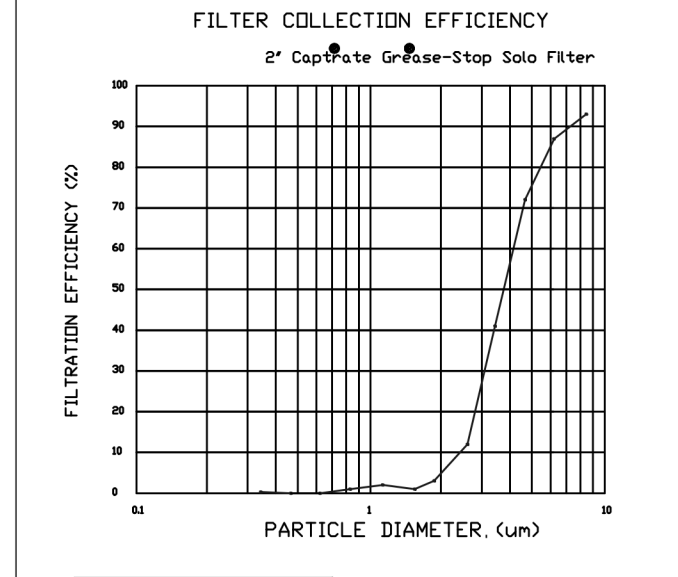
Listed under ETL File number: 3054804-001/002

BUILDING CODES	
CAPTIVE-AIRE HOODS HAVE OPTIONAL CLEARANCE REDUCTION SYSTEMS AVAILABLE AS FOLLOWS:	
MATERIAL	CLEARANCE REDUCTION SYSTEM
NON-COMBUSTIBLE	NONE REQUIRED
LIMITED-COMBUSTIBLE	3" UNINSULATED STANDOFF
COMBUSTIBLE	1" INSULATED STANDOFF

- CLEARANCE TO COMBUSTIBLES**
- INSTALLATION**
1. ALL ELECTRICAL "FIELD" CONNECTIONS AND RELATED INTERCONNECTIONS BY ELECTRICAL CONTRACTORS.
  2. ALL PLUMBING "FIELD" CONNECTIONS AND RELATED INTERCONNECTIONS BY PLUMBING CONTRACTORS.
  3. HANGING BRACKETS LOCATED AND WELDED AS SHOWN ON PLANS. ALL OTHER HANGING MATERIALS PROVIDED BY INSTALLING CONTRACTORS.
  4. ALL CONNECTIONS FROM CAPTIVEAIRE HOOD PER MECHANICAL CONTRACTOR'S PLANS.
  5. COOKING EQUIPMENT TO SHUT OFF IN EVENT OF FIRE.
  6. EXHAUST FANS TO TURN ON IN EVENT OF FIRE.
  7. ALL LIGHT FIXTURES SHOWN INSTALLED BY CAPTIVEAIRE ARE FACTORY PROVIDED. INTERCONNECTIONS BETWEEN HOODS AND TO SWITCHES ARE BY ELECTRICAL CONTRACTOR.
  8. LAMPS FOR LIGHT FIXTURES BY INSTALLING CONTRACTORS.
  9. SEISMIC RESTRAINTS ARE RESPONSIBILITY OF INSTALLING CONTRACTOR.
  10. INSTALLING CONTRACTORS ASSUME ALL RELATED RESPONSIBILITY FOR VERIFICATION OF DIMENSIONAL COMPLIANCE. CAPTIVEAIRE ENGINEERS WILL PROVIDE DIMENSIONAL ACCURACY, INTERPRETATION AND ADMINISTRATION OF CODE REQUIREMENTS IN STRICT ACCORDANCE TO ANY RELEASE FOR PRODUCTION OF EQUIPMENT SHOWN.

- BALANCE**
11. KITCHEN HOODS MUST BE BALANCED WITH KITCHEN.
  12. KITCHEN SHALL BE NEGATIVE WITH RESPECT TO DINING AREA.
  13. RESTAURANT SHALL BE POSITIVE WITH RESPECT TO AMBIENT PRESSURE.
- ADDITIONAL**
14. WRITTEN HOOD DIMENSIONS HAVE PRECEDENCE OVER SCALE.
  15. SIGNED AND "APPROVED" COPIES OF THIS DOCUMENT MADE BY REVIEWS BY THE FACTORY PRIOR TO COMMENCEMENT OF FABRICATION.

**GENERAL NOTES**



**FILTER DETAIL**

FOR QUESTIONS, CALL THE  
 Eastern PA Mechanical  
 REGION 108  
 PHONE: (267) 504 - 4126  
 EMAIL: reg108@captiveaire.com

**HOOD INFORMATION - JOB#6672025**

HOOD NO	TAG	MODEL	MANUFACTURER	LENGTH	MAX COOKING TEMP	TYPE	APPLIANCE DUTY	DESIGN CFM/FT	TOTAL EXH CFM	EXHAUST PLENUM RISER(S)				MUA CFM	AC CFM	HOOD CONSTRUCTION	HOOD CONFIG			
										WIDTH	LENG	HEIGHT	DIA				CFM	VEL	SP	END TO END
1	Hood (Gril)	5430 ND-2-ACPSP-F	CAPTIVEAIRE	7' 11"	600 DEG	I	HEAVY	175	1385	10"	13"	4"	1385	1534	-0.525"	1108	500	430 SS WHERE EXPOSED	ALONE	ALONE
2	Hood(Fryer)	5424 ND-2-ACPSP-F	CAPTIVEAIRE	4' 11"	600 DEG	I	HEAVY	175	860	10"	13"	4"	860	953	-0.426"	688	300	430 SS WHERE EXPOSED	ALONE	ALONE

**HOOD INFORMATION**

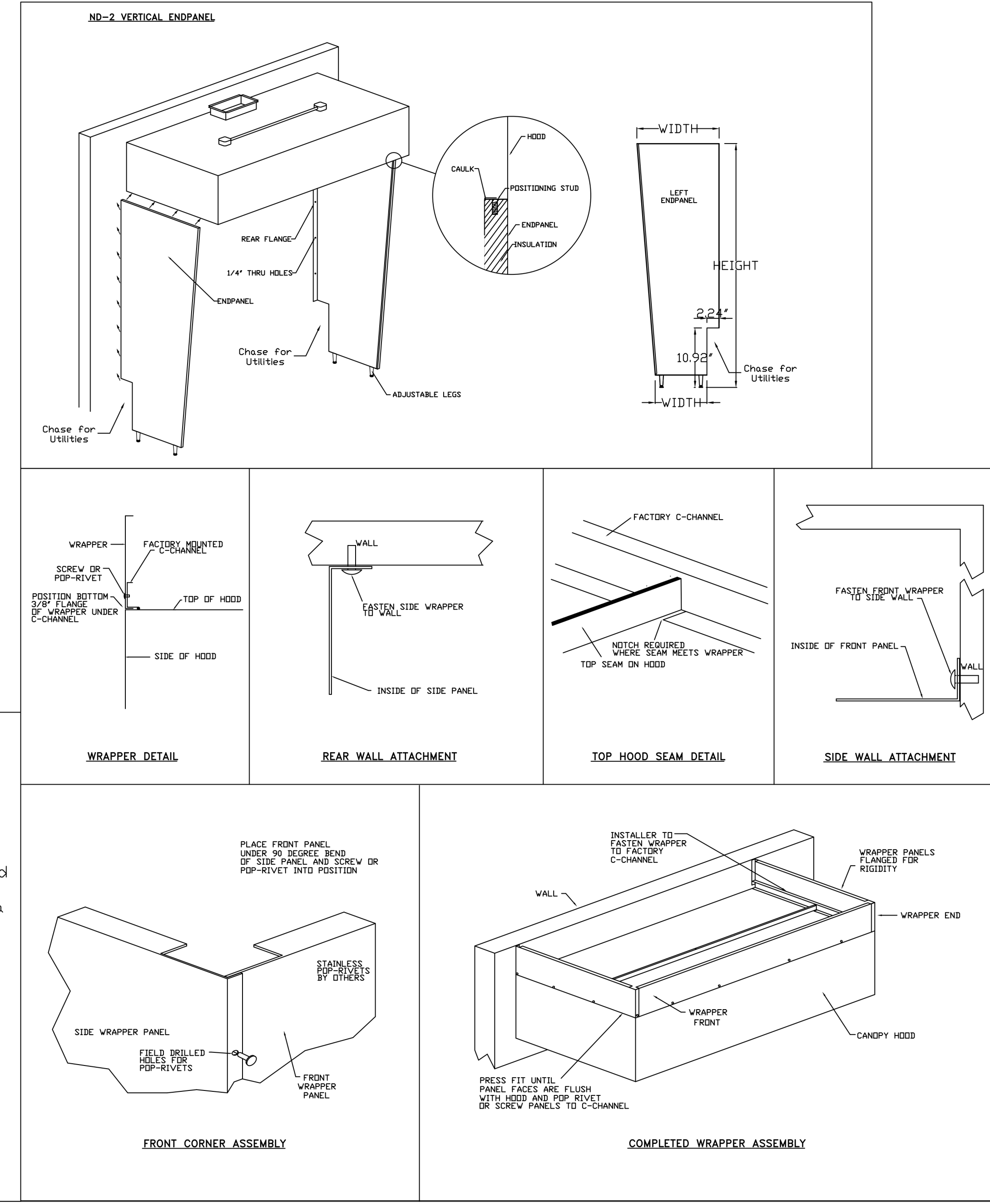
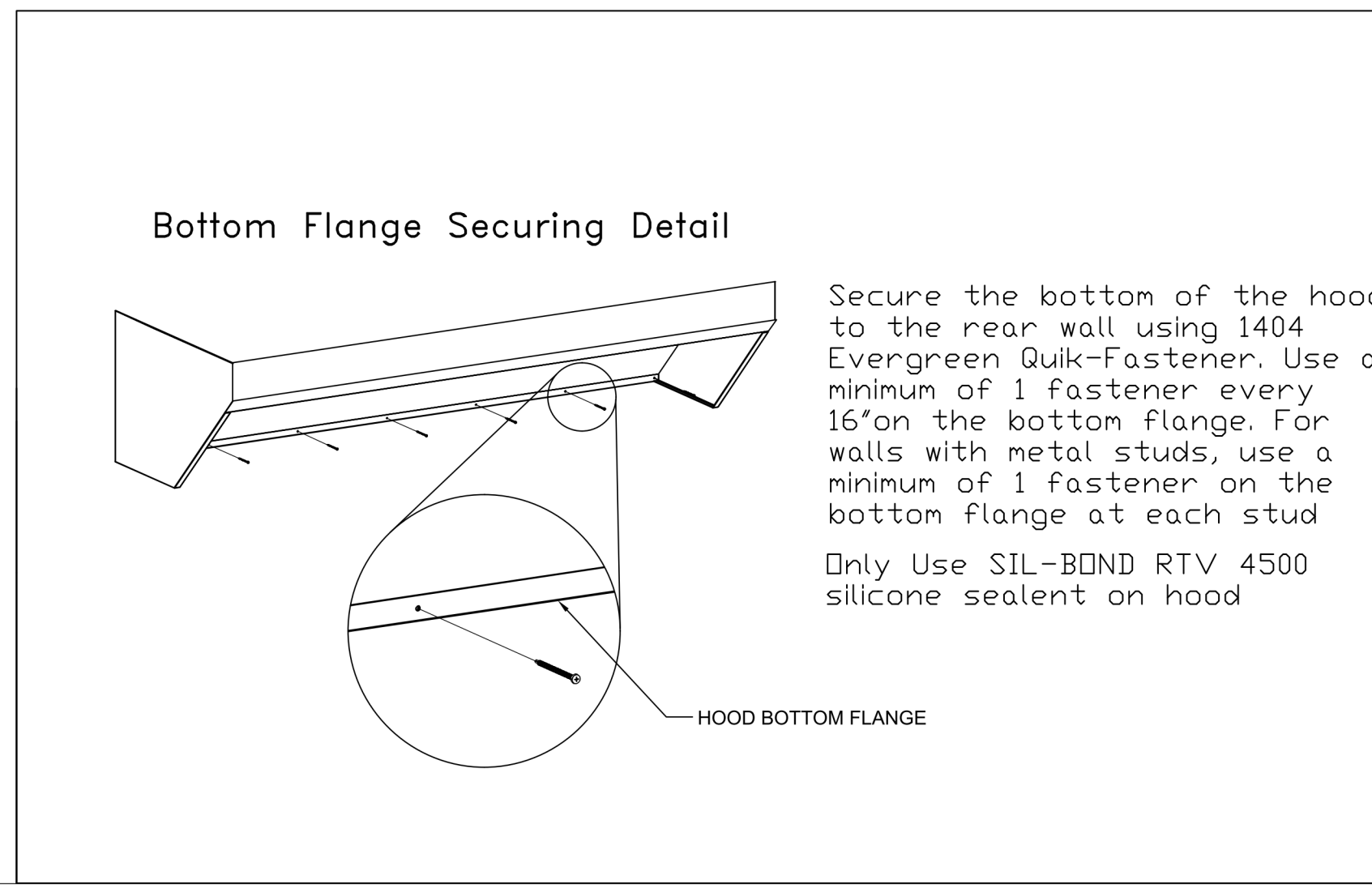
HOOD NO	TAG	TYPE	QTY	FILTER(S)		EFFICIENCY @ 7 MICRONS	QTY	LIGHT(S)		WIRE GUARD	LOCATION	SIZE	UTILITY CABINET(S)		ELECTRICAL	SWITCHES	FIRE SYSTEM	HOOD HANGING PIPING	WEIGHT
				HEIGHT	LENGTH			TYPE	SIZE				MODEL #	QUANTITY					
1	Hood (Gril)	CAPTRATE SLDL FILTER	5	20"	16"	85% SEE FILTER SPEC	2	RECESSED ROUND	NO									YES	613 LBS
2	Hood(Fryer)	CAPTRATE SLDL FILTER	3	16"	16"	85% SEE FILTER SPEC	2	RECESSED ROUND	NO	LEFT	12"x54"x24"	TANK FS	4.0/4.0/4.0	SC-321110MA	1 LIGHT 1 FAN			YES	896 LBS

**HOOD OPTIONS**

HOOD NO	TAG	OPTION
1	Hood (Gril)	FIELD WRAPPER 18.00" HIGH FRONT, LEFT. RIGHT END STANDOFF (FINISHED) 1' WIDE 54" LONG INSULATED. INSULATION FOR BACK OF HOOD. RISER SENSOR INSTALL 6IN PLEN. LEFT VERTICAL END PANEL 27" TOP WIDTH, 21" BOTTOM WIDTH, 80" HIGH INSULATED 430 SS. RIGHT WALL AS END PANEL. FIELD WRAPPER 18.00" HIGH FRONT, LEFT, RIGHT. INSULATION FOR BACK OF HOOD. RISER SENSOR INSTALL 6IN PLEN. RIGHT VERTICAL END PANEL 27" TOP WIDTH, 21" BOTTOM WIDTH, 80" HIGH INSULATED 430 SS. LEFT VERTICAL END PANEL 27" TOP WIDTH, 21" BOTTOM WIDTH, 80" HIGH INSULATED 430 SS.
2	Hood(Fryer)	FIELD WRAPPER 18.00" HIGH FRONT, LEFT, RIGHT. INSULATION FOR BACK OF HOOD. RISER SENSOR INSTALL 6IN PLEN. RIGHT VERTICAL END PANEL 27" TOP WIDTH, 21" BOTTOM WIDTH, 80" HIGH INSULATED 430 SS. LEFT VERTICAL END PANEL 27" TOP WIDTH, 21" BOTTOM WIDTH, 80" HIGH INSULATED 430 SS.

