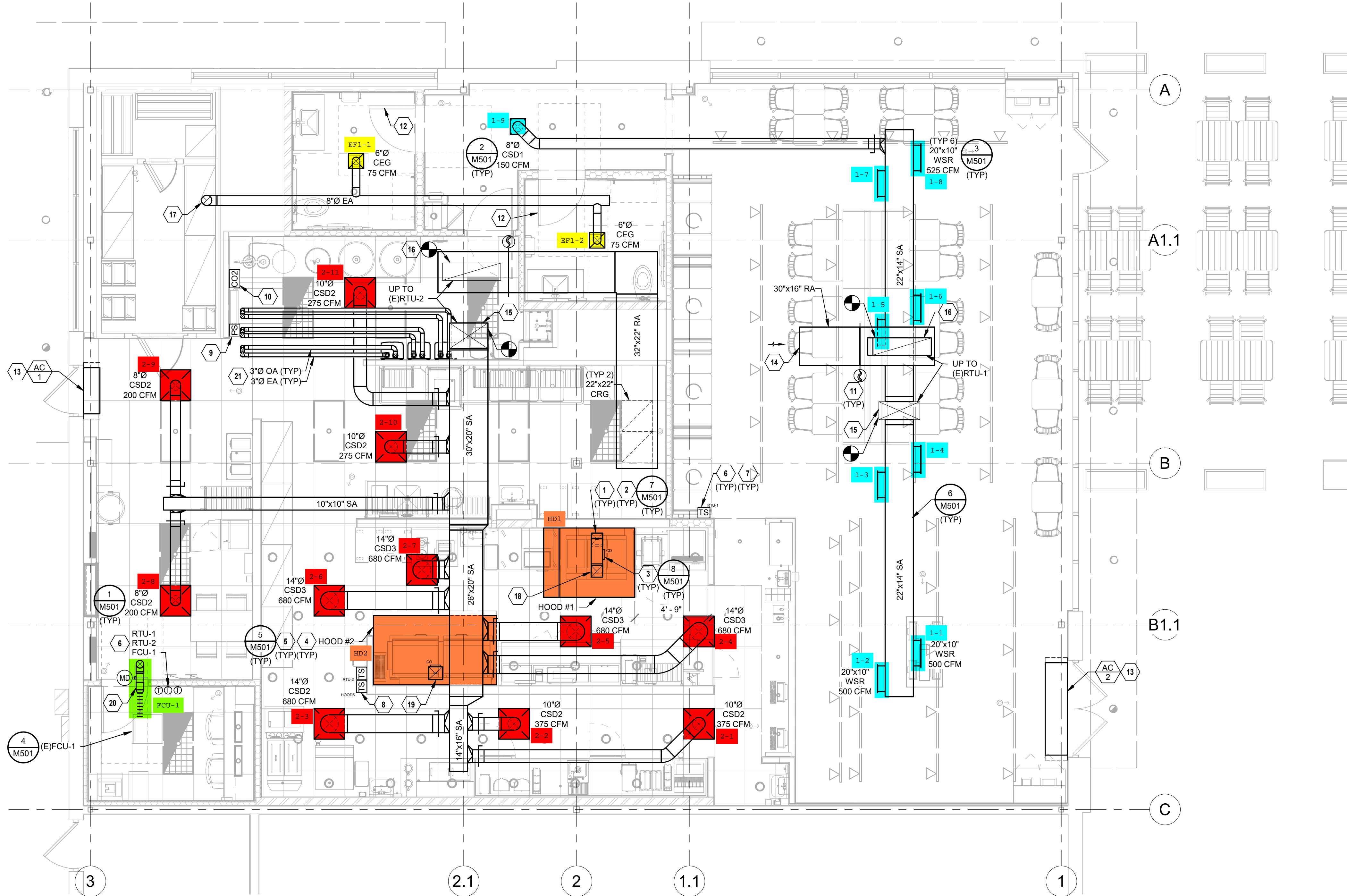


MECHANICAL GENERAL NOTES:

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

MECHANICAL PLAN NOTES:

- TYPE I GREASE HOOD EXHAUST DUCTWORK SHALL BE MINIMUM 16 GAUGE STEEL OR MINIMUM 18 GAUGE STAINLESS STEEL WITH LIQUID TIGHT WELDS.
- INSTALL ACCESS PANELS FOR CLEANING AS REQUIRED BY NFPA 96 AND LOCAL CODES. TRANSITION GREASE DUCTWORK AS REQUIRED TO HOOD AND FAN CONNECTIONS. PROVIDE 45° MAX OFFSETS AS REQUIRED TO COORDINATE WITH STRUCTURE. PROVIDE RADIUS ELBOWS WITHOUT TURNING VANES. SLOPE HORIZONTAL GREASE DUCT BACK TOWARDS HOOD AT MINIMUM OF 1/4" PER LINEAL FOOT. GREASE DUCTS SHALL BE CONTAINED IN A UL APPROVED GREASE DUCT WRAP SYSTEM.
- INSTALL "DUCTMATE ULTIMATE DOOR" ON DUCTS 12" OR LARGER AND INSTALL "DUCTMATE F2 SANDWICH ACCESS DOOR" FOR DUCTS LESS THAN 12" ON GREASE DUCT FOR CLEANING IN LOCATION SHOWN AT A MINIMUM AND AS REQUIRED BY NFPA 96 AND LOCAL CODES.
- TYPE I HOODS SHALL BE FURNISHED COMPLETE WITH INTERNALLY PIPED FIRE SUPPRESSION SYSTEM AND EXTERNAL FOAM SUPPLY BOTTLES WITH REMOTE PULL CONTROLS AND IN COMPLIANCE WITH NFPA 96, DIVISION 23 SHALL COORDINATE COMPLETE INSTALLATION WITH FIRE PROTECTION CONTRACTOR TO MEET APPROVAL OF LOCAL INSPECTOR AND CODE COMPLIANCE INCLUDING TESTING.
- HOOD SHALL OVERHANG THE COOKING SURFACE BY AT LEAST 6" ON BOTH SIDES.
- MOUNT THERMOSTATS, HUMIDITY SENSORS, AND TEMPERATURE SENSOR(S) ON WALL. THERMOSTATS AND SENSOR(S) SHALL BE LABELED TO MATCH THE UNIT TAG AND CORRESPOND TO THE ELECTRICAL LEGEND IN THE ELECTRICAL PANELBOARD SERVING THE EQUIPMENT. COORDINATE COLOR WITH ARCHITECT.
- COMBINATION TEMPERATURE SENSOR AND HUMIDITY SENSOR.
- MOUNT TEMPERATURE SENSOR PROVIDED WITH KITCHEN EXHAUST HOODS ON WALL.
- INSTALL HOOD FIRE SUPPRESSION MANUAL PULL STATION. COORDINATE EXACT LOCATION AND REQUIREMENTS WITH FIRE SUPPRESSION SYSTEM INSTALLER AND THE AUTHORITY HAVING JURISDICTION.
- CARBON DIOXIDE SENSOR WITH REMOTE ALARM REPEATER FURNISHED BY OWNERS 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
- INSTALL DUCT SMOKE DETECTOR IN RETURN AIR PLENUM.
- CONTRACTOR TO COORDINATE 1" UNDERCUT ON DOOR FOR EXHAUST AIR PATH.
- AIR CURTAIN MOUNTED ABOVE DOOR. INSTALL PER MANUFACTURER'S RECOMMENDATIONS.
- 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 SA DUCT THROUGH ROOF. FULL SIZE OF UNIT OPENING, AND CONNECT TO UNIT WITH FLEXIBLE CONNECTOR. TRANSITION 45 DEGREES THROUGH ROOF CURB.
- PROVIDE RA DUCT THROUGH ROOF. FULL SIZE OF UNIT OPENING, AND CONNECT TO UNIT WITH FLEXIBLE CONNECTOR. TRANSITION 45 DEGREES THROUGH ROOF CURB.
- PROVIDE EA DUCT THROUGH ROOF. FULL SIZE OF UNIT OPENING, AND CONNECT TO UNIT WITH FLEXIBLE CONNECTOR. TRANSITION 45 DEGREES THROUGH ROOF CURB.
- 9"X9" GREASE EXHAUST DUCT UP TO KEF-1 ON ROOF.
- 11"X10" GREASE EXHAUST DUCT UP TO KEF-2 ON ROOF.
- TRANSITION 8" OUTDOOR AIR DUCT TO 4" FLEXIBLE DUCTWORK AND CONNECT TO UNIT.
- PROVIDE COMBUSTION AIR AND EXHAUST PIPE AND ROUTE TO CONCENTRIC VENT THROUGH ROOF.



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

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

ENVIROMATIC
DON PFLEGERER
1.800.325.6476
inspections@enviromatic.com

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

CONTACT:
WILL TURNBOUGH
will@natonaltab.com
855-682-6822 ext704

Bergmeyer

800 South Figueroa St.
Los Angeles, CA 90017
213.337.1090

875 N High St.
Columbus, OH 43215
380.900.8887

Shepley St.
Boston, MA 02210
617.542.1025

CONSULTANTS:

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

SEAL SIGNATURE:



