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

MECHANICAL GENERAL NOTES:

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

MECHANICAL PLAN NOTES:

- TYPE I 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.
- 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 GAGE STEEL. DUCTS WITH A CROSS-SECTIONAL AREA OVER 155 SQUARE INCHES, BUT NOT MORE THAN 200 SQUARE INCHES SHALL BE 14 GAGE STEEL. DUCTS WITH A CROSS-SECTIONAL AREA EQUAL TO OR MORE THAN 200 SQUARE INCHES SHALL BE CONSTRUCTED OF 12 GAGE STEEL. IF STAINLESS STEEL IS USED FOR DUCT MATERIAL, THE GAGE STEEL MAY BE INCREASED UPWARD BY 1 EVEN SIZE.
- 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 AND LOCATED AT 12" AFF. THE SENSOR SHALL BE EQUIPPED WITH A LOCAL AUDIBLE AND VISUAL ALARM. THE LOW-LEVEL ALARM SHALL ACTIVATE THE LOCAL AUDIBLE AND VISUAL ALARM IF THE BUILDING HAS A FIRE ALARM. PROVIDE THE APPROPRIATE FIRE ALARM INTERFACE MODULE TO INTERLOCK WITH THE BUILDING FIRE ALARM SYSTEM. THE HIGH-LEVEL CO2 ALARM SHALL SIGNAL BUILDING FIRE ALARM WHEN EQUIPPED. LOW LEVEL ALARM - 0.5% = 5,000 PPM. HIGH LEVEL ALARM - 3.0% = 30,000 PPM.
- CARBON MONOXIDE DETECTOR FURNISHED BY OWNER. INSTALL AT 5'-0" AFF. COORDINATE FINAL LOCATION WITH OWNER REPRESENTATIVE.
- 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.
- INSTALL HOOD FIRE SUPPRESSION MANUAL PULL STATION. COORDINATE EXACT LOCATION AND REQUIREMENTS WITH FIRE SUPPRESSION SYSTEM INSTALLER AND THE AUTHORITY HAVING JURISDICTION.
- CONTRACTOR TO COORDINATE 1" UNDERCUT ON DOOR FOR EXHAUST AIR PATH.
- PROVIDE 14" GALVANIZED CONSTRUCTION HARDWARE CLOTH SCREEN OVER OPEN END OF RETURN DUCT. PROVIDE DUCT LINER IN BOOT. RETURN AIR DUCT SHALL BE MINIMUM 36" HORIZONTAL EXTENSION FOR SOUND ATTENUATION.
- PROVIDE CONCENTRIC VENT MODEL NUMBER PVC-3CT.
- PROVIDE RA DUCT THROUGH ROOF. FULL SIZE OF UNIT OPENING, AND CONNECT TO UNIT WITH FLEXIBLE CONNECTOR. TRANSITION 45 DEGREES THROUGH ROOF CURB.
- PROVIDE SA DUCT THROUGH ROOF. FULL SIZE OF UNIT OPENING, AND CONNECT TO UNIT WITH FLEXIBLE CONNECTOR. TRANSITION 45 DEGREES THROUGH ROOF CURB.
- INSTALL DUCT SMOKE DETECTOR IN RETURN AIR PLENUM.
- 10"x12" GREASE EXHAUST DUCT UP TO KEF-1 ON ROOF.
- 10"x10" GREASE EXHAUST DUCT UP TO KEF-2 ON ROOF.
- PROVIDE 14"x14" EA DUCT THROUGH ROOF. TRANSITION TO EXHAUST FAN INLET SIZE WITHIN CURB.
- REFER TO CAPTIVEAIRE DRAWINGS FOR DUCT CONNECTION SIZES TO KITCHEN EXHAUST HOODS.
- COMBINATION TEMPERATURE SENSOR AND HUMIDITY SENSOR.

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

ENVIROMATIC
DON PFELEDER
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 TURNBROUGH
will@nationaltab.com
855-682-6822 ext704

HENDERSON ENGINEERS
8345 LENEXA DRIVE, SUITE 300
LENEXA, KS 66224
TEL 913.742.5000 FAX 913.742.5001
WWW.HENDERSONENGINEERS.COM

Seal
PROFESSIONAL ENGINEER
NATHAN T. LOVE
24CE0003000



DATE 10/17/2024

Margaretta L. Terry,
Architect

DP3 Architects, Ltd.
15 South Main Street, Suite 400
Greenville, SC 29601
www.DP3architects.com

Project

SHAKE SHACK
SHAKE SHACK #1403
BRICK, NJ

Project Number 24134
Drawn By Author
Checked By Checker
Date 20 JUNE 2024

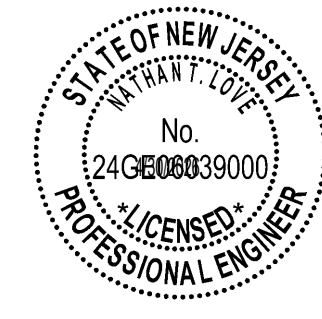
Revisions		
2024-06-20	PERMIT/BID SET	
2024-10-04	BID SET REVISION	
2024-10-17	ISSUED FOR CONSTRUCTION	

Drawing
MECHANICAL
FLOOR PLAN

M101

- MECHANICAL PLAN NOTES:**
- CONTRACTOR SHALL VERIFY WITH EQUIPMENT SUPPLIER EXACT ROUTING AND SIZE OF INSULATED REFRIGERANT PIPING. SINGLE LINESET SHOWN FOR CLARITY. INSTALL PER MANUFACTURER'S RECOMMENDATIONS.
 - AREA RESERVED FOR REFRIGERATION CONDENSER(S) PROVIDED BY KITCHEN EQUIPMENT CONTRACTOR. COORDINATE EQUIPMENT LOCATION AND CONDENSER INSTALLATION WITH KITCHEN EQUIPMENT CONTRACTOR.
 - MAINTAIN ALL OUTSIDE AIR INTAKES A MINIMUM OF 10'-0" RADIUS FROM EXHAUST, TYPICAL.
 - TURN DOWN 6"Ø INTAKE AND END OPEN OVER ROOF (MIN. 24" WITH INSECT SCREEN.
 - CONTRACTOR SHALL COORDINATE WITH NATIONAL TAB TO PROVIDE UV-PH INDOOR AIR PURIFICATION SYSTEM, MODEL PH-IPK-24V. INSTALL IN UNIT BLOWER COMPARTMENT PER MANUFACTURER'S INSTRUCTIONS.
 - REFERENCE PLUMBING DRAWINGS FOR CONDENSATE DRAIN ROUTING AND TERMINATION REQUIREMENTS.
 - PROVIDE CONCENTRIC VENT MODEL NUMBER PVC-3CT.

HENDERSON ENGINEERS
 8345 LENEKA DRIVE, SUITE 300
 LENEKA, NJ 08824
 TEL 913.742.5000 FAX 913.742.5001
 WWW.HENDERSONENGINEERS.COM
 2150003351
 N.J. CORPORATE NO. 24CGA27943400
 EXPIRES 9/31/2026

Seal
 PROFESSIONAL ENGINEER
 NATHAN T. LOVE
 24CE0003000

 DATE 10/17/2024

Margaretta L. Terry,
 Architect

DP3 Architects, Ltd.
 15 South Main Street, Suite 400
 Greenville, SC 29601
 864.232.8200
 www.DP3architects.com

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Revisions

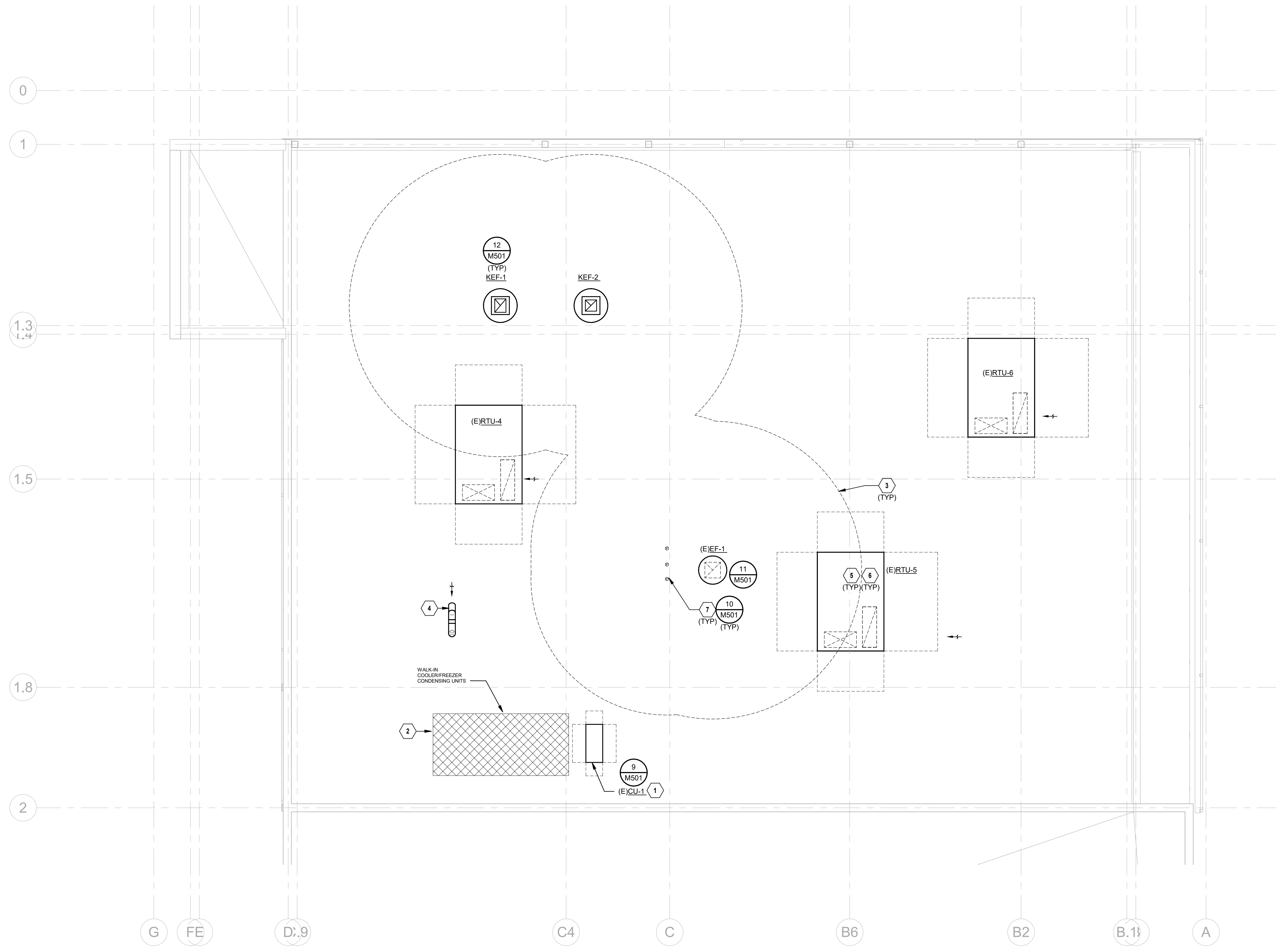
2024-06-20	PERMIT/BID SET
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2024-10-17	ISSUED FOR CONSTRUCTION

Drawing

MECHANICAL
 ROOF PLAN

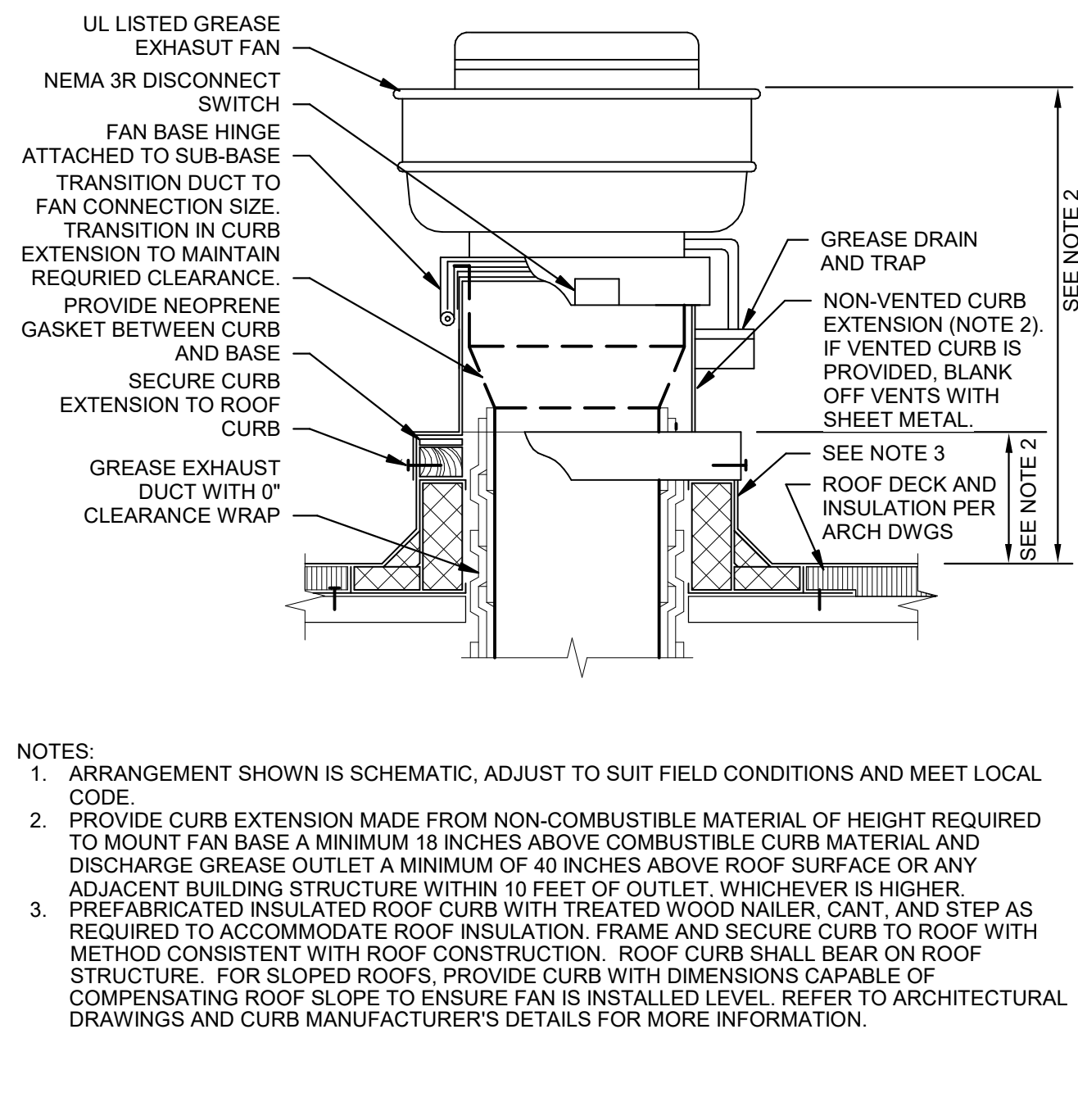
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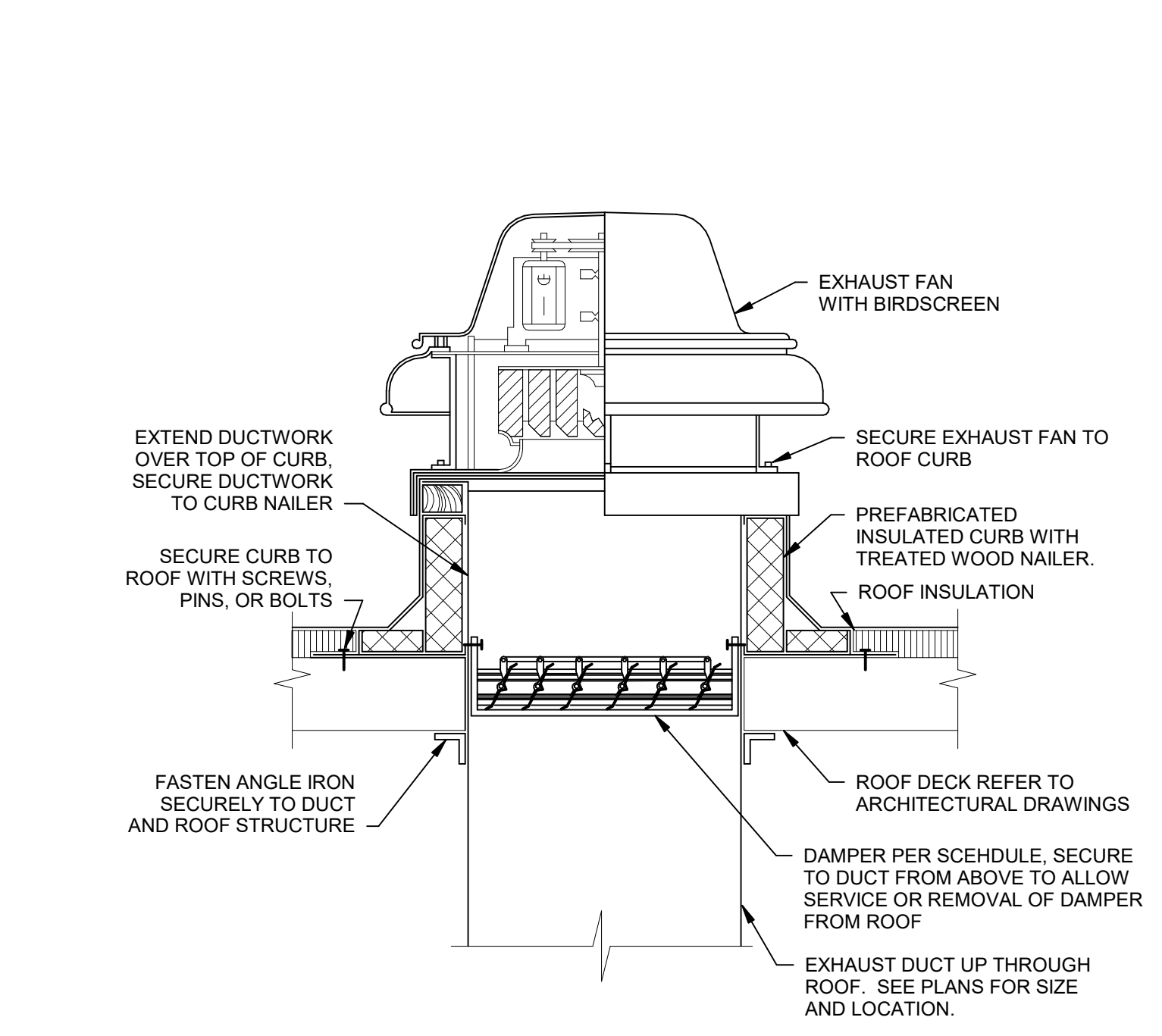


1 MECHANICAL ROOF PLAN
 1/4" = 1'-0"

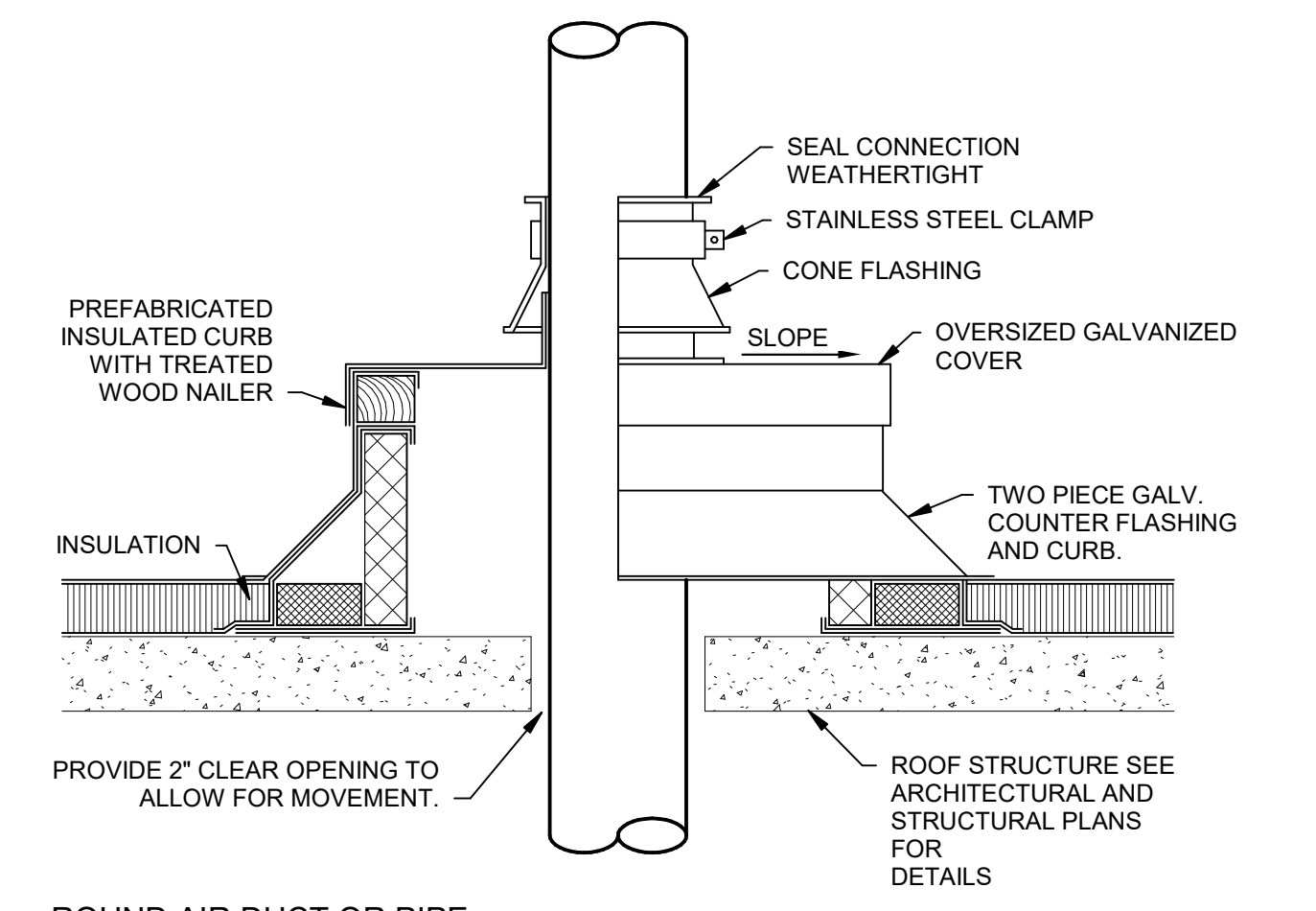
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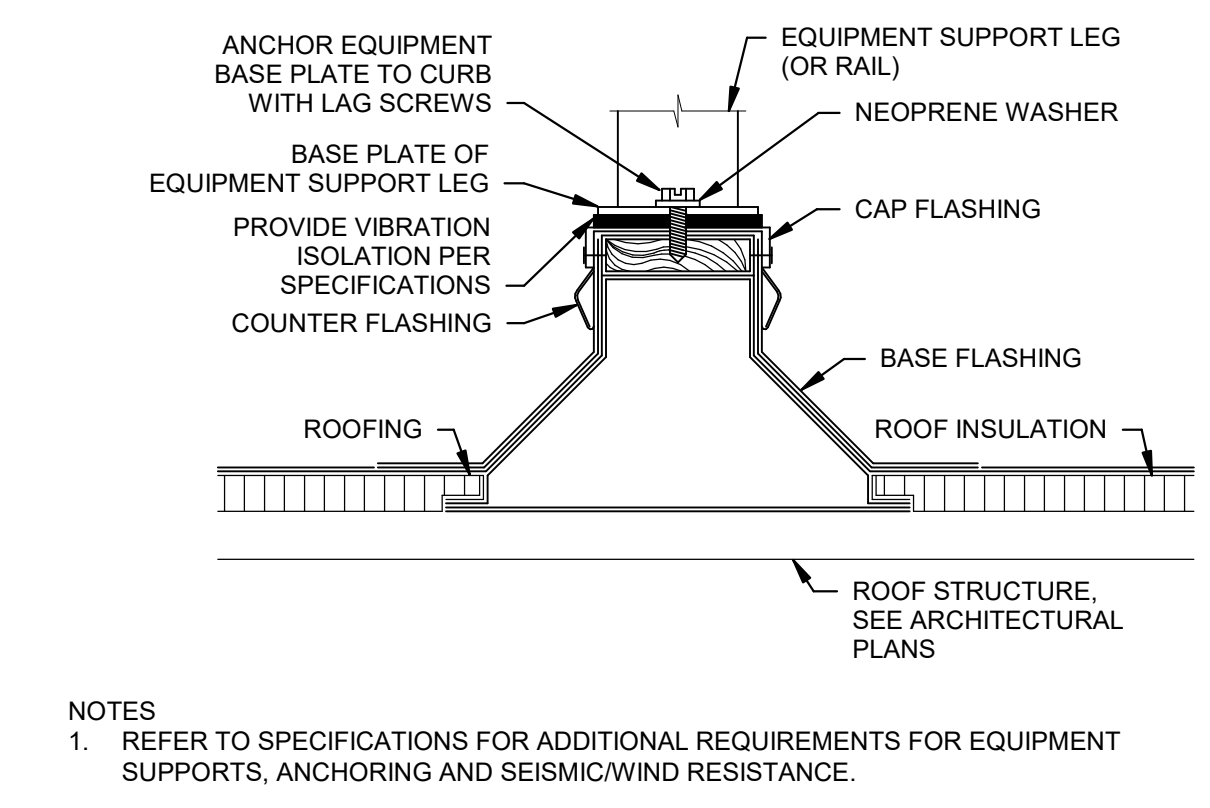
10 UPBLAST GREASE EXHAUST FAN DETAIL NTS