**PERFORATED SUPPLY PLENUM(S)**

HOOD NO	TAG	POS	LENGTH	WIDTH	HEIGHT	TYPE	RISER(S)				
							WIDTH	LENG	DIA	CFM	SP
1	Hood (Gril)	Front	96'	22'	6'	MUA	10"	28"		554	0.143"
						MUA	10"	28"		554	0.143"
						AC			8"	125	0.049"
						AC			8"	125	0.049"
						AC			8"	125	0.049"
						AC			8"	125	0.049"
2	Hood(Fryer)	Front	71'	22'	6'	MUA	8"	36"		688	0.169"
						AC			8"	100	0.032"
						AC			8"	100	0.032"
						AC			8"	100	0.032"



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**REVISIONS**

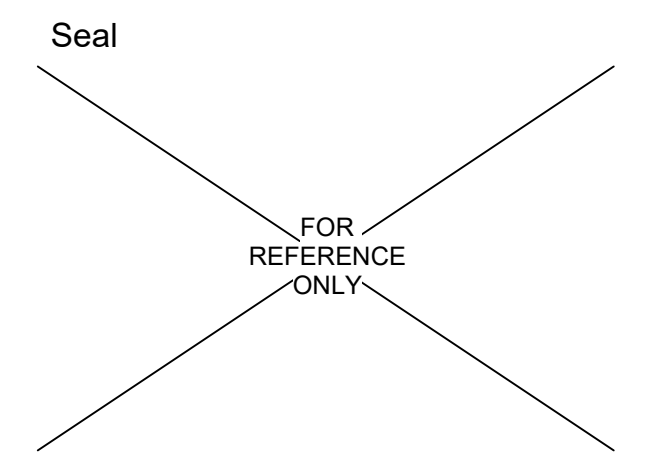
NO.	DESCRIPTION	DATE

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 Eastern PA Mechanical  
 www.captiveaire.com  
 PO Box 2520, 1 Union Ave. Bala Cynwyd, PA 19004 PHONE: (267) 504-4126 EMAIL: reg108@captiveaire.com

Shake Shack - NJ - 1532 - Middletown R2  
 MIDDLETOWN, NJ, 07748

**DATE:** 3/25/2024  
**DWG.#:** 6672025  
**DRAWN BY:** Joe Shilba  
**SCALE:** 3/4" = 1'-0"  
**MASTER DRAWING**

**SHEET NO.**  
 1



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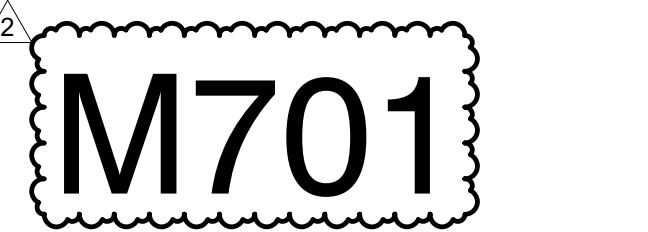
Project

**SHAKE SHACK**  
 SHAKE SHACK #1532  
 MIDDLETOWN, NJ

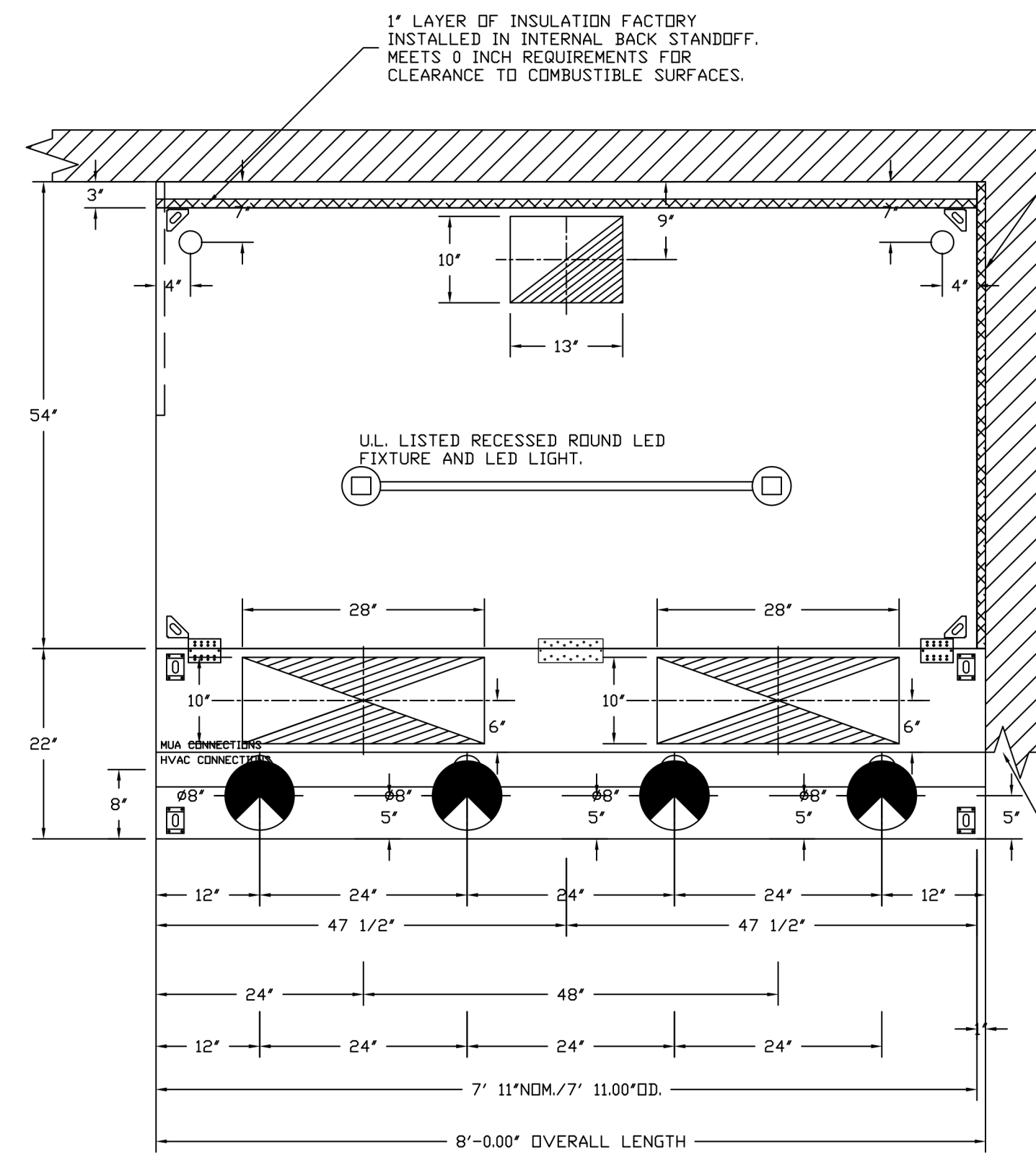
Project Number 23197  
 Drawn By EGA  
 Checked By MM  
 Date 12 DEC 2023

Revisions  
 2 April 8, 2024 ISSUE FOR CONSTRUCTION

Drawing  
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 DRAWINGS



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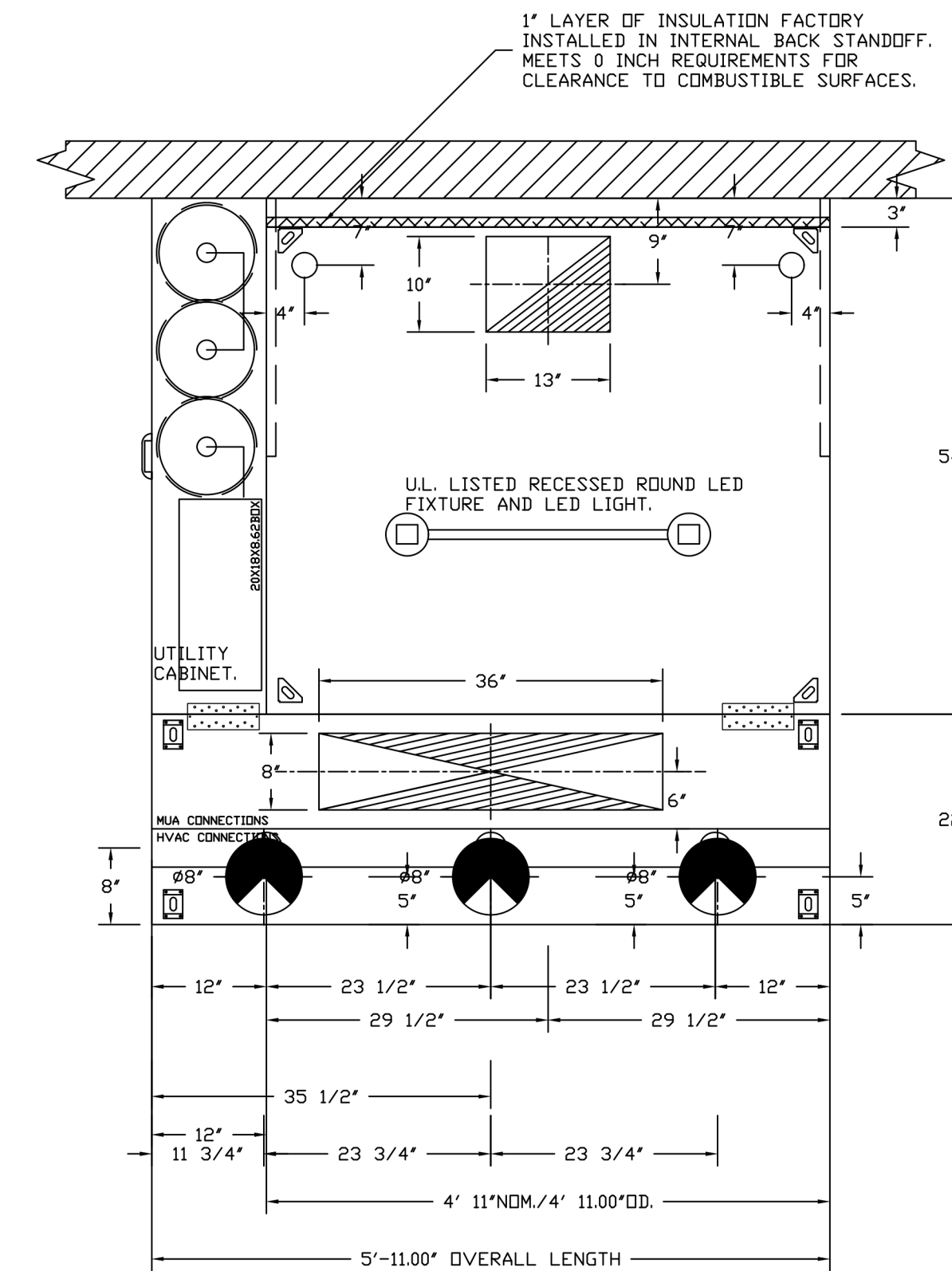
PLAN VIEW - HOOD #1 (Hood Grill)  
7' 11.00" LONG 5430ND-2-ACPSP-F

ACPSP SHIPS LOOSE FOR FIELD INSTALLATION

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

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

LIGHTING FOR ACPSP JOB # 6672025 - HOOD #1 INPUT: 120V AC, 1 PHASE, 50/60HZ, 3.5 WATTS PER LIGHT. TO CONTROL LIGHTS WITH HOOD LIGHT SWITCH, WIRE PER HOOD ELECTRICAL CONTROL PANEL SCHEMATIC. TO CONTROL LIGHTS WITH BUILDING LIGHT SWITCH, WIRE BLACK AND WHITE WIRE TO A 120VAC SERVICE. END TO END ACPSPS REQUIRE 120VAC FIELD WIRING FROM J-BOX TO J-BOX. REPLACE LIGHTS WITH LED LIGHTS ONLY.

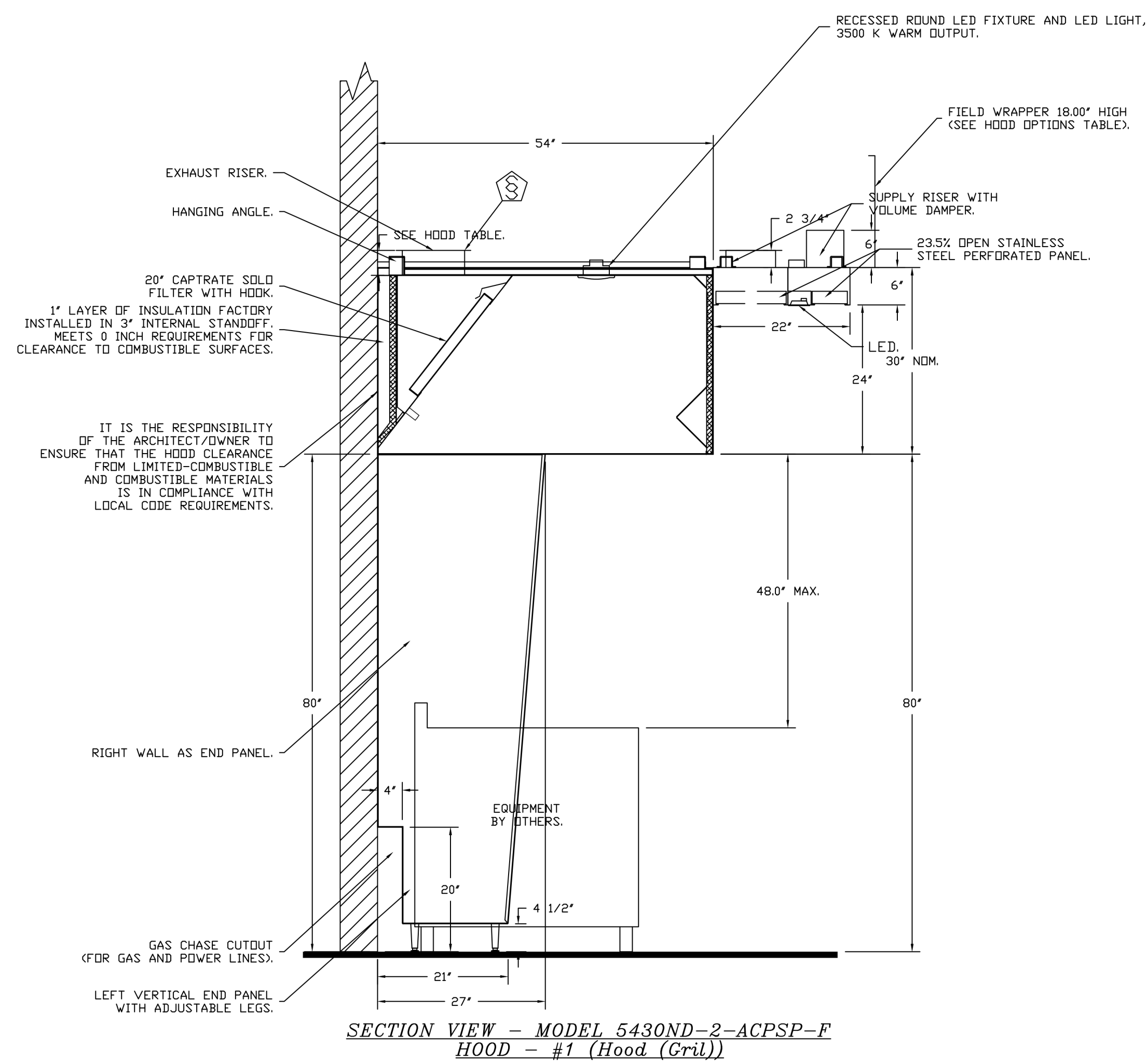


PLAN VIEW - HOOD #2 (Hood Fryer)  
4' 11.00" LONG 5424ND-2-ACPSP-F

ACPSP SHIPS LOOSE FOR FIELD INSTALLATION

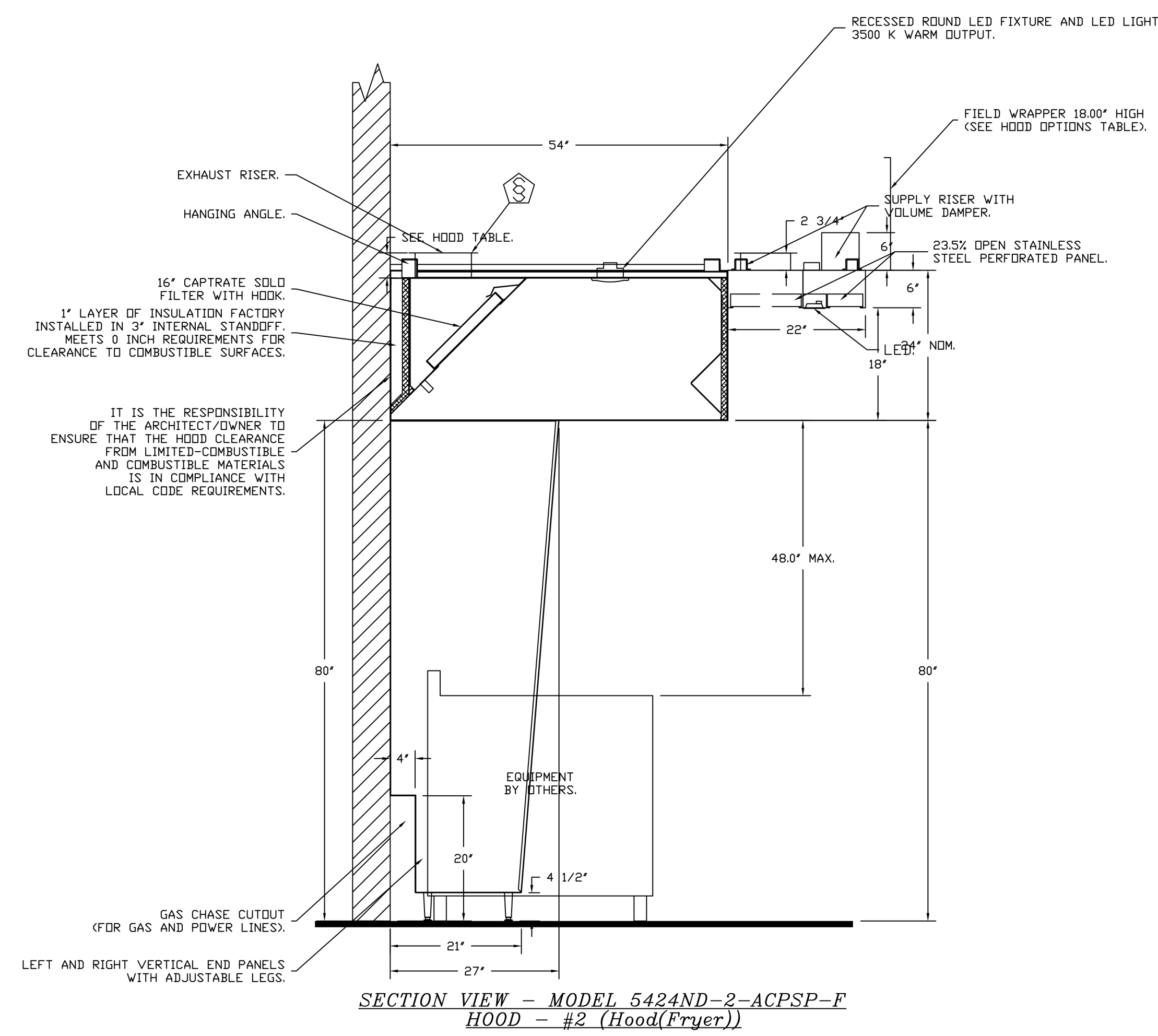
1" LAYER OF INSULATION FACTORY INSTALLED IN INTERNAL BACK STANDOFF. MEETS 0 INCH REQUIREMENTS FOR CLEARANCE TO COMBUSTIBLE SURFACES.