08/30/2024

HEI 2024-09-03 PERMIT / BID SET
NO. BY DATE DESCRIPTION

SHAKE SHACK

SHAKE SHACK SHORT PUMP

12170 W BROAD ST
RICHMOND, VA 23233
SHACK #1547

PERMIT / BID SET

MECHANICAL FLOOR PLAN

DRAWN BY: Author

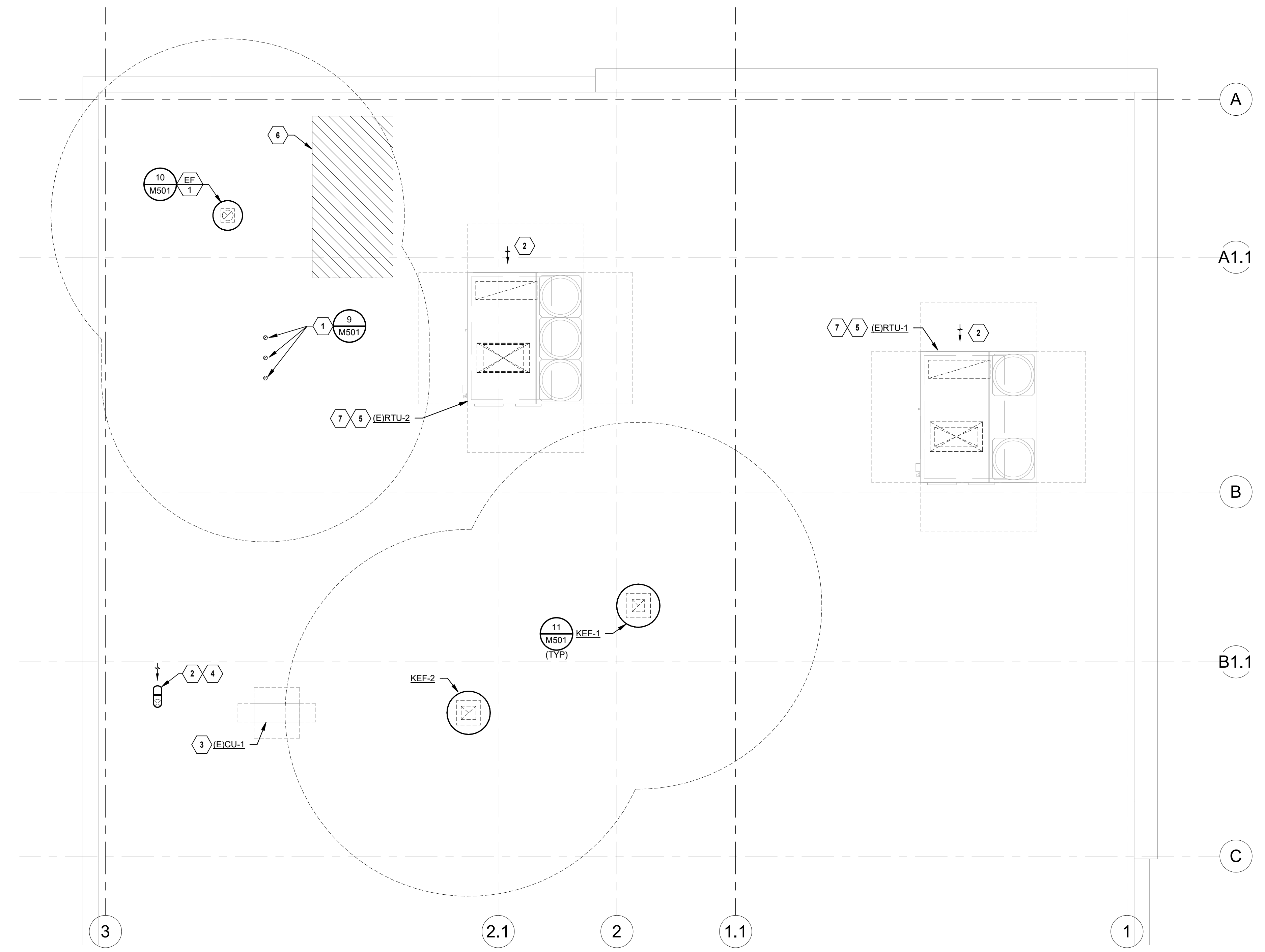
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JOB NO: 20240154.00

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MECHANICAL PLAN NOTES:

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



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

Bergmeyer

800 South Figueroa St.
Los Angeles, CA 90017
310.337.1090
www.bergmeyer.com

CONSULTANTS:

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

SEAL SIGNATURE:

BRIAN S. SANDER
Lic. No. 0402065007
PROFESSIONAL ENGINEER

08/30/2024

NO.	BY	DATE	DESCRIPTION
HEI	2024-09-03	PERMIT / BID SET	

SHAKE SHACK

SHAKE SHACK SHORT PUMP

12170 W BROAD ST
RICHMOND, VA 23233
SHACK #1547

PERMIT / BID SET

MECHANICAL ROOF PLAN

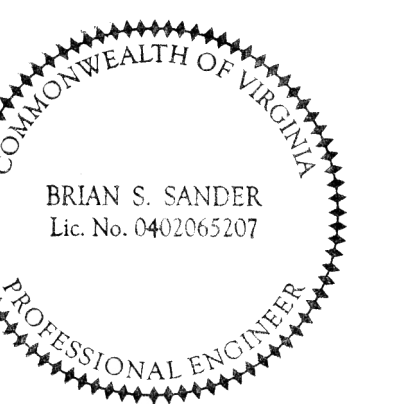
DRAWN BY: Author
CHECKED BY: Checker
JOB NO: 20240154.00

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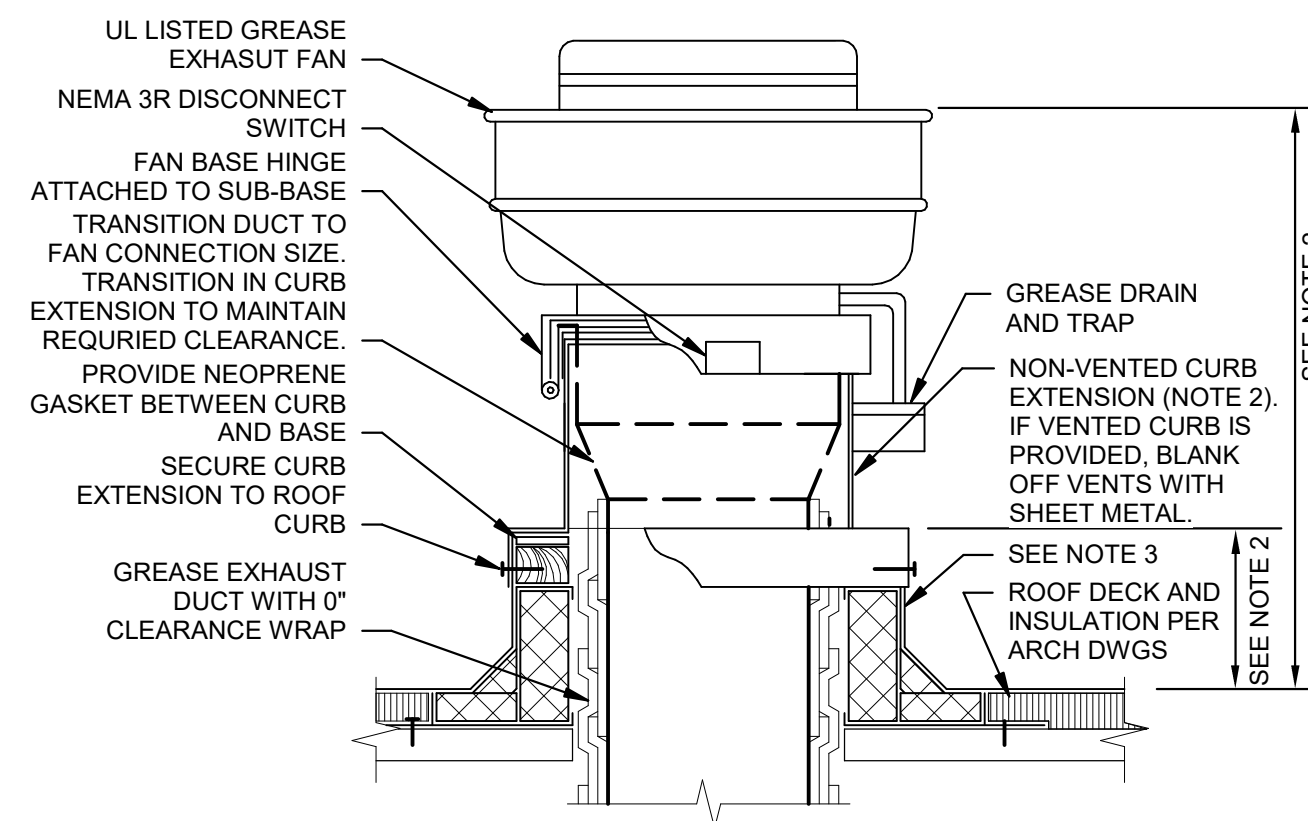
CONSULTANTS:



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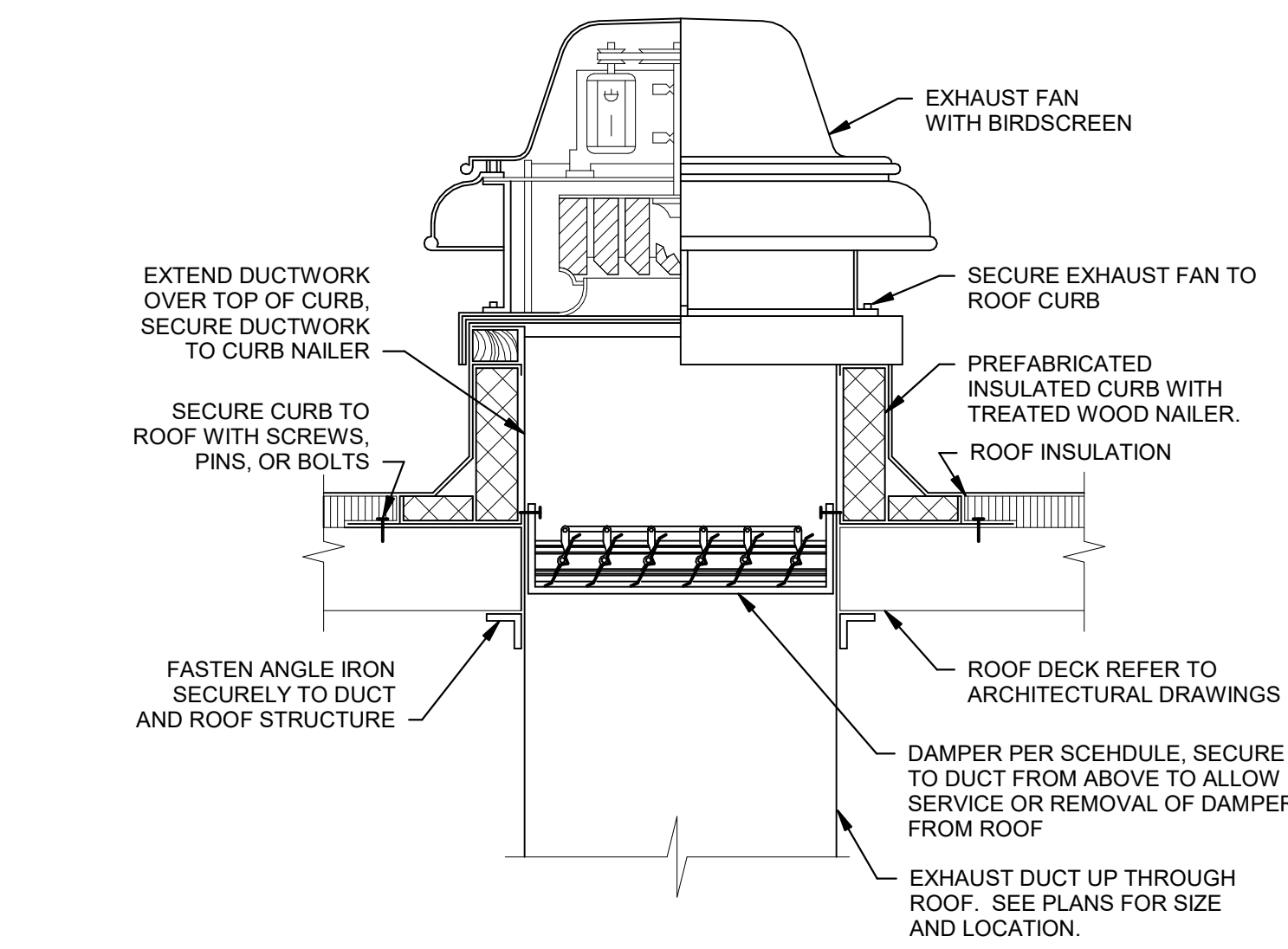