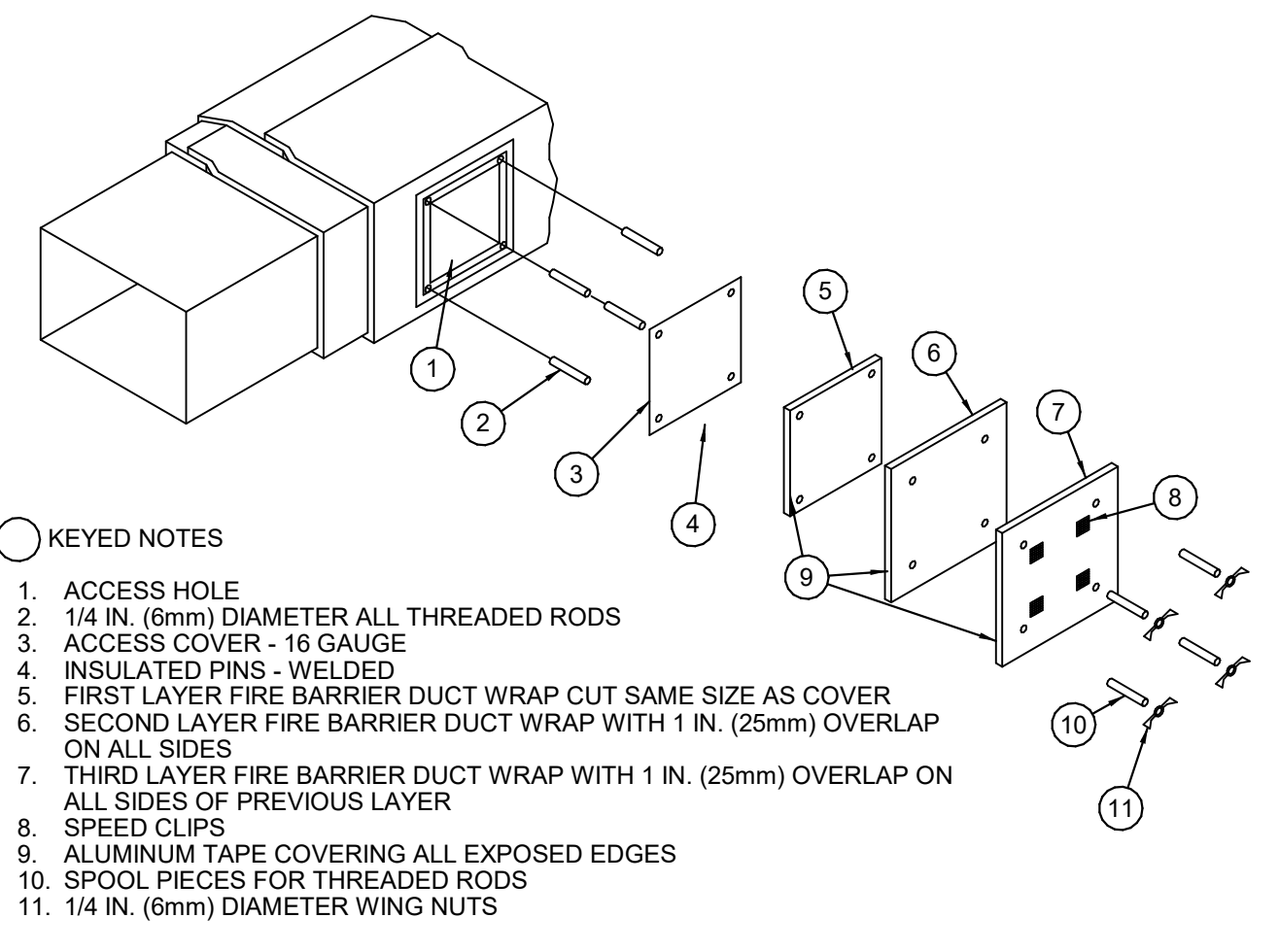
11 DOWNBLAST EXHAUST FAN DETAIL NTS



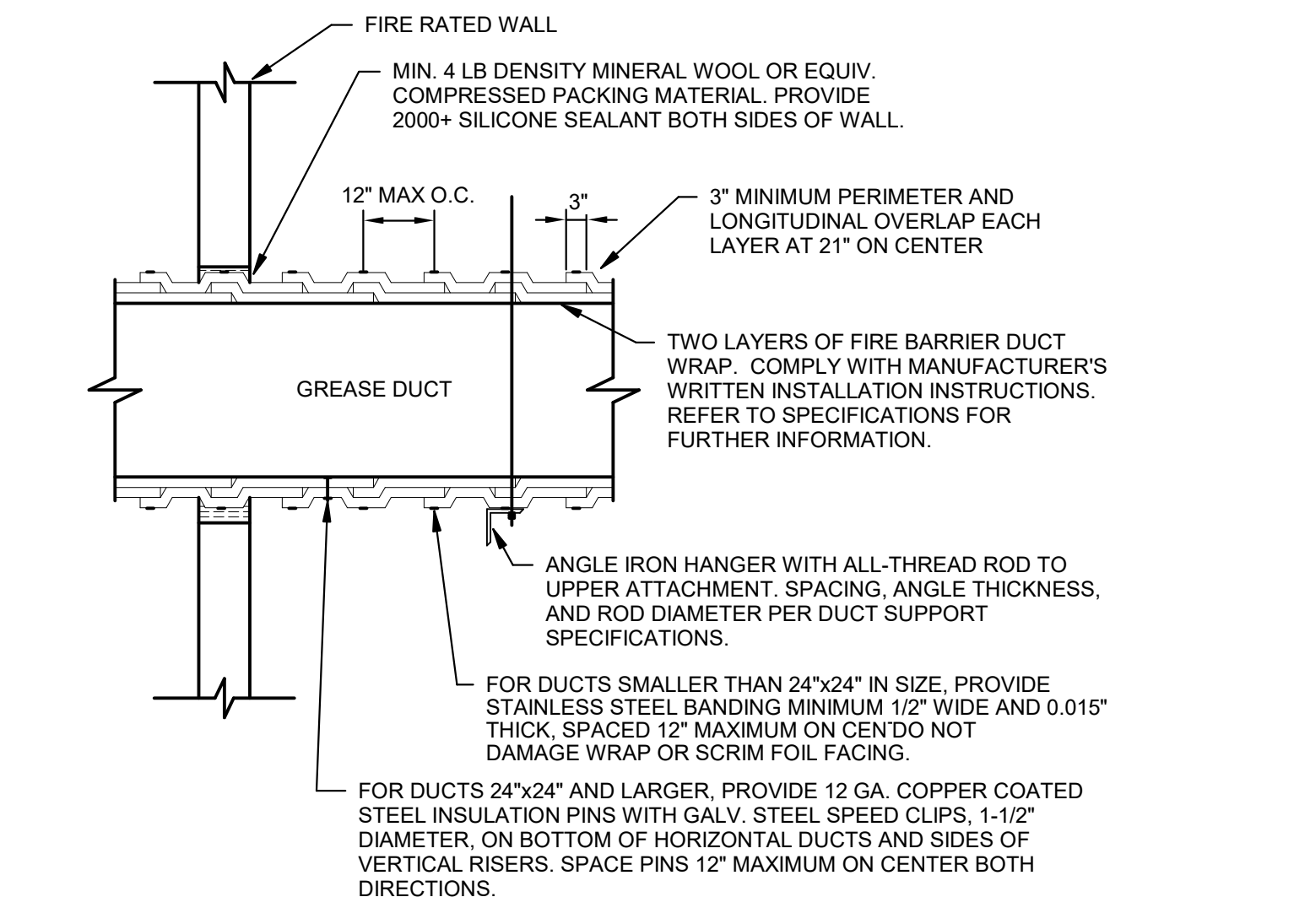
12 ROUND AIR DUCT OR PIPE PENETRATION THROUGH ROOF DETAIL NTS



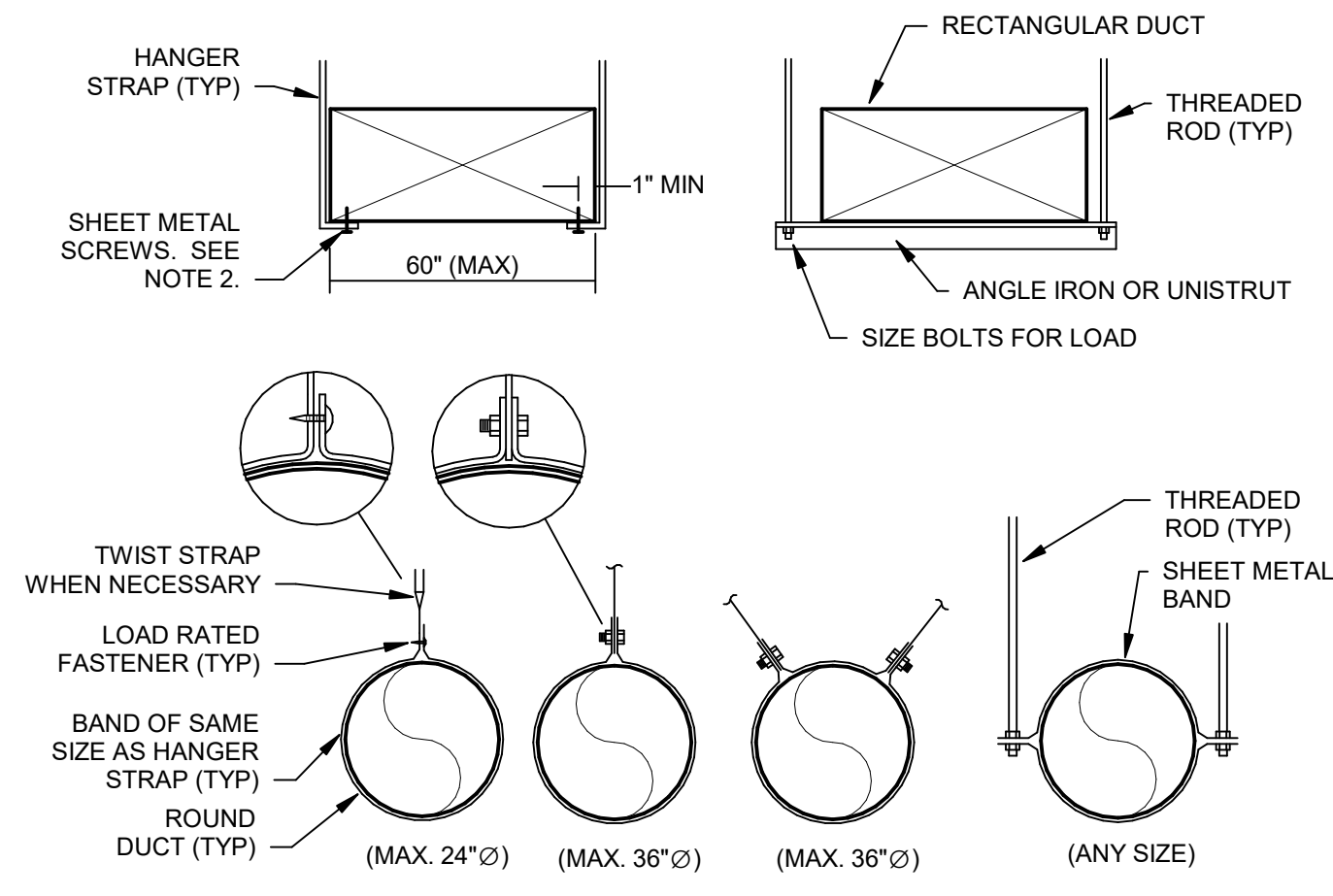
13 ROOF EQUIPMENT SUPPORT RAIL DETAIL NTS



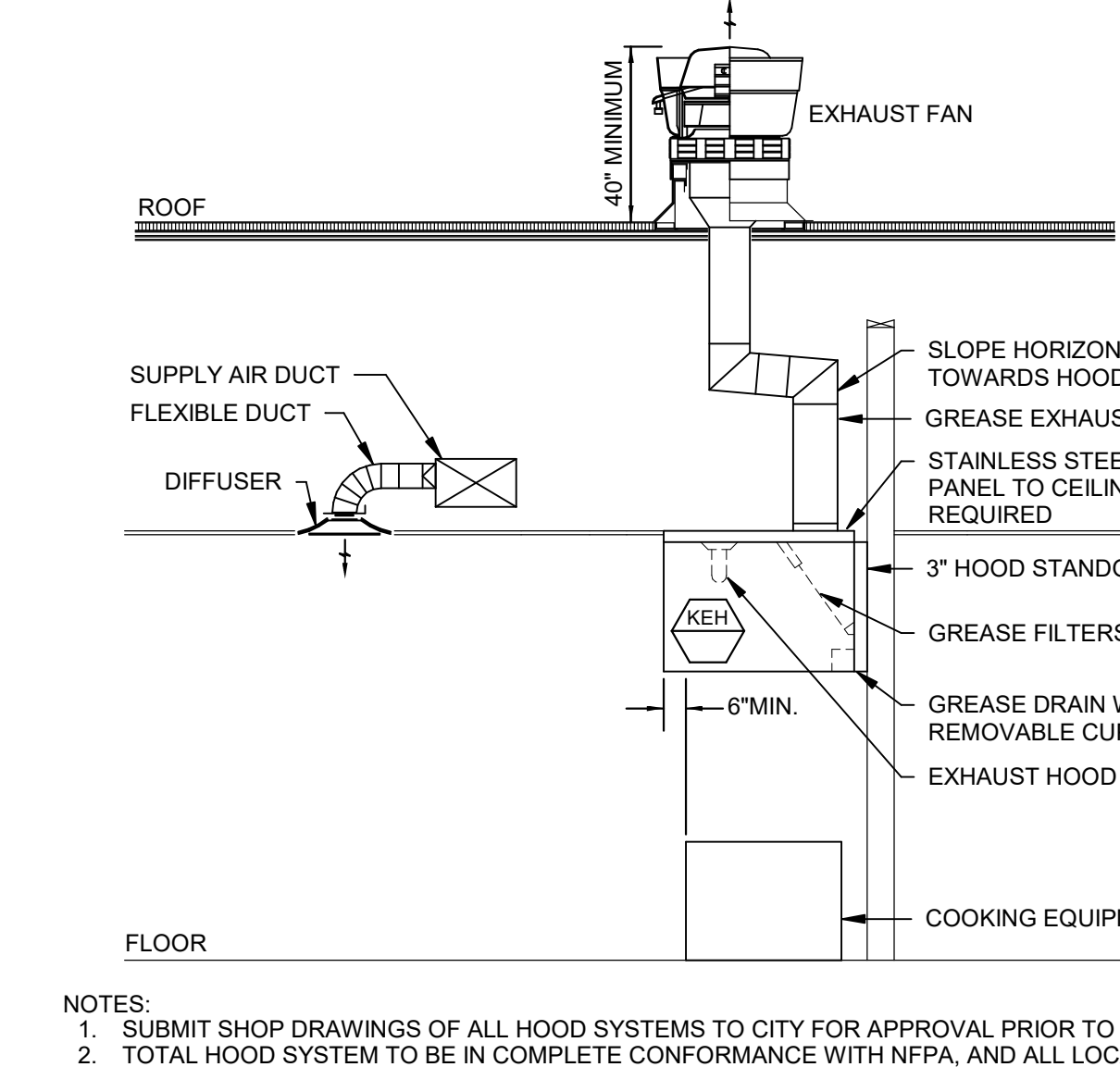
14 GREASE DUCT CLEANOUT ACCESS DOOR DETAIL NTS



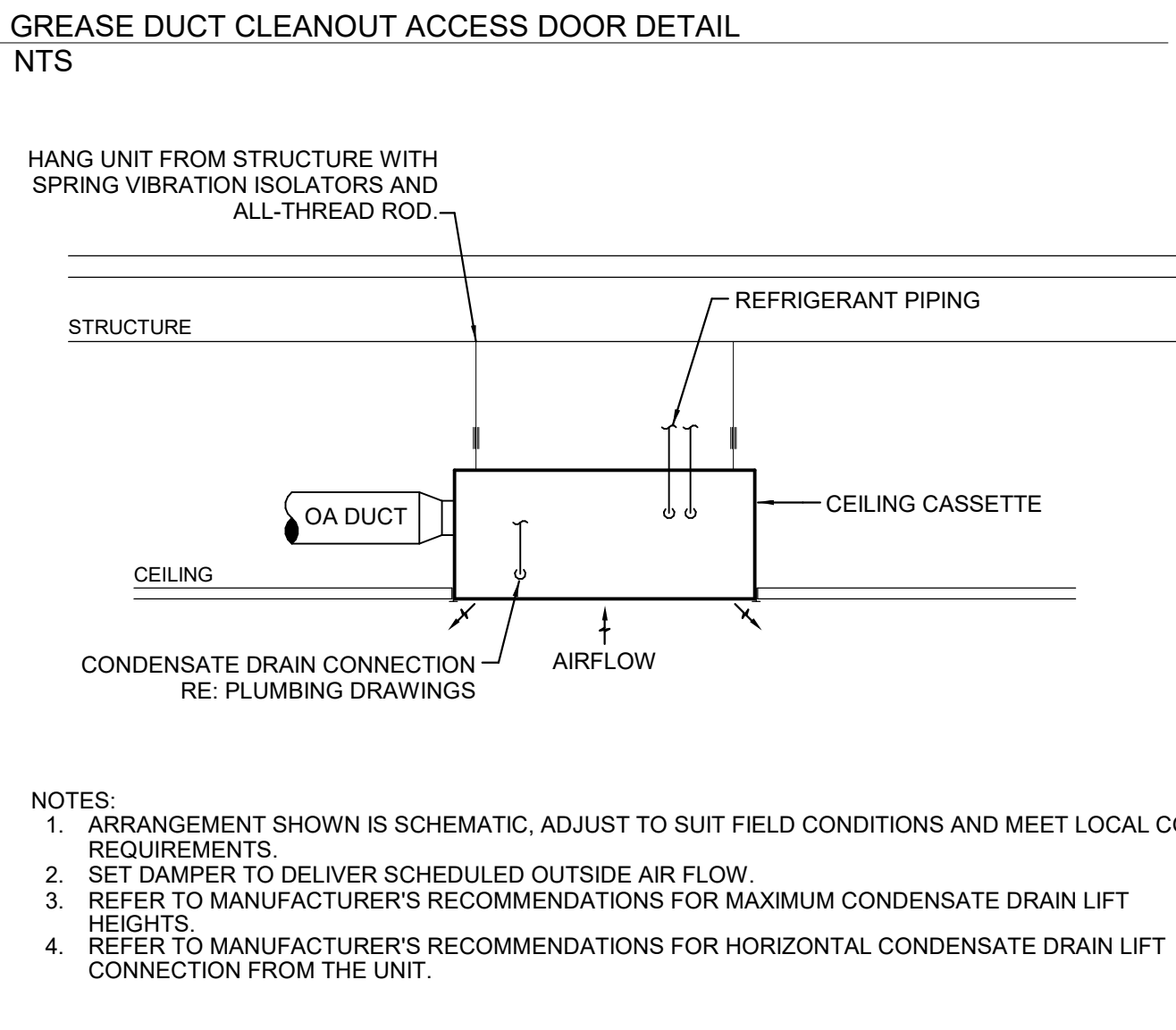
15 GREASE DUCT FIRE WRAP INSULATION INSTALLATION DETAIL NTS



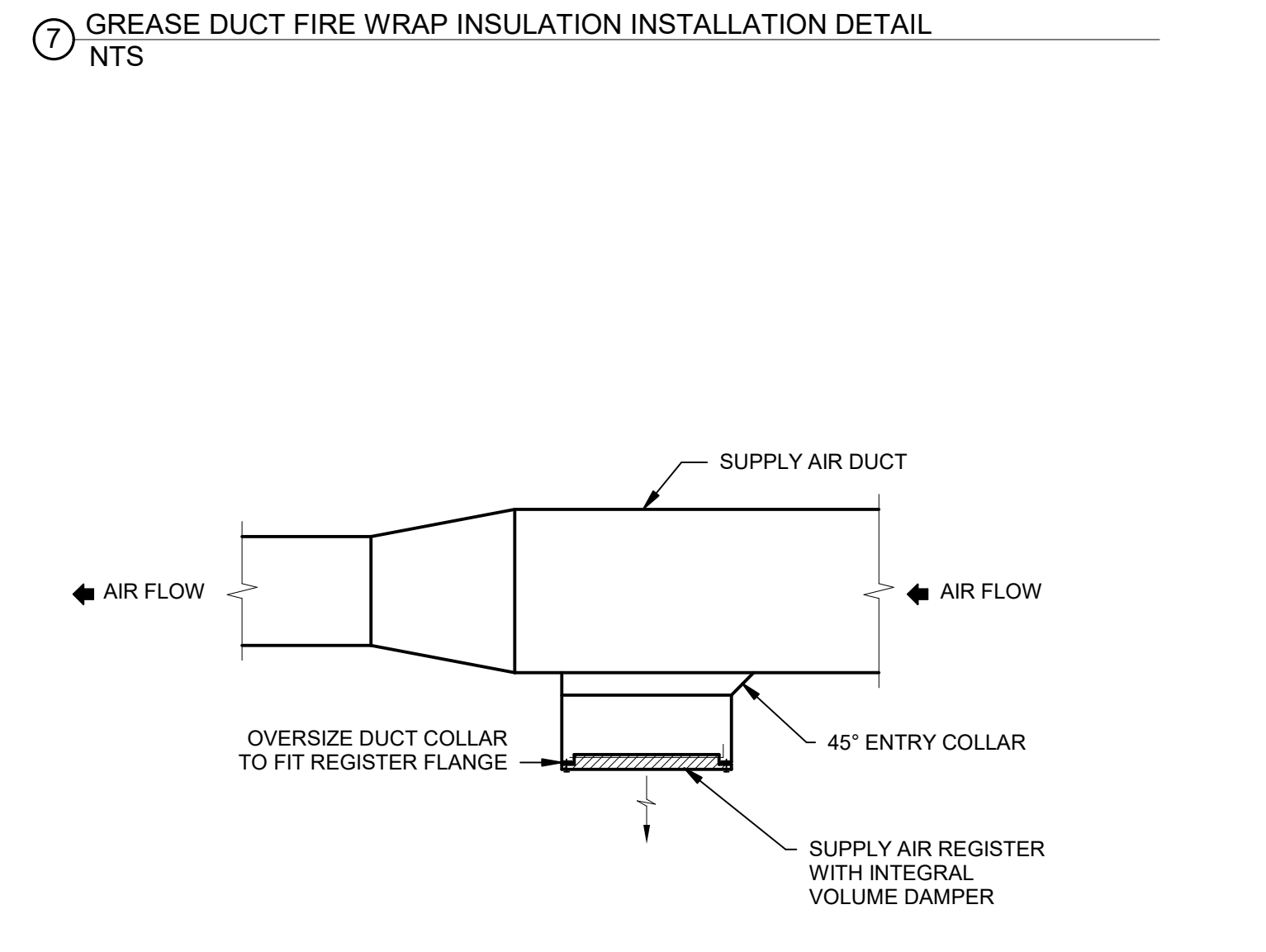
16 DUCT HANGER LOWER ATTACHMENT DETAILS NTS



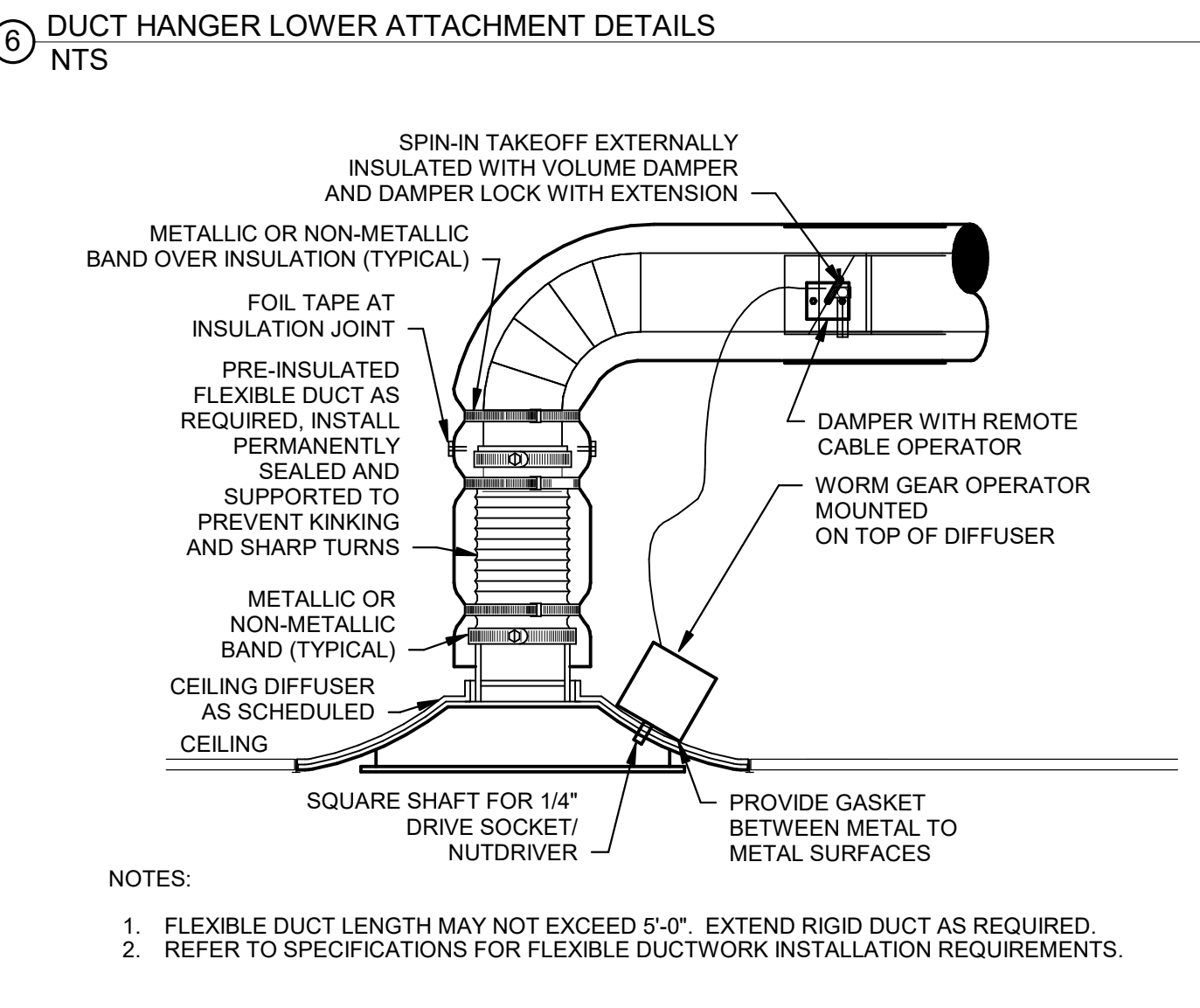
17 KITCHEN EXHAUST HOOD ELEVATION DETAIL NTS



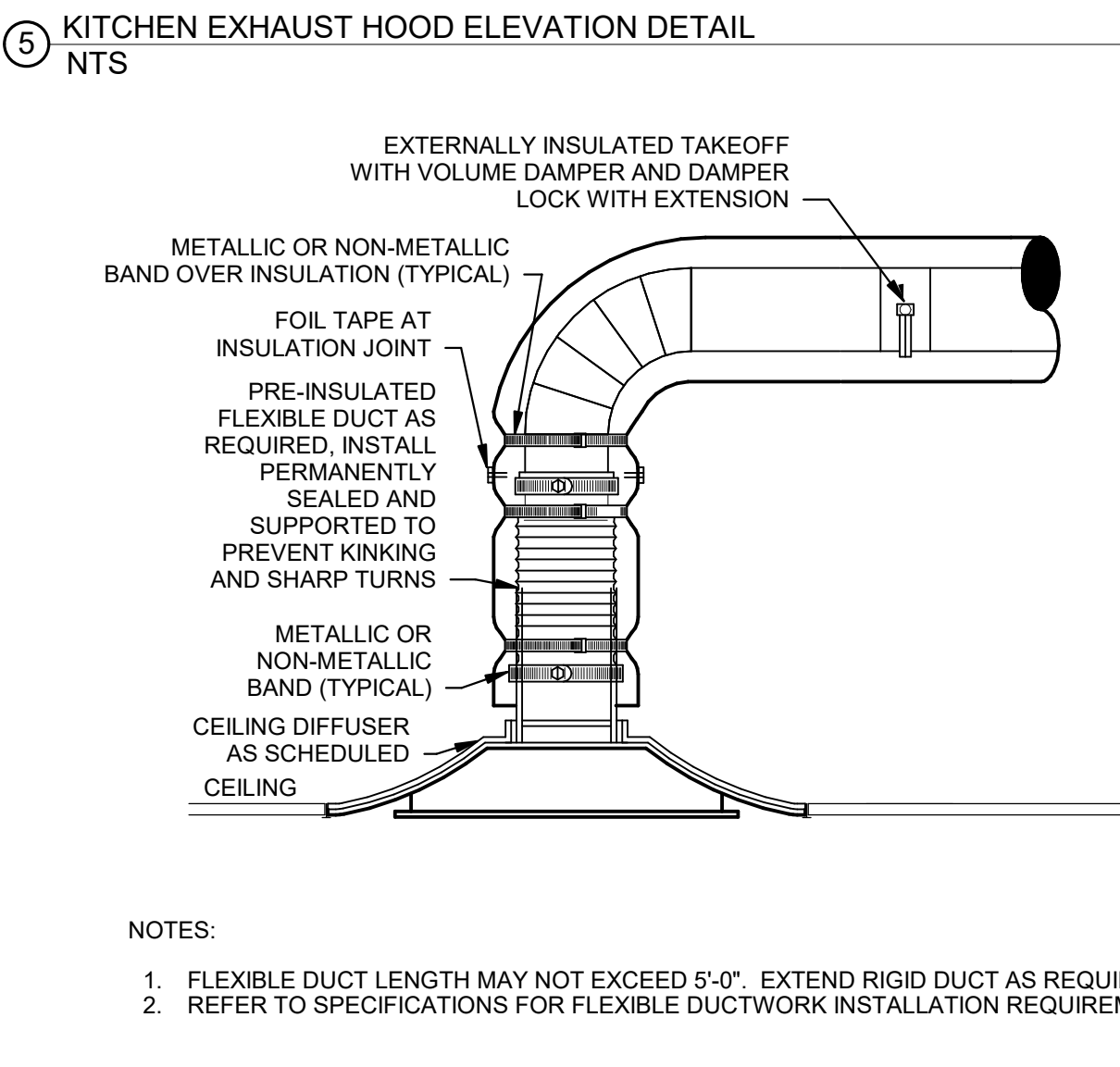
18 CEILING CASSETTE DETAIL NTS



19 DUCT MOUNTED REGISTER DETAIL NTS



20 HARD CEILING DIFFUSER DETAIL NTS



21 LAY-IN CEILING DIFFUSER DETAIL NTS



Margaretta L. Terry, Architect

Project

SHAKE SHACK®
SHAKE SHACK #1403
BRICK, NJ

Project Number 24134
Drawn By Author
Checked By Checker
Date 20 June 2024

Revisions
3 2024-06-20 PERMIT/BID SET
2024-10-17 ISSUED FOR CONSTRUCTION

Drawing
MECHANICAL DETAILS

M501

GENERAL MECHANICAL REQUIREMENTS

1. GENERAL INSTRUCTIONS

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

2. GENERAL MATERIALS AND INSTALLATION

- A. BUILDING OPERATION
- B. EXISTING EQUIPMENT REUSE AND REMOVAL
- C. EXCAVATION AND BACKFILLING
- D. COINCIDENTAL DAMAGE
- E. CUTTINGS 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. SEISMIC CONTROLS FOR MEPP SYSTEMS
- S. AIR FILTERS
- T. REFRIGERANT AND OIL
- U. DRENCH

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

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

4. HVAC EQUIPMENT

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

5. PIPING AND PIPING SPECIALTIES

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

6. TEMPERATURE CONTROLS

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

7. SEQUENCE OF OPERATION

- A. FAN COIL UNIT CONTROL
- B. KITCHEN EXHAUST FAN CONTROL
- C. MAKE-UP AIR UNIT CONTROL
- D. ROOFTOP UNIT CONTROL
- E. RESTROOM EXHAUST FAN (EF-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, offsets, control lines, and other installation requirements. Use the drawings as a guide when laying out the work and to verify that materials and equipment will fit into the designated spaces, and which when installed per manufacturers' requirements, will ensure a complete, coordinated, satisfactory, and properly operating system.