LIGHTING FOR ACPSP JOB # 6672025 - HOOD #2 INPUT: 120V AC, 1 PHASE, 50/60HZ, 3.5 WATTS PER LIGHT. TO CONTROL LIGHTS WITH HOOD LIGHT SWITCH, WIRE PER HOOD ELECTRICAL CONTROL PANEL SCHEMATIC. TO CONTROL LIGHTS WITH BUILDING LIGHT SWITCH, WIRE BLACK AND WHITE WIRE TO A 120VAC SERVICE. END TO END ACPSPS REQUIRE 120VAC FIELD WIRING FROM J-BOX TO J-BOX. REPLACE LIGHTS WITH LED LIGHTS ONLY.



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

IT IS THE RESPONSIBILITY OF THE ARCHITECT/OWNER TO ENSURE THAT THE HOOD CLEARANCE FROM LIMITED-COMBUSTIBLE AND COMBUSTIBLE MATERIALS IS IN COMPLIANCE WITH LOCAL CODE REQUIREMENTS.



SECTION VIEW - MODEL 5424ND-2-ACPSP-F  
HOOD - #2 (Hood Fryer)

IT IS THE RESPONSIBILITY OF THE ARCHITECT/OWNER TO ENSURE THAT THE HOOD CLEARANCE FROM LIMITED-COMBUSTIBLE AND COMBUSTIBLE MATERIALS IS IN COMPLIANCE WITH LOCAL CODE REQUIREMENTS.

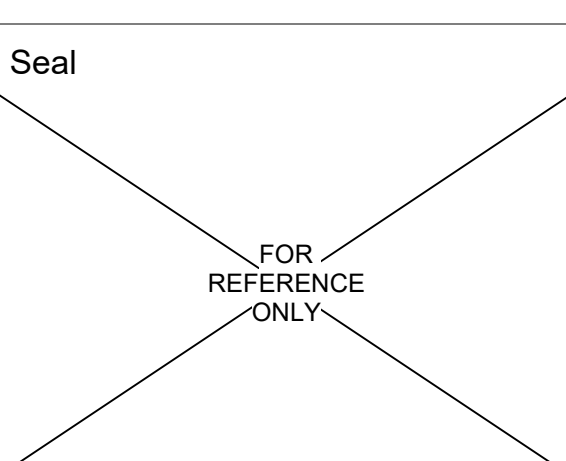
REVISIONS	
DESCRIPTION	DATE

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PO Box 2500, 1 Union Ave, Balls Blenheim, PA, 19004 PHONE: (267) 504-4128 EMAIL: rog118@captiveaire.com

Shake Shack - NJ - 1532 - MiddleTown R2  
MIDDLETOWN, NJ, 07748

DATE: 3/25/2024  
DWG.#: 6672025  
DRAWN BY: Joe.shilba  
SCALE: 3/4" = 1'-0"  
MASTER DRAWING

SHEET NO. 2



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Architect

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Project

**SHAKE SHACK**  
SHAKE SHACK #1532  
MIDDLETOWN, NJ

Project Number 23197  
Drawn By EGA  
Checked By MM  
Date 12 DEC 2023

Revisions  
2 April 8, 2024 ISSUE FOR CONSTRUCTION

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Drawing  
CAPTIVEAIR  
DRAWINGS

M702

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**FIRE SYSTEM INFORMATION - JOB#6672025**

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

**GAS VALVE(S)**

FIRE SYSTEM NO	TAG	TYPE	SIZE	SUPPLIED BY
1		SC ELECTRICAL	2.000	CAPTIVEAIRE SYSTEMS

**NOTES**

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

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

JOB #: 6672025.  
JOB NAME: SHAKE SHACK - NJ - 1532 - MIDDLETOWN R2.

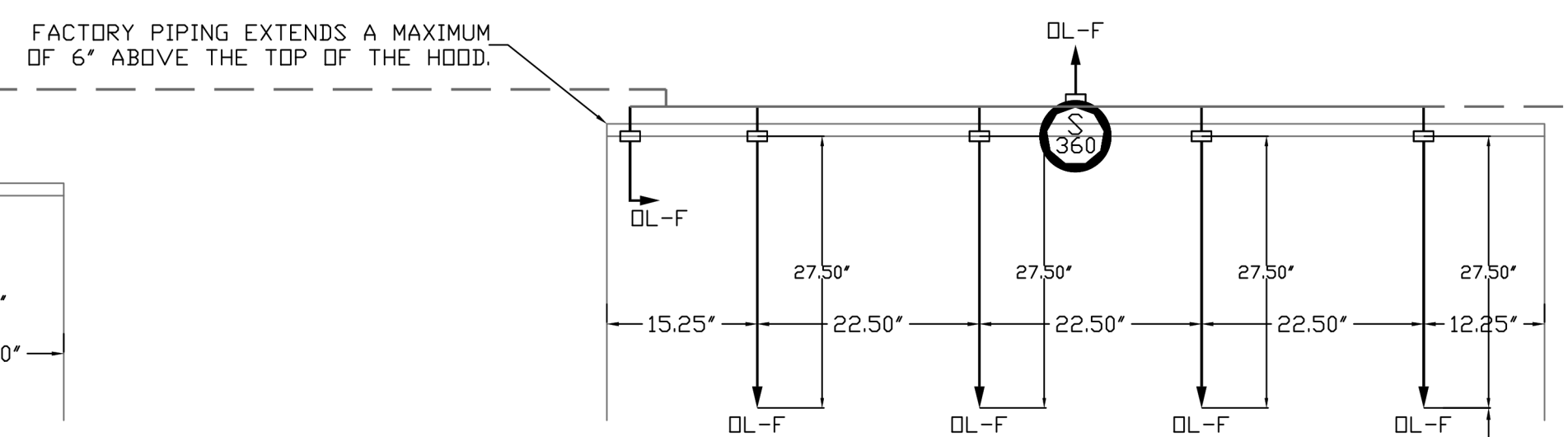
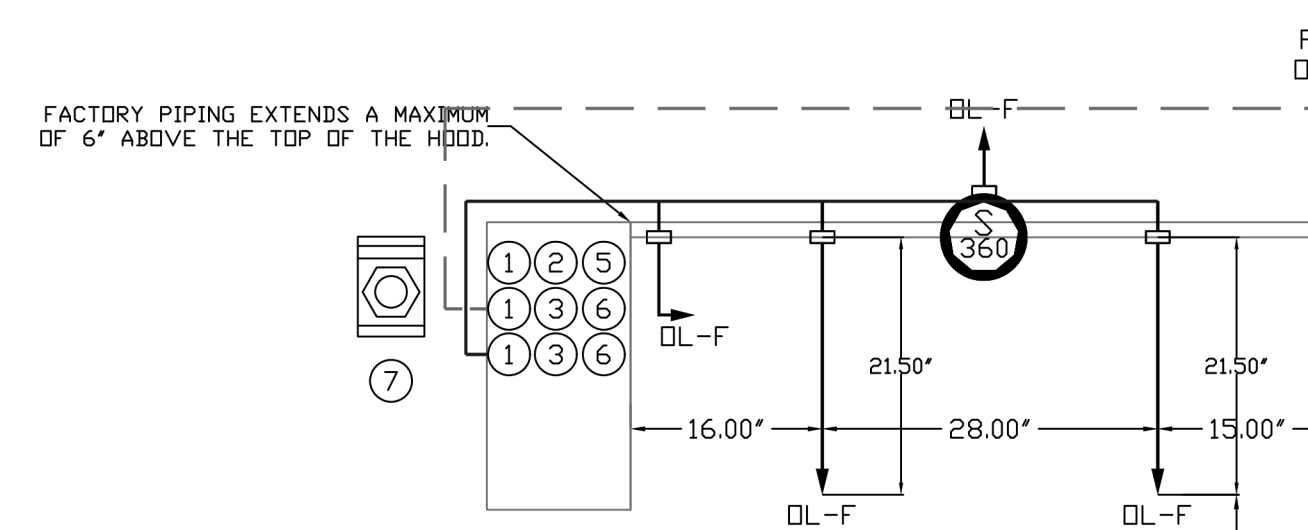
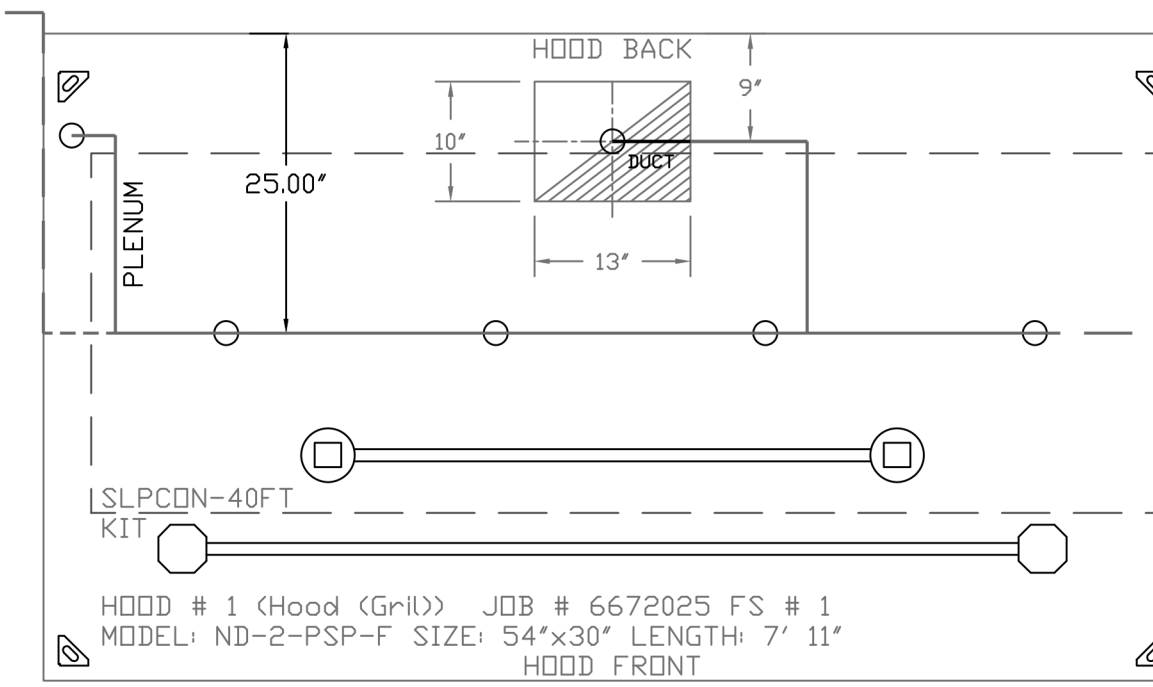
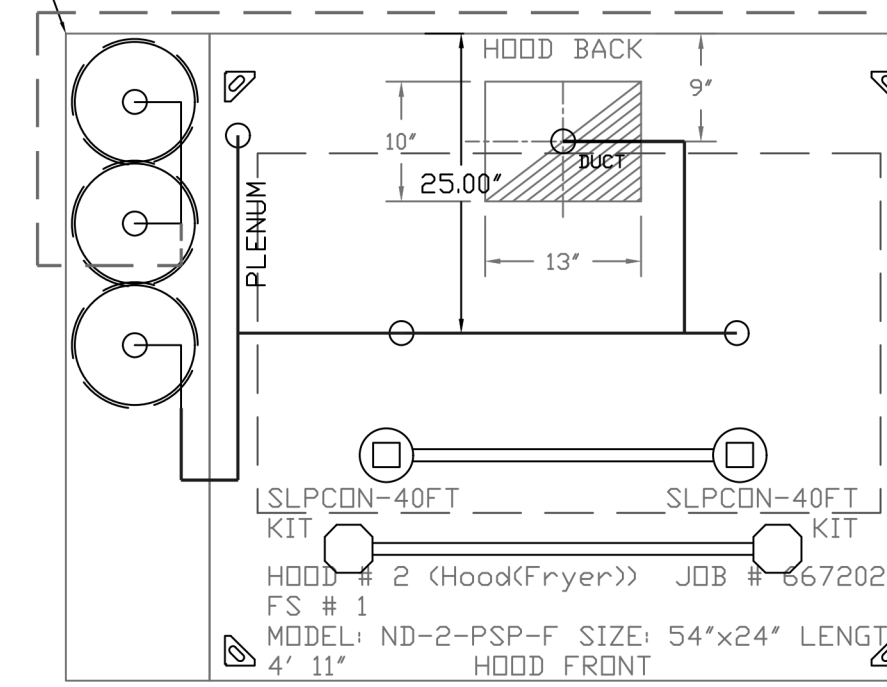
SYSTEM SIZE: TANK-SP-3 DESIGN FP: 46, MAXIMUM FP: 60.  
HOOD # 1 7' 11.00" LONG x 54" WIDE x 30" HIGH.  
RISER # 1 SIZE: 10" x 13".  
HOOD # 1 METAL BLOW-OFF CAPS INCLUDED.  
HOOD # 2 4' 11.00" LONG x 54" WIDE x 24" HIGH.  
RISER # 1 SIZE: 9" x 9".  
HOOD # 2 METAL BLOW-OFF CAPS INCLUDED.

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

**LEGEND - FIRE CABINET TANK SYSTEM**

- |   |                                 |
|---|---------------------------------|
| 1 | 4 GALLON TANK.                  |
| 2 | PRIMARY ACTUATOR RELEASE.       |
| 3 | SECONDARY ACTUATOR RELEASE.     |
| 4 | PRESSURE SUPERVISION SWITCH.    |
| 5 | PRIMARY HOSE ASSEMBLY.          |
| 6 | SECONDARY HOSE ASSEMBLY.        |
| 7 | REMOTE MANUAL ACTUATION DEVICE. |

- SYSTEM REQUIRES A MINIMUM OF 7 FT OF EQUIVALENT PIPE LENGTH BETWEEN TANK AND NEAREST APPLIANCE NOZZLE FOR MOST APPLIANCES. EACH 90 DEGREE ELBOW ADDS 13 FT OF EQUIVALENT LENGTH. SEE MANUAL FOR DETAILS.