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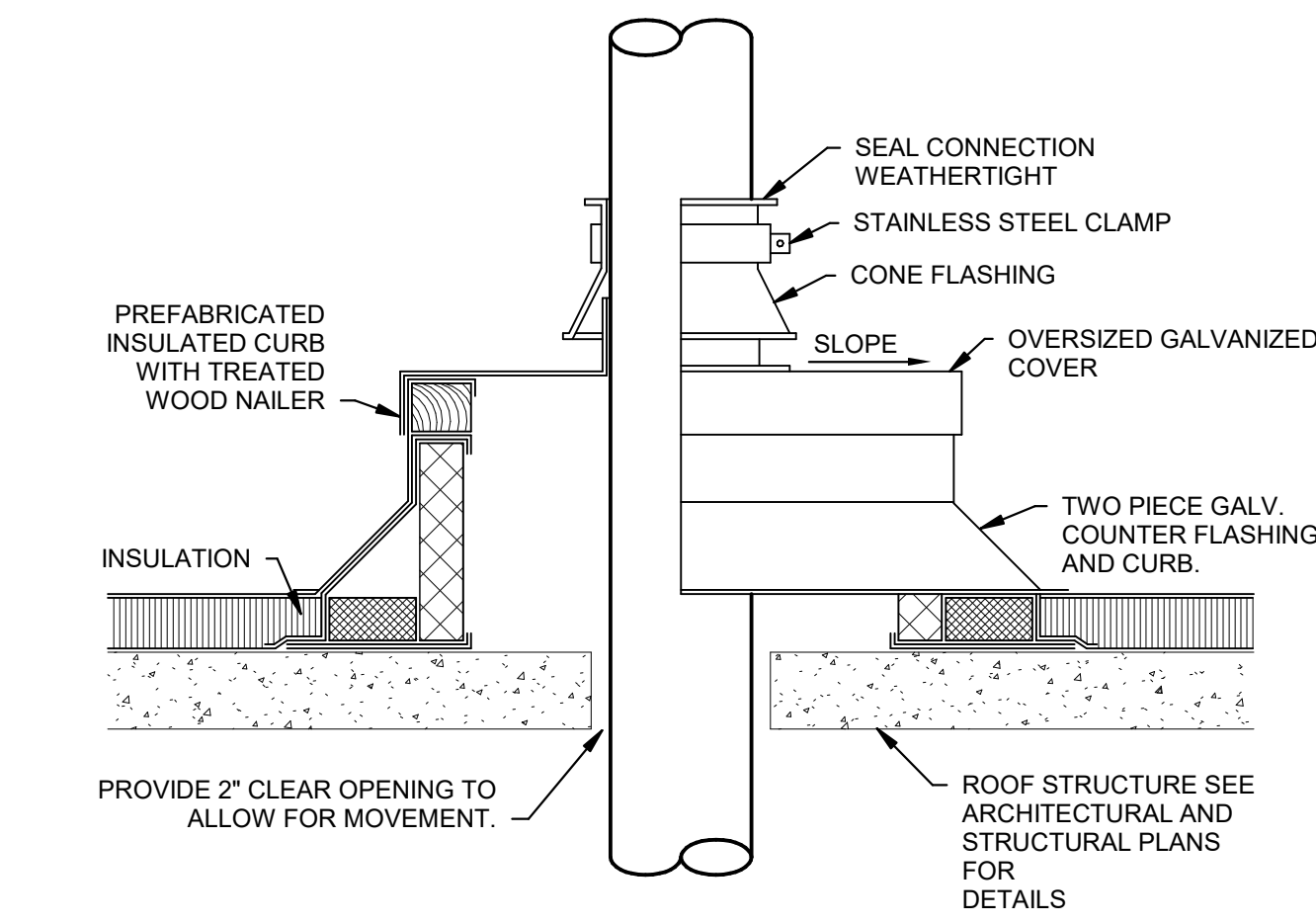


NOTES:
 1. ARRANGEMENT SHOWN IS SCHEMATIC, ADJUST TO SUIT FIELD CONDITIONS AND MEET LOCAL CODE
 2. PROVIDE CURB EXTENSION MADE FROM NON-COMBUSTIBLE MATERIAL OF HEIGHT REQUIRED TO MOUNT FAN BASE A MINIMUM 18 INCHES ABOVE COMBUSTIBLE CURB MATERIAL, AND DISCHARGE GREASE OUTLET A MINIMUM OF 40 INCHES ABOVE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