B. DEFINITIONS

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

1. Division 21 – Fire Suppression	Division 15
2. Division 22 – Fire Alarm	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, fitting, adjusting, 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 in 29 CFR 1910.7 (e.g., UL, ETL, CSA), and acceptable to the AHJ over this project. Nationally recognized testing laboratories and standards listed are used only to represent the characteristics required and are not intended to restrict the use of other NRTLs that are acceptable to the AHJ and standards that meet the specified criteria.

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

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

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

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

C. 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 equipment and materials. The General Contractor shall coordinate with other trades to ensure that all necessary clearances and openings are required. Contractor shall keep informed as to the work of other trades engaged in the construction of the project and shall execute work in a manner as to not interfere with or delay the work of other trades.

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 heret 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.

Plug, seal, or cap open ends of ductwork and piping systems while stored and installed during construction when not in use to prevent the entrance of debris into the systems. Remove temporary protection prior to starting equipment and turning the system over to the owner.

I. SUBSTITUTIONS

Materials, products, equipment, and systems described in the Bidding Documents establish a standard of required function, dimension, appearance and quality to be met by the proposed substitution. The base bid shall include only the products from manufacturers specifically 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 produce 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 will be furnished for proposed substitution as for specified Work.
5. If accepted substitution fails to perform as required, Contractor shall replace substitute material or system with that originally specified and bear costs incurred in replacement, removal, and labor required 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 time for 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 by the equipment identification acronym or number as used on the drawings and include performance curves, capacities, sizes, weights, materials, finishes, wiring diagrams, electrical requirements and deviations from specified equipment or materials. For equipment with motor starters or VFDs, include short circuit current ratings. Mark out applicable items. Shop drawings not 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. If not indicated, 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 submittals.

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 changes to three identical sets of the approved shop drawings. Insert one set into each copy of the manual described below.

See Division 01 and General Conditions for additional information.

M. OPERATION AND MAINTENANCE INSTRUCTIONS

During the course of construction, collect and compile a complete brochure of equipment furnished and installed on this project. Include operational and maintenance instructions, manufacturer's catalog sheets, wiring diagrams, parts lists, approved submittals and shop drawings, warranties, and descriptive literature, as furnished 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.

Include Record Drawings as described above.

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

N. SPARE PARTS

- Furnish to Owner, with receipt, the following spare parts for the equipment furnished for this project:
 1. One set of spare filters of each type required for each unit. In addition to the spare set of filters, install new filters prior to testing, adjusting, and balancing work and before turning system over to Owner.
 2. Furnish one complete set of belts 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.

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

P. WARRANTIES

Warrant each system and each element thereof against all defects due to faulty workmanship, design, or material for a period of 12 months from date of Substantial Completion, unless 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 rebalance existing ductwork, diffusers, registers, and grilles intended for reuse as required or as indicated on drawings.

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

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 performing 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 finish 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 Cork, Inc., Pate Company, Thybar or approved equal. Provide with fully millered raised cant and step to match roof insulation thickness, welded, minimum 1/8 gauge galvanized steel shell, internally reinforced to load bearing factors of equipment being supported, minimum 1-1/2 inch thick, 3 pound rigid insulation internal to shell to maintain continuous roof insulation where required, factory installed wood nailer, and minimum 16 gauge jacket with counterflashing where equipment does not fully cover the equipment. 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 or the seal certificate. 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 MEPP 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, Zurn, 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.

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. Verify the integrity of the entire network following the cable installation. Use appropriate test measures, 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 series 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 from National TAB shall be certified by the National Environmental Balancing Bureau (NEBB), Associated Air Balance Council (AABC), or Testing, Adjusting and Balancing Bureau (TABBA). 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, verify readings and balancing report showing air supply quantities and air entering and leaving air temperatures and pressures at design flow, fan 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 all 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 lab report. Adjust equipment to operate as intended by the specification. TAB report shall include a "report summary/note/s" 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 operation. Notify the Architect that adjustments have been made and that system is operating in accordance with safety controls. 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 Controls, Inc., Vibration Isolators, 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 isolation curves. Springs without becoming coil bound. Coils without becoming coil bound. Coat vibration isolators 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 as suitable for system use. 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 bearings readily neoprene and steel with 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-deflecting neoprene isolator in series with a steel spring. Design springs so the ratio of the horizontal to vertical spring constant is between one and two. The spring diameter shall be not less than 90 percent of the diameter 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 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 isolation function. The neoprene element shall have a maximum diameter of 50 and designed for 15 percent strain, with a static deflection of 0.05 inches. The steel diameter of SPNH shall be not less than 1/2 inch. The static deflection of SPNH shall be 2 inches. Provide SPNH hangers with 1 inch static deflection for water source heated 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-sheer bushings for lightweight (less than 100 pounds), suspended equipment supported by all thread rod and angle iron or Unistrut. Select for a minimum diameter of 50 and designed for 15 percent strain, with a static deflection of 0.15 inches. Provide Mason Industries Type HMB or equal.

R. SEISMIC CONTROLS FOR MEPP SYSTEMS

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

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

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

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

The Contractor shall submit the following shop drawing information to the AHJ and the Engineer for review and approval:

- Seismic analysis listing all applicable seismic design criteria.
 - Descriptive catalog data of seismic bracing materials.
 - Shop drawings showing bracing type and location.
 - Installation details of all bracing used.
 - Calculations showing that the seismic restraints meet the seismic requirements.
- Shop drawings and calculations shall be signed and sealed by a registered professional engineer, licensed in the state of the project and employed by the manufacturer of the seismic bracing products. Calculators shall include dead loads, static seismic loads, and capacity of materials utilized for connections.

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

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

S. AIR FILTERS

Provide AAF/Flanders Perfect Flat HC M8, Camfil Farr 30/30, pleated, throwaway type filters, minimum MERV 8, or similar as manufactured by Air Filter, Inc., Bioclimatic, Columbus, Koch, or approved equal, unless otherwise indicated.

Temporary filters used to protect openings in ductwork and inside equipment when permanent HVAC equipment is used during the construction period shall be pleated, throwaway type filters, minimum MERV 6.

T. REFRIGERANT AND OIL

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

U. IDENTIFICATION

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

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

Provide 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 facilities 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 Cooling and Heating; Brown for Energy Recirculation; Blue for other equipment types. Conform to ANSI A13.1 for Hazardous Equipment.

Provide etched 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, alkylid 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 5 feet on each side of wall, floor, and ceiling penetrations. Provide additional markers in congested areas or at multiple duct runs as required for clarity.

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

A. DUCT INSULATION

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

Provide rectangular liner conforming to ASTM C1071, Type I or II that is 1-1/2 inch thick, 1-1/2 pound density, minimum R-8.0 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-8.0 Johns Manville "Spiracoacoust" 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 tapes as follows:

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

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

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

For supply and return ductwork located above 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 Armaflex flexible elastomeric insulation or equivalent meeting ASTM C534 with integral 1/2 inch rigid foam cladding laminated to factory. Cover all seams with Armaflex seal tape.
- Exterior insulation consisting of 2 inch thickness of flexible elastomeric insulation meeting ASTM C534 or 3 density rigid fiberglass meeting ASTM C612, and jacket consisting of 20 gauge conformed 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 density rigid fiberglass meeting ASTM C612, and jacket consisting of 15.5 mils thick Venturplast UL V5 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-F" 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. on 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, Micro, PHD Manufacturing, PMP Systems, Roof Top Brks, Unistrut (Alcoa), 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 50 percent excess capacity without becoming coil bound. Provide 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 for the shop after fabrication and prior to shipping.

Seal ductwork with heavy liquid sealant, Hardcoat Intropig 601, Design Polymer PD 1010, Unistrut Mogul duct sealer or approved equal, approved equal, where shown. Unistrut (Alcoa), Zai Foster, or approved equal. Seal all longitudinal and transverse ductwork joints airtight to meet SMACNA Class A. Tapes and mastics shall be listed and labeled in accordance with UL 181A.

Provide radial 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 spigot vanes. Vanes shall be the entire length of the bend. Provide mitered elbows where space does not permit radial elbows, where shown on the drawings, or at the option of the contractor, where space does not permit full radius elbows, provide short radius elbows with 45 degree 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 are not ducted to all weather conditions. The static deflection of SPNH shall be 2 inches. Provide short radius elbows where 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 carvers connectors, 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 inch slack.

Provide balancing dampers, manufactured by Gesco, Greenheck, Louvers & Dampers, Nalor Industries, Pottorff, Ruskin, Tamco, or approved equal, where shown. Provide complete control of air flow. Splitter dampers shall be controlled by locking quadrants; Round Volume 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 model 803 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 blade stiffeners, reinforced blade, self-balancing bearing, and remote operator mounting plate. External operator shall attach to damper as a single piece with no linkage adjustment required. Damper shall be adjustable through the diffuser frame with standard 1/4 inch nut/driver or flat screwdriver. Provide 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 to duct. Do not install 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 ceiling cup with cover plate may be used for access to cable operator. Provide round damper by Metropolitan Air Technology model RT-250, Young's Regulator model 5020-1200, or approved equal. Provide rectangular damper by Metropolitan Air Technology model RT-200, Young's Regulator model 802-1200, or approved equal. Provide remote cable damper by Metropolitan Air Technology model RT-WGA, Young's Regulator model 27D-27S, or approved equal.

Round or oval ductwork shall be FlakGroup Mesco, Unistrut, 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 36"	22	20
36" 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 liquid sealant may 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 gauges 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 inches to 6 inches w.g.) flexible duct shall be Flexmaster type 88, Thermalex type G-RM, M-NE, JPL type Silver Jacket, or equal (fire retardant polyethylene) protective vapor barrier, UL 181 Class 1, acoustical insulated duct, R-6.0 fiberglass insulation. Provide CPE liner with steel 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 cone 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. INSULATION FOR INSTANTANEOUS WATER HEATER FLUES AND COMBUSTION AIR INTAKES

Insulate instantaneous water heater flues and combustion air intakes with 1 inch thick fiberglass insulation conforming to ASTM C547 with Type I vapor barrier jacket conforming to ASTM C1136. Manufacture insulation in pre-molded sections with a white fiberglass reinforced foil laminate all-service jacket. Insulate fittings and cover with Zenlon type pre-molded PVC coverings. Fittings, jackets, PVC coverings and adhesives shall not exceed flame spread rating of 25 and smoke development rating of 50 per ASTM E84.

E. 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 Centrotech "InnoFlue" or equal by Nova Fire Group "Z-DENS".

Vents and combustion air ducts for condensing type appliances shall be Schedule 40 PVC pipe and socket fittings meeting ASTM D2685 and UL 1738, manufactured by IPEX. Use solvent cement meeting ASTM D2654 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.

F. AIR DEVICES

Provide air devices as scheduled on drawings, manufactured by Carnes, Krueger, Metalaire, 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 Architect/ reflected ceiling plans.

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 required by the Engineer.

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

Provide sealed 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 appearance. 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.

G. 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 round, 1/8 inch thick for aluminum, with flanges for duct mounting. Provide elastomeric or neoprene seals, mechanically attached and field replaceable. Provide a minimum of one damper actuator per section. Test damper performance in accordance with AMCA 500-D.

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

MotORIZED dampers used for ventilation air intake, exhaust air, or relief air shall have duct 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 Carnes, CESCO, Pottorff, Nalor, or Ruskin. Reference manufacturer with model number for outside air dampers is Ruskin CD-50 constructed of aluminum, and all other applications is Ruskin CD-35 constructed of galvanized steel.

Provide damper operator for each automatic damper with sufficient capacity to operate the damper under all conditions and to guarantee light 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 loss, 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 transformers for damper motors if different voltages are required.

H. EXHAUST AIR SYSTEMS

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

I. KITCHEN EXHAUST AIR SYSTEMS

Install kitchen grease exhaust package furnished by the owner. System includes kitchen hood, grease exhaust fan/pullout 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 ventual opening of the fan inlet. Provide gasket at flanged connection to fan rated for 1500 degrees Fahrenheit and grease applications. Enclose duct in fireproof enclosure per locally adopted mechanical code or, if approved by local code official, in fire rated wrap insulation. Insulation shall be minimum two-hour rated duct wrap insulation for Type I hood grease exhaust duct applications and shall conform to ASTM E2336 where required to comply with IMC. Insulation shall be flexible wrap enclosure rated for minimum 2000 degrees Fahrenheit and fire zero clearance to combustibles. Insulation shall be non-mineral wool, passive, low bio-persistent fiber totally encapsulated on all sides with aluminum foil. Insulation shall be as manufactured by Certainteed, Thermal Ceramics, Unifrax or 3M. Slope duct back towards hood at minimum of 1/8 inch per linear foot. All Contractor's ductwork shall be constructed of galvanized steel. UL listed concentric ductwork package that complies with UL 1876 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 Meta-Fab, Schebler, Sealkirk, or approved equal. Provide manufacturers UL listing number and verification certificate as a part of the shop drawing submission. Install duct package in strict conformance with manufacturer's instructions and recommendations.

All portions of grease duct systems shall be tested for leakage in accordance with the "Grease Duct Test" paragraph of the IMC. Leakage tests shall be by water leakage type or equivalent test methods as approved by the local code official to determine that all joints are 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 portion of the test code official to 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.

4. HVAC EQUIPMENT

A. ELECTRIC UNIT HEATERS

Provide electric unit heaters as scheduled on the drawings, manufactured by Berko, Brash, Indecro, Markel, OMark, 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. 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, AHR 410 and NSF 37. Unit housings shall be constructed of aluminum, aluminumized steel, or galvanized steel/wal powder coated/aluminumized, with steel mounting brackets. Unit shall have air adjustment by way of multi-speed motors or adjustable intake louvers. Units shall have an adjustable discharge nozzle. Units shall have statically and dynamically balanced fans with direct drive fan motors. Motors shall be single speed/intermittent mounted, continuous duty, with permanently sealed lubricated ball bearings, and internal disconnect.

Furnish unit with washable panel with welded galvanized steel mounting frames, gasketed, with fasteners for bolting together built-up filter banks. Furnish unit with built-in line voltage thermostat wired to air curtain junction box. Furnish with plunger-type automatic door switch, start-stop pushbutton station, 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 buses, terminal strip, and NEMA 250 enclosure.

5. PIPING AND PIPING SPECIALTIES

A. REFRIGERANT PIPING AND INSULATION

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

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

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

Solder filler metals: ASTM B32, 95-5 Tin-Antimony.

- Bracing pipe materials:
- AW5 A5.8, Classification Bag-5, Silver (Ag) 44.0-46.0 percent, Zinc (Z) 23.0-27.0 percent, and Copper (Cu) 29.0-31.0 percent.
 - AW5 A5.8, Classification BCU-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, Armaflex or equal. Insulate suction and liquid lines between the expansion valve, evaporator, and compressor with 1/2 inch thick insulation on pipes less than 1 inch in size and 1 inch thick for pipes 1 inch and larger. Insulate hot gas and liquid lines between the compressor condenser, and expansion valve with 1 inch thick insulation on pipes less than 1-1/2 inch and 1-1/2 inch thick for pipes 1-1/2 inch and larger. Piping insulation shall have a flame spread of 25 or less, and a smoke developed rating of 50 or less when tested in accordance with ASTM E84. Coat insulation that is exposed to the elements with a protective sealer. Install and support piping to keep noise and vibration to a minimum. Support and secure piping to Unistrut type supports so that no vibration passes to the building structure. Pipe attachments shall be copper-plated or have nonmetallic coating for electrolytic protection where attachments are in direct contact with copper tubing. Install a support within one foot of each change of direction. Mount pipe hangers around the outside of the insulation with saddles to prevent hangers from rupturing the insulation. Replace insulation that is cut or broken by the hangers.

Run refrigerant lines parallel and perpendicular to wall and floor lines

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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. ROOFTOP UNIT CONTROL

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

D. RESTROOM EXHAUST FAN (EF-1) CONTROL

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

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

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

1.2 INFORMATIONAL SUBMITTALS

- Construction Checklists: Draft construction checklists will be created by CxA for Contractor review.
- 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".
 - Refrigerant piping, including the following:
 - Refrigerant piping, fittings, and specialties.
 - Refrigerant charge.
 - General duty and specialty valves.
 - Meters and gauges.
 - Air distribution systems, including the following:
 - Supply, return, and exhaust systems.
 - Metal ducts, liners, and fittings.
 - Nonmetal ducts and fittings.
 - Air-duct accessories, including volume dampers, fire and smoke dampers, turning vanes, sound attenuators, and flexible connectors.
 - Duct-mounted access doors and panels.
 - Kitchen exhaust system, including the following:
 - Exhaust and makeup air system.
 - Metal ducts, liners, and fittings.
 - Air-duct accessories, including volume dampers, fire and smoke dampers, turning vanes, sound attenuators, and flexible connectors.
 - Duct-mounted access doors and panels.
 - Exhaust fans.
 - Make-Up air unit.
 - Air-handling equipment, including the following:
 - Fans and motors.
 - Indoor air-handling units with and without coils, dampers, and filters.
 - Outdoor air-handling units with and without coils, dampers, and filters.

B. PART 3 EXECUTION

3.1 CONSTRUCTION CHECKLISTS

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

3.2 CONSTRUCTION CHECKLIST REVIEW

- Review and provide written comments on draft construction checklists. CxA will create required draft construction checklists and provide item to Contractor.
- Return draft construction checklist review comments within 5 days of receipt.
- When review comments have been resolved, the CxA will provide final construction checklists marked "Approved for Use, (date)".
- Use only construction checklists marked "Approved for Use, (date)".

3.3 Cx TESTING PREPARATION

- 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.
- 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

- Comply with construction checklist requirements, including installation checks, startup, and performance tests requirements for HVAC systems and equipment.
- Measure capacities and effectiveness of systems, assemblies, subsystems, equipment and components, including operational and control functions, to verify compliance with acceptance criteria.
- Coordinate schedule with, and perform Cx activities at the direction of CxA.
- Provide technicians, instrumentation, tools, and equipment to perform and document the following:
 - Construction checklist verification tests.
 - Construction checklist verification tests demonstrations
 - Cx test demonstrations.

3.5 START-UP DOCUMENTATION COMMON TO ALL SYSTEMS

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

3.6 MECHANICAL IDENTIFICATION

- Include all applicable "Start-Up Checks Common to All Systems".
- Start-Up Checks: Perform the following checks:
 - 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.
 - Adjusting: Relocate any mechanical identification device which has become visually blocked by work of this division or other divisions.
 - Cleaning: Clean face of identification devices, and glass frames of valve charts.

3.7 MECHANICAL INSULATION

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

3.8 PIPING GENERAL

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

3.9 AC MOTORS

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

3.10 PACKAGED HEATING AND COOLING UNITS

- Include all applicable "Start-Up Checks Common to All Systems".
- Refer to AC Motors in this section.
- 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.
- Start-Up Checks: Perform the following inspections/checks during start-up:
 - Test controls and demonstrate compliance with requirements. Replace damaged or malfunctioning controls and equipment.
 - Install new filters after start-up.

3.11 TERMINAL UNITS

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

3.12 FANS

- Include all applicable "Start-Up Checks Common to All Systems".
- 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.
- Start-Up Checks: Perform the following inspections/checks during start-up:
 - Inspect the field assembly of components and installation of the units, piping, ductwork, and electrical connections.
 - 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.
 - Adjust and lubricate dampers and linkages for proper damper operation.
 - 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.
 - Ensure vibration isolation integrity is maintained with the fan installation and associated connections.
 - Lubricate bearings, pulleys, belts, and other moving parts with factory-recommended lubricants.
 - Stroke all dampers to ensure free and full travel.

3.13 DUCTWORK ACCESSORIES

- Include all applicable "Start-Up Checks Common to All Systems".
- Start-Up Checks: Perform the following checks during start-up and as specified:
 - Cleaning: Clean factory-finished surfaces. Repair any marred or scratches surfaces with manufacturer's touch-up paint.
- Start-Up Tests: In addition to specifications, perform the following as a minimum:
 - 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.
 - Label access doors in accordance with Division 21 Section "Mechanical Identification"
 - Adjusting: Adjust ductwork accessories for proper settings, install fusible links in-fire dampers and adjust for proper action.

END OF SECTION 23



Seal

PROFESSIONAL ENGINEER
NATHAN T. LOVE
2463903900



DATE 10/17/2024

Margaretta L. Terry,
Architect

DP3 Architects, Ltd.
15 South Main Street, Suite 400
Greenville, SC 29601
864.232.8200
www.DP3architects.com

Project

SHAKE SHACK®
SHAKE SHACK #1403
BRICK, NJ

Project Number 24134
Drawn By Author
Checked By Checker
Date 20 JUNE 2024

Revisions

3	2024-06-20	PERMIT/BID SET
	2024-10-17	ISSUED FOR CONSTRUCTION

Drawing

MECHANICAL
SPECIFICATIONS

M592

ROOFTOP UNIT CONTROL MATRIX						
CONTROL FEATURE	UNITS			NOTES		
	(E)RTU-4 KITCHEN SETPOINT OR Y/N	(E)RTU-5 KITCHEN SETPOINT OR Y/N	(E)RTU-6 DINING SETPOINT OR Y/N			
SETPOINTS						
COOLING - OCCUPIED SETPOINT	"F	75	75	75		
COOLING - UNOCCUPIED SETPOINT	"F	80	80	80		
HEATING - OCCUPIED SETPOINT	"F	70	70	70		
HEATING - UNOCCUPIED SETPOINT	"F	60	60	60		
DEHUMIDIFICATION SETPOINT - HUMIDITY SENSOR FEEDBACK	% RH	NA	NA	50%		B
PROGRAMMED CONTROL FEATURES						
HVAC SYSTEM OCCUPIED/UNOCCUPIED MODE - PROGRAMMABLE THERMOSTAT		Y	Y	Y		B
REMOTE TEMPERATURE AND HUMIDITY SENSOR		Y	Y	Y		B
EQUIPMENT ACCESSORIES AND CONTROL MODULES						
OUTSIDE AIR DAMPER - MOTOR OPERATED (MODULATING)		Y	Y	Y		L
INTEGRATED ECONOMIZER - DIFFERENTIAL ENTHALPY ENABLE (OA ENTHALPY < RA ENTHALPY)	BTULB	Y	Y	Y		E
RELIEF - BAROMETRIC DAMPER		N	N	Y		
RELIEF - CONSTANT VOLUME POWERED EXHAUST FAN		Y	Y	N		H
COOLING COIL (DX - STAGED)		Y	Y	Y		M
DEHUMIDIFICATION - HOT GAS REHEAT		N	N	Y		O
HEATING COIL (NATURAL GAS)		Y	Y	Y		M
SUPPLY FAN CONTROL METHODS						
ON DURING OCCUPIED HOURS		Y	Y	Y		
CYCLE WITH LOADS DURING UNOCCUPIED HOURS		Y	Y	Y		
VARIABLE VOLUME - STAGED FAN CONTROL IN RESPONSE TO ACTIVE COOLING COIL STAGES		Y	Y	Y		M, G
SAFETIES, INTERLOCKS, AND ALARMS						
GAS VALVE SAFETY		Y	Y	Y		F
RETURN AIR SMOKE DETECTOR - SAFETY SHUTDOWN		Y	Y	Y		U
FIRE ALARM CONTROL PANEL - SAFETY SHUTDOWN INTERLOCK		Y	Y	Y		
KITCHEN EXHAUST SYSTEM INTERLOCK		Y	Y	Y		S

DIV. 23 CONTRACTOR SHALL PROVIDE CONTROL PANEL(S), WIRING, THERMOSTAT(S), TEMPERATURE SENSOR(S), HUMIDISTAT(S), AND/OR CO2 SENSOR(S) WHERE SHOWN ON THE DRAWINGS AND AS REQUIRED TO FACILITATE THE SCHEDULED CONTROL MODULES AND SEQUENCES OF OPERATION. EACH UNIT SHALL CONTROL BASED ON ITS OWN INTERNAL SAFETIES, TIME DELAYS, AND SEQUENCES UNLESS NOTED OTHERWISE. COORDINATE WITH OWNER FINAL BUILDING AND EQUIPMENT SCHEDULES DURING STARTUP. REFERENCE DIVISION SPECIFICATIONS FOR INDIVIDUAL DEVICE REQUIREMENTS.