NOZZLE HEIGHT 35'-50" FROM COOKING SURFACE. (45.25')

NOZZLE HEIGHT 35'-50" FROM COOKING SURFACE. (45.25')

TANK OVERLAPPING PROTECTION - 30 HIGH PROXIMITY 25.00" L X 30.00" D

TANK OVERLAPPING PROTECTION - 30 HIGH PROXIMITY 30.00" L X 30.00" D

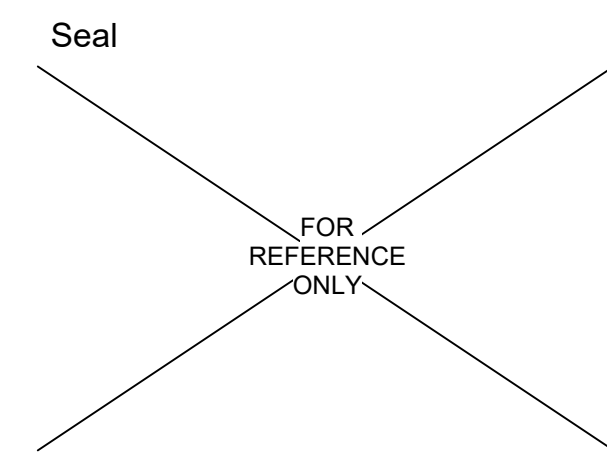
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Shake Shack - NJ - 1532 - Middle town R2  
MIDDLETOWN, NJ, 07748

**DATE:** 3/25/2024  
**DWG.#:** 6672025  
**DRAWN BY:** joe.shiiba  
**SCALE:** 3/4" = 1'-0"  
**MASTER DRAWING**

**SHEET NO.**  
3



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Project

**SHAKE SHACK**  
SHAKE SHACK #1532  
MIDDLETOWN, NJ

Project Number 23197  
Drawn By EGA  
Checked By MM  
Date 12 DEC 2023

Revisions  
2 April 8, 2024 ISSUE FOR CONSTRUCTION

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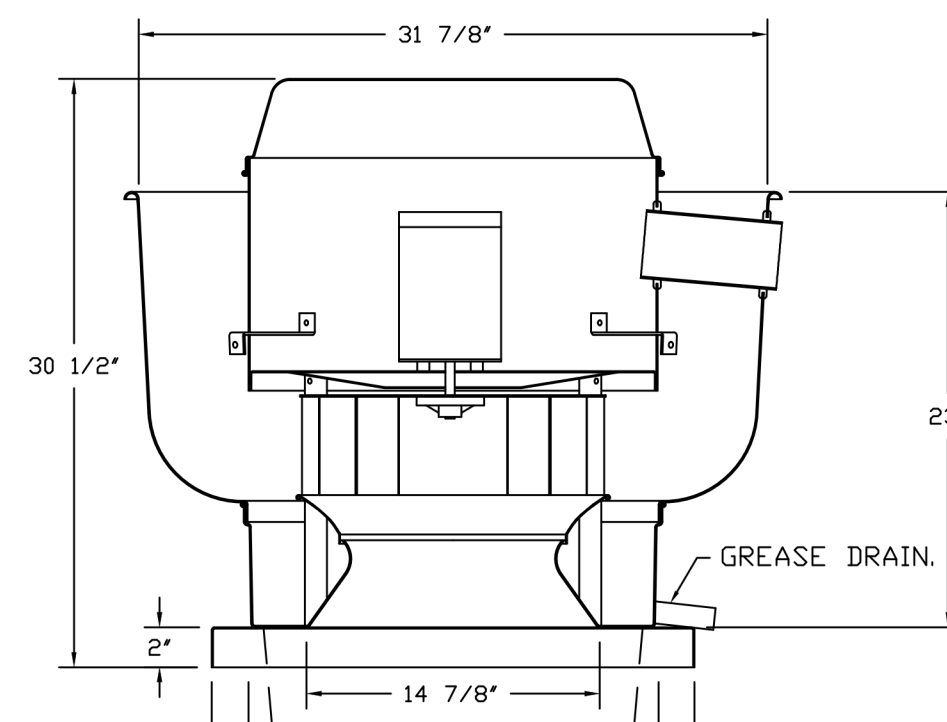
Drawing  
**CAPTIVEAIRE**  
DRAWINGS

**M703**

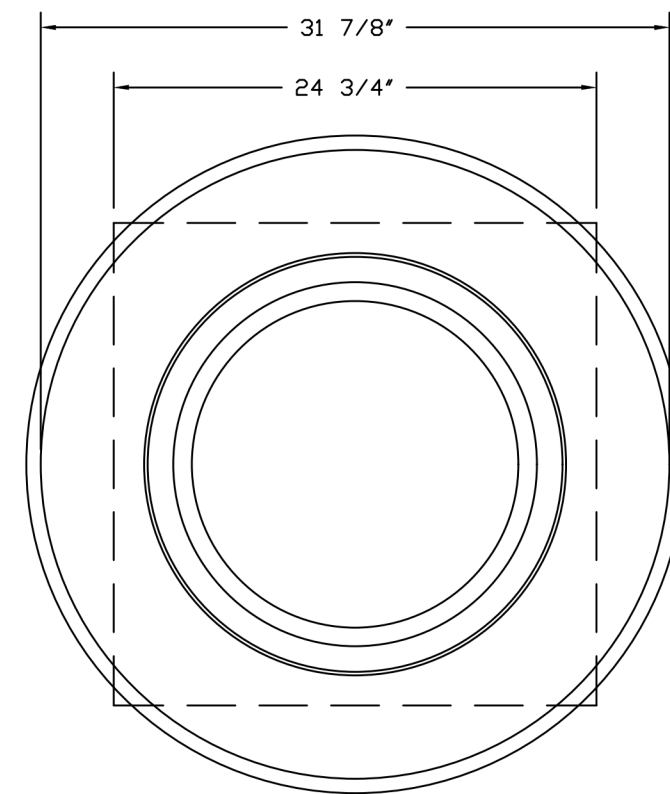


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FANS\_M (KEF (GRILL)), #2 (KEF (FRYER)) - DRBSHFA EXHAUST FAN



DUCTWORK BETWEEN EXHAUST RISER ON HOOD AND FAN (BY OTHERS).



TOP VIEW

**FEATURES:**

- DIRECT DRIVE CONSTRUCTION (NO BELTS/PULLEYS).
- ROOF MOUNTED FANS.
- RESTAURANT MODEL.
- UL705 AND UL762 AND ULCS-5645
- VARIABLE SPEED CONTROL.
- INTERNAL WIRING.
- THERMAL OVERLOAD PROTECTION (SINGLE PHASE).
- HIGH HEAT OPERATION 300°F (149°C).
- GREASE CLASSIFICATION TESTING.
- NEMA 3R SAFETY DISCONNECT SWITCH.

**NORMAL TEMPERATURE TEST**

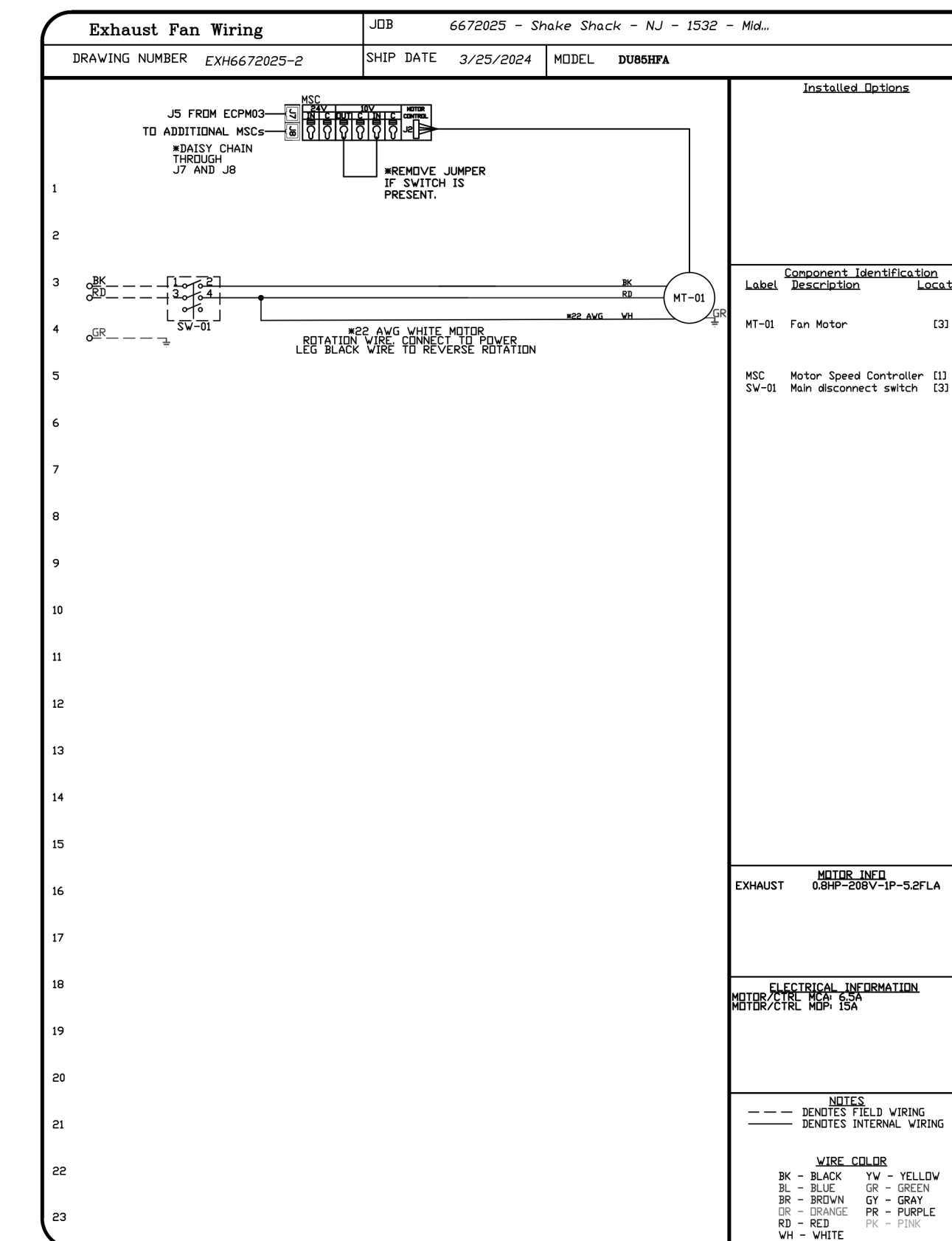
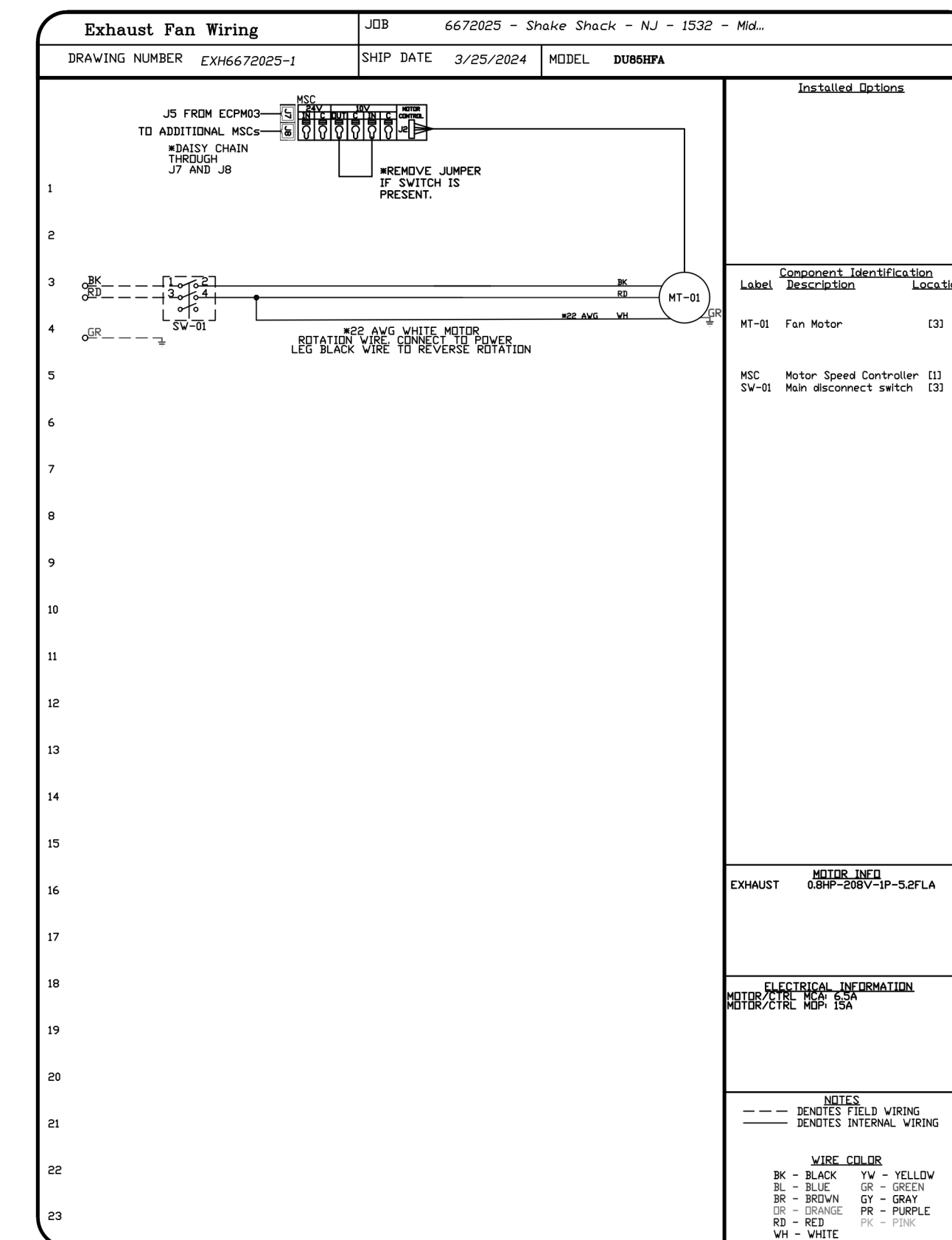
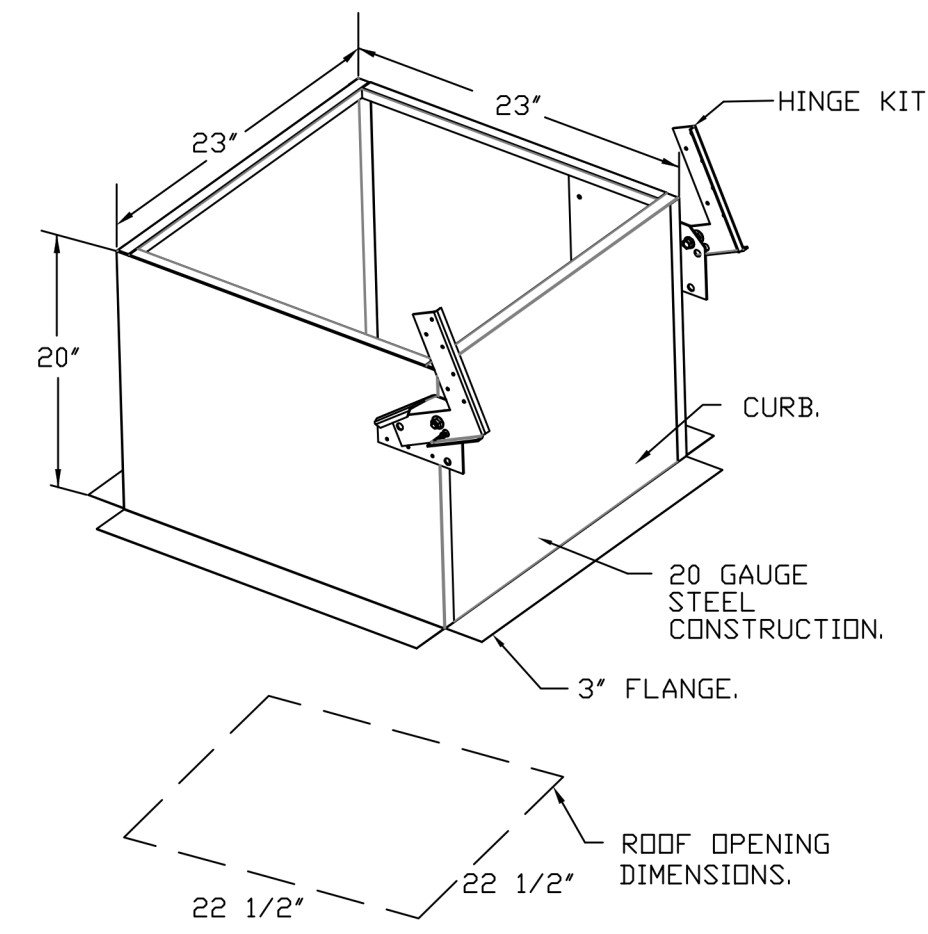
EXHAUST FAN MUST OPERATE CONTINUOUSLY WHILE EXHAUSTING AIR AT 300°F (149°C) UNTIL ALL FAN PARTS HAVE REACHED THERMAL EQUILIBRIUM, AND WITHOUT ANY DEGRADATING EFFECTS TO THE FAN WHICH WOULD CAUSE UNSAFE OPERATION.