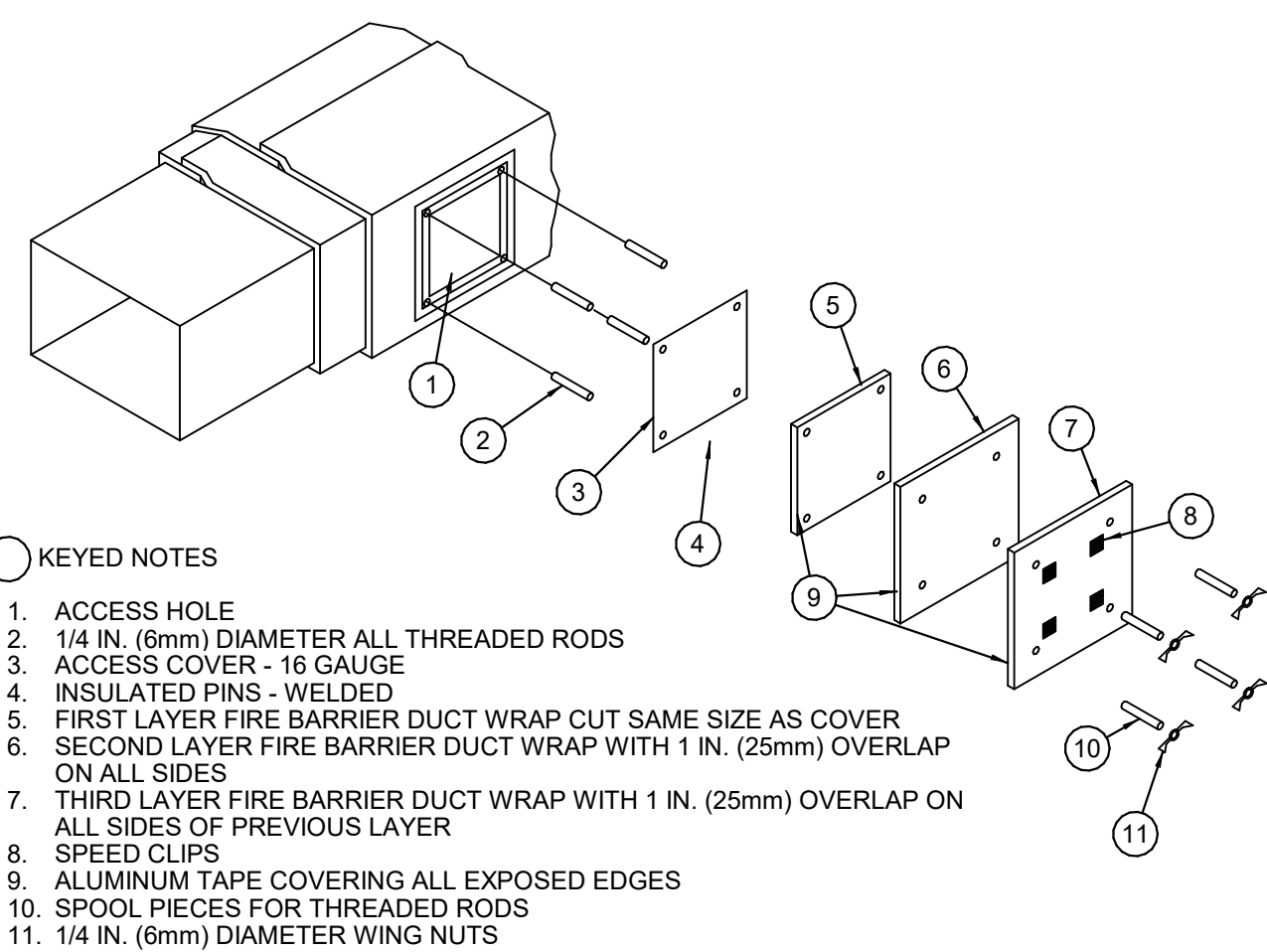
11 UPBLAST GREASE EXHAUST FAN DETAIL NTS



10 DOWNBLAST EXHAUST FAN DETAIL NTS

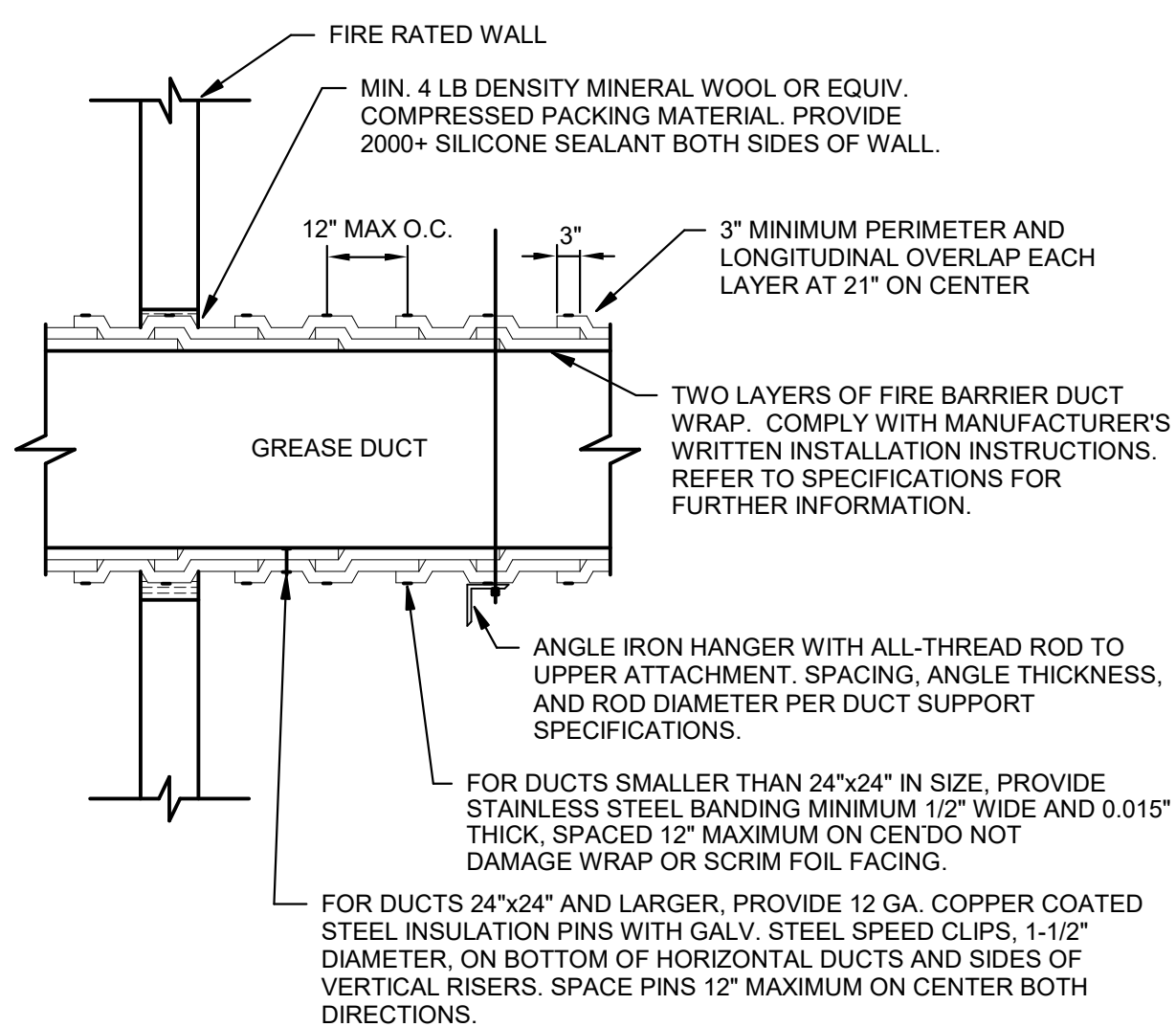


9 ROUND AIR DUCT OR PIPE PENETRATION THROUGH ROOF DETAIL NTS



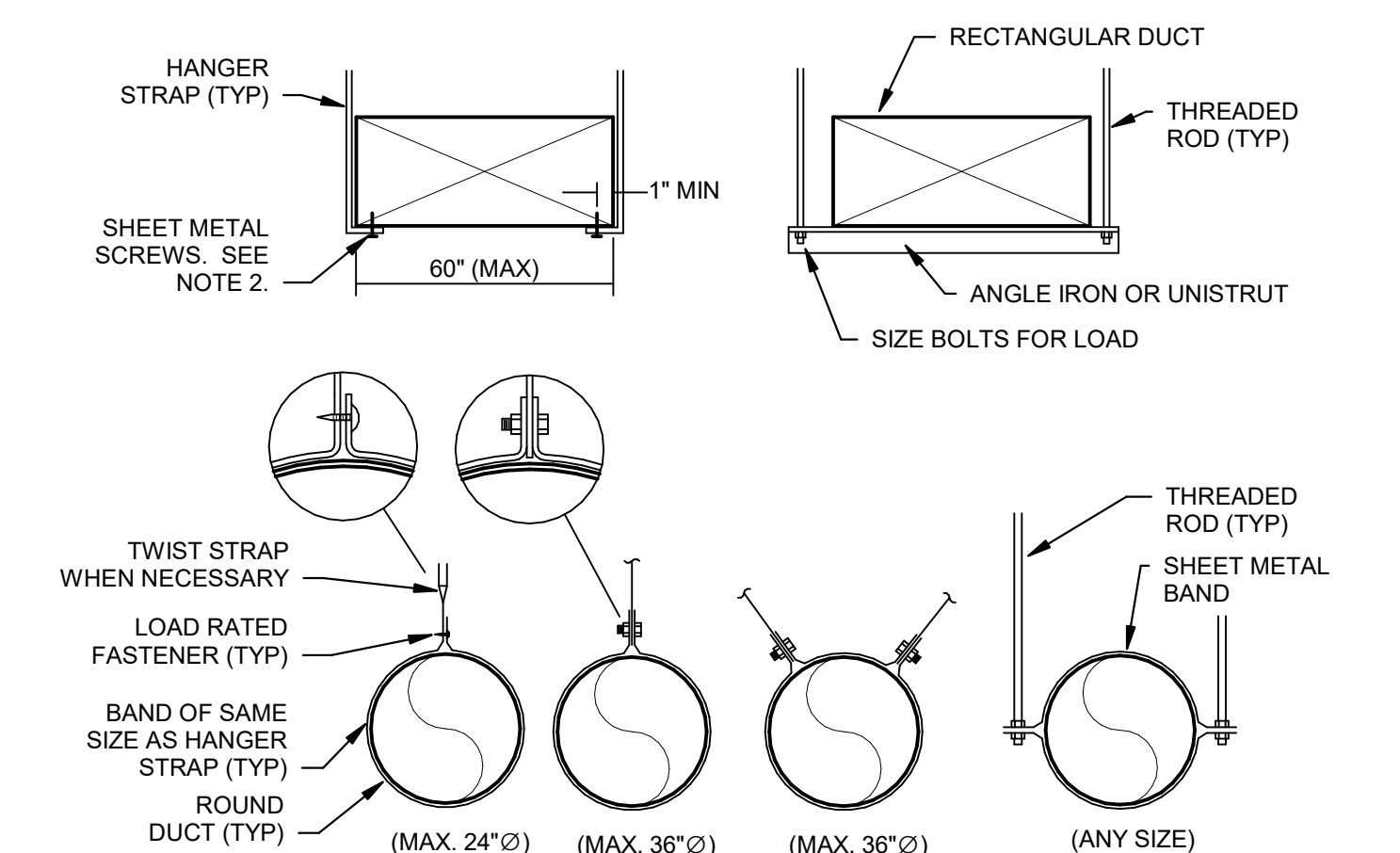
NOTES:
 1. FOR REFERENCE ONLY. INSTALL PER MANUFACTURER'S RECOMMENDATIONS.
 2. AT CONTRACTOR'S OPTION, A LISTED UL 1978 GREASE ACCESS DOOR PRODUCT MAY BE SUBSTITUTED FOR THE ACCESS DOOR PICTURED IN THIS DETAIL. DOOR SHALL BE RATED FOR UP TO 2,300F AND MEET NFPA66 STANDARDS. BOLTS SHALL BE LONG ENOUGH FOR DUCT WRAP SYSTEM (WHEN USED). INSTALL IN ACCORDANCE WITH MANUFACTURER'S LITERATURE.

8 GREASE DUCT CLEANOUT ACCESS DOOR DETAIL NTS



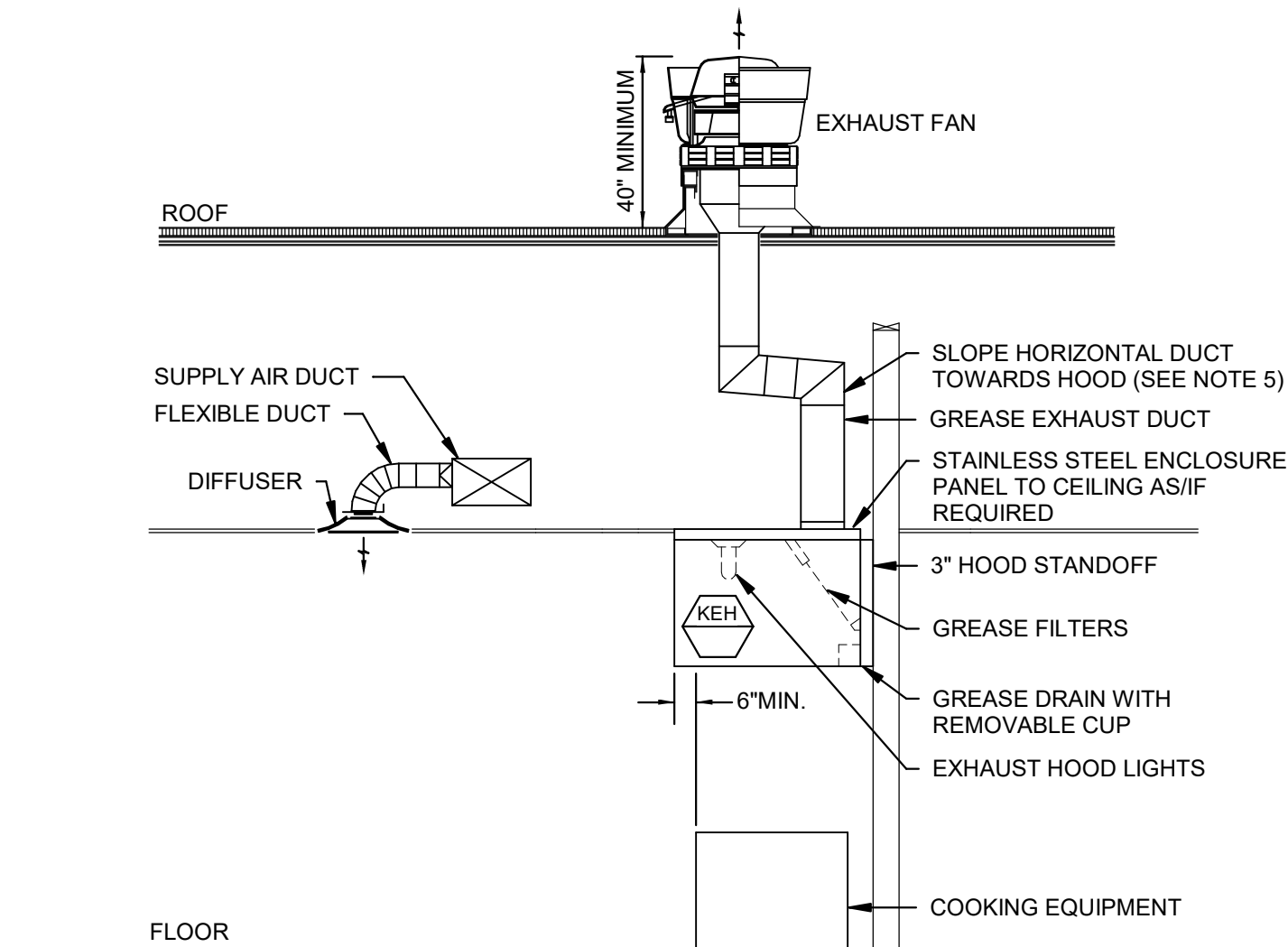
NOTES:
 1. INSTALL GREASE EXHAUST AND FIRE RATED DUCT WRAP IN ACCORDANCE WITH THE MANUFACTURER'S APPROVED INSTRUCTIONS AND UL LISTED INSTALLATION DETAILS. TECHNIQUES THAT DIFFER FROM THE ABOVE METHOD ARE ACCEPTABLE IF THEY ARE UL TESTED AND APPROVED.