NOTES:
 B. DIVISION 23 CONTRACTOR SHALL PROVIDE DEVICE.
 E. IF SETPOINT VALUE IS LISTED, IT INDICATES ECONOMIZER HIGH-LIMIT SHUT/OFF. UNIT SHALL BE IN ECONOMIZER IF CONDITIONS ARE LESS THAN SETPOINT. THE FOLLOWING SENSORS SHALL DETERMINE ECONOMIZER ON POINT: OUTSIDE AIR TEMPERATURE; DIVISION 23 PROVIDED AS PART OF ECONOMIZER CONTROL MODULE. RETURN AIR TEMPERATURE; DIVISION 23 PROVIDED AS PART OF ECONOMIZER CONTROL MODULE. OUTSIDE AIR HUMIDITY; DIVISION 23 PROVIDED AS PART OF ECONOMIZER CONTROL MODULE. RETURN AIR HUMIDITY; DIVISION 23 PROVIDED AS PART OF ECONOMIZER CONTROL MODULE.
 F. DEVICE SHALL BE FACTORY MOUNTED AND PRE-WIRED FOR OPERATION SUBJECT TO THE ONBOARD CONTROLLER.
 H. POWERED EXHAUST FAN SHALL STAGE ON AND OFF ACCORDING TO DAMPER POSITION.
 L. EQUIPMENT MANUFACTURER SHALL PROVIDE MODULATING DAMPER AND CONTROLS CAPABLE OF ADJUSTING THE DAMPER POSITION TO MAINTAIN THE SCHEDULED OUTSIDE AIR ON THE DRAWINGS ACROSS ALL FAN SPEEDS. DIV. 23 CONTRACTOR SHALL PROGRAM MULTIPLE DAMPER POSITION SETPOINTS IN THE FIELD DURING TESTING AND BALANCING TO MAINTAIN MINIMUM VENTILATION WHEN NOT IN ECONOMIZER. DAMPER SHALL BE CLOSED DURING UNOCCUPIED HOURS.
 M. UNITARY CONTROLLER SHALL MODULATE AND/OR CYCLE SUPPLY FAN SPEED SETTING AND COIL CAPACITY STAGES SUBJECT TO THE INTERNAL SAFETIES AND SEQUENCES TO MAINTAIN SCHEDULED SETPOINTS.
 O. PROGRAM DEHUMIDIFICATION SEQUENCE BASED ON ZONE AIR HUMIDITY.
 Q. PROVIDE STAGED FAN CONTROL WITH MINIMUM 2 FAN SPEEDS. LOW SPEED SHALL NOT EXCEED 66% OF FULL SPEED AND SHALL DRAW NO MORE THAN 40% OF FAN POWER AT FULL SPEED.
 S. INTERLOCK RTU WITH KITCHEN EXHAUST HOOD SYSTEM(S) TO SHUT DOWN UPON SIGNAL FROM HOOD FIRE EXTINGUISHING SYSTEM. INTERLOCK RTU WITH KITCHEN EXHAUST FAN TO ENERGIZE WHEN HOOD SYSTEM IS ENERGIZED FOR PRESSURIZATION.
 U. DIVISION 28 CONTRACTOR SHALL PROVIDE DEVICE.

ROOFTOP UNIT SCHEDULE (DX COOLING, NATURAL GAS HEAT) (SCHEDULE FOR REFERENCE ONLY, UNITS PROVIDED BY LANDLORD)																														
MARK	MANUFACTURER	MODEL	NOMINAL TONS	UNIT TYPE	SUPPLY FAN				COOLING COIL				HEAT EXCHANGER								ELECTRICAL			WEIGHT (LBS)	NOTES					
					CFM	ESP (IN)	HP	VFD (Y/N)	TH (MBH)	SH (MBH)	EAT (°F DB)	LAT (°F WB)	REFR TYPE	MIN EFF (IEER)	MIN NO STAGES	MIN OUT (MBH)	NOM INPUT (MBH)	MIN EFF (%)	EAT (°F DB)	LAT (°F DB)	MIN NO STAGES	MIN O/A (CFM)	VIPH			MCA	MOCP	DISC TYPE		
(E)RTU-4	CARRIER	48FCM12	10	SINGLE ZONE	3,000	0.8	2.4	Y	108.6	77.0	79.9	67.1	56.5	55.6	R410A	15	2	106.14	224	81	52.2	85	2	900	2093	54	60	NON-FUSED	1341	A-O
(E)RTU-5	CARRIER	48FCM12	10	SINGLE ZONE	3,000	0.8	2.4	Y	108.6	77.0	79.9	67.1	56.5	55.6	R410A	15	2	106.14	224	81	52.2	85	2	900	2093	54	60	NON-FUSED	1341	A-O
(E)RTU-6	CARRIER	48FCM12	10	SINGLE ZONE	3,200	0.8	2.5	Y	119.6	81.1	79.9	67.1	56.9	55.2	R410A	15	2	113.22	224	81	52.2	85	2	960	2093	54	60	NON-FUSED	1341	A-O

NOTES:
 A. REFER TO ROOFTOP UNIT CONTROL MATRIX FOR CONTROL FEATURES, MODULES, AND ACCESSORIES THAT SHALL BE PROVIDED WITH THE EQUIPMENT.
 B. EQUIPMENT SIZED FOR 100°F AMBIENT TEMPERATURE.
 C. PROVIDED 2" MERV 8 EFFICIENT PLEATED THROWAWAY AIR FILTERS.
 D. PROVIDED FACTORY MOUNTED DISCONNECT INSTALLED ON SERVICE SIDE OF UNIT.
 E. STARTERS FOR ALL MOTORS SHALL BE FURNISHED INTEGRAL WITH UNIT.
 F. PROVIDED SINGLE POINT POWER CONNECTION.
 G. COORDINATED SIZE OF CONDUCTOR TERMINATION LUGS WITH CONDUCTOR SIZES SHOWN ON ELECTRICAL DRAWINGS.
 H. PROVIDED 125 VAC, 20 AMP DUPLEX CONVENIENCE RECEPTACLE MOUNTED TO UNIT READY FOR FIELD WIRING WITH A COVER UL LISTED FOR WET AND DAMPER LOCATIONS WHEN IN USE.
 I. SPECIFIED FAN ESP ACCOUNTS FOR DUCT LOSSES EXTERNAL TO UNIT.
 J. PROVIDED MOTOR HORSEPOWER TO OVERCOME INTERNAL UNIT STATIC PRESSURE DROP PLUS SPECIFIED EXTERNAL STATIC PRESSURE DROP. NOMINAL MOTOR HP SHALL BE NO LARGER THAN THE FIRST AVAILABLE NOMINAL MOTOR SIZE GREATER THAN THE REQUIRED HP.
 K. PROVIDED INSULATED ROOF CURB WITH MINIMUM HEIGHT REQUIRED TO MAINTAIN BOTTOM OF MINIMUM OF 14 INCHES ABOVE FINISHED ROOF SURFACE. PROVIDED SLOPED CURB IF NEEDED TO MATCH ROOF SLOPE.
 L. COORDINATED WITH ROOF INSULATION THICKNESS AND ROOF TAPER AT INSTALLED LOCATION. COORDINATE CURB TYPE WITH DRAWINGS.
 M. SCHEDULED WEIGHT IS THE MAXIMUM ALLOWABLE OPERATING WEIGHT OF THE EQUIPMENT ONLY.
 N. COOLING COIL LAT IS LEAVING AIR TEMPERATURE OF COIL.
 O. PROVIDED GUARDS TO PROTECT CONDENSER COIL FROM HAIL OR OTHER DAMAGE.
 P. PROVIDED HEATER TO MEET OR EXCEED SCHEDULED MINIMUM MBH OUTPUT. NOMINAL INPUT IS BASED ON LISTED MANUFACTURER'S STANDARD PRODUCT. COORDINATE EQUIPMENT GAS LOAD WITH PLUMBING CONTRACTOR IF DIFFERENT FROM THAT SCHEDULED. MEET MINIMUM EFFICIENCY SCHEDULED.

UNIT HEATER SCHEDULE (ELECTRIC)									
MARK	MANUFACTURER	MODEL	OUTPUT (MBH)	OUTPUT (KW)	MIN. NO. OF STAGES	CFM	MAX. AMPS	VIPH	NOTES
UH-1	QMARK	COF-568	17.1	5	3	300	24	208/1	A-E

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

NOTES:
 A. EQUIPMENT FURNISHED AND INSTALLED PER THE RESPONSIBILITY SCHEDULE.
 B. PROVIDE WITH UNIT MOUNTED THERMOSTAT.
 C. FURNISH WITH RECESSED MOUNTING ENCLOSURE.
 D. PROVIDE NECESSARY MOUNTING BRACKET AND ACCESSORIES FOR CEILING MOUNTING.
 E. PROVIDE FACTORY MOUNTED DISCONNECT INSTALLED ON SERVICE SIDE OF UNIT.

HEAT PUMP CONDENSING UNIT SCHEDULE																	
MARK	SERVICE	MANUFACTURER	MODEL	REFR TYPE	COOLING CAPACITY				HEATING CAPACITY				ELECTRICAL			WEIGHT (LBS)	NOTES
					TH (MBH)	AMBIENT (DB)	MIN EFF (SEER)	CAP (DB)	EAT (°F DB)	LAT (°F WB)	MIN OUT (MBH)	MIN EFF (%)	COP 47°F	MCA	MOCP		
CU-1	FCU-1	CARRIER	38MARBQ18AA3	R410A	10.6	98.0	19.0	9.2	13.8	3.3	18	25	208/1	102.5		A-H	

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

NOTES:
 A. EQUIPMENT FURNISHED AND INSTALLED PER THE RESPONSIBILITY SCHEDULE. REF ARCHITECTURAL DRAWINGS.
 B. EQUIPMENT CAPACITY SCHEDULED IS MINIMUM CAPACITY THAT MUST BE PROVIDED AT AMBIENT TEMPERATURE INDICATED.
 C. CONTRACTOR SHALL VERIFY WITH EQUIPMENT SUPPLIER EXACT QUANTITY AND SIZE OF REFRIGERANT PIPING.
 D. PROVIDE LIQUID LINE FILTER DRYER AND SIGHT GLASS.
 E. PROVIDE PREFABRICATED EQUIPMENT SUPPORT RAILS.
 F. DISCONNECT SWITCH FURNISHED BY DIVISION 28 CONTRACTOR.
 G. STARTERS FOR ALL MOTORS SHALL BE FURNISHED INTEGRAL WITH UNIT.
 H. COORDINATE SIZE OF CONDUCTOR TERMINATION LUGS WITH CONDUCTOR SIZES SHOWN ON ELECTRICAL DRAWINGS.

PROJECT DESIGN CONDITIONS											
CLIMATE CONDITIONS						BUILDING OPERATING HOURS					
WEATHER STATION: MONMOUTH JET CENTER, NJ						MONDAY - FRIDAY: TBD BY OWNER					
CLIMATE ZONE: 4A						SATURDAY: TBD BY OWNER					
HEATING (DB): 99.6%						SUNDAY: TBD BY OWNER					
COOLING (DB/MCWB): 0.4%						HOLIDAY: TBD BY OWNER					

SPACE / UNIT DESCRIPTION	SET POINTS										SPACE OPERATING HOURS OCCUPIED / UNOCCUPIED			NOTES	
	COOLING / DE-HUMIDIFICATION				HEATING			HUMIDIFICATION			M-F	SAT	SUN		
	OC	UNOCC	MAX RH %	MIN RH %	OC	UNOCC	MIN RH %	MAX RH %	CONTROL METHOD	BASE PPM					MAXIMUM PPM
DINING AREAS	75	80	50%	NA	70	60	NA	NA	NA	NA	NA	TBD	TBD	TBD	A,B,C
OFFICES	75	80	50%	NA	70	60	NA	NA	NA	NA	NA	TBD	TBD	TBD	A,B,C
MECHANICAL ROOM	NA	NA	NA	NA	70	60	NA	NA	NA	NA	NA	TBD	TBD	TBD	A,B,C
KITCHENBOH	75	80	50%	NA	70	60	NA	NA	NA	NA	NA	TBD	TBD	TBD	A,B,C

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

BUILDING AIR BALANCE SUMMARY ECONOMIZER MODE				
UNIT NO.	SUPPLY (CFM)	OUTDOOR (CFM)	EXHAUST (CFM)	PERCENT OA/SA
(E)RTU-4	3,000	3,000	--	100%
(E)RTU-5	3,000	3,000	--	100%
(E)RTU-6	3,200	3,200	--	100%
FCU-1	450	40	--	9%
(E)KEF-1	--	--	1,188	--
(E)KEF-2	--	--	860	--
(E)EF-1	--	--	300	--
RELIEF RTU-4	--	--	2,100	--
RELIEF RTU-5	--	--	2,100	--
RELIEF RTU-6	--	--	2,240	--
TOTALS	9,650	9,240	8,788	--
TOTAL AIRFLOW AVAILABLE FOR PRESSURIZATION (CFM)				452
PERCENT POSITIVE PRESSURIZATION				4.9%

BUILDING AIR BALANCE SUMMARY NORMAL OPERATION				
UNIT NO.	SUPPLY (CFM)	OUTDOOR (CFM)	EXHAUST (CFM)	PERCENT OA/SA
(E)RTU-4	3,000	900	--	30%
(E)RTU-5	3,000	900	--	30%
(E)RTU-6	3,200	960	--	30%
FCU-1	450	40	--	9%
(E)KEF-1	--	--	1,188	--
(E)KEF-2	--	--	860	--
(E)EF-1	--	--	300	--
TOTALS	9,650	2,800	2,348	--
TOTAL AIRFLOW AVAILABLE FOR PRESSURIZATION (CFM)				452
PERCENT POSITIVE PRESSURIZATION				16.1%

GRILLE, REGISTER, AND DIFFUSER SCHEDULE									
MARK	MANUFACTURER	SERVICE	MODEL	CONSTRUCTION MATERIAL	FACE TYPE	MOUNTING LOCATION	FACE SIZE (IN)	MAX NC	NOTES
CEG	E.H. PRICE	EXHAUST GRILLE W/ DAMPER	80D	STEEL	EGGCRATE	SURFACE	12x12	30	A B C F G H
CRG	E.H. PRICE	RETURN GRILLE	80	STEEL	EGGCRATE	LAY-IN	24x24	30	A B C F H
CS01	E.H. PRICE	SUPPLY DIFFUSER	SCD	STEEL	SQUARE CONE	SURFACE	12x12	30	A B C F H J K L
CS02	E.H. PRICE	SUPPLY DIFFUSER	SCD	STEEL	SQUARE CONE	LAY-IN	24x24	30	A B C F H K
CS03	E.H. PRICE	SUPPLY DIFFUSER	PDOR	STEEL	PERFORATED	LAY-IN	24x24	30	A B C F H
WRG	E.H. PRICE	RETURN GRILLE W/DAMPER	530D	STEEL	LOUVERED FACE	WALL OR DUCT	(SEE PLANS)	30	A B C D F H
WSR	E.H. PRICE	SUPPLY REGISTER W/ DAMPER	520D	STEEL	LOUVERED FACE	WALL OR DUCT	(SEE PLANS)	30	A B C D E F G H

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

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

OUTSIDE AIR REQUIREMENTS, IMC-2021 (IP)													
SYSTEM DESIGNATION	SYSTEM TAB NAME OR LIST 'SINGLE'	SINGLE-ZONE SYSTEMS ONLY		MULTI-ZONE SYSTEMS ONLY		FLOOR AREA SERVED BY SYSTEM [A _s] (SF)	SYSTEM AVERAGED AREA-BASED OUTDOOR AIR RATE (CFM/SF)	SYSTEM POPULATION (P)	SYSTEM AVERAGED PEOPLE-BASED OUTDOOR AIR RATE (CFM/P)	REQUIRED O/A INTAKE FLOW [V _o] (CFM)	REQUIRED DCV O/A INTAKE FLOW [V _o] (CFM)	DESIGN O/A INTAKE FLOW [V _o] (CFM)	NOTES
		SINGLE-ZONE SYSTEM VENTILATION ZONE	SINGLE ZONE WORST CASE ZONE AIR DISTRIBUTION EFFECTIVENESS [E _z]	SYSTEM VENTILATION EFFICIENCY [E _v]	ASSOCIATED VENTILATION ZONE								
(E)RTU-4 & (E)RTU-5	MULTIZONE ((E)RTU-4 & (E)RTU-5)	-	-	0.78	1.225	1,225	0.120	24.5	7.50	425	313	960	
(E)RTU-6	MULTIZONE ((E)RTU-6)	-	-	0.90	1,415	1,415	0.151	53.69	7.50	686	336	1,800	
(E)FCU-1	SINGLE ZONE	OFFICE	0.80	-	69	69	0.060	2	5.00	18	N/A	40	
TOTALS										1,129	649	2,800	

GENERAL NOTES:
 1. VENTILATION CALCULATIONS BASED ON IMC-2021.
 2. SYSTEM POPULATIONS BASED ON MAX SEATING AND/OR CODE MAXIMUM VALUES.
 3. SINGLE ZONE SYSTEMS (V_{o1} + V_{o2}). SYSTEM VENTILATION EFFICIENCY CALCULATION IS NOT REQUIRED FOR SINGLE ZONE SYSTEMS. WORST CASE AIR DISTRIBUTION EFFECTIVENESS BETWEEN HEATING AND COOLING MODES OF OPERATION IS SHOWN IN TABLE.
 4. 100% O/A SYSTEMS (V_{o1} + V_{o2} zones V_{o2}). WHEN ONE AIR HANDLER SUPPLIES ONLY OUTDOOR AIR TO ONE OR MORE ZONES, EACH ZONE IS INDIVIDUALLY CALCULATED WITH ITS WORST CASE ZONE AIR DISTRIBUTION EFFECTIVENESS (HEATING/COOLING).
 5. MULTI-ZONE REGULATING SYSTEMS: CALCULATOR USED TO DETERMINE VENTILATION AIRFLOW IN COMPLIANCE WITH IMC-2021 VPP AND ASHRAE 62-1.2019 APPENDIX A. VENTILATION RATE SHOWN IS ACTUAL CALCULATED WITH CORRECTION FACTORS INCLUDED. EACH ZONE IS CALCULATED WITH ITS WORST CASE ZONE AIR DISTRIBUTION EFFECTIVENESS (HEATING/COOLING) AS PART OF CALCULATIONS TO FIND E_v.



8345 LENEAX DRIVE, SUITE 300
LENEAX, NC 28624
TEL 913.742.5000 FAX 913.742.5001
WWW.HENDERSONENGINEERS.COM

2150003351
N.J. CORPORATE NO. 246A27943400
EXPIRES 9/31/2026



DATE 10/17/2024

Margaretta L. Terry,
Architect

DP3 Architects, Ltd.
15 South Main Street, Suite 400
Greenville, SC 29601
864.232.8200
www.DP3architects.com

Project

SHAKE SHACK #1403
BRICK, NJ

Project Number 24134
Drawn By Author
Checked By Checker
Date 20 JUNE 2024

Revisions
 2 2024-06-20 PERMIT/BID SET
 2 2024-10-04 BID SET REVISION
 3 2024-10-17 ISSUED FOR CONSTRUCTION

Drawing
MECHANICAL SCHEDULES

M601

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NATHAN T. LOVE

COMcheck Software Version COMcheckWeb
Mechanical Compliance Certificate

Project Information

Energy Code: 2021 IECC
 Project Title: Shake Shack Brick,NJ
 Location: Lakewood, New Jersey
 Climate Zone: 4a
 Project Type: New Construction

Construction Site: Owner/Agent: Designer/Contractor:
 Brick Town Plaza Shake Shack Henderson Engineers
 Brick, New Jersey 08723 8345 Lenexa Dr #300
 Lenexa, Kansas 66214

Additional Efficiency Package(s)

Credits: 10.0 Required 0.0 Proposed

Mechanical Systems List

Quantity System Type & Description

3 Water Heater:
 Gas Instantaneous Water Heater, Capacity: 0 gallons, Input Rating: 199 kBtu/h w/ Circulation Pump
 No minimum efficiency requirement applies.

Mechanical Compliance Statement

Compliance Statement: The proposed mechanical design represented in this document is consistent with the building plans, specifications, and other calculations submitted with this permit application. The proposed mechanical systems have been designed to meet the 2021 IECC requirements in COMcheck Version COMcheckWeb and to comply with any applicable mandatory requirements listed in the Inspection Checklist.

Name - Title: Cesar Giron Signature: *Cesar Giron* Date: 06/03/2024

Project Title: Shake Shack Brick,NJ Report date: 06/03/24
 Data filename: Page 1 of 6

Section # & Req.ID	Mechanical Rough-In Inspection	Complies?	Comments/Assumptions
C402.2.6 [ME11]²	Thermally ineffective panel surfaces of sensible heating panels have insulation >= R-3.5.	<input type="checkbox"/> Complies <input type="checkbox"/> Does Not <input type="checkbox"/> Not Observable <input type="checkbox"/> Not Applicable	
C403.9 [ME144]²	Large diameter fans where installed shall be tested and labeled in accordance with AMCA 230.	<input type="checkbox"/> Complies <input type="checkbox"/> Does Not <input type="checkbox"/> Not Observable <input type="checkbox"/> Not Applicable	
C403.7.2 [ME115]²	Enclosed parking garage ventilation has automatic contaminant detection and capacity to stage or modulate fans to 50% or less of design capacity.	<input type="checkbox"/> Complies <input type="checkbox"/> Does Not <input type="checkbox"/> Not Observable <input type="checkbox"/> Not Applicable	
C403.7.5 [ME116]²	Kitchen exhaust systems comply with replacement air and conditioned supply air limitations, and satisfy hood rating requirements and maximum exhaust rate criteria.	<input type="checkbox"/> Complies <input type="checkbox"/> Does Not <input type="checkbox"/> Not Observable <input type="checkbox"/> Not Applicable	
C403.4.1 [ME63]²	Heating for vestibules and air curtains with integral heating include automatic controls that shut off the heating system when outdoor air temperatures > 45F. Vestibule heating and cooling systems controlled by a thermostat in the vestibule with heating setpoint = 60F and cooling setpoint >= 60F.	<input type="checkbox"/> Complies <input type="checkbox"/> Does Not <input type="checkbox"/> Not Observable <input type="checkbox"/> Not Applicable	
C408.2.2 [ME53]²	Air outlets and zone terminal devices have means for air balancing.	<input type="checkbox"/> Complies <input type="checkbox"/> Does Not <input type="checkbox"/> Not Observable <input type="checkbox"/> Not Applicable	
C403.11.3 [ME123]²	Refrigerated display cases, walk-in coolers or walk-in freezers served by remote compressors and remote condensers not located in a condensing unit, have fan-powered condensers that comply with Sections C403.11.3.1 and refrigeration compressor systems that comply with C403.11.3.2.	<input type="checkbox"/> Complies <input type="checkbox"/> Does Not <input type="checkbox"/> Not Observable <input type="checkbox"/> Not Applicable	

Additional Comments/Assumptions:

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

Project Title: Shake Shack Brick,NJ Report date: 06/03/24
 Data filename: Page 4 of 6

COMcheck Software Version COMcheckWeb
Inspection Checklist
 Energy Code: 2021 IECC

Requirements: 0.0% were addressed directly in the COMcheck software
 Text in the "Comments/Assumptions" column is provided by the user in the COMcheck Requirements screen. For each requirement, the user certifies that a code requirement will be met and how that is documented, or that an exception is being claimed. Where compliance is itemized in a separate table, a reference to that table is provided.

Section # & Req.ID	Plan Review	Complies?	Comments/Assumptions
C406 [PRS]	Plans, specifications, and/or calculations provide all information with which compliance can be determined for the additional energy efficiency package options.	<input type="checkbox"/> Complies <input type="checkbox"/> Does Not <input type="checkbox"/> Not Observable <input type="checkbox"/> Not Applicable	

Additional Comments/Assumptions:

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

Project Title: Shake Shack Brick,NJ Report date: 06/03/24
 Data filename: Page 2 of 6

Section # & Req.ID	Rough-In Electrical Inspection	Complies?	Comments/Assumptions
C405.7 [EL26]²	Low-voltage dry-type distribution electric transformers meet the minimum efficiency requirements of Table C405.6.	<input type="checkbox"/> Complies <input type="checkbox"/> Does Not <input type="checkbox"/> Not Observable <input type="checkbox"/> Not Applicable	
C405.8 [EL27]²	Electric motors meet the minimum efficiency requirements of Tables C405.7(1) through C405.7(4). Efficiency verified through certification under an approved certification program or the equipment efficiency ratings shall be provided by motor manufacturer (where certification programs do not exist).	<input type="checkbox"/> Complies <input type="checkbox"/> Does Not <input type="checkbox"/> Not Observable <input type="checkbox"/> Not Applicable	
C405.9.1 [EL28]²	Escalators and moving walks comply with ASME A17.1/CSA B44 and have automatic controls configured to reduce speed to the minimum permitted speed in accordance with ASME A17.1/CSA B44 or applicable local code when not conveying passengers.	<input type="checkbox"/> Complies <input type="checkbox"/> Does Not <input type="checkbox"/> Not Observable <input type="checkbox"/> Not Applicable	
C405.10 [EL29]²	Total voltage drop across the combination of feeders and branch circuits <= 5%.	<input type="checkbox"/> Complies <input type="checkbox"/> Does Not <input type="checkbox"/> Not Observable <input type="checkbox"/> Not Applicable	
C405.1.1 [EL30]²	At least 90% of dwelling unit permanently installed lighting shall have lamp efficacy >= 65 lm/W or luminaires with efficacy >= 45 lm/W or comply with C405.2.4 or C405.3.	<input type="checkbox"/> Complies <input type="checkbox"/> Does Not <input type="checkbox"/> Not Observable <input type="checkbox"/> Not Applicable	
C405.11.1 [EL31]²	50% of 15/20 amp receptacles installed in enclosed offices, conference rooms, copy rooms, break rooms, classrooms and workstations and > 25% of branch circuit feeders for modular furniture will have automatic receptacle control in accordance with C405.11.1.	<input type="checkbox"/> Complies <input type="checkbox"/> Does Not <input type="checkbox"/> Not Observable <input type="checkbox"/> Not Applicable	

Additional Comments/Assumptions:

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

Project Title: Shake Shack Brick,NJ Report date: 06/03/24
 Data filename: Page 5 of 6

Section # & Req.ID	Plumbing Rough-In Inspection	Complies?	Comments/Assumptions
C404.5, C404.5.1, C404.5.2 [PL6]²	Heated water supply piping conforms to pipe length and volume requirements. Refer to section details.	<input type="checkbox"/> Complies <input type="checkbox"/> Does Not <input type="checkbox"/> Not Observable <input type="checkbox"/> Not Applicable	
C404.6.1, C404.6.2 [PL3]²	Automatic time switches installed to automatically switch off the recirculating hot-water system or heat trace.	<input type="checkbox"/> Complies <input type="checkbox"/> Does Not <input type="checkbox"/> Not Observable <input type="checkbox"/> Not Applicable	
C404.6.3 [PL7]²	Pumps that circulate water between a heater and storage tank have controls that limit operation from startup to <= 3 minutes after end of heating cycle.	<input type="checkbox"/> Complies <input type="checkbox"/> Does Not <input type="checkbox"/> Not Observable <input type="checkbox"/> Not Applicable	
C404.6.1.1 [PL8]²	Demand recirculation water systems have controls that start the pump upon receiving a signal from the action of a user of a fixture or appliance and limits the temperature of the water entering the cold-water piping to 104°F.	<input type="checkbox"/> Complies <input type="checkbox"/> Does Not <input type="checkbox"/> Not Observable <input type="checkbox"/> Not Applicable	

Additional Comments/Assumptions:

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

Project Title: Shake Shack Brick,NJ Report date: 06/03/24
 Data filename: Page 3 of 6

Section # & Req.ID	Final Inspection	Complies?	Comments/Assumptions
C404.3 [F11]²	Heat traps installed on supply and discharge piping of non-circulating systems.	<input type="checkbox"/> Complies <input type="checkbox"/> Does Not <input type="checkbox"/> Not Observable <input type="checkbox"/> Not Applicable	
C404.4 [F12]²	All piping insulated in accordance with section details and Table C403.12.3.	<input type="checkbox"/> Complies <input type="checkbox"/> Does Not <input type="checkbox"/> Not Observable <input type="checkbox"/> Not Applicable	
C404.6.1 [F12]²	Controls are installed that limit the operation of a recirculation pump installed to maintain temperature of a storage tank. System return pipe is a dedicated return pipe or a cold water supply pipe.	<input type="checkbox"/> Complies <input type="checkbox"/> Does Not <input type="checkbox"/> Not Observable <input type="checkbox"/> Not Applicable	
C408.1.1 [F15]²	Building operations and maintenance documents will be provided to the owner. Documents will cover manufacturers' information, specifications, programming procedures and means of illustrating to owner how building equipment and systems are intended to be installed, maintained, and operated.	<input type="checkbox"/> Complies <input type="checkbox"/> Does Not <input type="checkbox"/> Not Observable <input type="checkbox"/> Not Applicable	

Additional Comments/Assumptions:

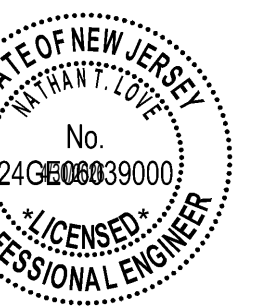
1 High Impact (Tier 1) 2 Medium Impact (Tier 2) 3 Low Impact (Tier 3)

Project Title: Shake Shack Brick,NJ Report date: 06/03/24
 Data filename: Page 6 of 6

HENDERSON ENGINEERS
 8345 LENEXA DRIVE, SUITE 300
 LENEXA, KS 66214
 TEL 913.742.5000 FAX 913.742.5001
 WWW.HENDERSONENGINEERS.COM
 2150003351
 N.J. CORPORATE NO. 24GA27943400
 EXPIRES 9/31/2026

Seal

PROFESSIONAL ENGINEER
 NATHAN T. LOVE
 24CE0039000



DATE 10/17/2024

Margaretta L. Terry, Architect

DP3 Architects, Ltd.
 15 South Main Street, Suite 400
 Greenville, SC 29601
 864.232.8200
 www.DP3architects.com

Project

SHAKE SHACK
 SHAKE SHACK #1403
 BRICK, NJ

Project Number 24134
 Drawn By Author
 Checked By Checker
 Date 20 JUNE 2024

Revisions

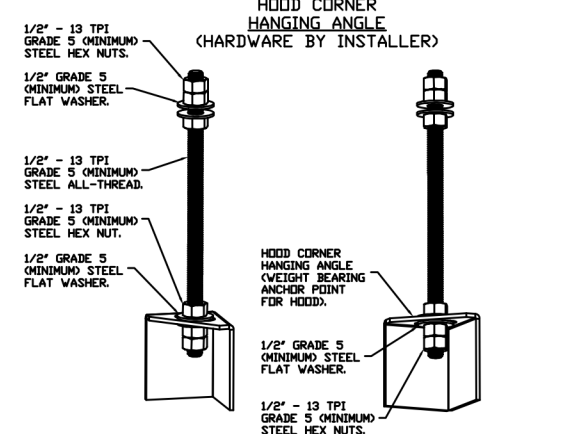
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Drawing

MECHANICAL ENERGY CODE COMPLIANCE

M630

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HANGING ANGLE DETAILS

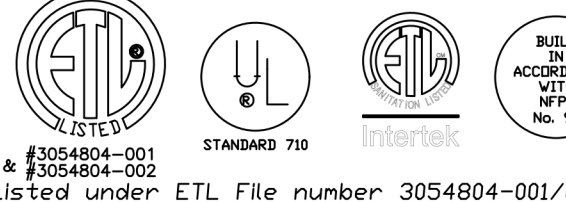
HOOD STYLE / MODEL	450 DEGREES cfm/ft.	600 DEGREES cfm/ft.	700 DEGREES cfm/ft.
CANOPY ND-2	150	200	250
CANOPY ND-2 w/ END PANELS	105	140	175
SLOPED SND-2	228	294	-
ISLAND ND-2WI	269	300	350
ISLAND ND-2I	346	422	475

ETL HOOD LISTING DETAIL

EXHAUST CFM = LENGTH OF HOOD X CFM/LIN.FT. (LOAD)
 SUPPLY CFM = EXHAUST CFM X PERCENTAGE REQUIRED
 TOTAL DUCT AREA (sq. in.) = 144 X CFM / FPM²
 DUCT LENGTH = TOTAL DUCT AREA / DUCT WIDTH

VENTILATION VELOCITY DUCT SIZES ARE CALCULATED USING AN EXHAUST VELOCITY OF 1500-1800 FPM AND A SUPPLY VELOCITY OF 3000 FPM

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

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

BALANCE

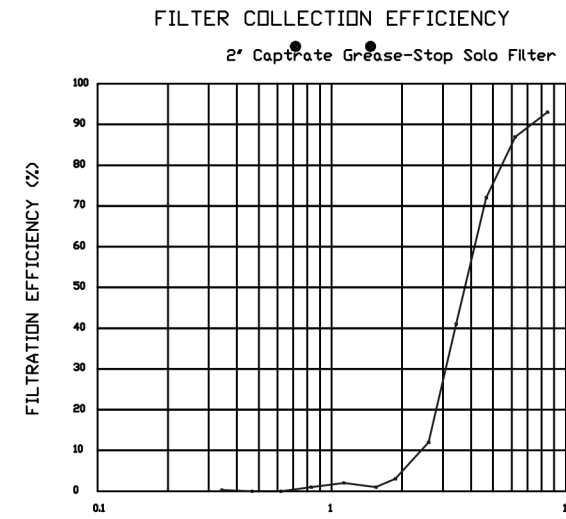
- KITCHEN HOODS MUST BE BALANCED WITH KITCHEN.
- KITCHEN SHALL BE NEGATIVE WITH RESPECT TO DINING AREA.
- RESTAURANT SHALL BE POSITIVE WITH RESPECT TO AMBIENT PRESSURE.

ADDITIONAL

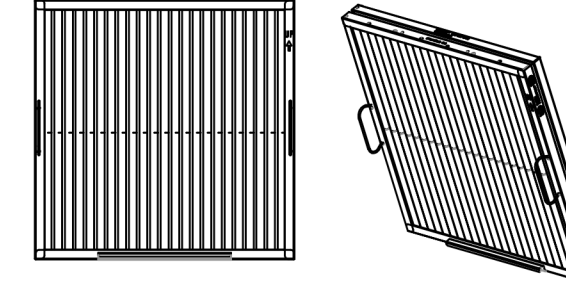
- WRITTEN HOOD DIMENSIONS HAVE PRECEDENCE OVER SCALE.
- SHOWN AND "APPROVED" COPIES OF THIS DOCUMENT MUST BE PROVIDED TO THE FACTORY PRIOR TO COMMENCEMENT OF FABRICATION.

GENERAL NOTES

FILTER COLLECTION EFFICIENCY



Particulate Diameter (µm)



CaptiveAire Captrate Solo Filter
 ETL Listed Grease Extracting Filters
 Made From 430 Stainless Steel

FILTER DETAIL

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

HOOD INFORMATION - JOB#6771478

HOOD NO	TAG	MODEL	MANUFACTURER	LENGTH	MAX COOKING TEMP	TYPE	APPLIANCE DUTY	DESIGN CFM/FT	TOTAL EXH CFM	EXHAUST PLENUM RISER(S)					HOOD CONSTRUCTION	HOOD CONFIG		
										WIDTH	LENG	HEIGHT	DIA	CFM		VEL	SP	END TO END
1	Hood (Grill)	5430 ND-2	CAPTIVEAIRE	7' 11"	450 DEG	I	MEDIUM	150	1188	10"	11"	4"	1188	1555	-0.462'	430 SS WHERE EXPOSED	ALONE	ALONE
2	Hood (Fryer)	5430 ND-2	CAPTIVEAIRE	4' 11"	600 DEG	I	HEAVY	175	860	9"	9"	4"	860	1529	-0.494'	430 SS WHERE EXPOSED	ALONE	ALONE

HOOD INFORMATION

HOOD NO	TAG	FILTER(S)				LIGHT(S)				UTILITY CABINET(S)				FIRE SYSTEM PIPING	HOOD HANGING WEIGHT		
		TYPE	QTY	HEIGHT	LENGTH	EFFICIENCY @ 7 MICRONS	QTY	TYPE	WIRE GUARD	LOCATION	SIZE	TYPE	SIZE			MODEL #	QUANTITY
1	Hood (Grill)	CAPTRATE SOLD FILTER	5	20"	16"	85% SEE FILTER SPEC	2	RECESSED ROUND	NO						YES	484 LBS	
2	Hood (Fryer)	CAPTRATE SOLD FILTER	3	20"	16"	85% SEE FILTER SPEC	2	RECESSED ROUND	NO	LEFT	12"x54"x30"	TANK FS	4.0/4.0/4.0	SC-320110MA	1 LIGHT 1 FAN	YES	747 LBS

HOOD OPTIONS

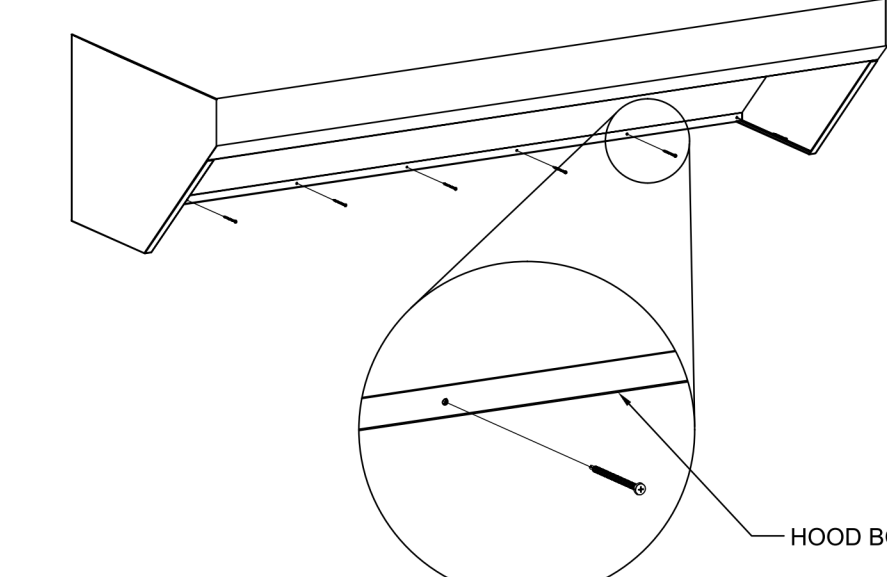
HOOD NO	TAG	OPTION
1	Hood (Grill)	FIELD WRAPPER 18.00" HIGH FRONT, LEFT, RIGHT.
		RIGHT END STANDOFF (FINISHED) 1" WIDE 54" LONG INSULATED.
		INSULATION FOR BACK OF HOOD.
		RISER SENSOR INSTALL 6IN PLEN.
2	Hood (Fryer)	LEFT VERTICAL END PANEL 27" TOP WIDTH, 21" BOTTOM WIDTH, 80" HIGH INSULATED 430 SS.
		GFCI DUPLEX OUTLET, 20A 125V - HOOD FRONT LEFT - HORIZONTAL - DIST FROM END: 3.50 DIST FROM BOTTOM: 4.00.
		RIGHT WALL AS END PANEL.
		FIELD WRAPPER 12.00" HIGH FRONT, LEFT, RIGHT.
2	Hood (Fryer)	RIGHT QUARTER END PANEL 23" TOP WIDTH, 0" BOTTOM WIDTH, 23" HIGH 430 SS.
		LEFT QUARTER END PANEL 23" TOP WIDTH, 0" BOTTOM WIDTH, 23" HIGH 430 SS.
		INSULATION FOR BACK OF HOOD.
		RISER SENSOR INSTALL 6IN PLEN.

CLEARANCE TO COMBUSTIBLES

HOODS #	SURFACE	*CLEARANCE
1	TOP	18"
	FRONT	0"
	BACK	0"
	LEFT	18"
2	RIGHT	0"
	TOP	18"
	FRONT	0"
	BACK	0"
2	LEFT	0"
	RIGHT	18"

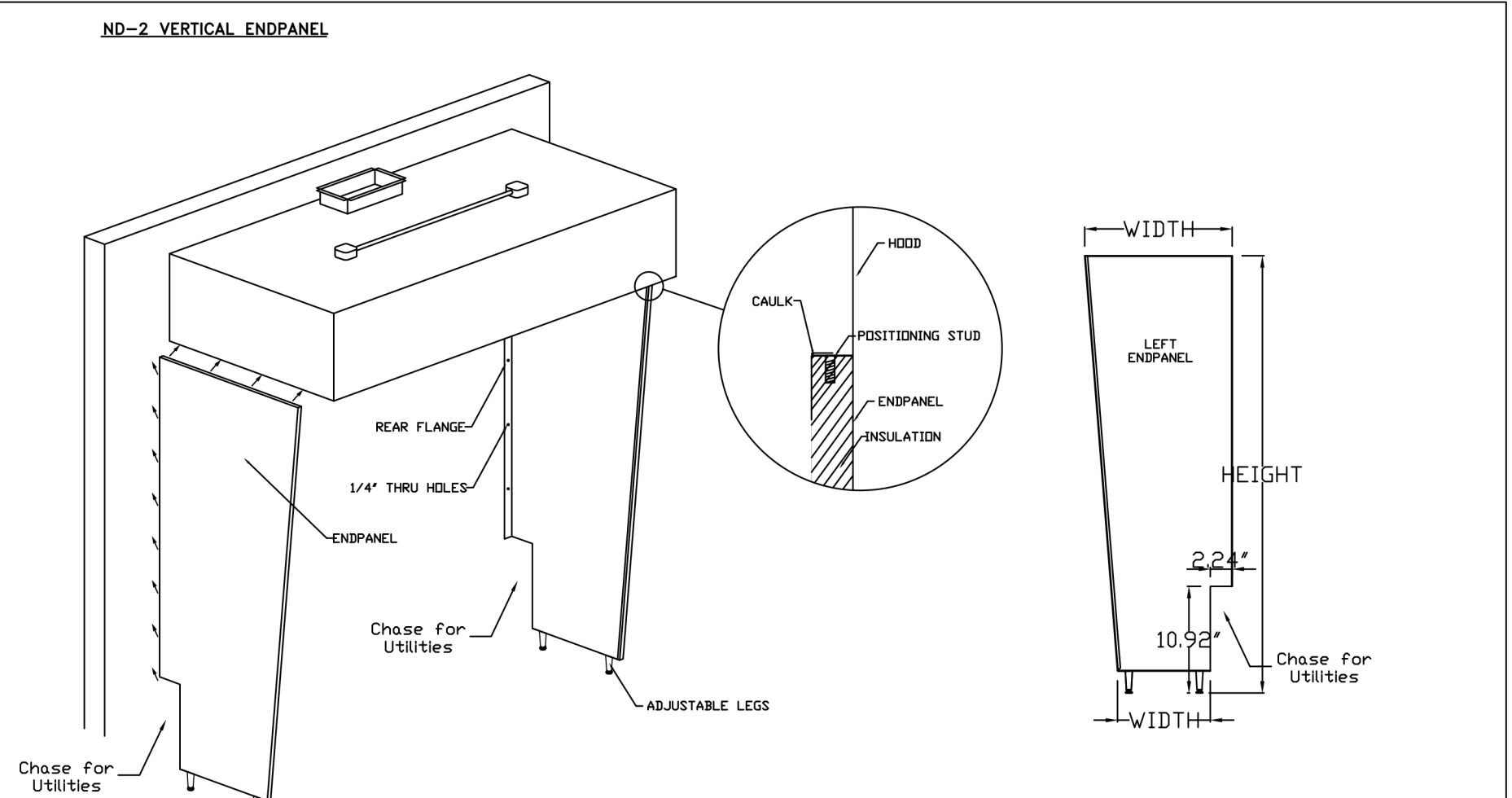
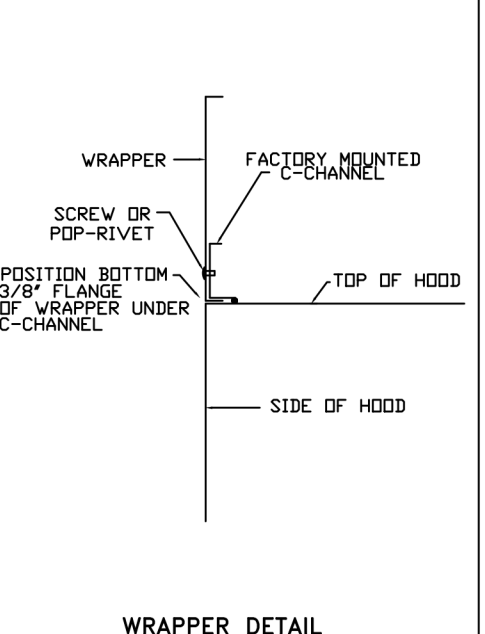
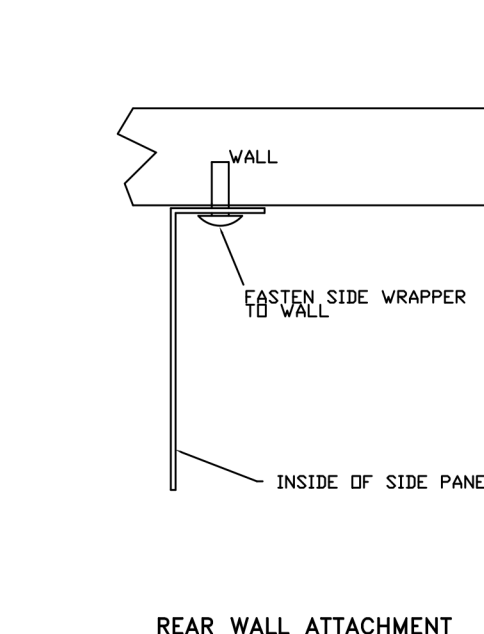
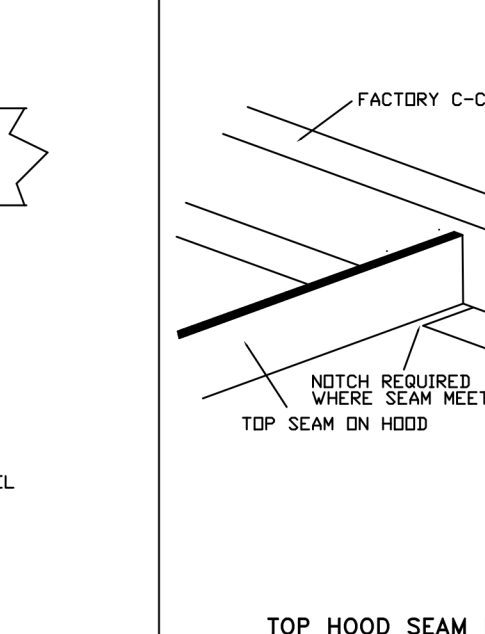
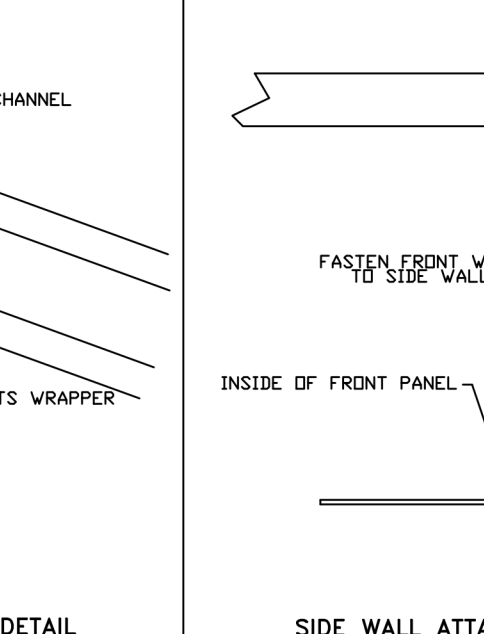
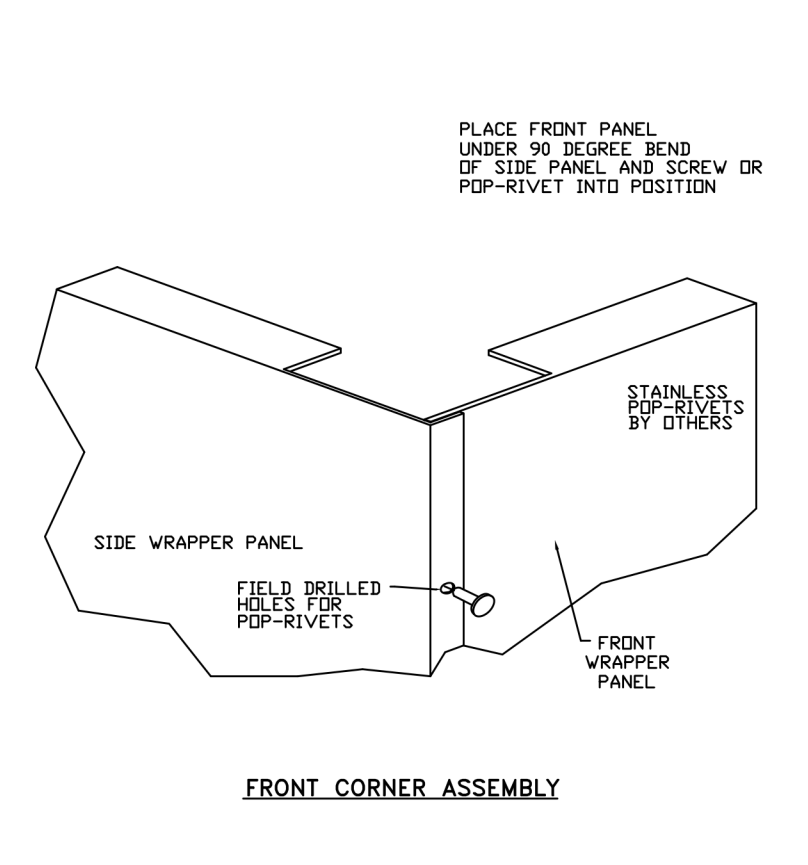
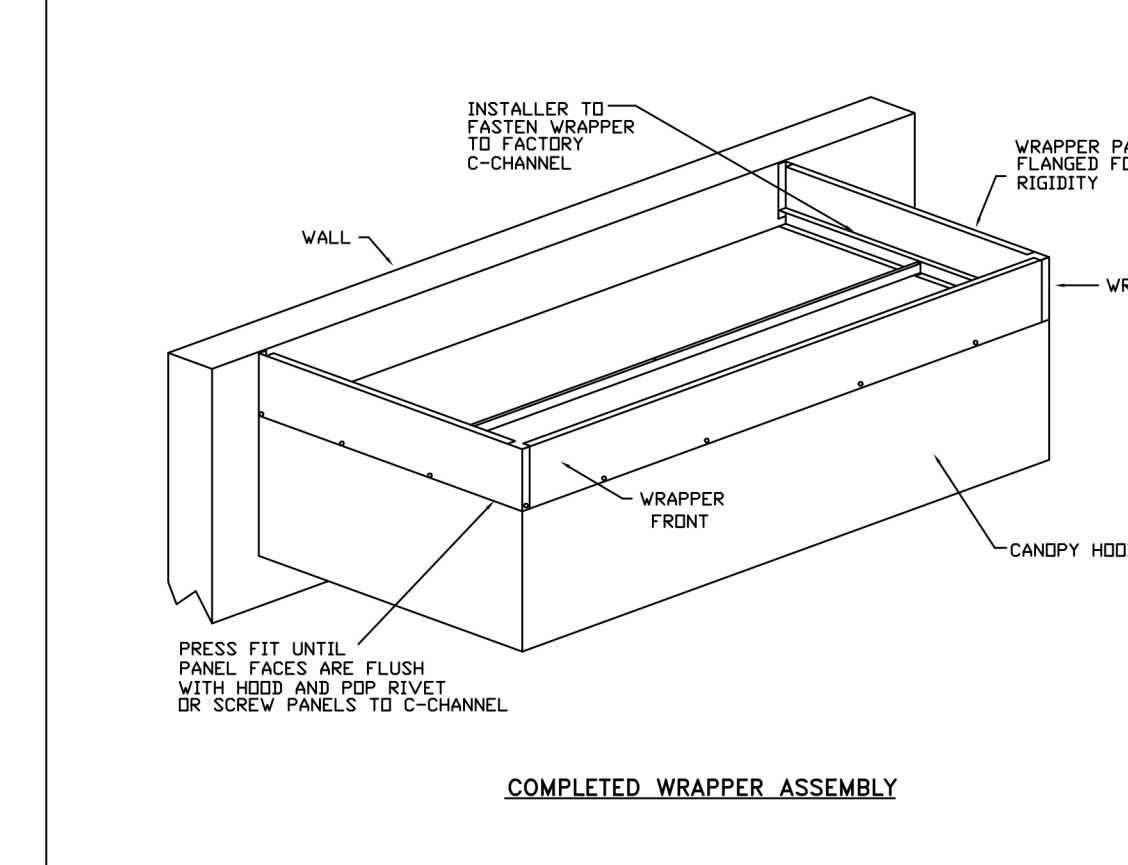
- *0" CLEARANCE TO COMBUSTIBLES CONFORMS TO UL710 STANDARD.
 - HOOD MOUNTED UTILITY CABINETS REQUIRE 36" SERVICE CLEARANCE.

Bottom Flange Securing Detail



Secure the bottom of the hood to the rear wall using 1404 Evergreen Quik-Fastener. Use a minimum of 1 fastener every 16" on the bottom flange. For walls with metal studs, use a minimum of 1 fastener on the bottom flange at each stud.

Only Use SIL-BOND RTV 4500 silicone sealant on hood.