**ABNORMAL FLARE-UP TEST**

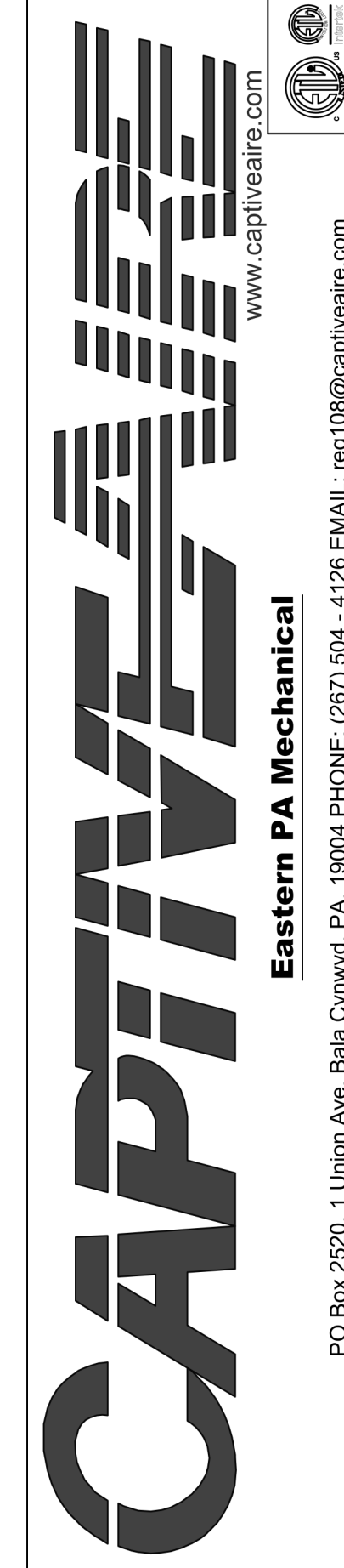
EXHAUST FAN MUST OPERATE CONTINUOUSLY WHILE EXHAUSTING BURNING GREASE VAPORS AT 600°F (316°C) FOR A PERIOD OF 15 MINUTES WITHOUT THE FAN BECOMING DAMAGED TO ANY EXTENT THAT COULD CAUSE AN UNSAFE CONDITION.

**OPTIONS**

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

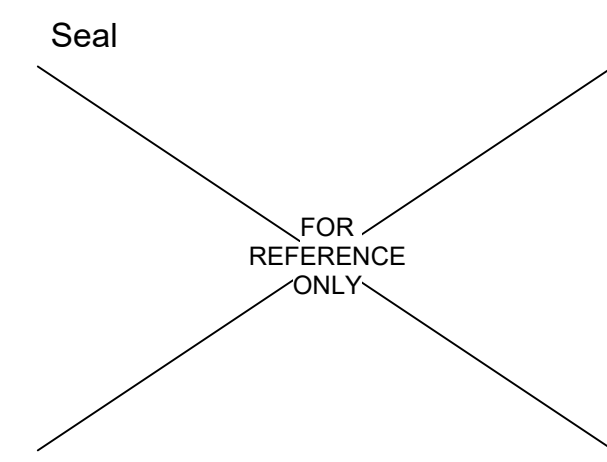


REVISIONS	
DESCRIPTION	DATE



Shake Shack - NJ - 1532 - Middletown R2  
MIDDLETOWN, NJ, 07748

DATE: 3/25/2024  
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Project

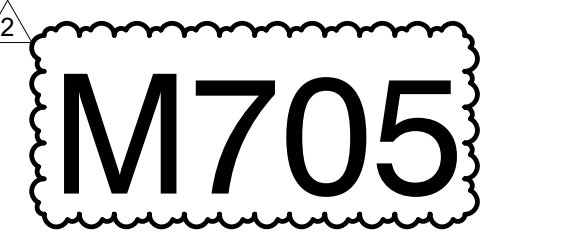
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DRAWINGS



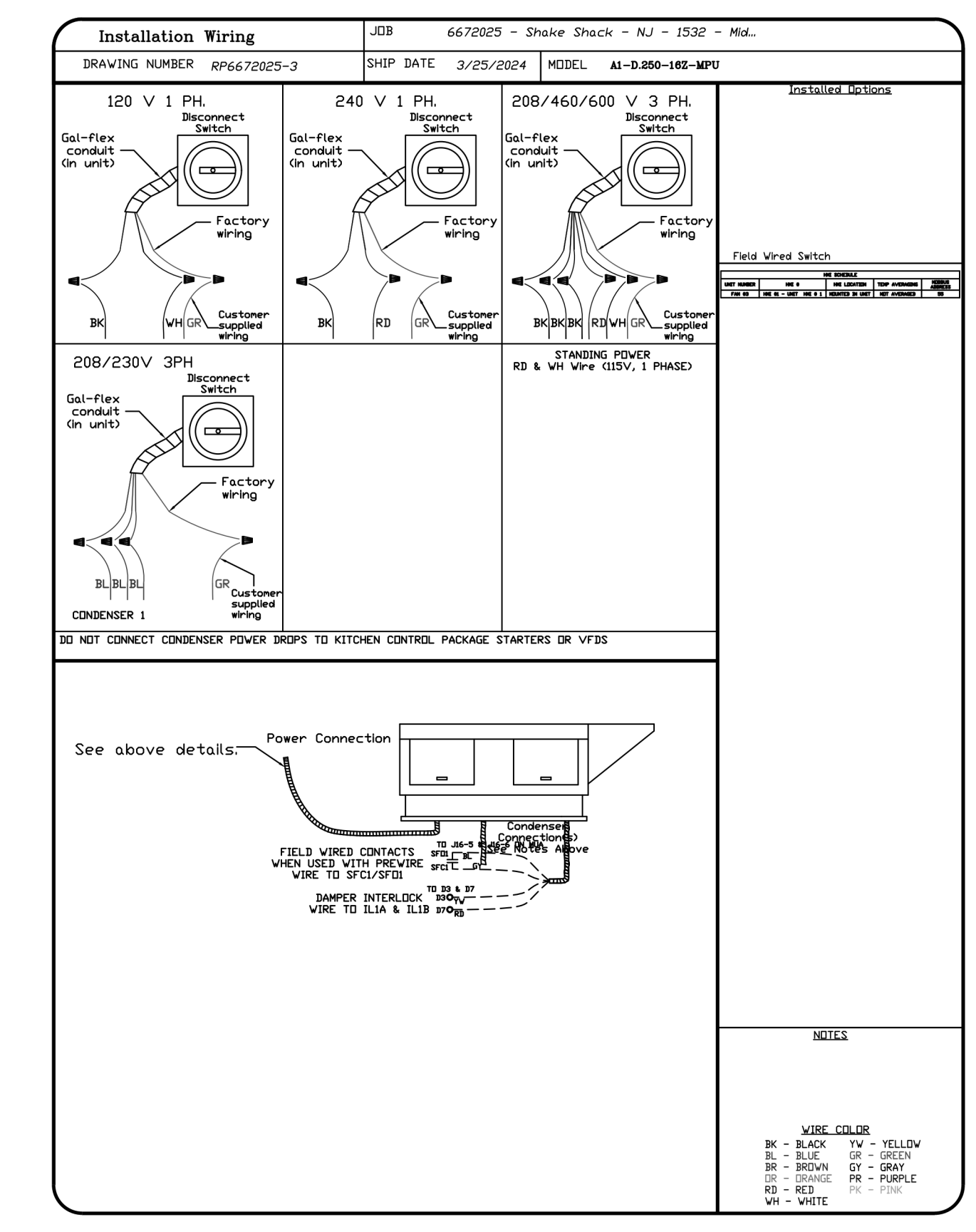
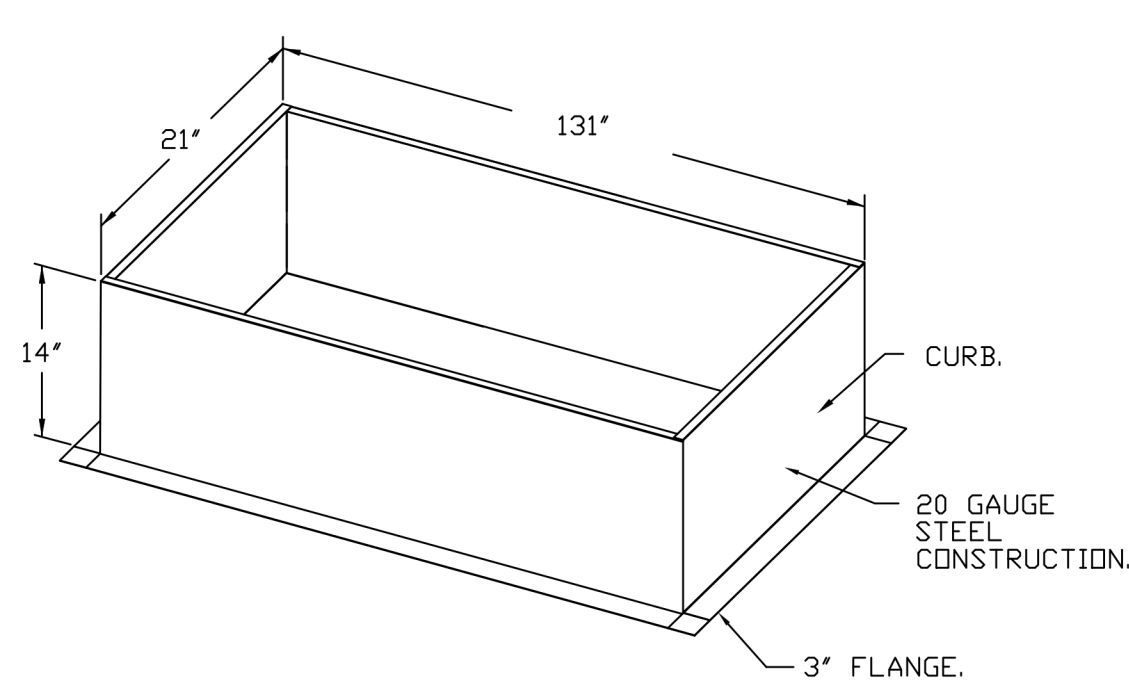
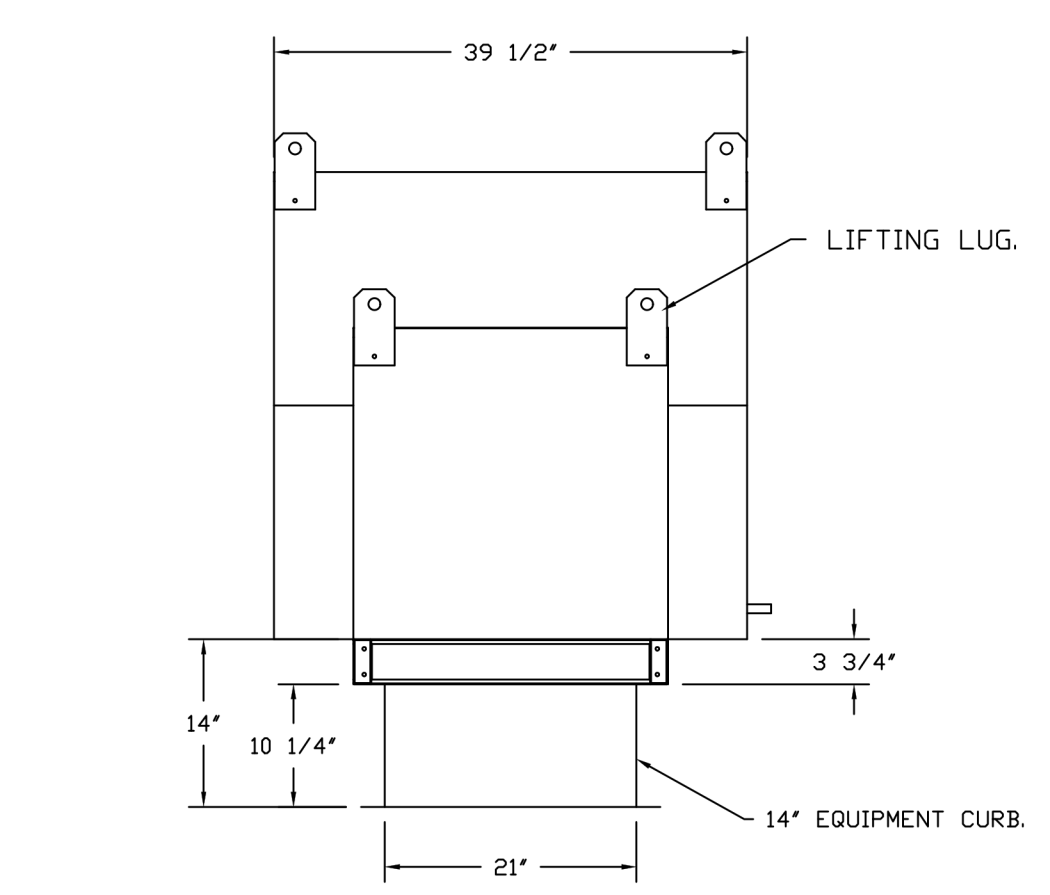
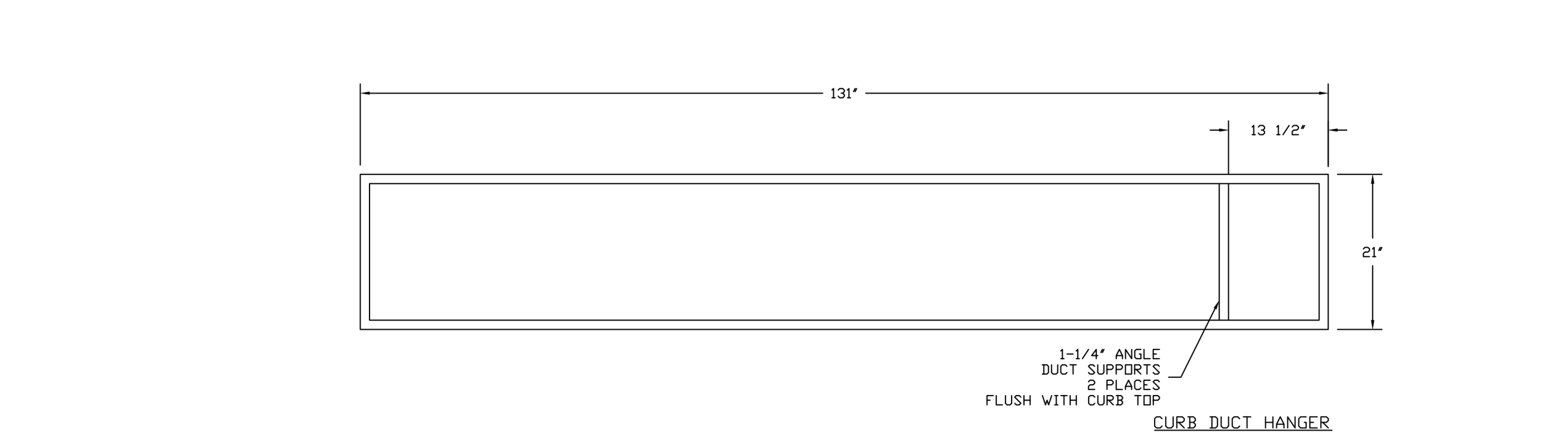
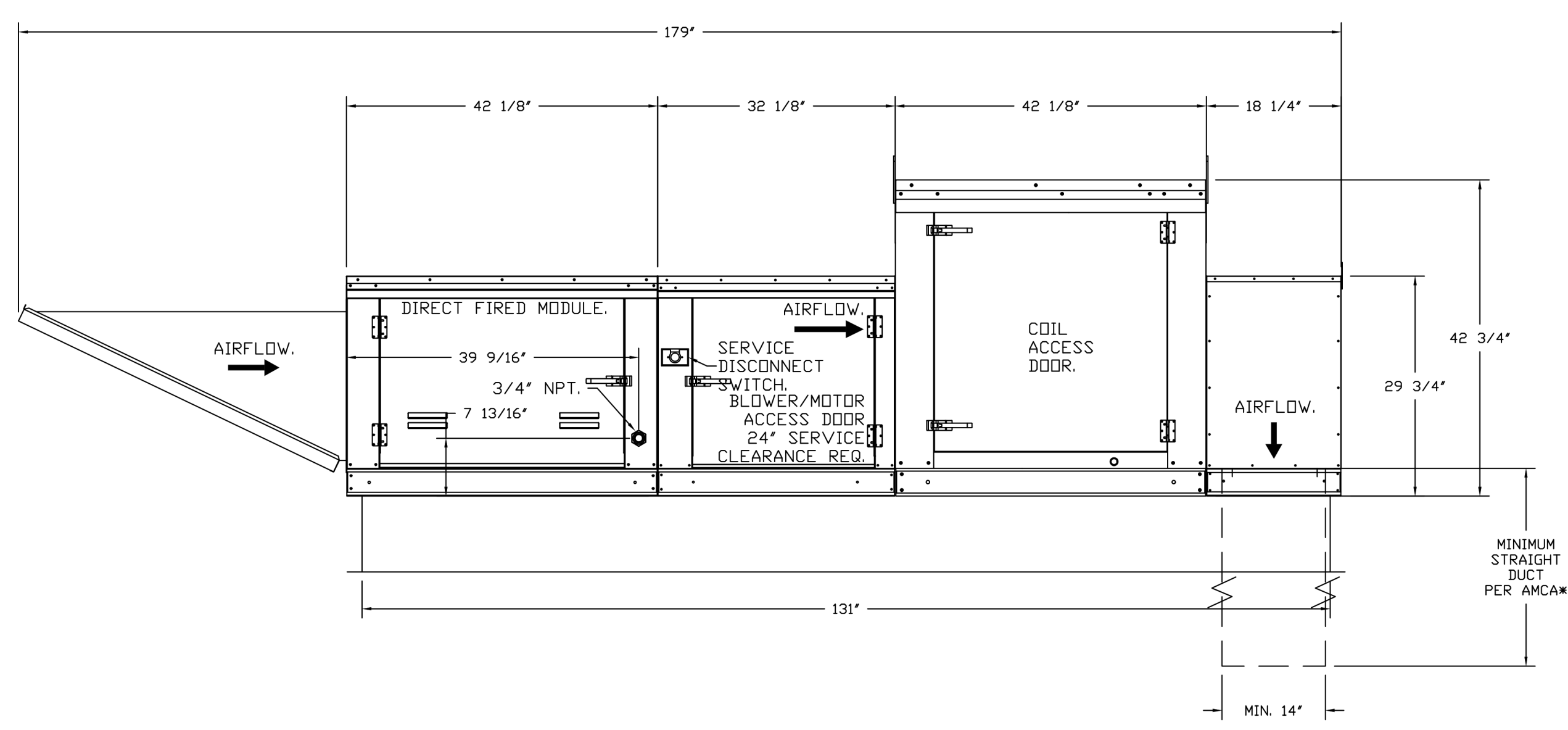
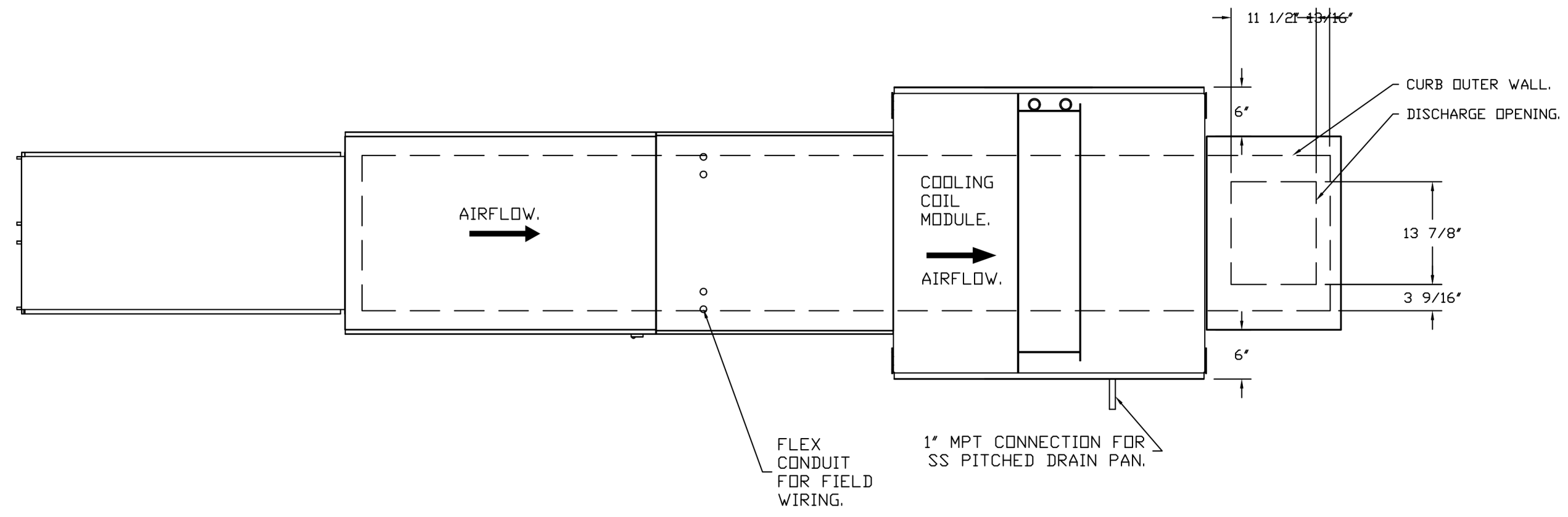
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- FAN #3 A1-D-250-16Z-MPU - HEATER (MAU-D)
- DIRECT GAS FIRED HEATED MAKE UP AIR UNIT WITH 16' DIRECT DRIVE FAN.
  - INTAKE HOOD WITH EZ FILTERS.
  - DOWN DISCHARGE - AIR FLOW LEFT -> RIGHT.
  - GAS PRESSURE GAUGE, 0-35" 2.5" DIAMETER, 1/4" THREAD SIZE.
  - GAS PRESSURE GAUGE, -5 TO +15 INCHES WC, 2.5" DIAMETER, 1/4" THREAD SIZE.
  - SHIP LOOSE, GAS STRAINER, TO BE INSTALLED UPSTREAM OF UNIT CONNECTION, 3/4" CONNECTION.
  - CASUALTY BUILDING MONITORING SYSTEM COMMUNICATIONS MODULE, REQUIRES INTERNET & FIELD WIRED ETHERNET CONNECTION OR 3G CELLULAR SERVICE. INCLUDES REV 3 COMM MODULE, RJ45 TO MODBUS CONVERTER, 3 FT CAT5 CABLE, AND 1 FT OF SHIELDED TWISTED PAIR.
  - MOTORIZED BACK DRAFT DAMPER 16" X 18" FOR SIZE 1 STANDARD & MODULAR HEATER UNITS W/EXTENDED SHAFT, STANDARD GALVANIZED CONSTRUCTION, 3/4" REAR FLANGE, LOW LEAKAGE, TFBIBOS ACTUATOR INCLUDED.
  - COMMERCIAL SMOKE DETECTOR INTERLOCK (DETECTOR BY OTHERS).
  - CLOGGED FILTER SWITCH WITH NOTIFICATION ON HMI.
  - 3 TON, SINGLE CIRCUIT MODULAR PACKAGED COOLING CONDENSER, IX COIL, FILTER/DRYER KIT, THERMAL EXPANSION VALVE, 0.100 TO 1.800 CFM, WHEN ORDERED WITH OPPOSITE AIRFLOW CONDENSERS ACCESS AND COIL PIPING WILL REMAIN IN STANDARD POSITION. DRAIN AND SLIDS WILL MOVE TO THE OPPOSITE SIDE. ANY OTHER CHANGE WILL REQUIRE CLI. CONDENSERS REQUIRE SEPARATE 208V, 3 PHASE POWER SUPPLY UNLESS ORDERED WITH SINGLE POINT CONNECTION COIL = 223100N.
  - DOWNTURN PLENUM FOR SIZE 1 COOLING COIL MODULE - REQUIRED FOR DOWN DISCHARGE COOLING COIL APPLICATIONS.
  - CURB DUCT HANGER - 1-1/4" ANGLE IRON FRAME WELDED TO CURB TO SUPPORT STANDARD SIZE DUCTWORK. PRICED PER CURB, ONLY AVAILABLE WHEN CURB ASSEMBLY IS ORDERED.
  - FREESTAT FACTORY SET AT 35°F AND 10 MINUTES.
  - SHIP CONDENSER LOOSE, THE REFRIGERATION LINES WILL NEED TO BE STUBBED OUT 12 INCHES. THE SUCTION LINE NEEDS TO BE INSULATED INSIDE THE COIL MODULE. ROTARY DISCONNECT SHOULD NOT BE INSTALLED ON THE PSDT, BLANK PSDT SHOULD BE USED IN PLACE. ALL PIPING AND WIRING BETWEEN INDOOR AND OUTDOOR UNITS BY OTHERS.
  - ECM WIRING PACKAGE MODBUS CONTROL FOR SUPPLY EC ZIEHL FANS, MSC CONTROLLER.
  - HINGED DOUBLE WALL INSULATED DOOR ASSEMBLY (TURNER/BLOWERS/MPU SECTION).
  - 2 YEAR PARTS WARRANTY.