7 GREASE DUCT FIRE WRAP INSULATION INSTALLATION DETAIL NTS



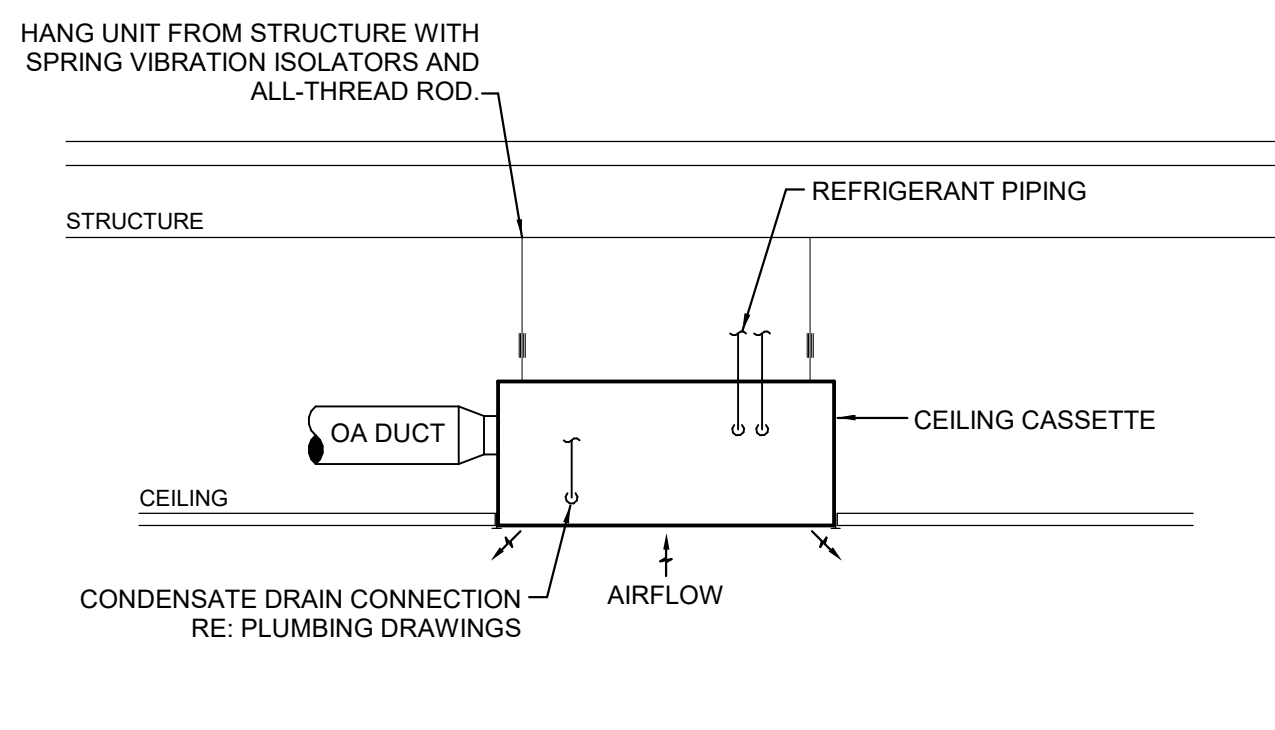
NOTES:
 1. USE THREADED ROD FOR RECTANGULAR DUCTS LARGER THAN 60" WIDE
 2. OMIT SHEET METAL SCREWS IF HANGER STRAP IS CONTINUOUS AND LOOPS UNDER ENTIRE RECTANGULAR DUCT
 3. FOR ROUND DUCTS LARGER THAN 36" Ø, USE TWO HANGER RODS TO SUPPORT DUCT FROM EACH SIDE.
 4. HANGERS MUST NOT DEFORM DUCT SHAPE.

6 DUCT HANGER LOWER ATTACHMENT DETAILS NTS



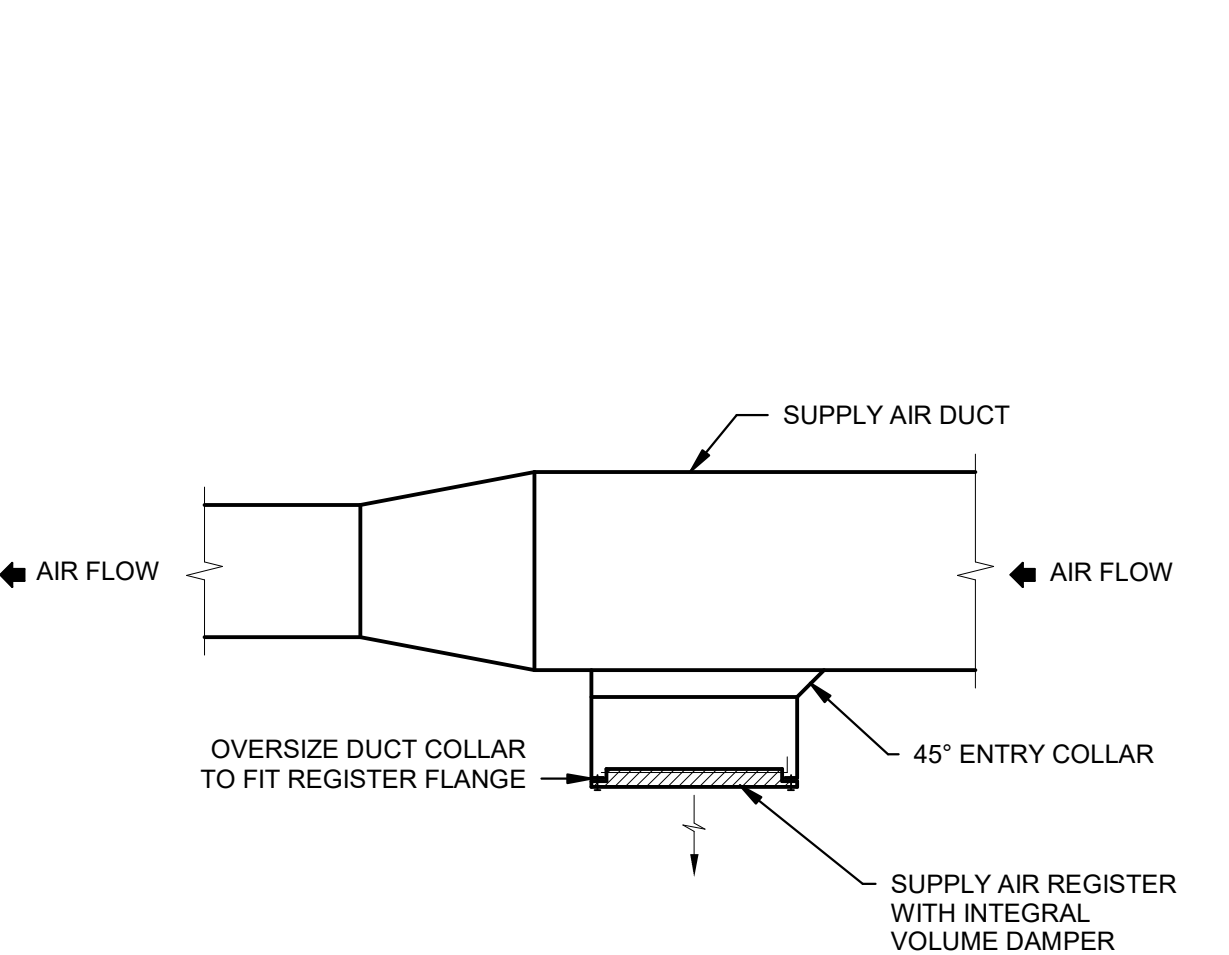
NOTES:
 1. SUBMIT SHOP DRAWINGS OF ALL HOOD SYSTEMS TO CITY FOR APPROVAL PRIOR TO INSTALLATION.
 2. TOTAL HOOD SYSTEM TO BE IN COMPLETE CONFORMANCE WITH NFPA, AND ALL LOCAL CODES AND REGULATIONS.
 3. COORDINATE ALL FIRE PROTECTION SYSTEMS WITH FIRE PROTECTION CONTRACTOR WHO SHALL ALSO BE RESPONSIBLE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