NOTE:
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REVISIONS

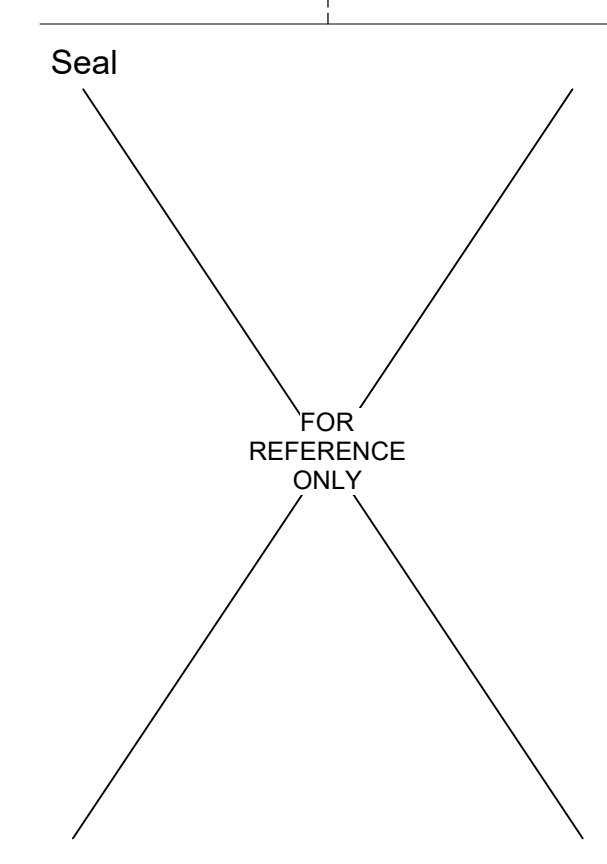
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DATE: 5/1/2024
DWG.#: 6771478
DRAWN BY: Joe.shilba
SCALE: 3/4" = 1'-0"
MASTER DRAWING

SHEET NO.
 1

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

Shake Shack-1403-Brick.NJ
 BRICK, NJ, 08723



Margaretta L. Terry,
 Architect

DP3 Architects, Ltd.
 15 South Main Street, Suite 400
 Greenville, SC 29601
 864.232.8200
 www.dp3architects.com

SHAKE SHACK
 SHAKE SHACK #1403
 BRICK, NJ

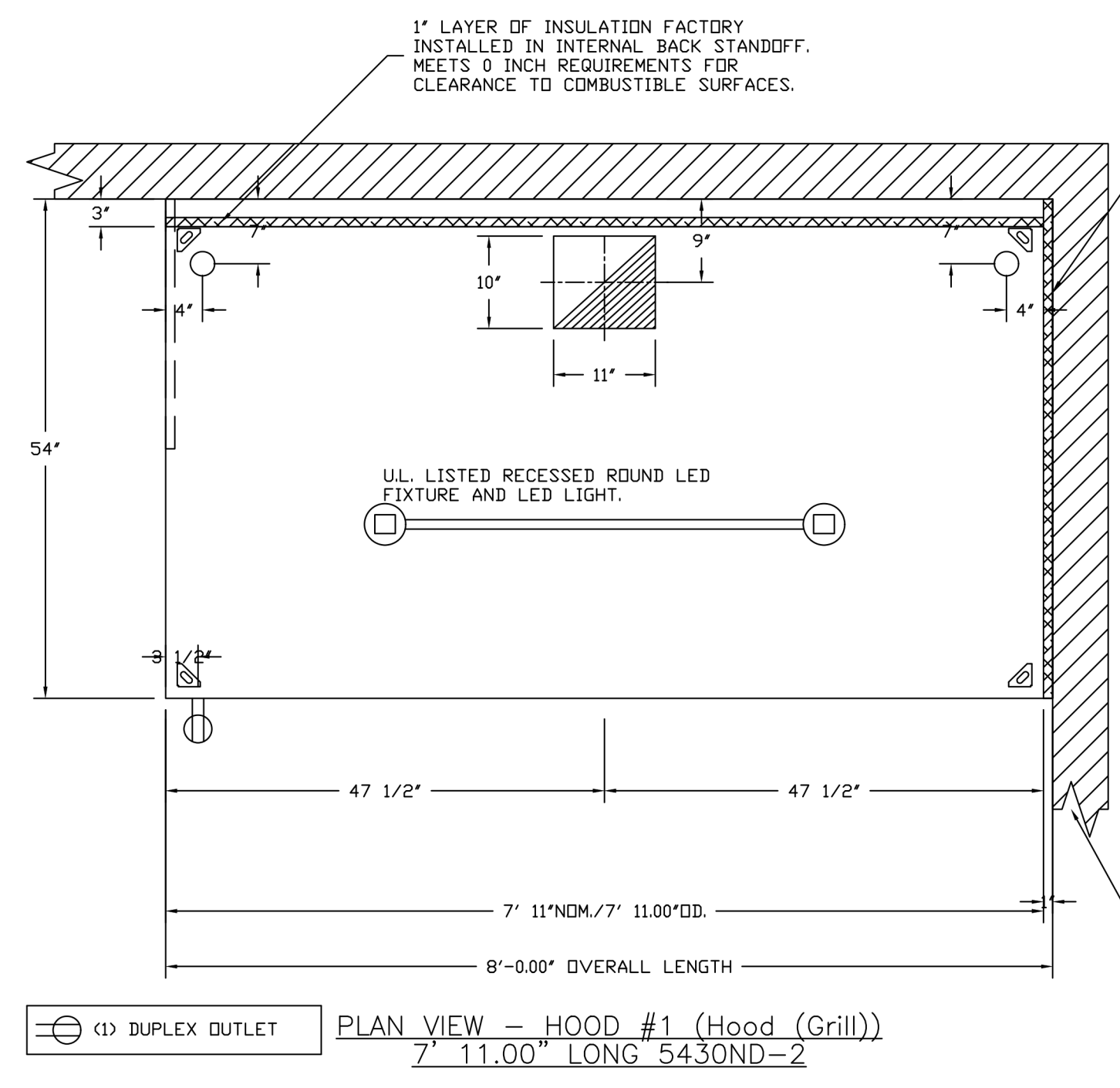
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 Drawn By Author
 Checked By Checker
 Date 20 JUNE 2024

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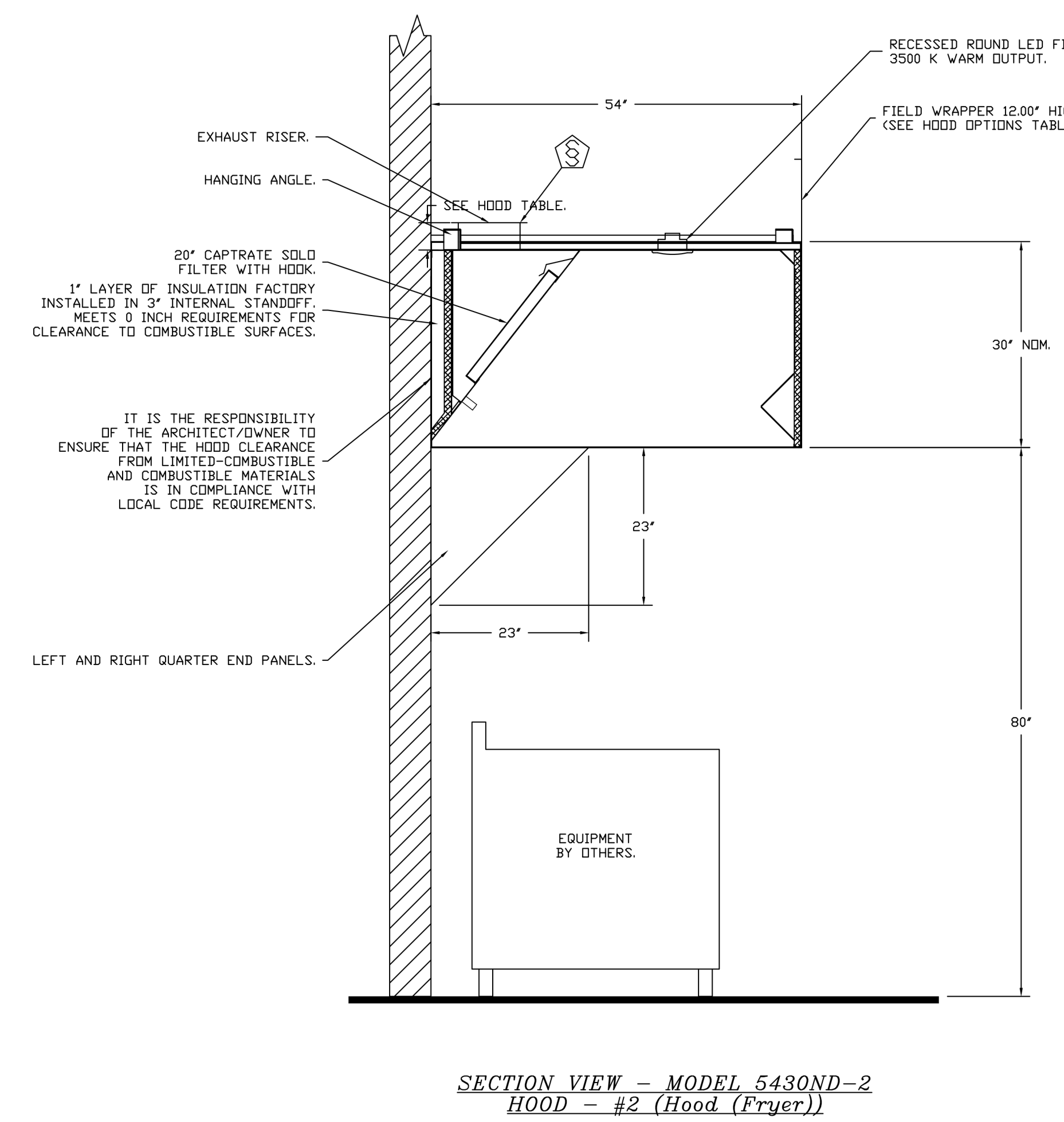
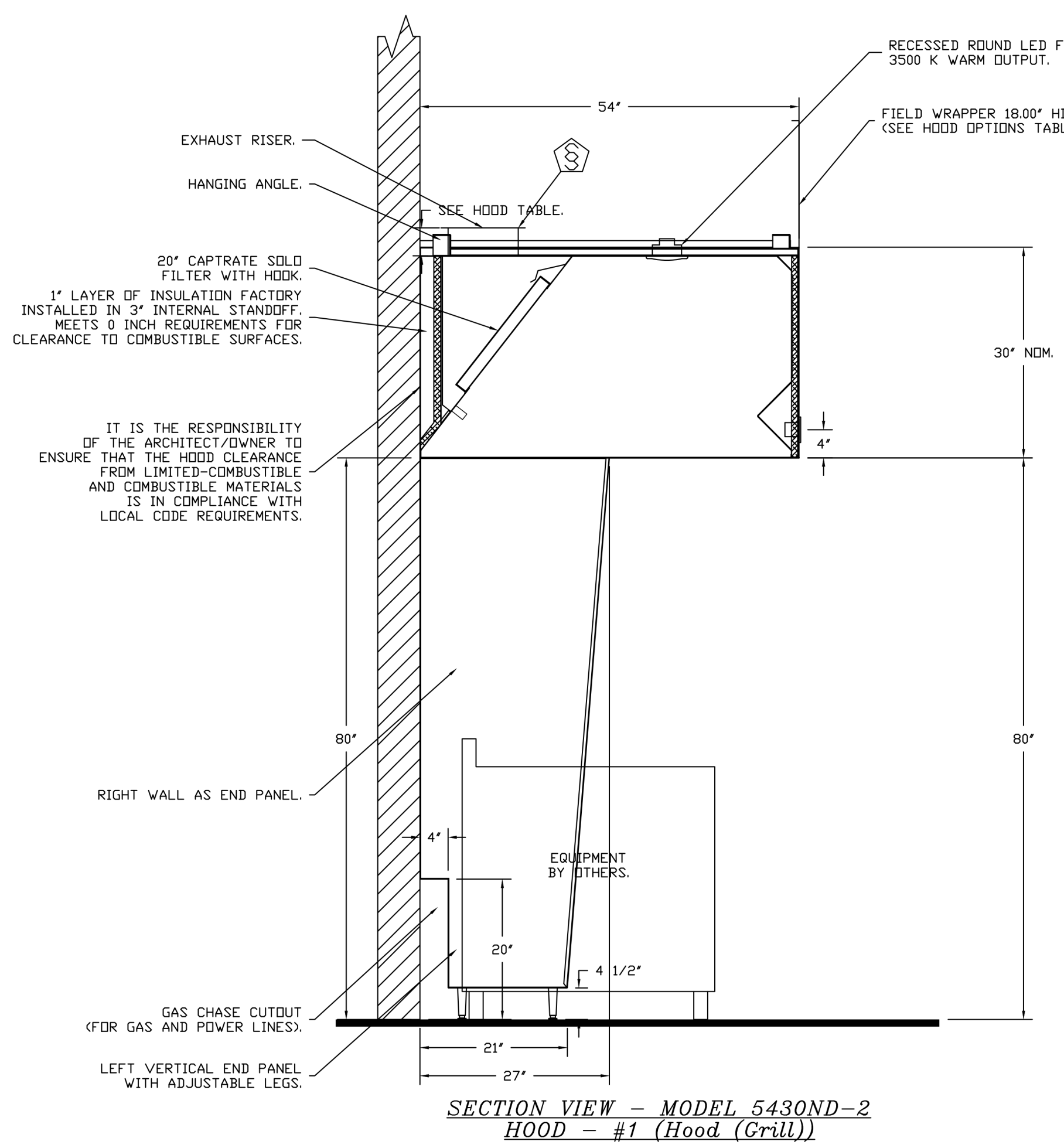
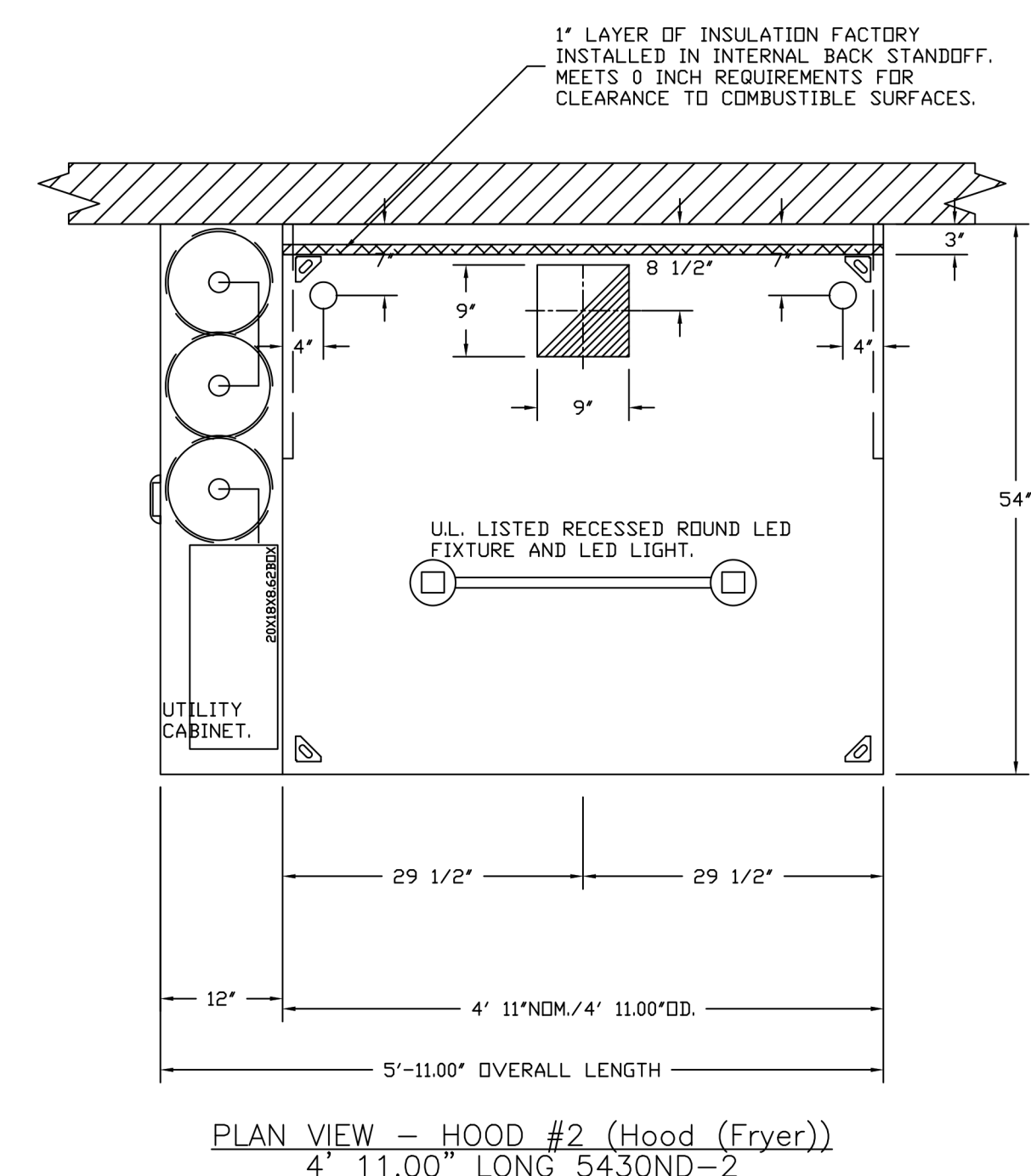
Drawing
CAPTIVEAIRE
DRAWINGS

M701

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

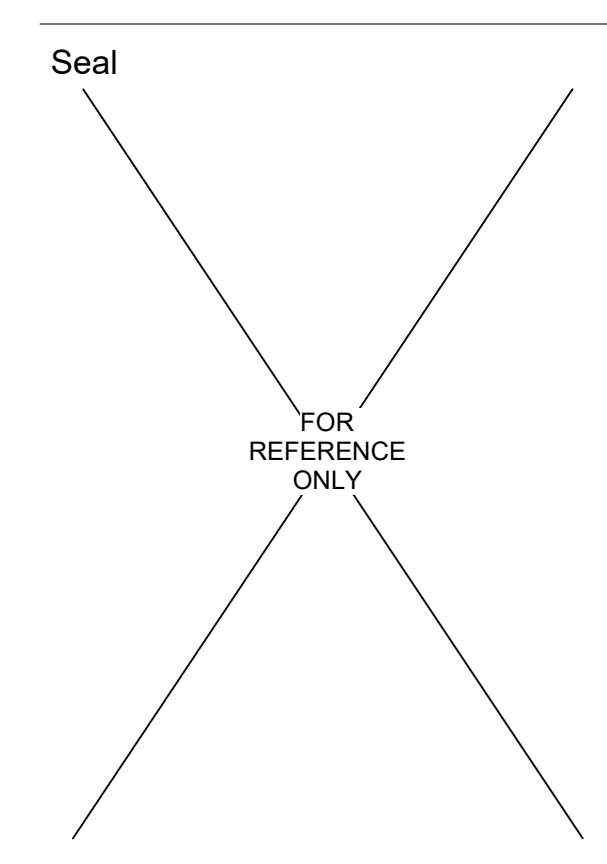


REVISIONS	
DESCRIPTION	DATE

CAPTIVEAIRE
Eastern PA Mechanical
www.captiveaire.com
PO Box 2520, 1 Union Ave., Bala Cynwyd, PA, 19004 PHONE: (267) 501-4125 EMAIL: reg.108@captiveaire.com

Shake Shack-1403-Brick,NJ
BRICK, NJ, 08723

DATE: 5/1/2024
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DRAWN BY: Joe.Shilka
SCALE: 3/4" = 1'-0"
MASTER DRAWING
SHEET NO. 2



Margaretta L. Terry,
Architect

DP3 Architects, Ltd.
15 South Main Street, Suite 400
Greenville, SC 29601
864.232.8200
www.DP3architects.com

Project

SHAKE SHACK
SHAKE SHACK #1403
BRICK, NJ

Project Number 24134
Drawn By Author
Checked By Checker
Date 20 JUNE 2024

Revisions
3 2024-06-20 PERMIT/BID SET
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FIRE SYSTEM INFORMATION - JOB#6771478

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

CAS VALVE(S)

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

NOTES

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

- APPLIANCE DIMENSIONS LISTED REPRESENT THE COOKING SURFACE SIZE, NOT THE OVERALL APPLIANCE SIZE.
- THIS FIRE SYSTEM COMPLIES WITH UL 300 REQUIREMENTS.

- DL-F NOZZLE PART NUMBER REPLACES 3070-3/8H-10-SS

JOB #: 6771478

JOB NAME: SHAKE SHACK-1403-BRICK,NJ.

SYSTEM SIZE: TANK-SP-3 DESIGN FP: 46, MAXIMUM FP: 60.

HOOD # 1 7' 11.00" LONG x 54" WIDE x 30" HIGH.

RISER # 1 SIZE: 10" x 11".

HOOD # 1 METAL BLOW-OFF CAPS INCLUDED.

HOOD # 2 4' 11.00" LONG x 54" WIDE x 30" HIGH.

RISER # 1 SIZE: 9" x 9".

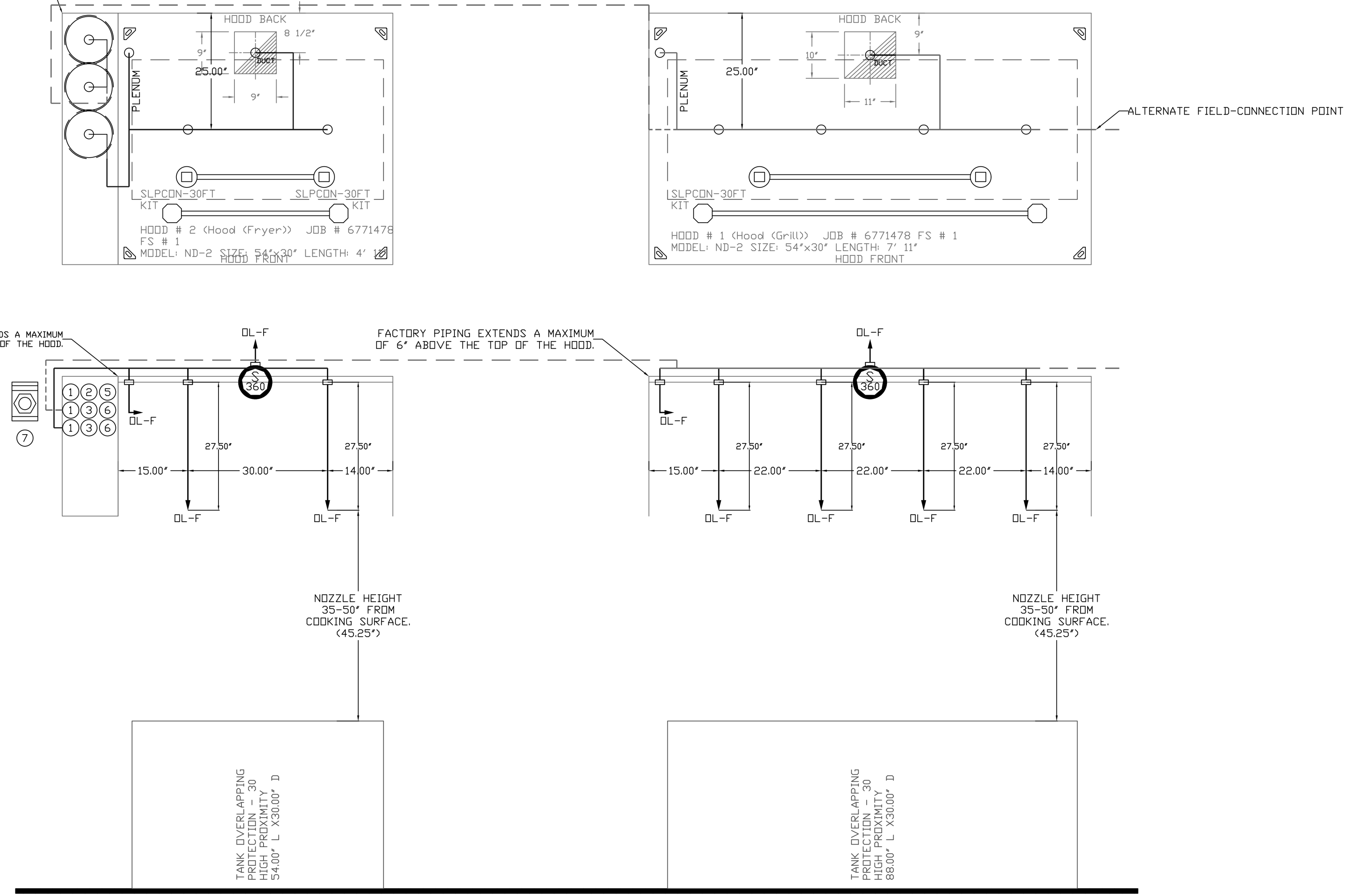
HOOD # 2 METAL BLOW-OFF CAPS INCLUDED.

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

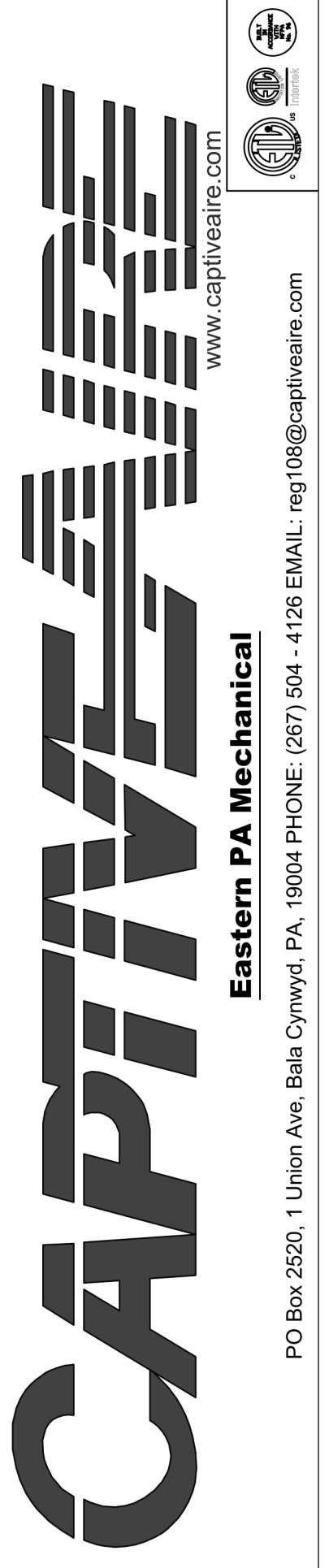
LEGEND - FIRE CABINET TANK SYSTEM

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

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



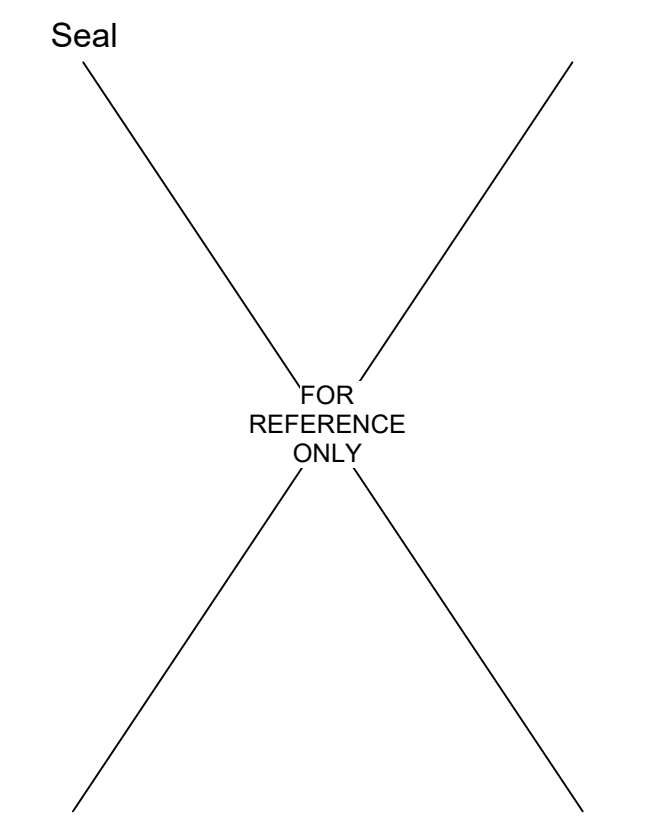
REVISIONS	
DESCRIPTION	DATE



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 2024-10-17 ISSUED FOR CONSTRUCTION

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EXHAUST FAN INFORMATION - JOB#6771478

FAN UNIT NO	TAG	QTY	FAN UNIT MODEL #	MANUFACTURER	CFM	ESP	RPM	MOTOR ENCL	HP	BHP	PHASE	VOLT	FLA	DISCHARGE VELOCITY	WEIGHT (LBS)	SDNES
1	KEF(GRILL)	1	DUBSHFA	CAPTIVEAIRE	1188	1500	1424	TEAD-ECM	0.750	0.4970	1	208	5.2	376 FPM	90	12.7
2	KEF(FRYER)	1	DUBSHFA	CAPTIVEAIRE	860	1500	1354	TEAD-ECM	0.750	0.4270	1	208	5.2	272 FPM	90	11.4

FAN OPTIONS

FAN UNIT NO	TAG	QTY	DESCRIPTION
1	KEF(GRILL)	1	GREASE BOX
		1	FAN BASE CERAMIC SEAL - DU/DR8SHFA - INSTALLED AT PLANT - FDR GREASE DUCTS
		1	ECM WIRING PACKAGE - EXHAUST - MODBUS CONTROL -MSC- (TELCD), CCW ROTATION
		1	2 YEAR PARTS WARRANTY
2	KEF(FRYER)	1	GREASE BOX
		1	ECM WIRING PACKAGE - EXHAUST - MODBUS CONTROL -MSC- (TELCD), CCW ROTATION
		1	FAN BASE CERAMIC SEAL - DU/DR8SHFA - INSTALLED AT PLANT - FDR GREASE DUCTS
		1	2 YEAR PARTS WARRANTY