NOTE: SUPPLY DUCT MUST BE INSTALLED TO MEET SMACNA STANDARDS. A MINIMUM STRAIGHT DUCT LENGTH MUST BE MAINTAINED DOWNSTREAM OF UNIT DISCHARGE AS OUTLINED IN AMCA PUBLICATION 201. WHEN USING RECTANGULAR DUCTWORK, ELBOWS MUST BE RADIUS THROAT, RADIUS BACK WITH TURNING VANES. FLEXIBLE DUCTWORK AND SQUARE THROAT/SQUARE BACK ELBOWS SHOULD NOT BE USED. ANY TRANSITION AND/OR TURNS IN THE DUCTWORK WILL CAUSE SYSTEM EFFECT. SYSTEM EFFECT WILL DRAMATICALLY INCREASE STATIC PRESSURE AND REDUCE AIRFLOW. DO NOT RELY ON UNIT TO SUPPORT DUCT IN ANY WAY. FAILURE TO PROPERLY SIZE DUCTWORK MAY CAUSE SYSTEM EFFECTS AND REDUCE PERFORMANCE OF THE EQUIPMENT. SUGGESTED STRAIGHT DUCT SIZE 15 1/4" X 14".

NOTE: CONDENSERS SHIPPED LOOSE FOR REMOTE MOUNTING. ALL WIRING AND PIPING BETWEEN INDOOR AND OUTDOOR UNIT TO BE COMPLETED BY OTHERS.

SUPPLY SIDE HEATER INFORMATION:  
 WINTER TEMPERATURE = 11°F, TEMP. RISE = 65°F.  
 BTUS CALCULATED OFF ACTUAL AIR DENSITY.  
 OUTPUT BTUS AT ALTITUDE OF 0.0 FT. = 121990  
 INPUT BTUS AT ALTITUDE OF 0.0 FT. = 132598  
 OUTPUT BTUS AT ALTITUDE OF 89 FT. = 121616  
 INPUT BTUS AT ALTITUDE OF 89 FT. = 132191.

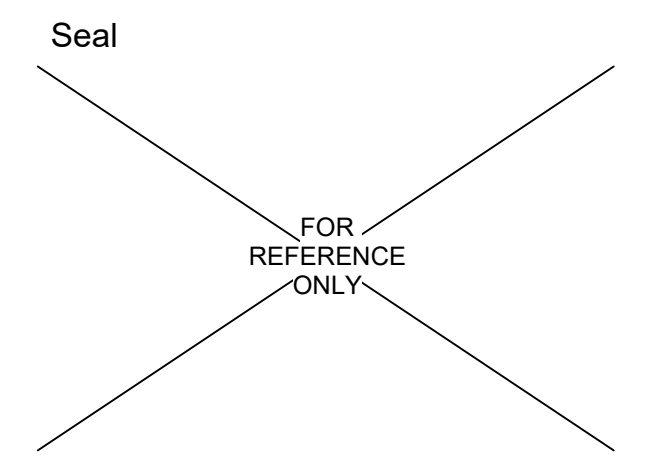


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Shake Shack - NJ - 1532 - Middle town R2  
 MIDDLETOWN, NJ, 07748

<b>DATE:</b>	3/25/2024
<b>DWG.#:</b>	6672025
<b>DRAWN BY:</b>	Joe.Shilba
<b>SCALE:</b>	3/4" = 1'-0"
<b>MASTER DRAWING</b>	
<b>SHEET NO.</b>	6



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Project

**SHAKE SHACK**  
 SHAKE SHACK #1532  
 MIDDLETOWN, NJ

Project Number 23197  
 Drawn By EGA  
 Checked By MM  
 Date 12 DEC 2023

Revisions  
 2 April 8, 2024 ISSUE FOR CONSTRUCTION

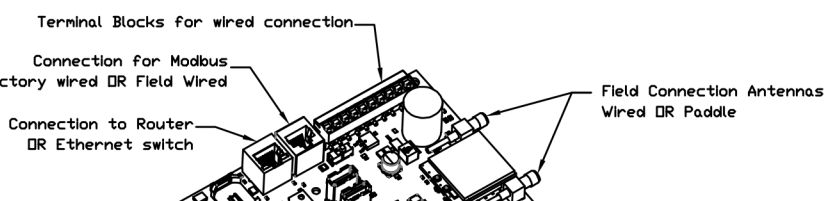
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**ELECTRICAL PACKAGE - JOB#6672025**

NO	TAG	PACKAGE #	LOCATION	SWITCHES		OPTION	FANS CONTROLLED					
				LOCATION	QUANTITY		FAN TAG	TYPE	HP	VOLT	FLA	
1		SC-321110MA	UTILITY CABINET LEFT	UTILITY CABINET LEFT	1 LIGHT	SMART CONTROLS THERMOSTATIC CONTROL V./ RELAY ON/OFF WITH SUPPLY	KEF(GH)I	EXHAUST	1	0.750	208	5.2
				HOOD # 2	1 FAN		KEF(FRYER)	EXHAUST	1	0.750	208	5.2
							MAU-1	SUPPLY	3	2.500	208	5.7