5 KITCHEN EXHAUST HOOD ELEVATION DETAIL NTS

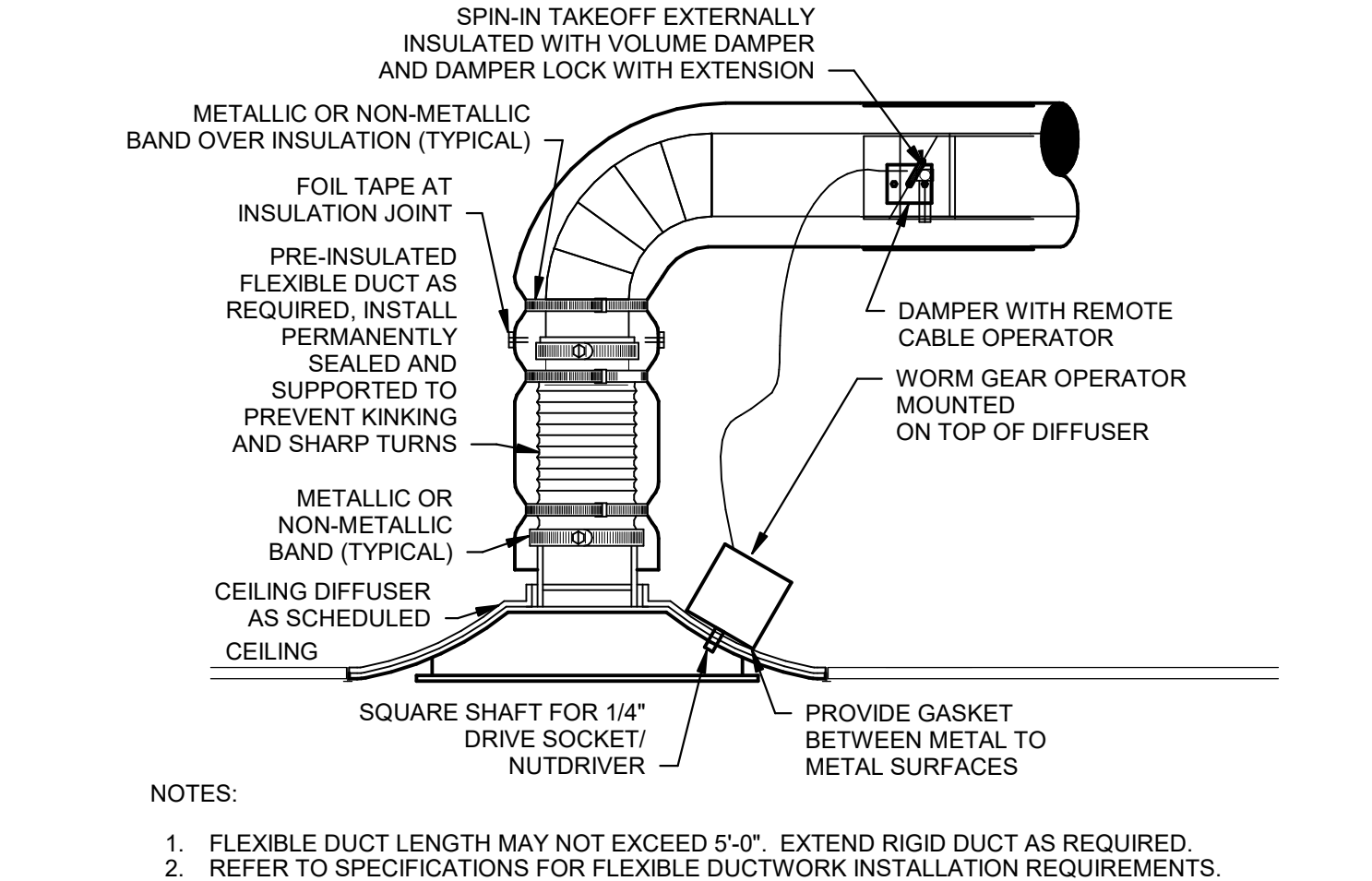


NOTES:
 1. ARRANGEMENT SHOWN IS SCHEMATIC, ADJUST TO SUIT FIELD CONDITIONS AND MEET LOCAL CODE REQUIREMENTS.
 2. SET DAMPER TO DELIVER SCHEDULED OUTSIDE AIR FLOW.
 3. REFER TO MANUFACTURER'S RECOMMENDATIONS FOR MAXIMUM CONDENSATE DRAIN LIFT HEIGHTS.
 4. REFER TO MANUFACTURER'S RECOMMENDATIONS FOR HORIZONTAL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

4 CEILING CASSETTE DETAIL NTS

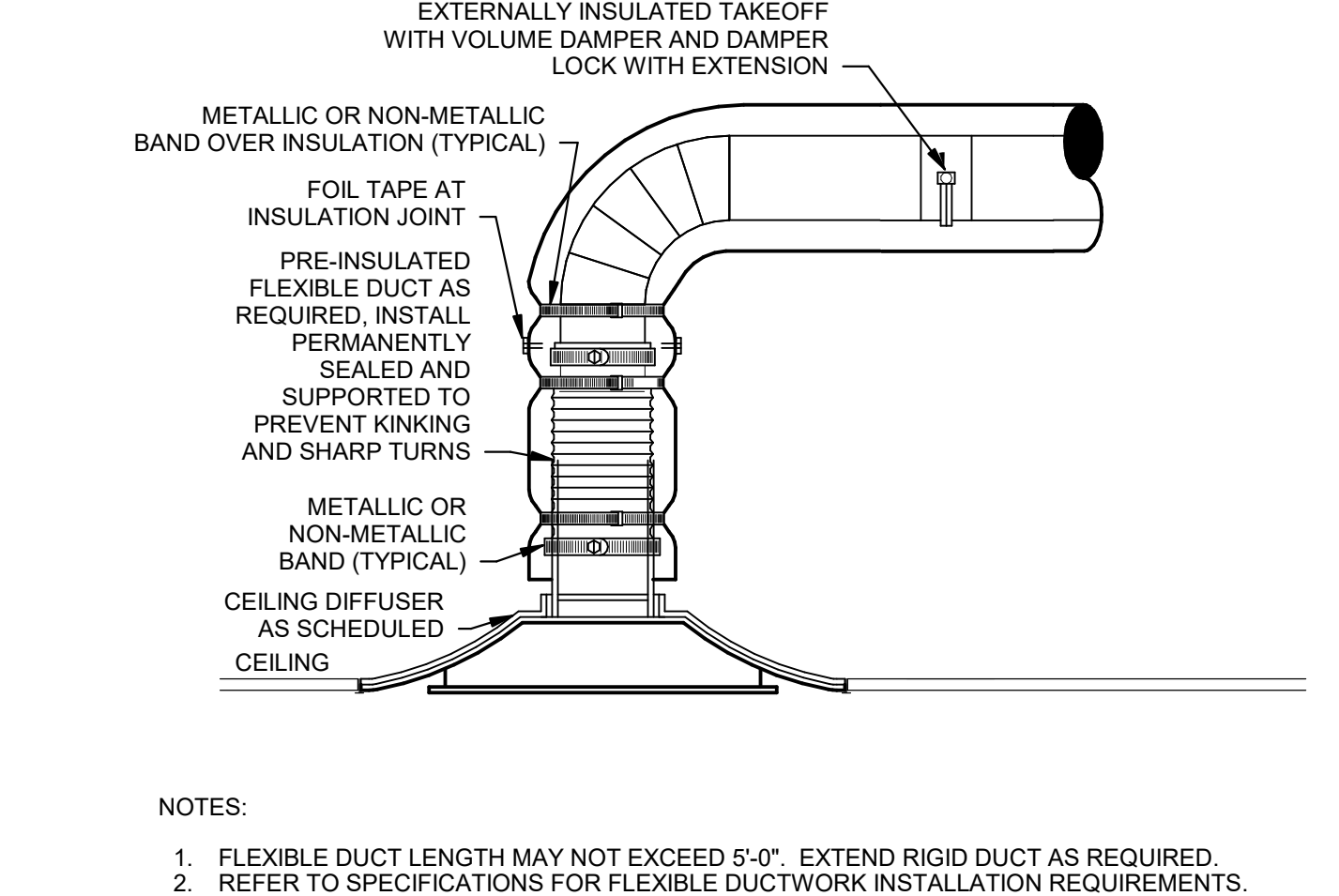


3 DUCT MOUNTED REGISTER DETAIL NTS



NOTES:
 1. FLEXIBLE DUCT LENGTH MAY NOT EXCEED 5'-0". EXTEND RIGID DUCT AS REQUIRED.
 2. REFER TO SPECIFICATIONS FOR FLEXIBLE DUCTWORK INSTALLATION REQUIREMENTS.

2 HARD CEILING DIFFUSER DETAIL NTS



NOTES:
 1. FLEXIBLE DUCT LENGTH MAY NOT EXCEED 5'-0". EXTEND RIGID DUCT AS REQUIRED.
 2. REFER TO SPECIFICATIONS FOR FLEXIBLE DUCTWORK INSTALLATION REQUIREMENTS.

1 LAY-IN CEILING DIFFUSER DETAIL NTS

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SHAKE SHACK SHORT PUMP

12170 W BROAD ST
 RICHMOND, VA 23233
 SHACK #1547

PERMIT / BID SET

MECHANICAL DETAILS

DRAWN BY: Author
 CHECKED BY: Checker
 JOB NO: 20240154.00

M501

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Division 23: HEATING, VENTILATING, AND AIR CONDITIONING

1. GENERAL INSTRUCTIONS

A. GENERAL REQUIREMENTS

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

B. DEFINITIONS

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

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

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

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

Provide: "to furnish and install."

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

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

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

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

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

- 1. Substitutions for Cause: Changes proposed by Contractor that are required due to changed Project conditions, such as unavailability of product, regulatory changes, or unavailability of required warranty terms.
- 2. Substitutions for Convenience: Changes proposed by Contractor or Owner that are not required in order to meet other Project requirements but may offer advantage to Contractor or Owner.

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

C. 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 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 piping and equipment. Workmanship shall be the finest possible by experienced mechanics. Installations shall comply with applicable codes and laws. Contractor shall keep informed as to the work of other trades engaged in the construction of the project and shall execute work in a manner as to not interfere with or delay the work of other trades.

Figured dimensions shall be taken in preference to scale dimensions. Contractor shall take his own measurements at the building, as variations may occur. Contractor shall be held responsible for errors that could have been avoided by proper checking and inspection. Provide materials with trim that will properly fit the types of ceiling, wall, or floor finishes actually installed. Model numbers listed in the specifications or shown on the drawings are not intended to designate the required trim.

G. ORDINANCES AND CODES

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

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

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

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

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

H. PROTECTION OF EQUIPMENT AND MATERIALS

Store and protect from damage equipment and materials delivered to job site. For materials and equipment susceptible to changing weather conditions, dampness, or temperature variations, store inside in conditioned spaces. For materials and equipment not susceptible to these conditions, cover with waterproof, tear-resistant, heavy tarp or polyethylene plastic as required to protect from plaster, dust, dirt, paint, water, or other 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 identical 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 approved, Contractor shall replace substitute material or system with that originally specified and bear costs incurred to complete the entire system as required.
- 6. Coordination, installation and changes in the Work as necessary for accepted substitution will be complete in all respects.

No substitutions will be considered unless the Substitution Request Form is completed and attached with the appropriate substitution documentation. No substitution will be considered prior to receipt of bids, 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.

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 sufficient detail so as to demonstrate compliance with these contract documents and the design concept. Prior to transmitting submittals, verify that the equipment submitted is mutually compatible and suitable for the intended use, will fit the available space, and maintain manufacturer recommended service clearances. If the size of equipment furnished makes necessary any change in location or configuration, submit a shop drawing showing the proposed layout.