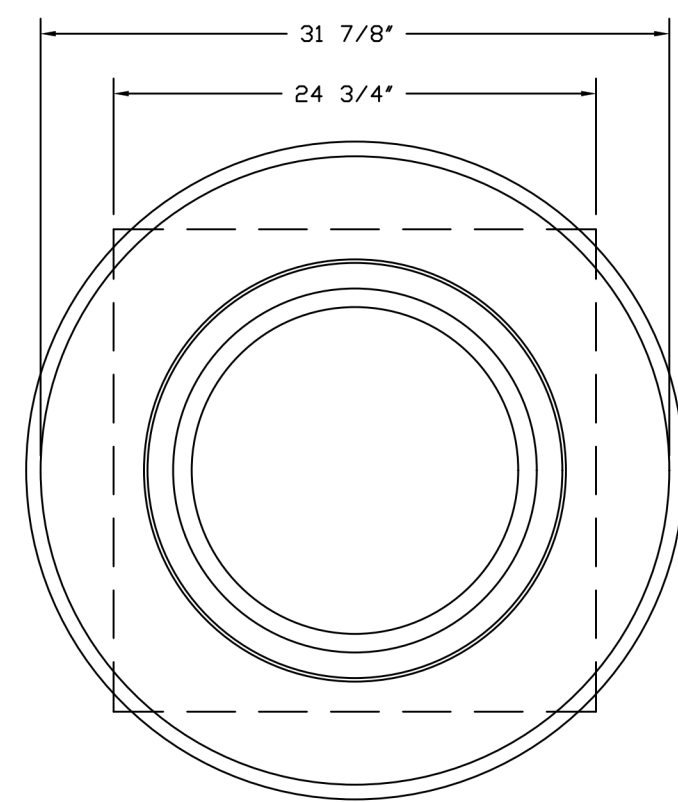
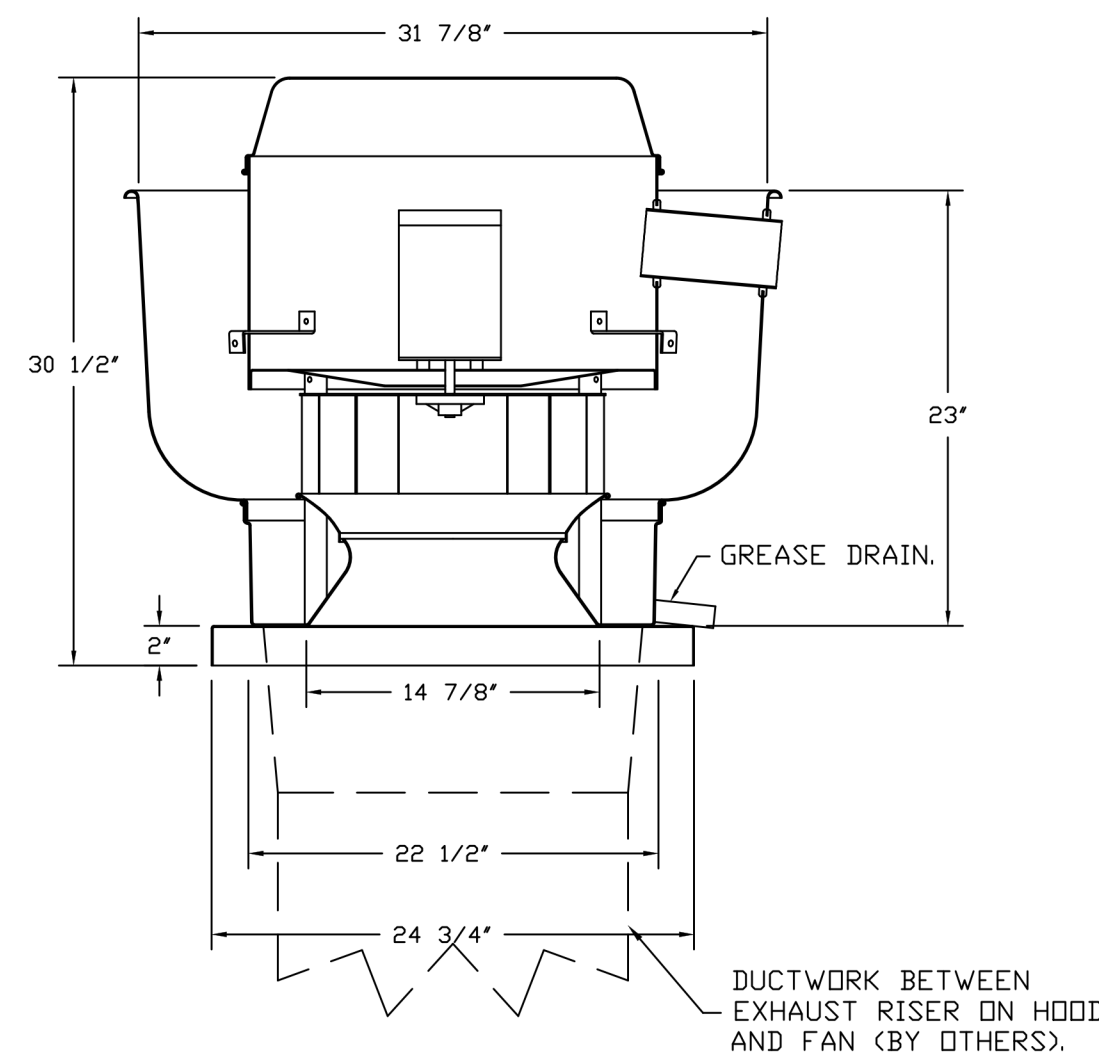
FAN ACCESSORIES

FAN UNIT NO	TAG	EXHAUST				SUPPLY			
		GREASE CUR	GRAVITY DAMPER	WALL MOUNT	SIDE DISCHARGE	GRAVITY DAMPER	MOTORIZED DAMPER	WALL MOUNT	
1	KEF(GRILL)	YES							
2	KEF(FRYER)	YES							

CURB ASSEMBLIES

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

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



TOP VIEW

FEATURES:

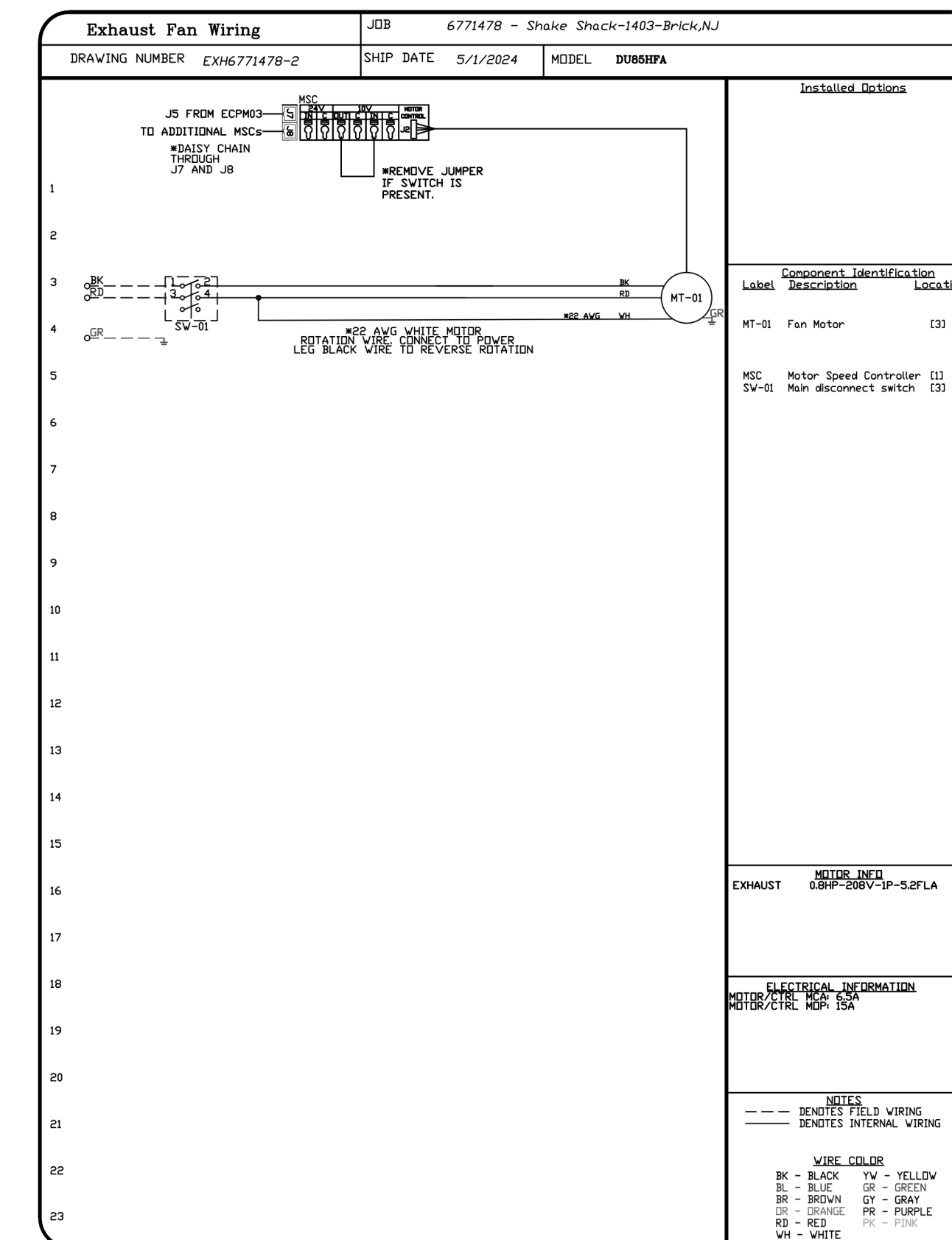
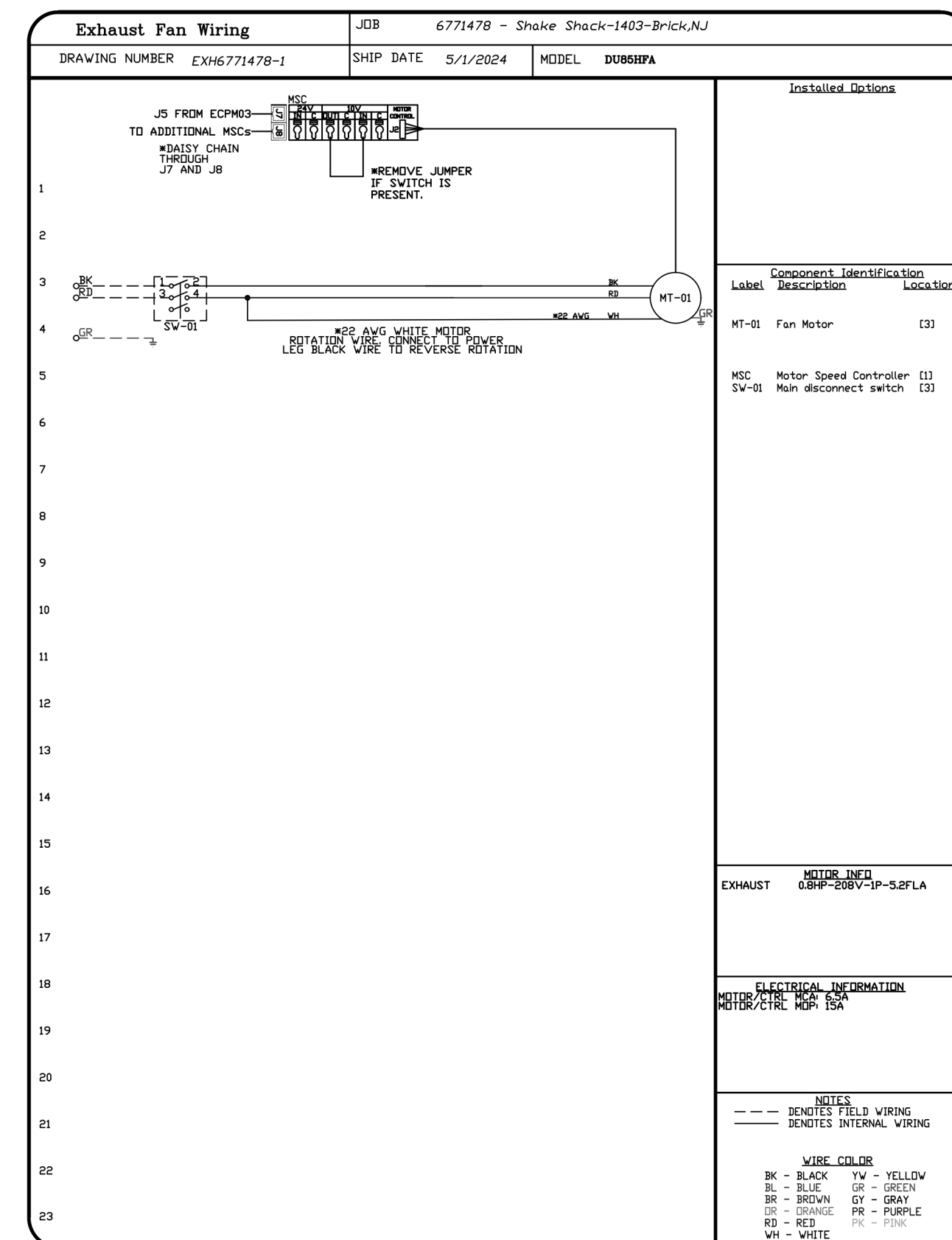
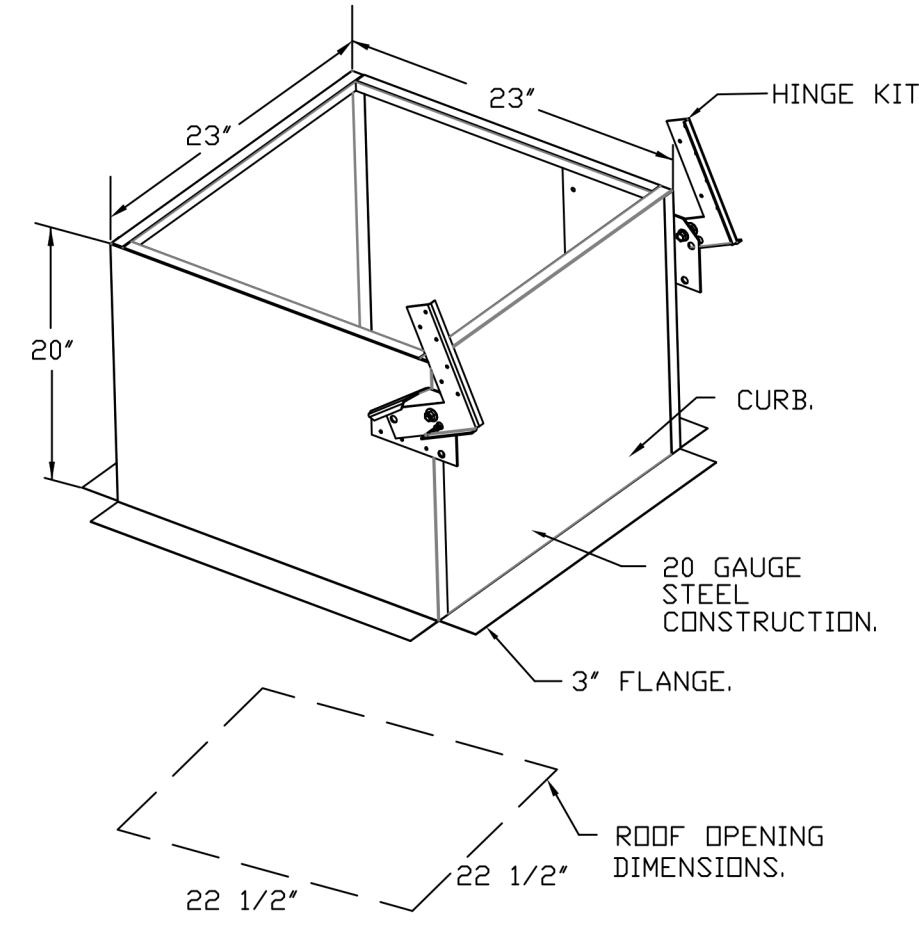
- DIRECT DRIVE CONSTRUCTION (NO BELTS/PULLEYS).
- ROOF MOUNTED FANS.
- RESTAURANT MODEL.
- UL705 AND UL762 AND ULC-S645
- VARIABLE SPEED CONTROL.
- INTERNAL WIRING.
- THERMAL OVERLOAD PROTECTION (SINGLE PHASE).
- HIGH HEAT OPERATION 300°F (149°C).
- GREASE CLASSIFICATION TESTING.
- NEMA 3R SAFETY DISCONNECT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

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

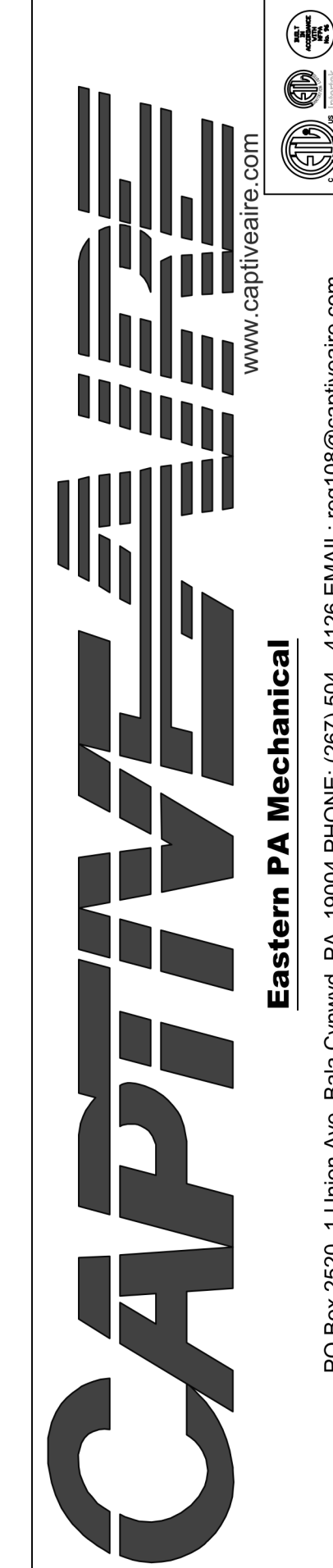
ABNORMAL FLARE-UP TEST
EXHAUST FAN MUST OPERATE CONTINUOUSLY WHILE EXHAUSTING BURNING GREASE VAPORS AT 600°F (316°C) FOR A PERIOD OF 15 MINUTES WITHOUT THE FAN BECOMING DAMAGED TO ANY EXTENT THAT COULD CAUSE AN UNSAFE CONDITION.

OPTIONS

- GREASE BOX.
- FAN BASE CERAMIC SEAL - DU/DR8SHFA
- INSTALLED AT PLANT - FDR GREASE DUCTS.
- ECM WIRING PACKAGE - EXHAUST - MODBUS CONTROL -MSC- (TELCD), CCW ROTATION.
- 2 YEAR PARTS WARRANTY.



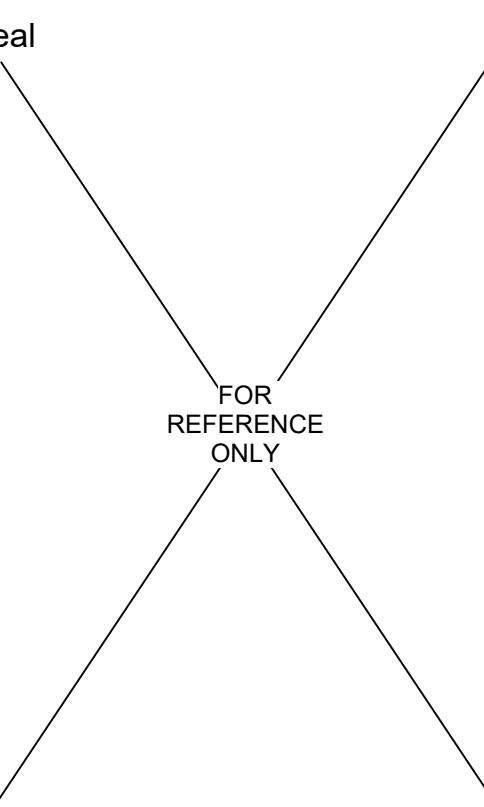
REVISIONS	
DESCRIPTION	DATE



Shake Shack-1403-Brick,NJ
BRICK, NJ, 08723

DATE: 5/1/2024
DWG.#: 6771478
DRAWN BY: Joe.Shibo

SCALE: 3/4" = 1'-0"
MASTER DRAWING
SHEET NO. 4



Margaretta L. Terry,
Architect

DP3 Architects, Ltd.
15 South Main Street, Suite 400
Greenville, SC 29601
864.232.8200
www.dp3architects.com

Project

SHAKE SHACK®
SHAKE SHACK #1403
BRICK, NJ

Project Number 24134
Drawn By Author
Checked By Checker
Date 20 JUNE 2024

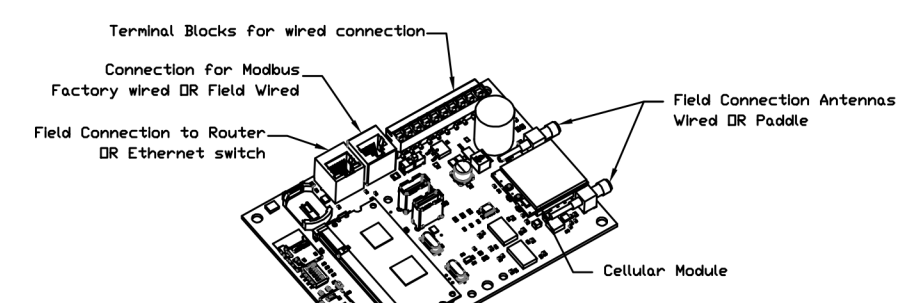
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ELECTRICAL PACKAGE - JOB#6771478												
NO	TAG	PACKAGE #	LOCATION	SWITCHES	OPTION	FANS CONTROLLED						
				LOCATION UTILITY CABINET LEFT	QUANTITY		FAN TAG	TYPE	HP	VOLTS	FLA	
1		SC-320110MA	UTILITY CABINET LEFT	HOOD # 2	1 LIGHT 1 FAN	SMART CONTROLS THERMOSTATIC CONTROL W/ RELAY ON/OFF WITH SUPPLY	KEFG#RH	EXHAUST	1	0.750	208	5.2
							KEFG#Fryer	EXHAUST	1	0.750	208	5.2