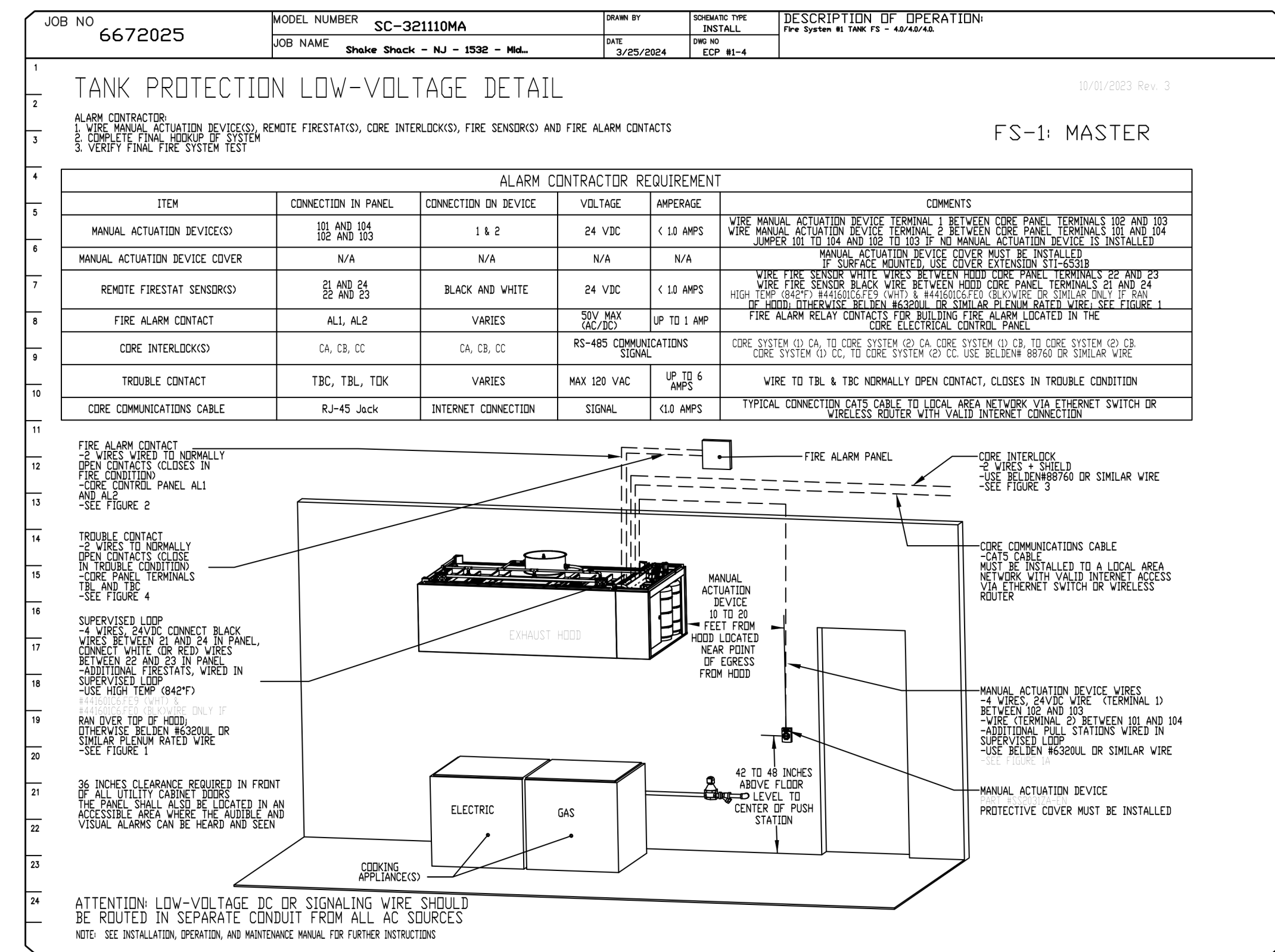
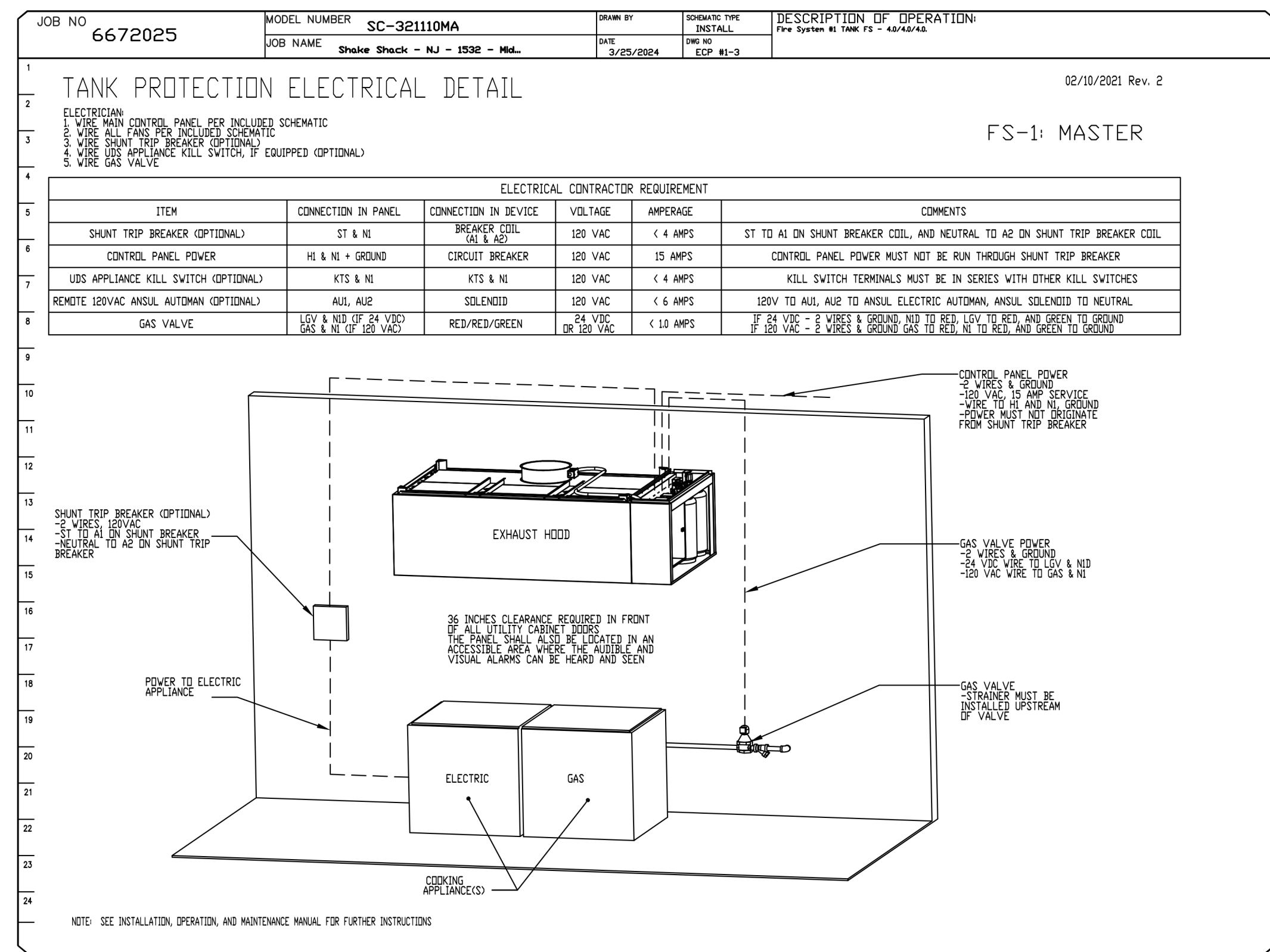
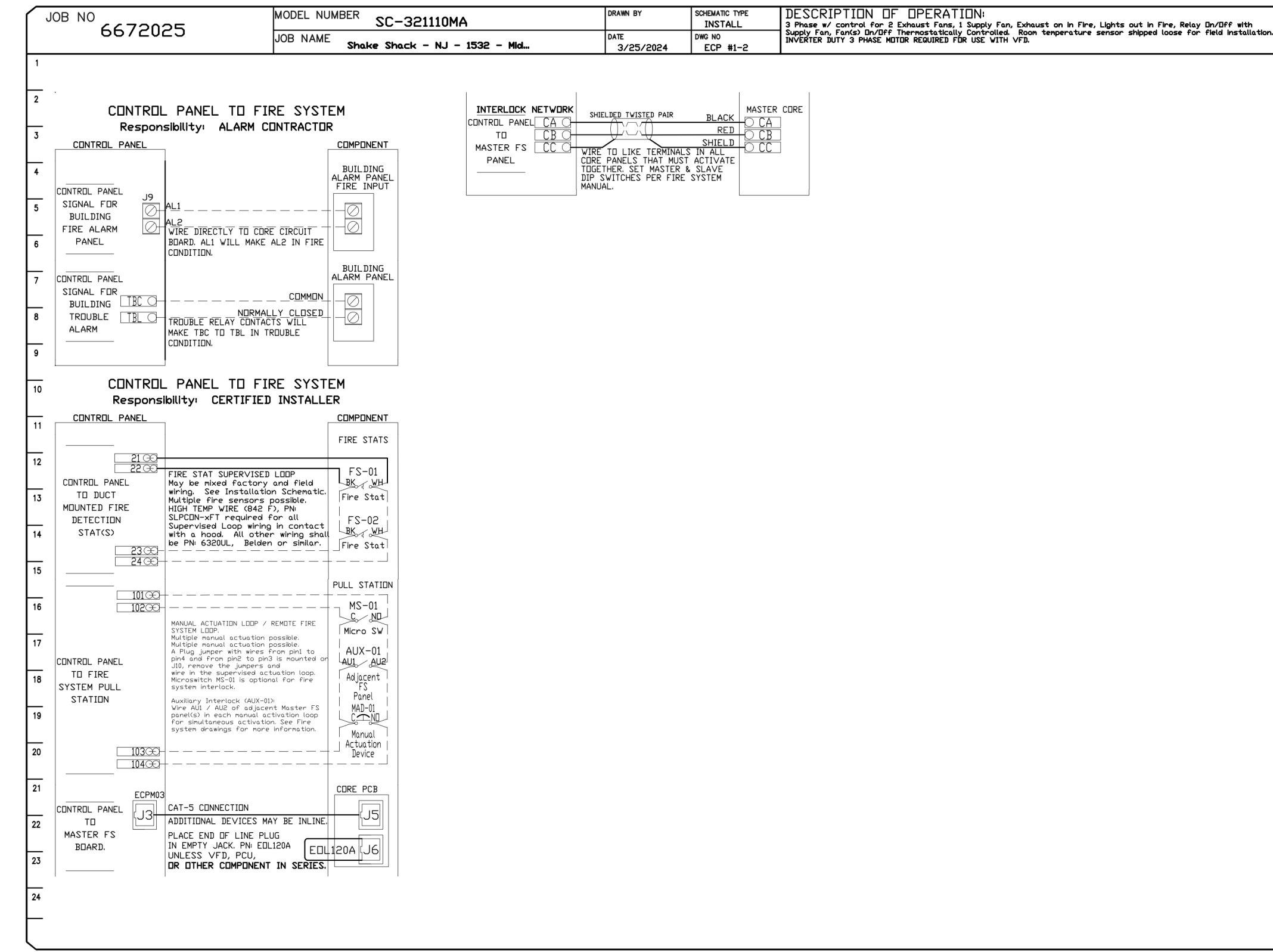
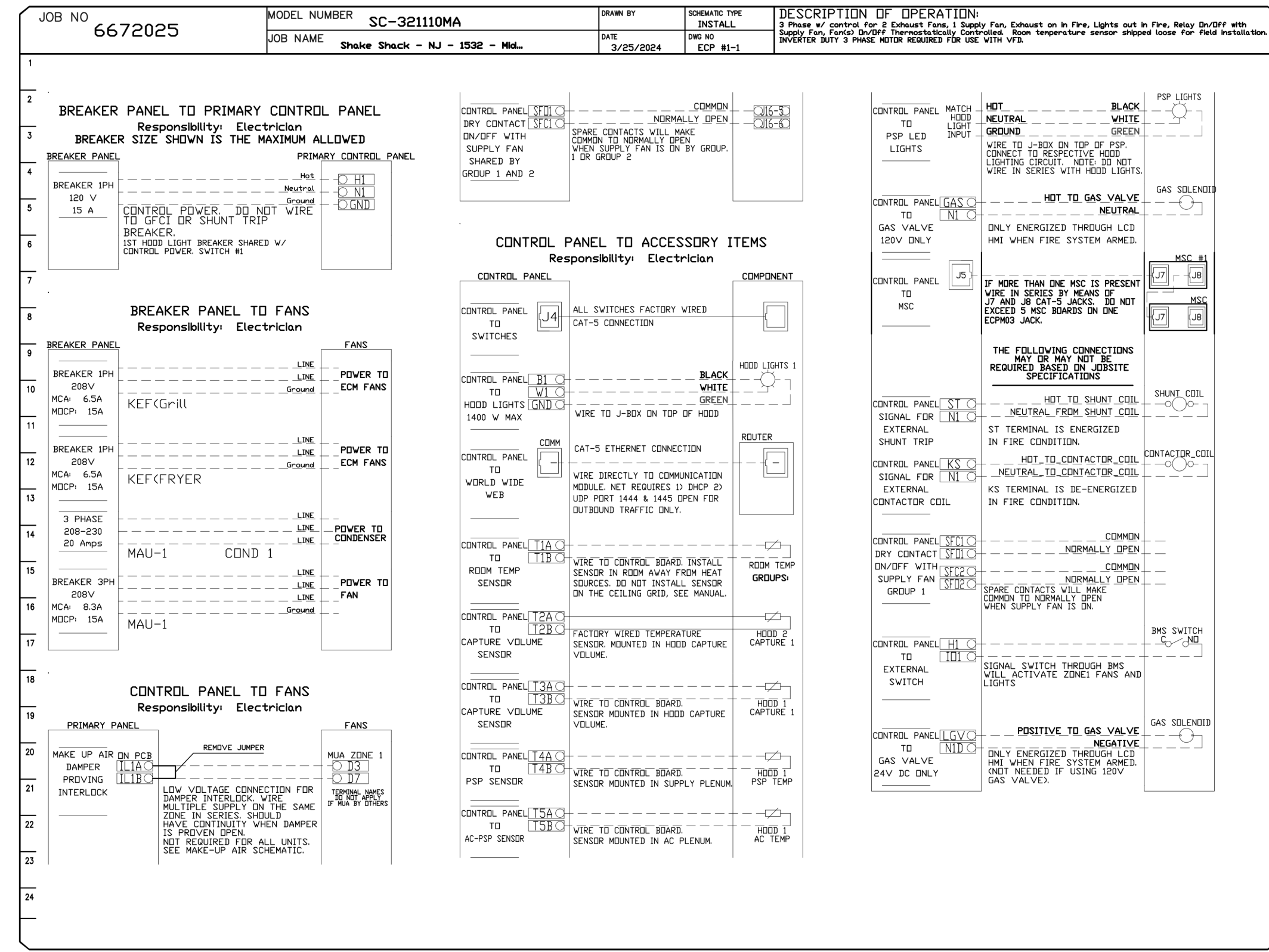


**CASink Monitor and Control**

Head control panel to support communications to cloud-based Building Management System.  
Head Control Panel to allow cloud-based Building Management System to monitor real time parameters outlined as MONITOR on the points list.  
Head Control Panel to allow cloud-based Building Management System to control parameters outlined as CONTROL on the points list.  
Head Control Panel to allow cloud-based Building Management System to implement SYSTEM ECONOMIZER control strategies for fully integrated Building Management.

**MONITORING AND CONTROL POINTS LIST**

DCV Packages	Function	DCV Packages	Function
Room Temperature	MONITOR	Room Temperature(s)	MONITOR
Duct Temperature(s)	MONITOR	Duct Temperature(s)	MONITOR
Water Discharge Temperature	MONITOR	Water Discharge Temperature	MONITOR
Machine RTU Discharge Temperature	MONITOR	Machine RTU Discharge Temperature	MONITOR
Fan Speed	MONITOR	Controller Faults	MONITOR
Fan Amperage	MONITOR	Fan Status	MONITOR
Fan Power	MONITOR	Fan Status	MONITOR
RTU Faults	MONITOR	Building Pressure	MONITOR
Controller Faults	MONITOR	FCU Filter Clog Percentages	MONITOR
Fan Faults	MONITOR	Fan Conditions	MONITOR
CO2 Fire System	MONITOR	CO2 Fire System	MONITOR
Building Pressure	MONITOR	Building Pressure	MONITOR
FCU Filter Clog Percentages	MONITOR	Fan Status(s)	MONITOR & CONTROL
Fan Conditions	MONITOR	Light Status(s)	MONITOR & CONTROL
CO2 Fire System	MONITOR	CO2 Fire System	MONITOR
Building Pressure	MONITOR	Building Pressure	MONITOR
FCU Filter Clog Percentages	MONITOR	FCU Filter Clog Percentages	MONITOR
Fan Status	MONITOR	Fan Status	MONITOR
Light Status	MONITOR	Light Status	MONITOR
Block Status	MONITOR	Block Status	MONITOR