Transmit submittals as early as required to support the project schedule. Allow for two weeks Engineer review time, plus to/from mailing time via the Architect, plus a duplication of this time for resubmittal, if needed. Only resubmit those sections requiring 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 information 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 and labeled in a 3-ring binder. Each item or model number shall be clearly marked and accessories indicated. Label the catalog data with the equipment identification acronym or number as used on the drawings and include performance curves, capacities, sizes, weights, materials, finishes, wiring diagrams, electrical requirements and deviations from specified equipment or materials. For equipment with motor starters or VFDs, include short circuit current ratings. Mark out inapplicable items. Shop drawings will be returned without review if the above mentioned requirements are not met.

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

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

K. ELECTRONIC DRAWING FILES

In preparation of shop drawings or record drawings, Contractor may, at his option, obtain electronic drawing files in AutoCAD or DXF format on CD-ROM disk, DVD disk, flash drive or direct download, as desired, from the Engineer for a shipping and handling fee of \$200 for a drawing set up to 12 sheets and \$15 per sheet for each additional sheet. Contact the Architect for written authorization and Engineer for the necessary release agreement form and to specify shipping method and drawing format. In addition to payment, the written authorization from the Architect and release agreement form from the Engineer must be received before electronic drawing files will be sent.

L. RECORD DRAWINGS (AS-BUILT DRAWINGS)

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

See Division 01 and General Conditions for additional information.

M. OPERATION AND MAINTENANCE INSTRUCTIONS

During the course of construction, collect and compile a complete brochure of equipment furnished and installed on this project. Include operational and maintenance instructions, manufacturer's catalog sheets, wiring diagrams, parts lists, approved submittals and shop drawings, warranties, and other information 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. Remedial 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 REMOVE 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 weatherlight 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 use as required or as indicated on drawings.

Clean and refurbish existing HVAC equipment required for use 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 curbs 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-lamped (by each) 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 substance 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 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 refresh areas disturbed by work to the condition of adjoining surfaces in a manner satisfactory to the Architect.

F. ROUGH-IN

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

G. STRUCTURAL SUPPORT SYSTEMS

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

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

H. PRE-ENGINEERED ROOF EQUIPMENT SUPPORTS AND CURBS

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

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

- 1. Rail Equipment Supports: Secure each equipment support leg to the rail with a minimum of 4 points of connection per leg.
- 2. Roof Curbs: Secure each curb to equipment support with 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, 1/4 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 support rail and curb. Secure brackets to equipment and curb nailer using an integral of 8 points of connection per bracket. Provide one bracket at each corner along the length of the unit.

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 enclosures 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, Tilus, 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 watertight and weatherlight with non-shrink, non-hardening commercial sealant. Pack with mineral wool and seal both ends with minimum of 1/2 inch of sealant.

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

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

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

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

Seal concrete or masonry exterior wall penetrations below grade with "wall pipes" and mechanical sleeve seals. Provide cast iron "wall pipes" with integral waterstop ring manufactured by Jay R. Smith, Josam, Wade, Watts or Zurn. Provide modular mechanical sleeve seals, manufactured by Galpico, Metraflex, or Thunderline / Link Seal.

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

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

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

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

K. FIRESTOPPING

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

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

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

Where project conditions require modification to qualified testing and inspecting agency

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 wires containing high voltage wiring and equipment may not be used for low-voltage wiring except for the purpose of interfacing the two panels (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 procedures for each particular cable. Label all wiring and cabling at each end within 2 inches of termination with the controller termination number. Label control devices used in the system with permanent labels using the identifiers that match the record documents.

O. EQUIPMENT FURNISHED BY OTHERS

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

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

P. SYSTEM TESTING, ADJUSTING, AND BALANCING

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

The final test and balance of the building HVAC systems shall be completed by National TAB (no exceptions) and contracted by the General Contractor. The representative from National TAB shall be certified by the National Environmental Balancing Bureau (NEBB), Associated Air Balance Council (AABC), or Testing, Adjusting and Balancing Bureau (TABB). TAB shall be performed in accordance with the most current edition of the certified agencies procedural standard for testing, adjusting and balancing and shall comply with the strictest interpretation of that standard for execution and reporting of all TAB work.

Work shall include but not be limited to: Perform test readings on fans, units, coils, pumps, etc., and adjust equipment to deliver specified amounts of air. Prepare testing and balancing report log showing air supply quantities, air entering and leaving temperatures and pressures at design flow, fan and unit test readings, motor voltage and amp draws, etc., and submit six copies of the final compilation of data to the Architect for evaluation and approval before final inspection of the project. Balance air systems to within plus or minus 10 percent for terminal devices and plus or minus 5 percent for main ducts and air handling equipment in airflow in the amount of air shown on the drawings. TAB Contractor shall record space temperatures and make adjustments in airflow to each diffuser to obtain uniform temperature (no greater than +/- 3 F) in spaces. Document temperatures and adjustments in tab report. Adjust equipment to operate as intended by the manufacturer. TAB report shall include a "report summary/marks" section in accordance with the procedural standard that provides both system set up and a summary of deficiencies as defined by the procedural standard.

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

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

Q. VIBRATION ISOLATION

Provide vibration isolation equipment and materials by a single manufacturer. If type and 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 Caidyn, Kinetics Noise Control, Mason Industries, Inc., Vibron Eliminator Co., Inc., Vibration Mounting and Controls, or Vibro-Acoustics, provided their systems are in compliance with the specified design and performance requirements.

General Requirements: Select vibration isolators by the weight distribution to produce uniform deflection. Vibration isolators shall have either known un-deflected heights or calibration markings so that, after adjustment, the static deflection can be verified, thus determining that the load is within the proper range of the isolator. Isolators shall operate in the linear portion of their load versus deflection curves. Spring isolators 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 paint. Install and adjust vibration isolators in accordance with manufacturer's written instructions.

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

Isolator Types:

1. Type WP (Waffle Pads): Provide 5/16 inch thick neoprene pads ribbed or waffled on both sides. Manufacture pads with bridge bracing quality and select for a maximum diameter of 50 and designed for 15 percent strain, with a static deflection of 0.05 inches. Incorporate steel load-spreading plates where required between the equipment and the neoprene pad to provide selected deflection. If the isolator is bolted to the structure, install a neoprene mounting sleeve under the bolt head between the steel washer and the base plate to prevent metal to metal contact. Provide Mason Industries Type WP 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 80 percent of the compressed height of the spring at rated load. Loaded springs shall operate within the linear portion of their load versus deflection curve over a deflection range of not less than 50 percent above design deflection. Spring diameter and hanger box 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 longer hanger rod and hanger box and short-circuiting the isolating function. The neoprene element shall have a maximum diameter of 50 and designed for 15 percent strain, with a static deflection of not less than 0.4 inches. Unless otherwise specified, the static deflection of SPNH hangers shall be 2 inches. Provide SPNH hangers with 1 inch static deflection for water source heat pumps and fan-powered VAV terminal units. When installed, do not coat the spring element and do not allow the hanger box to rotate through a full 360 degree arc without encountering obstructions. Provide Mason Industries Type 30N or equal.
3. Type NR (Neoprene Bushing): Provide neoprene, rubber-in-shear bushings for lightweight (less than 100 pounds), suspended equipment supported from structure with all threaded rod and angle iron or Unistrut. Select for a maximum diameter of 50 and designed for 15 percent strain, with a static deflection of 0.15 inches. Provide Mason Industries Type HMIB or equal.

R. AIR FILTERS

Provide AAF/Flanders Perfect Pleat HC M8, Camfil Far 3030, pleated, throwaway type filters, minimum MERV 8, or similar as manufactured by Air Filter, Inc., Biomedical, Columbus, Koch, or approved equal, unless otherwise indicated.

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

E. REFRIGERANT AND OIL

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

T. IDENTIFICATION

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

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

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

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

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

Provide stenciled signs for equipment identification at Contractor's option or where distance of required identification requires lettering larger than 1 inch height. Stencil paint shall be exterior type, oil-based, alkyd 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 C 1338 for fungi resistance, and shall be cleanable using duct cleaning methods and equipment outlined by the National Air Duct Cleaning Association (NADCA) duct cleaning guide. Install with adhesive and mechanical fasteners in accordance with manufacturer's instructions and recommendations. Ductwork sizes shown on drawings are inside clear dimensions. Increase sheet metal by liner thickness in both directions where liner is installed.

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

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

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

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

At entrance 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 Duct wrap, Certainteed or equivalent Johns Manville, Owens-Corning, or Knaufl with heavy-duty foil-scrim-kraft facing, and with joints taped with 3 inch wide foil tape as follows:

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

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

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

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

1. Exterior insulation and jacket consisting of 2 inch thickness of Armaflex flexible elastomeric insulation or equivalent meeting ASTM C534 with integral 12 mils thick UV resistant cladding laminated at factory. Cover all seams with Armaflex seal tape. Exterior insulation consisting of 2 inch thickness of flexible elastomeric insulation meeting ASTM C534 or 3 lb density rigid fiberglass meeting ASTM C612, and jacket consisting of 20 gauge corrugated aluminum jacket with aluminum fitting covers and minimum three aluminum attachment bands per section.
2. Exterior insulation consisting of 2 inch thickness of flexible elastomeric insulation meeting ASTM C534 or 3 lb density rigid fiberglass meeting ASTM C612, and jacket consisting of 15.5 mils thick Venturoplast Plus UV resistant cladding.

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

B. DUCTWORK

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

Provide pre-engineered roof duct supports supports by Cooper B-Line, Elite Components, ERICO, FNV, Miro, PFD Manufacturing, PHP Systems, Roof Top Box, Unistrut (Alkorex), Zai Foster, or approved equal. Support ductwork on the roof with pre-engineered roof duct supports that are designed for the roofing membrane, not requiring any attachment to the roof structure and not penetrating the roofing assembly, with embedded support fixtures as required to support the duct. Provide steel pedestal type supports with minimum 18x18 inch thermoplastic or rubber base of 4 inch wide 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 duct supports directly to the roof structure in accordance with the manufacturer's installation instructions or provide intermediate duct supports engineered to meet the wind resistance and seismic design criteria. Reference Section, "PRE-ENGINEERED ROOF EQUIPMENT SUPPORTS."