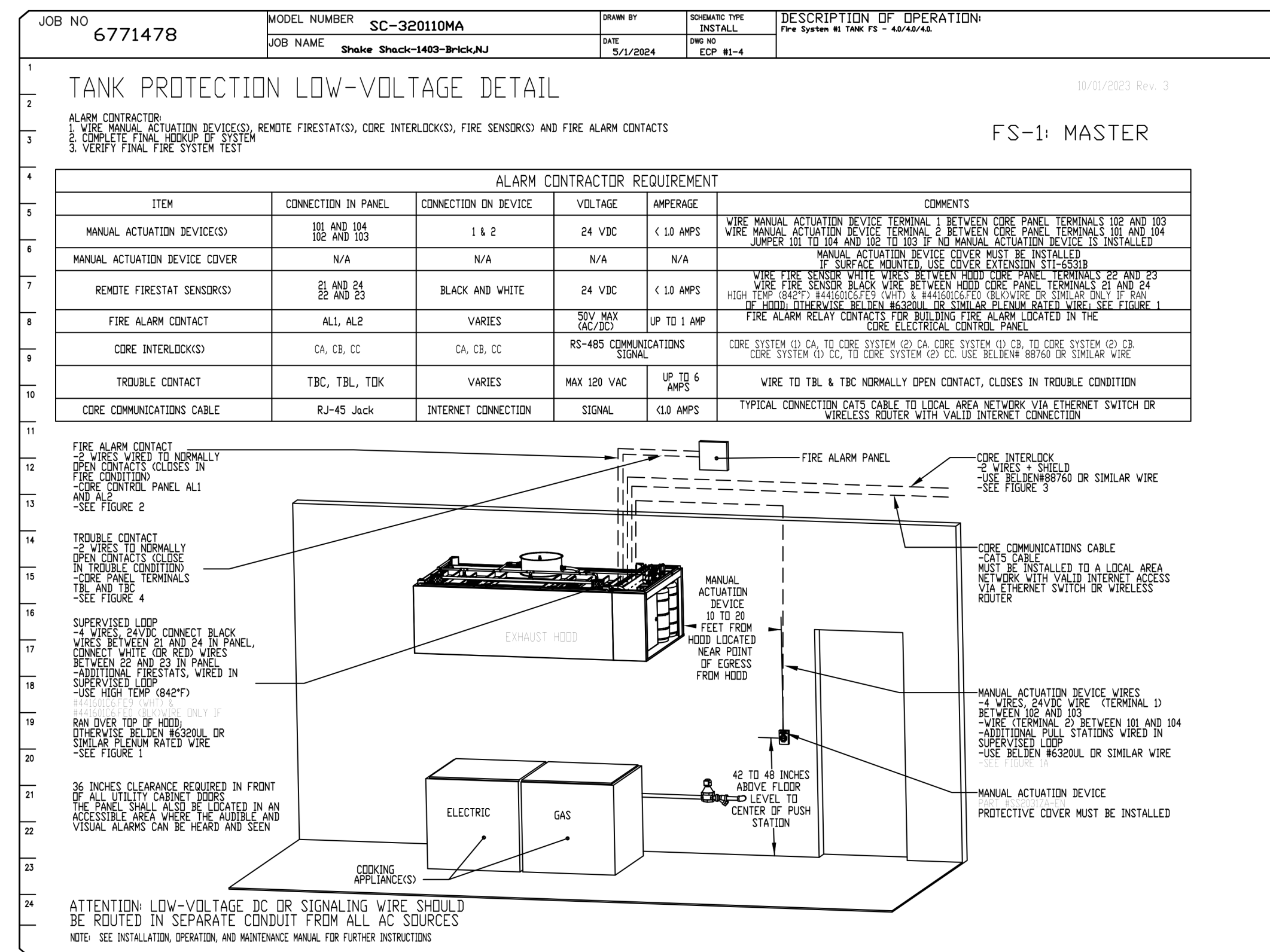
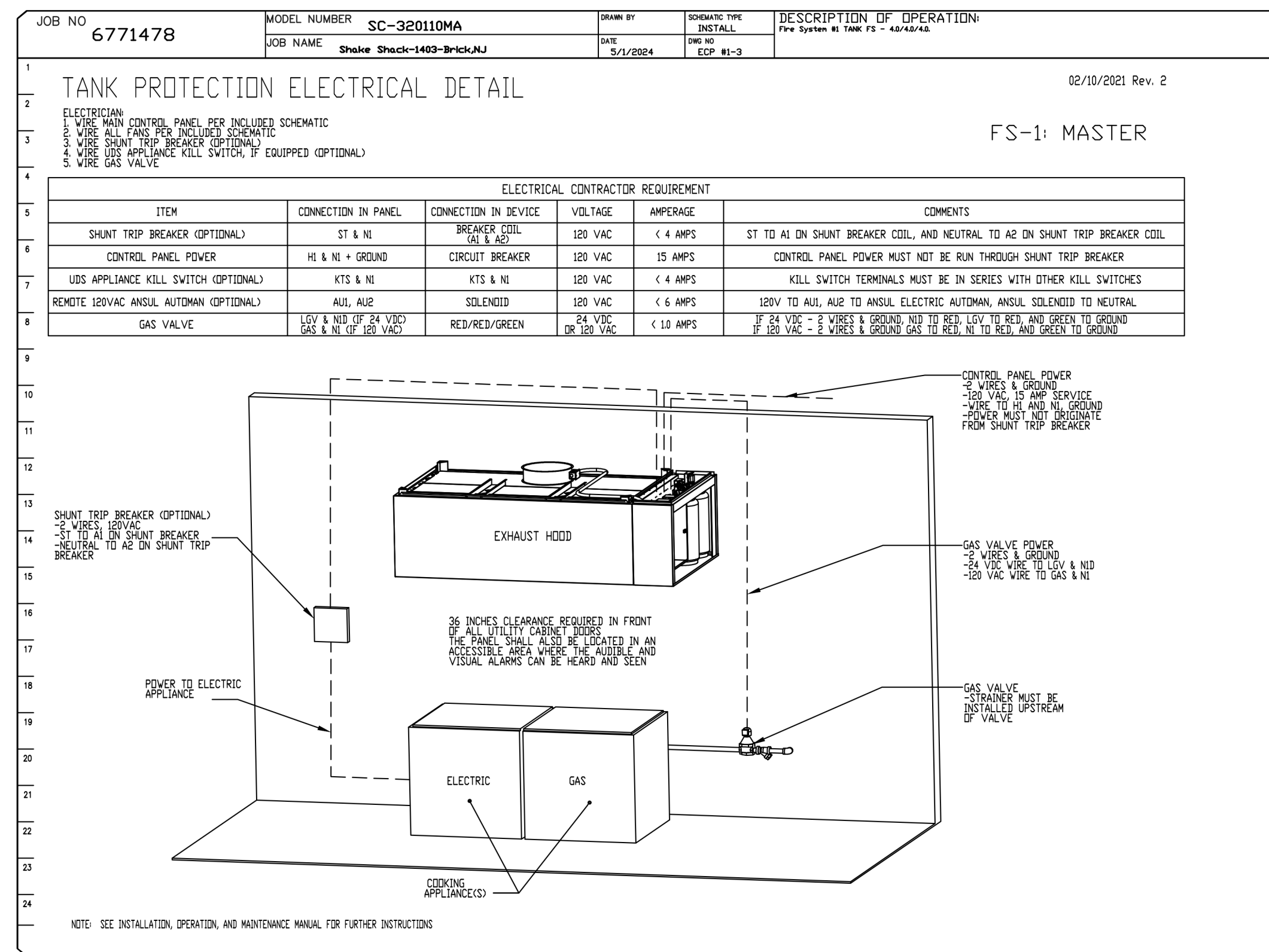
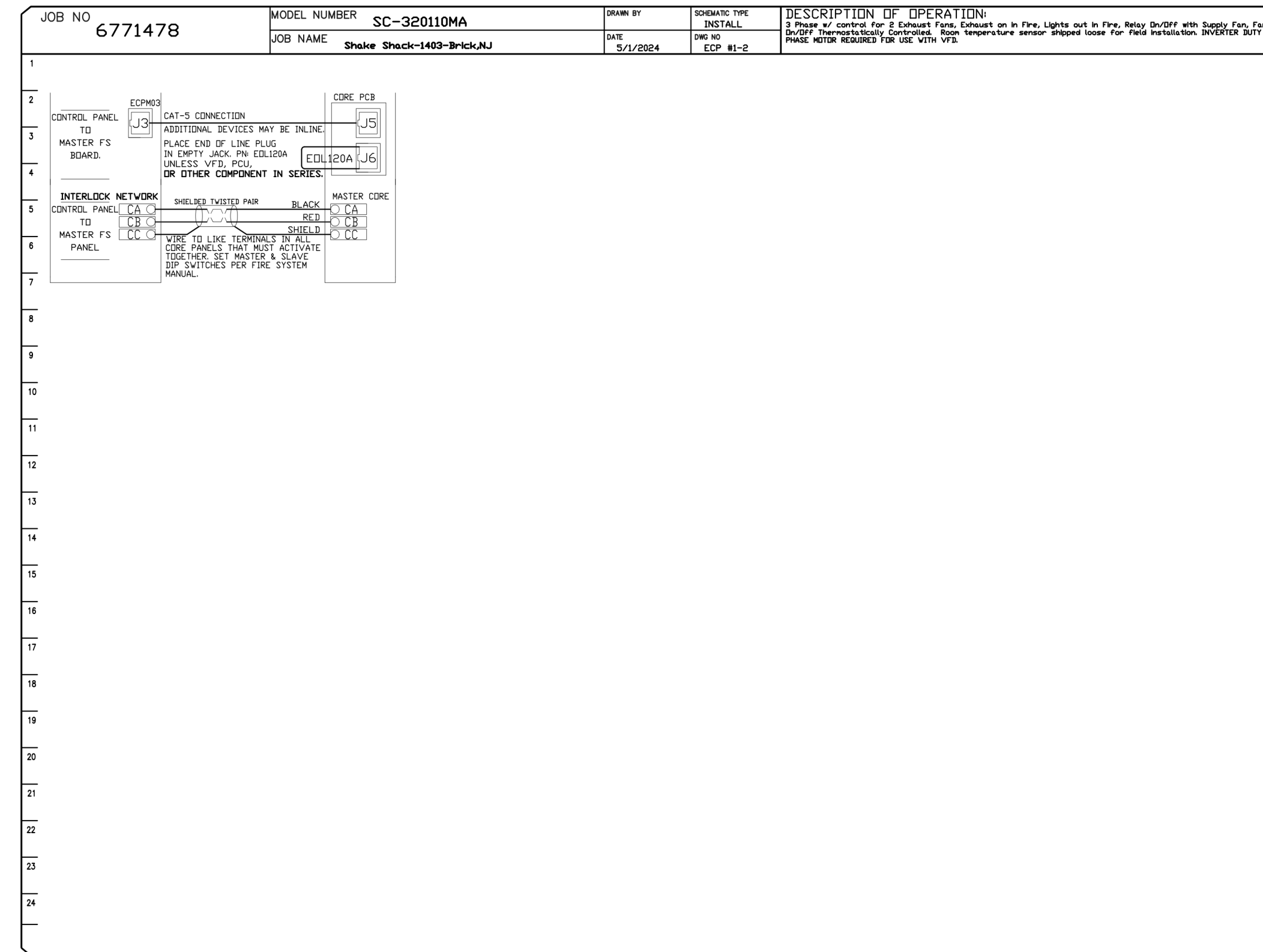
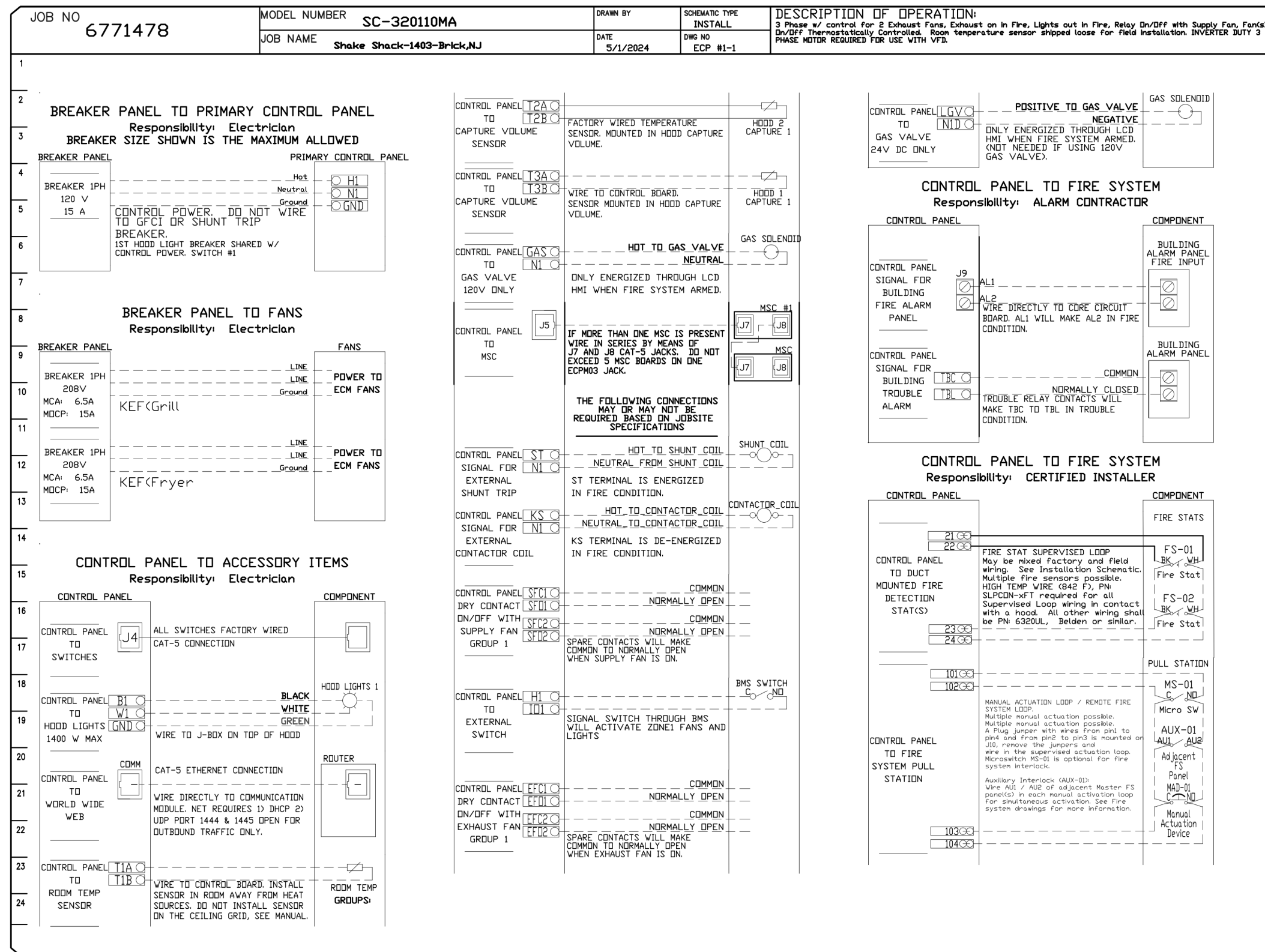


CASlink Monitor and Control

- Hood control panel to support communications to cloud-based Building Management System.
- Hood Control Panel to allow cloud-based Building Management System to monitor real time parameters outboard or MONITOR on the points list.
- Hood Control Panel to allow cloud-based Building Management System to control parameters outboard or CONTROL on the points list.
- Hood 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
Return Discharge Temperature	MONITOR	Return Discharge Temperature	MONITOR
Return RTD Discharge Temperature	MONITOR	Return RTD Discharge Temperature	MONITOR
Fan Speed	MONITOR	Controller Faults	MONITOR
Fan Amperage	MONITOR	Fan Status	MONITOR
Fan Power	MONITOR	LED Faults	MONITOR
Controller Faults	MONITOR	DCV Filter Clip Percentage	MONITOR
Fan Faults	MONITOR	Fan Condition	MONITOR
Fan Status	MONITOR	COSE Fire System	MONITOR
LED Faults	MONITOR	Building Pressure	MONITOR
DCV Filter Clip Percentage	MONITOR	DCV Filter Clip Percentage	MONITOR & CONTROL
Fan Condition	MONITOR	Light(s) Button(s)	MONITOR & CONTROL
COSE Fire System	MONITOR	Flash Button	MONITOR & CONTROL
Building Pressure	MONITOR & CONTROL		
Prep Time Button	MONITOR & CONTROL		
Flash Button	MONITOR & CONTROL		
Flash Button	MONITOR & CONTROL		



REVISIONS	
DESCRIPTION	DATE

Seal

FOR REFERENCE ONLY

Margaretta L. Terry, Architect

DP3 Architects, Ltd.
15 South Main Street, Suite 400
Greenville, SC 29601
864.232.8200
www.dp3architects.com

Project

SHAKE SHACK®
SHAKE SHACK #1403
BRICK, NJ

Project Number: 24134
Drawn By: Author
Checked By: Checker
Date: 20 JUNE 2024

Revisions

2024-06-20	PERMIT/BID SET
2024-10-17	ISSUED FOR CONSTRUCTION

DATE: 5/1/2024

DWG.#: 6771478

DRAWN BY: Joe Shiloo

SCALE: 3/4" = 1'-0"

MASTER DRAWING

SHEET NO. 5

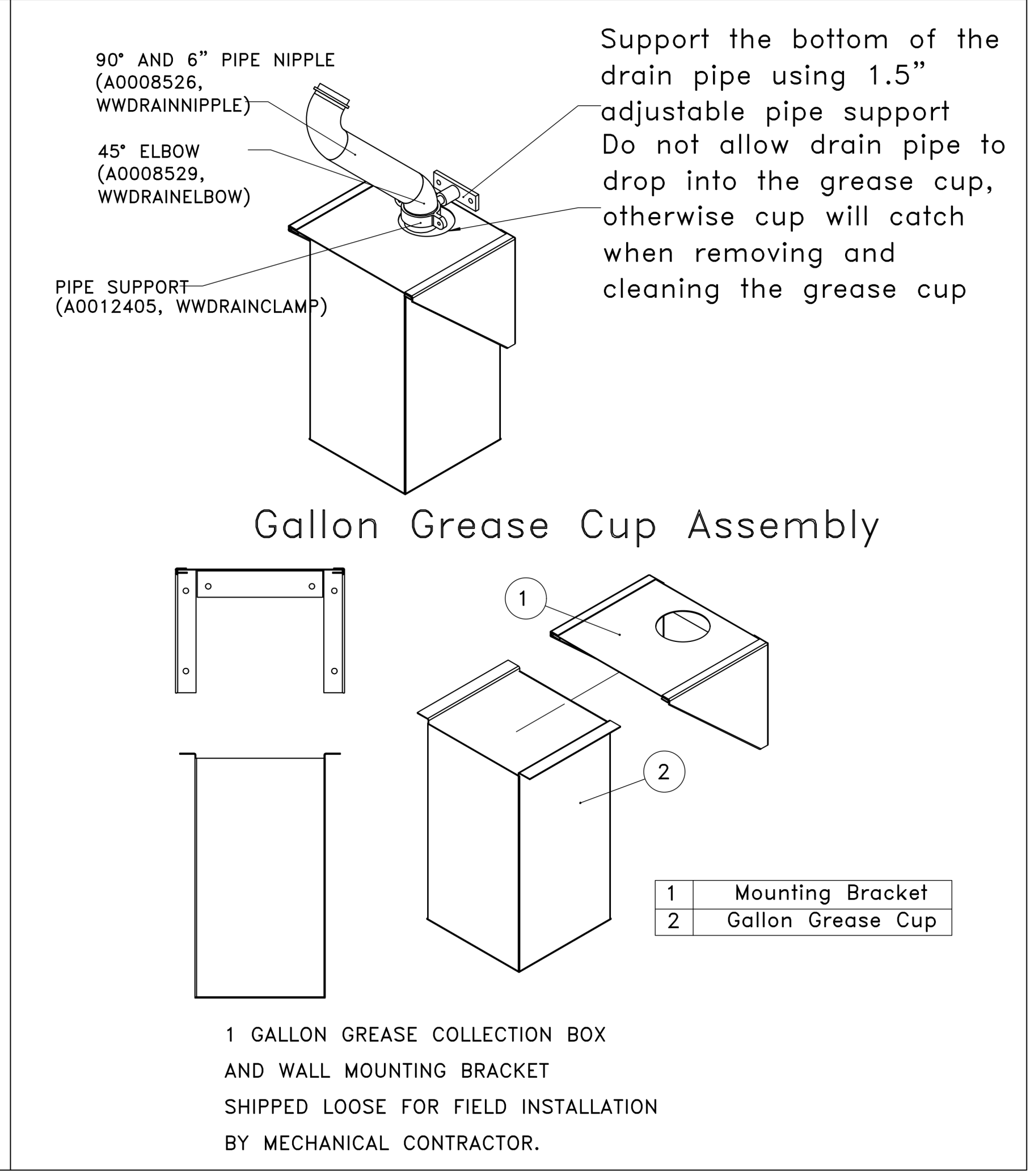
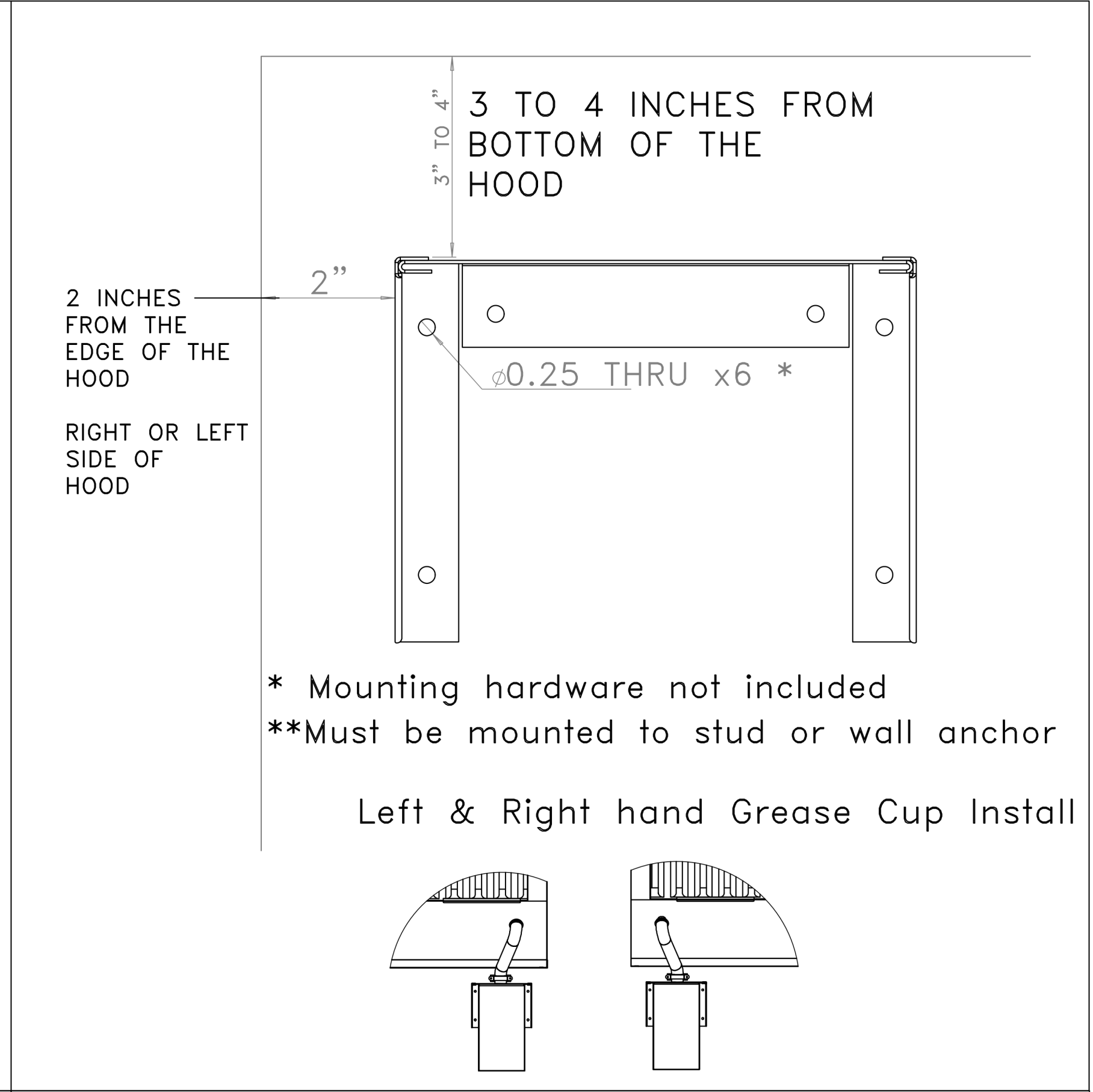
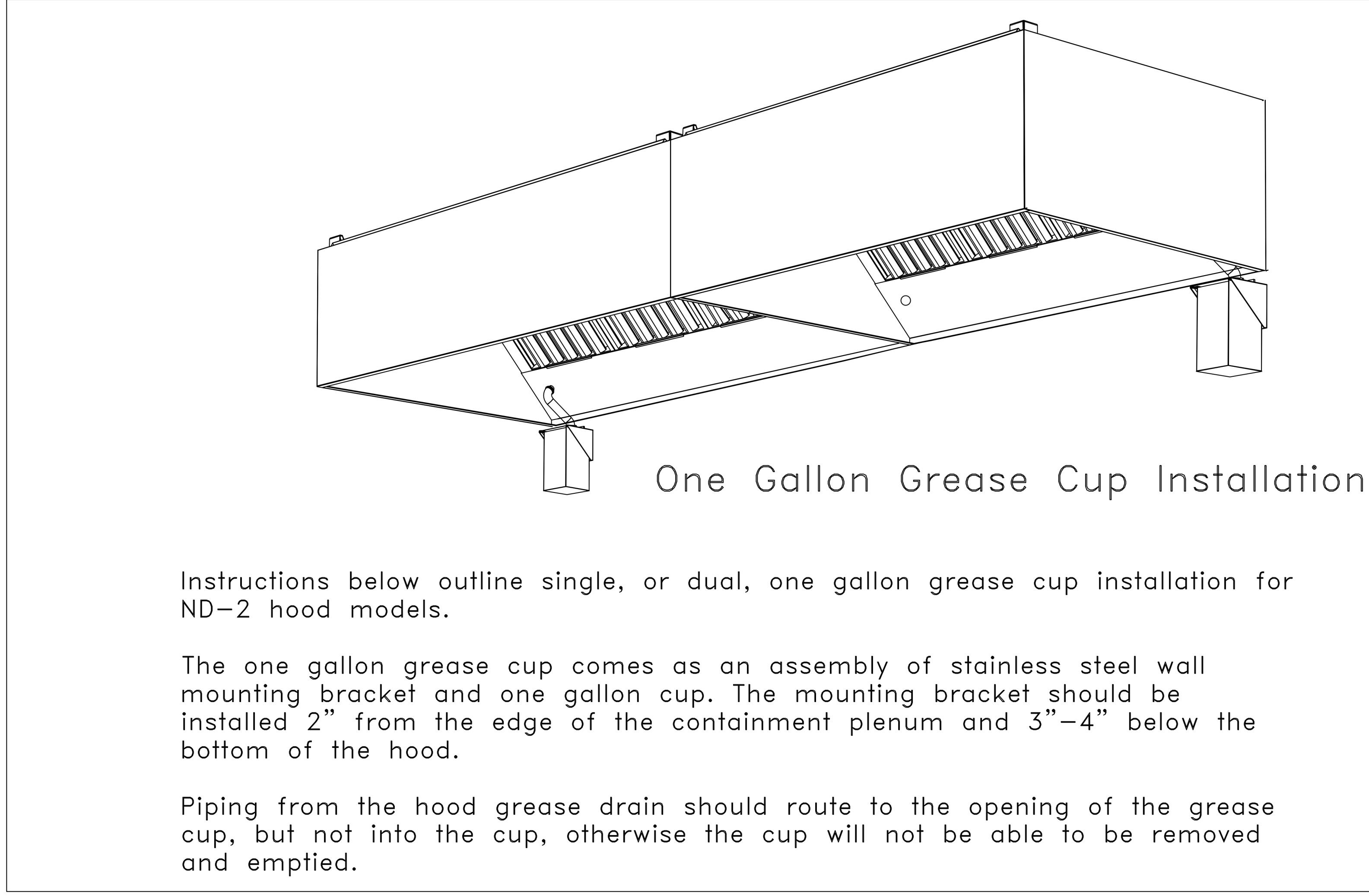
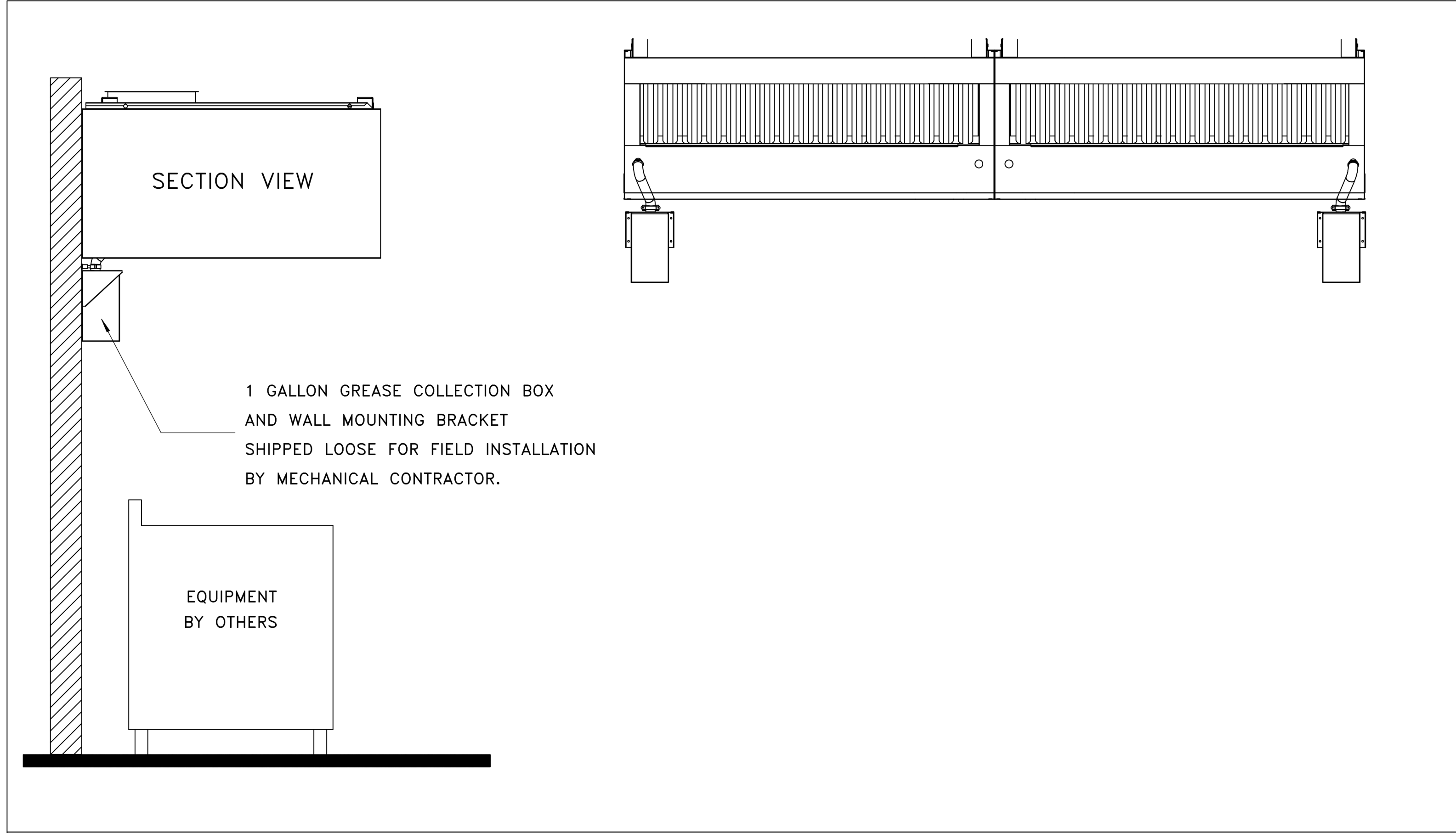
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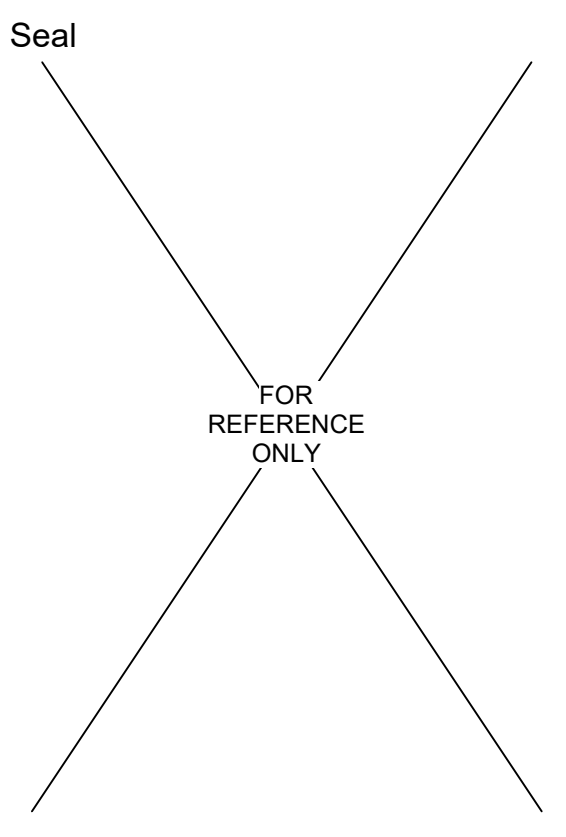
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CAPTIVEAIRE
 Eastern PA Mechanical
 www.captiveaire.com
 PO Box 2520, 1 Union Ave, Balla Cynwyd, PA, 19004 PHONE: (267) 504-4128 EMAIL: reg1@captivair.com

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DRAWN BY: Joe.shiloo
SCALE: 3/4" = 1'-0"
MASTER DRAWING

SHEET NO.
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