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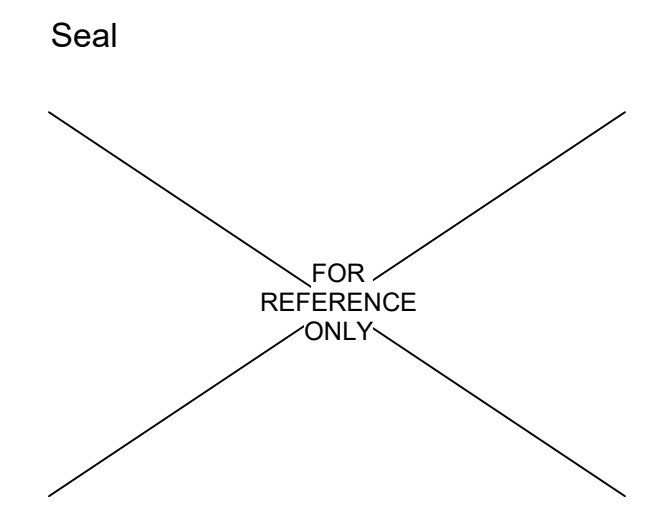
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**DRAWN BY:** Joe.shiliba  
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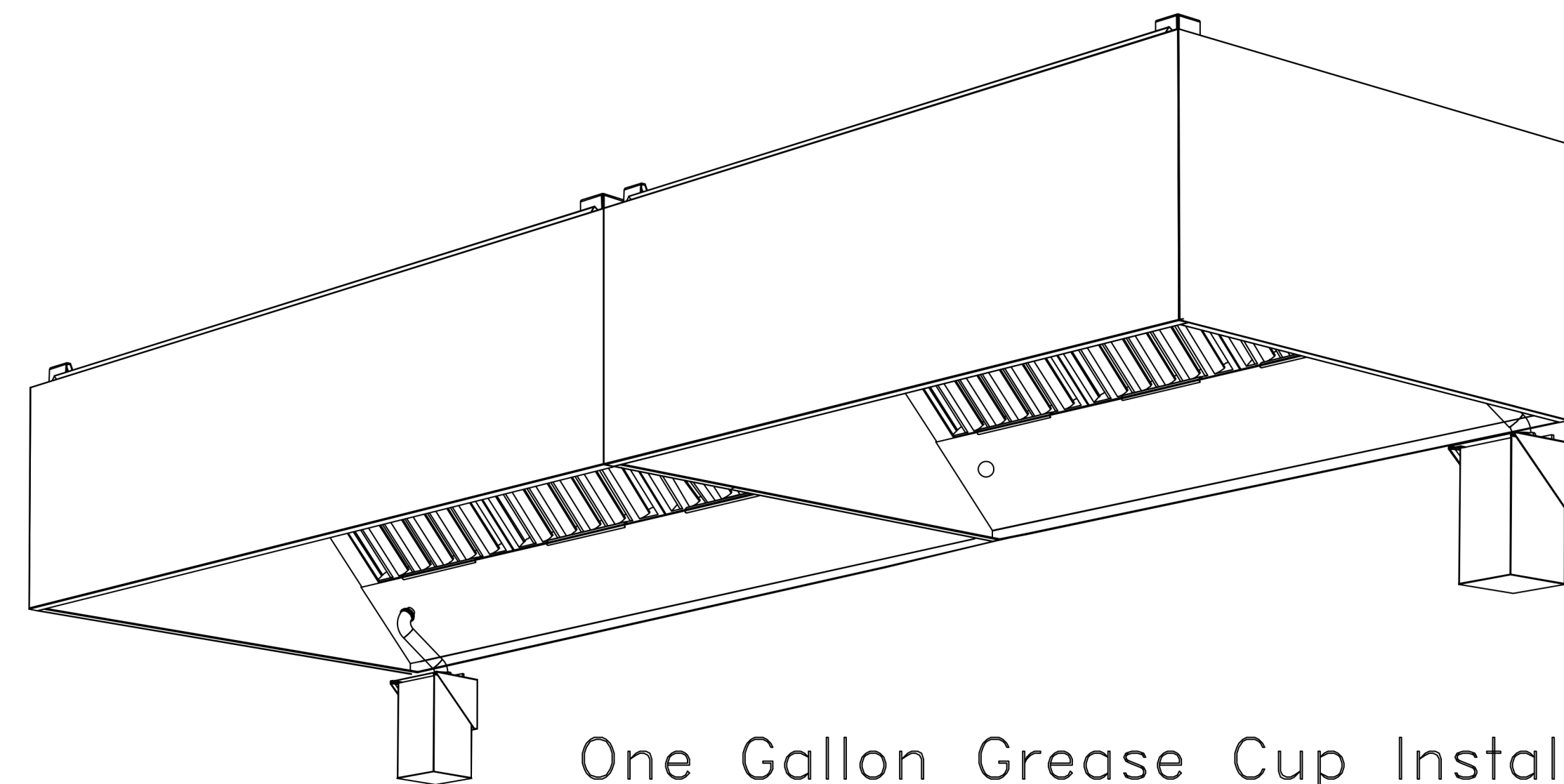
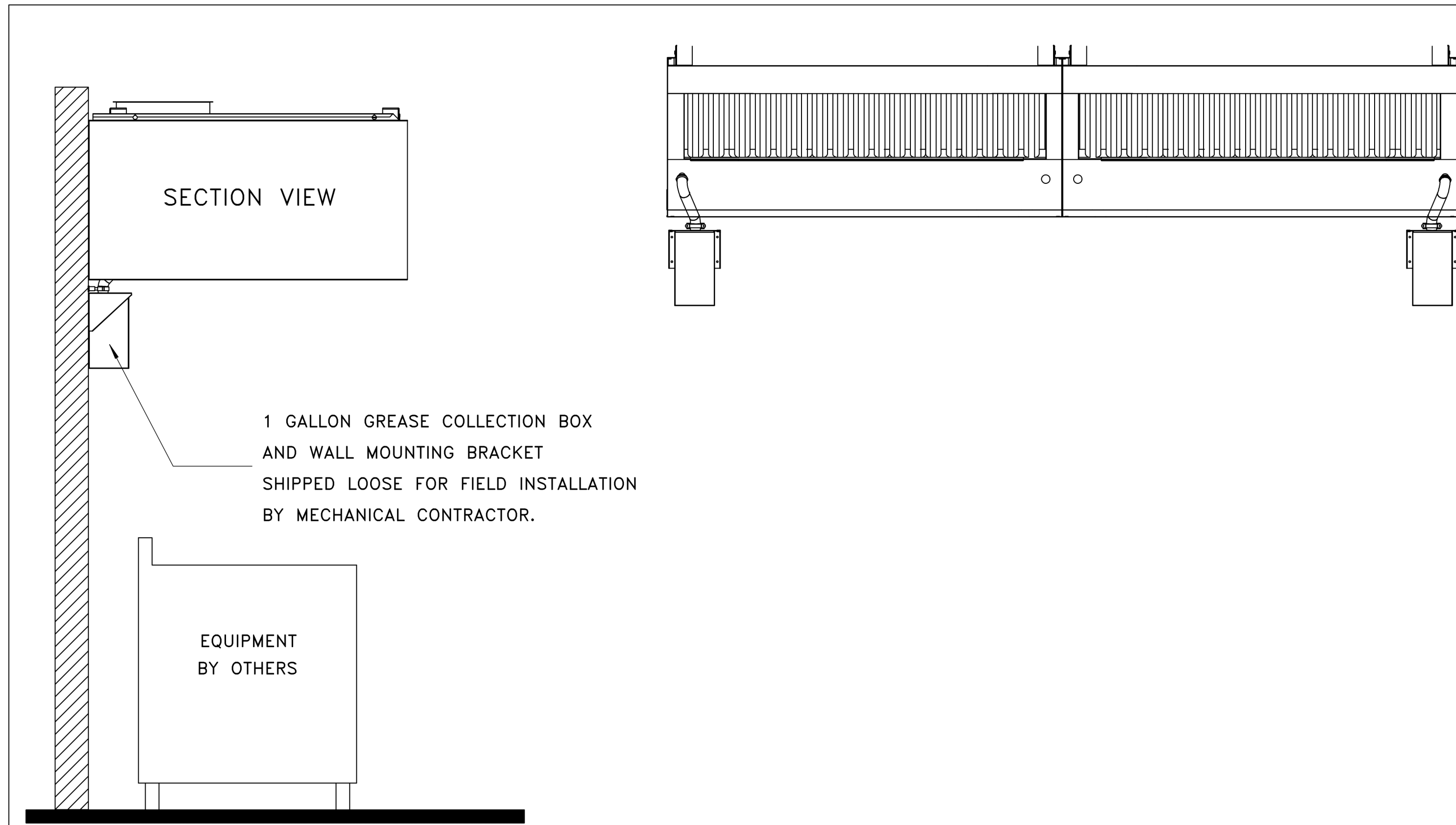
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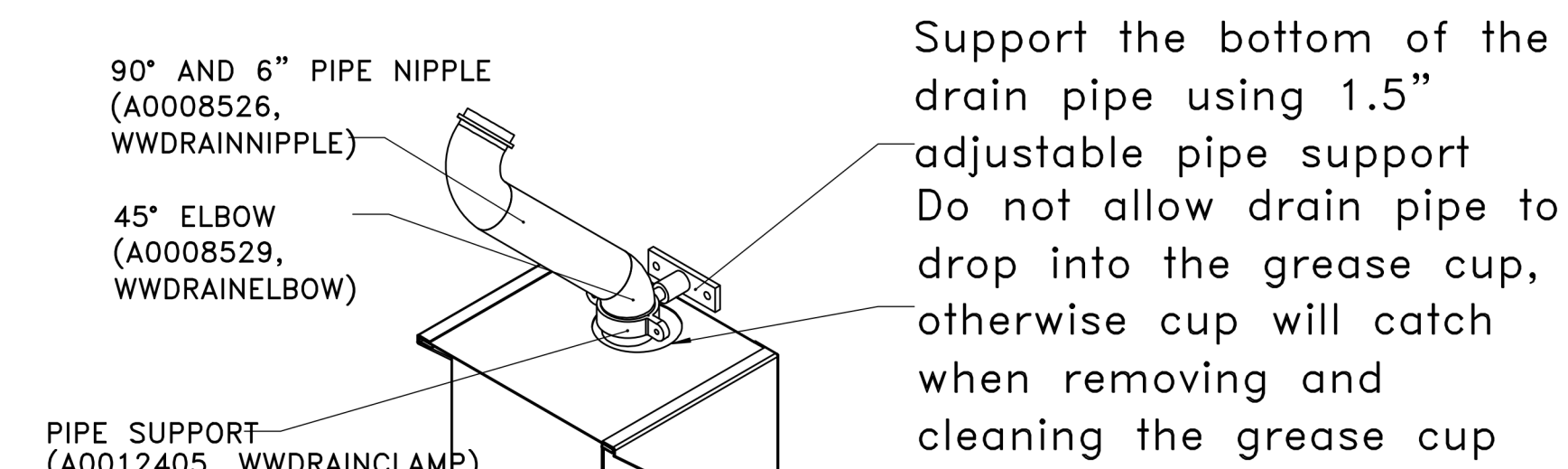
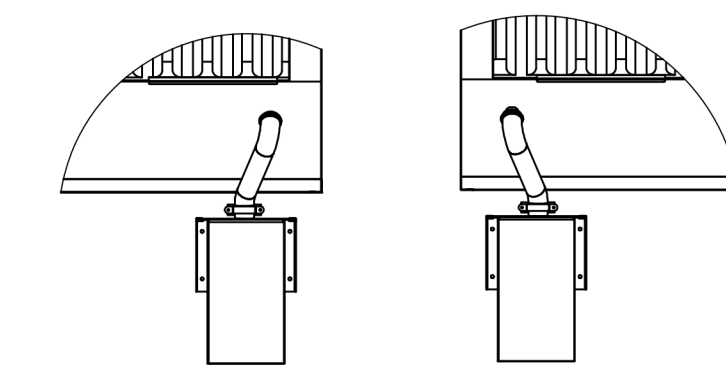
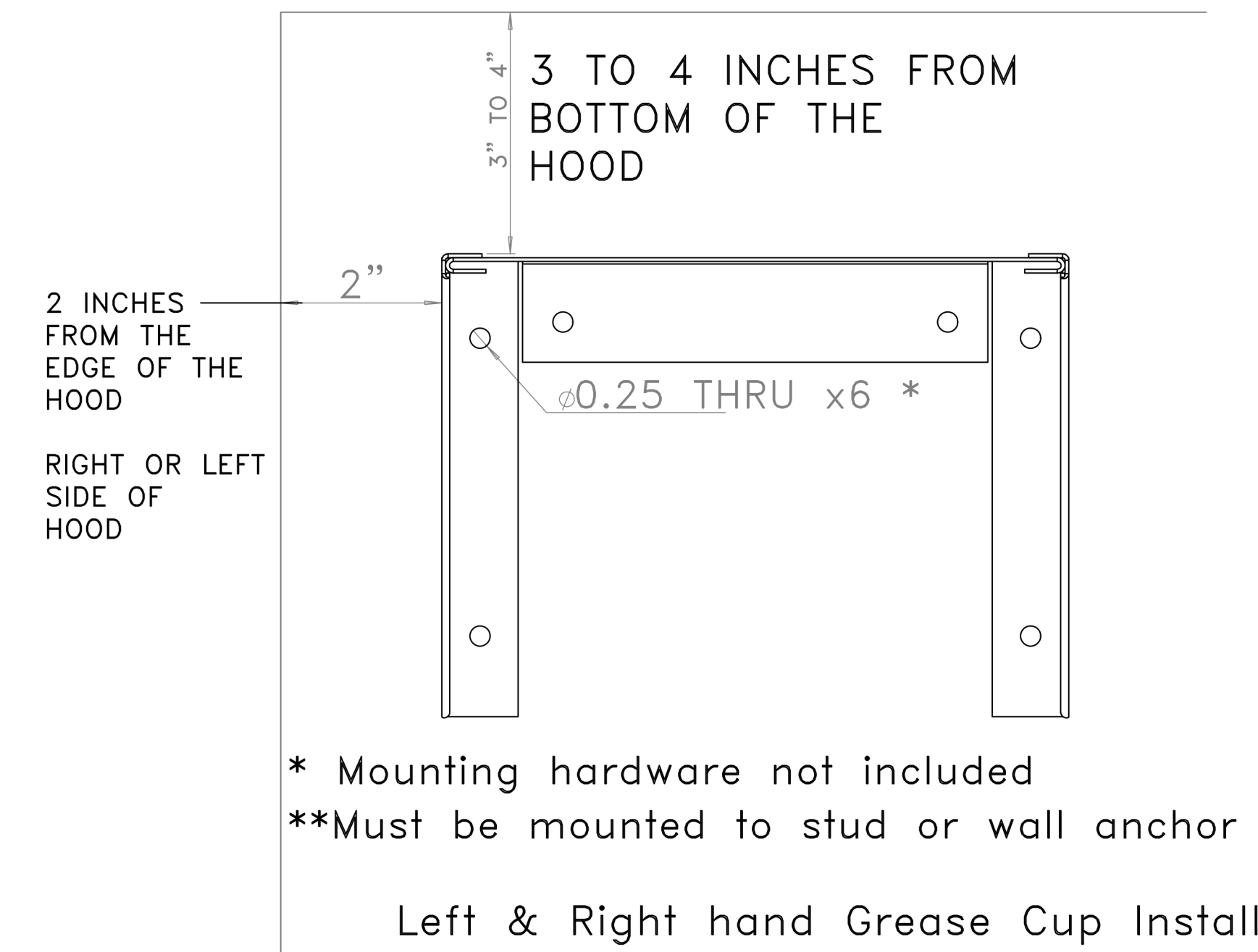


One Gallon Grease Cup Installation

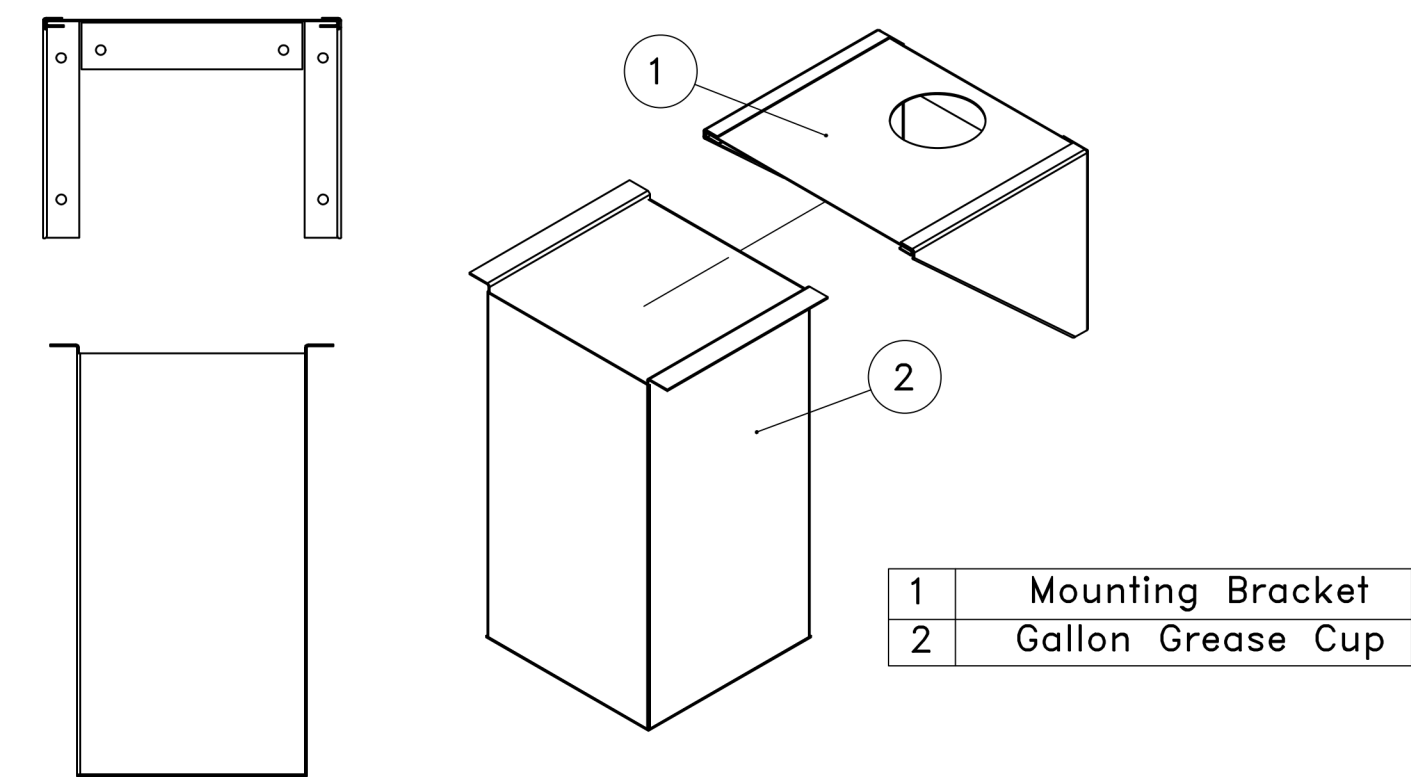
Instructions below outline single, or dual, one gallon grease cup installation for ND-2 hood models.

The one gallon grease cup comes as an assembly of stainless steel wall mounting bracket and one gallon cup. The mounting bracket should be installed 2" from the edge of the containment plenum and 3"-4" below the bottom of the hood.

Piping from the hood grease drain should route to the opening of the grease cup, but not into the cup, otherwise the cup will not be able to be removed and emptied.



Gallon Grease Cup Assembly



1 GALLON GREASE COLLECTION BOX AND WALL MOUNTING BRACKET SHIPPED LOOSE FOR FIELD INSTALLATION BY MECHANICAL CONTRACTOR.

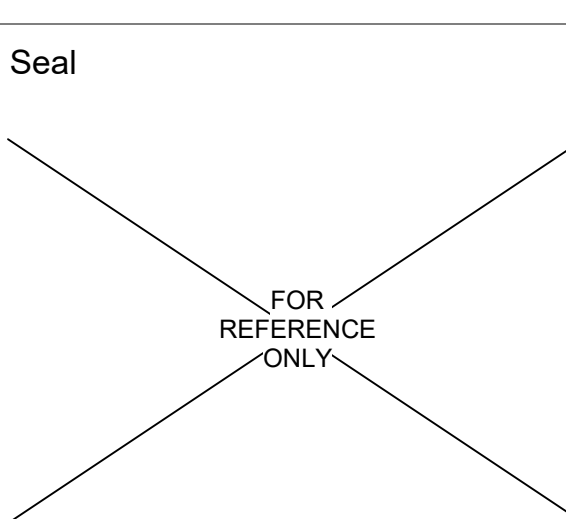
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