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

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

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

Provide radius elbows, turns, and offsets with a minimum centerline radius of 1-1/2 times the duct width. Where space does not permit full radius elbows, provide short radius elbows with a minimum of two continuous splitter vanes. Vanes shall be the entire length of the bend. Provide mirrored elbows where space does not permit radius elbows, where shown on the drawings, or at the option of the contractor with the engineer's approval. Mirrored elbows less than 45 degrees shall not require turning vanes. Mirrored elbows 45 degrees and greater shall be performed as described above. Tests shall be performed on the installed elbows to verify that the ductwork. Vanes for mirrored elbows shall be provided in all supply and exhaust ductwork and in return and outside air ductwork that has an air velocity exceeding 1000 fpm. Do not install vanes in grease ductwork. The use of square throat, radius edge elbows is prohibited. Remove all sharp corners and burrs from all installed elbows and fittings 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 gaskets, corrugated connections, Duro-Dyne, Elgen, Ventaficor or equal. Flexible connectors shall have a flame spread of 25 or less and smoke developed rating not higher than 50. Make airtight joints and install with minimum 1-1/2 inches slack.

Provide balancing dampers, manufactured by Cesco, Greenheck, Louvers & Compers, Nalor Industries, Pattorf, Ruskin, Tamco, or approved equal, where shown on drawings and wherever necessary for complete control of air flow. Splitter dampers shall be controlled by locking quadrants, provide Young Regulator or Ventlok and bearings for the damper rod. Rectangular volume dampers shall be opposed blade interlocking type. Round volume dampers shall be single-blade type consisting of circular blade mounted to a shaft. Provide Flexmaster model 51D or equal 45 degree rectangular/round side takeoff fitting with model B03 damper with locking quadrant and insulation build out for round ductwork branch takeoffs to individual air devices. Omit damper at takeoff fitting when damper is located downstream of takeoff.

Where access to dampers through a hard ceiling is required, provide a concealed, remote cable-operated, butterfly-type volume damper assembly with external worm gear operator. Damper assembly shall include duct casing with rolled bead stiffeners, reinforced blade, self-lubricating bearing, and 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 in branch duct. Do not install in diffuser neck. Install remote operator on the back of the diffuser frame or side of a slot diffuser plenum. Support cable assembly to avoid bends and kinks in cable at manufacturer recommended intervals. Where approved by architect, a ceiling cup with cover plate may be used for access to cable operator. Provide round dampers by Metropolitan Air Technology model RT-250, Young's Regulator model 5020-1200, or approved equal. Provide rectangular dampers by Metropolitan Air Technology model RT-200, Young's Regulator model 820-1200, or approved equal. Provide remote cable control by Metropolitan Air Technology model RT-WGA, Young's Regulator model 270-275, or approved equal.

Round or oval ductwork shall be FlakGroup Semco, United, Hercules Industries or equal, sheetmetal, with smooth interior surface, with lip pressure (duct pressure class up to and including 2 inches w.g.) Round ductwork gauges per the following table (reference SMACNA HVAC duct control standards for gauges when pressures exceed 2 inches w.g.)

Size	Duct Gauge	Filling Gauge
14" & under	29	24
15" thru 20"	24	22
20" thru 30"	22	20
30" thru 50"	20	20
50" 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 joint 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 with fittings larger than 24 inches in diameter. Filling gauge shall be 22 gauge for 36 inch fittings and 20 gauge for larger sizes, 90 degree tees shall be conical type. Seal longitudinal and transverse ductwork joints airtight with heavy liquid sealant applied according to manufacturer's instructions. Provide gauge thickness in medium pressure (duct pressure class 3 inches to 6 inches w.g.) ductwork as recommended by SMACNA.

C. FLEXIBLE DUCT

Low pressure (duct pressure class up to and including 2 inches w.g.) and medium pressure (duct pressure class 2.1 inch to 6 inches w.g.) flexible duct shall be Flexmaster type 88, Thermaflex type G-KM, M-KE, JPL type Silver Jacket, or equal (provide retardant polyethylene protective vapor barrier, UL-181 Class 1, acoustical insulated duct, R-6.0 fiberglass insulation. Provide PE liner with steel wire mesh 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 core connection and a metallic or non-metallic clamp over the tape and two wraps of duct tape or a clamp over the outer jacket. Duct clamps shall be labeled in accordance with UL-181B and marked 181B-C. Duct tape shall be labeled in accordance with UL 181B and marked 181B-FX.

D. PLASTIC FLUE GAS VENTS

Provide UL 1739 listed plastic flue gas vents, with positive or negative flue pressures complying with NFPA 211 and suitable for condensing gas products. Provide PVC system by IPEX "System 1738", or Polypropylene system by CentriChem "Infolite" or equal by Nova Flex Group "Z-DENS."

Vents and combustion air ducts for condensing type appliances shall be Schedule 40 PVC pipe and socket fittings meeting ASTM D2665 and UL 1738, manufactured by IPEX. Use solvent cement meeting ASTM D2564 and make joints in accordance with ASTM D2665.

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

E. AIR DEVICES

Provide air devices as scheduled on drawings, manufactured by Carnes, Krueger, Metalaire, Nalor Industries, Price, Tius, 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, CFM for each air device, styles, borders, etc. Clearly marked with specified equipment number. Submit samples of each air device as requested by the Engineer.

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

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

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's installation instructions prior to installation of drywall. Contractor shall use manufacturer's hard ceiling clips for mounting to ceiling framing. Screws through face of linear slot diffuser are not acceptable. Provide alignment components by the manufacturer. Provide plenums by the slot diffuser manufacturer. Plenums shall be internally insulated by the manufacturer with minimum 1/4 inch thick, R fiberglass insulation.

F. CONTROL DAMPERS

Provide factory fabricated, parallel blade control dampers sized as shown on the drawings and as specified. Individual damper sections shall be larger than 48 inches wide and 60 inches in maximum blade width of 6 inches. Frame construction shall be minimum 16 gauge galvanized steel for rectangular dampers, 20 gauge for round, 1/8 inch thick for aluminum, with flanges for duct mounting. Provide elastomeric or neoprene seals, mechanically attached and field replaceable. Provide a minimum of one damper actuator per section. Test damper performance in accordance with AMCA 500-D.

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

Motorized dampers used for ventilation air intake, exhaust air, or relief air shall have leakage rates not to exceed 4.0 CFM/square foot in full closed position at 1 inch W.C. pressure differential across the damper.

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

G. EXHAUST AIR SYSTEMS

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

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

H. KITCHEN EXHAUST AIR SYSTEMS

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

Provide ducts connecting Type 1 exhaust hoods to exhaust fans made of #16 gauge black iron with continuously welded joints and clean-out doors. Provide transition at connection to fan with opening size equal to or greater than the venturi opening of the fan inlet. Provide gasket at flanged connection for rain/leakwater and grease applications. Enclose duct in fireproof enclosure per locally adopted mechanical code or, if approved by local code official, in fire rated wrap insulation. Insulation shall be minimum two-hour rated duct wrap insulation for Type I hood grease exhaust duct applications and shall conform to ASTM E2336 where required to comply with IMC. Insulation shall be flexible wrap enclosure rated for minimum 2000 degrees Fahrenheit and for zero clearance to combustibles. Insulation shall be non-mineral wool, passive, low bio-persistent fiber totally encapsulated on all sides with aluminum foil. Insulation shall be as manufactured by Certainteed, Thermal Ceramics, Unifrax or 3M. Slope duct back towards hood at minimum 1/4 inch per linear foot. At Contractor's option, a UL listed complete ductwork package that complies with UL 1078 standard for grease ducts may be used in lieu of the welded black iron duct for connecting hood to exhaust fan. Ductwork package shall be as manufactured by Metal-Fab, Schebler, Selkirk, or approved equal. Provide manufacturer's UL listing number and verification certificate as a part of the shop drawing submittal. Install duct package in strict conformance with manufacturer's instructions and recommendations.

All portions of grease duct systems shall be tested for leakage in accordance with the "Grease Duct Test" paragraph of the IMC. Leakage tests shall be by water leakage 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 using Environmental Corporation of America or owner approved testing devices and greater shall be performed on the grease duct system. Tests shall be performed on the installed ductwork. If tested unit 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. AIR CURTAINS

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

Furnish unit with washable panel filters 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 switch, factory-installed time-delay relay, and mounting brackets and accessories. Furnish unit with motor control panel complete with motor starter, 115V transformer with primary and secondary fuses, terminal strip, and NEMA 250 enclosure.

B. 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 specified before the installation. Tubing shall be factory or field insulated with flexible unicellular insulation with thickness as specified below.

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

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

Brazing filler metals:

1. AWS A5.8, Classification BA9-5: Silver (Ag) 44.0-46.0 percent, Zinc (Z) 23.0-27.0 percent, and Copper (Cu) 29.0-31.0 percent.
2. AWS A5.8, Classification BCu-P-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 and to appear straight and in good order. Pitch suction lines down slightly (1 inch in 20 feet) towards the compressor. Provide oil traps at the base of vertical suction risers over 6 feet high. Install liquid line sight glasses in liquid lines nearest the expansion valve. Factory mount expansion valves with the sensing bulbs shipped loose. Field mount expansion valve bulb after refrigerant piping is complete (damage may occur if bulbs come in contact with heat).

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

B. SYSTEM EVACUATION AND CHARGING

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

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

6. TEMPERATURE CONTROLS

A. GENERAL REQUIREMENTS

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

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

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

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

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

B. WIRING

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

8. COMMISSIONING OF MECHANICAL SYSTEMS
Commissioning of HVAC System

A. PART 1 GENERAL

1.1 SUMMARY

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

1.2 INFORMATIONAL SUBMITTALS

- a. Construction Checklists: Draft construction checklists will be created by CxA for Contractor review.
- b. Construction Checklists: Installation and Performance test checklists for systems, assemblies, subsystems, equipment, and components to be part of the Cx process and according to requirement in Section 019113 "General Commissioning Requirement."
1. Refrigerant piping, including the following:
 - a. Refrigerant piping, fittings, and specialties.
 - b. Refrigerant charge.
 - c. General duty and specialty valves.
 - d. Meters and gages.
 2. Air distribution systems, including the following:
 - a. Supply, return, and exhaust systems.
 - b. Metal ducts, liners, and fittings.
 - c. Nonmetal ducts and fittings.
 - d. Air-duct accessories, including volume dampers, fire and smoke dampers, turning vanes, sound attenuators, and flexible connectors.
 - e. Duct-mounted access doors and panels.
 3. Kitchen exhaust system, including the following:
 - a. Exhaust and makeup air system.
 - b. Metal ducts, liners, and fittings.
 - c. Air-duct accessories, including volume dampers, fire and smoke dampers, turning vanes, sound attenuators, and flexible connectors.
 - d. Duct-mounted access doors and panels.
 - e. Exhaust fans.
 4. Make-Up air unit
 5. Air-handling equipment, including the following:
 - a. Fans and motors.
 - b. Indoor air-handling units with and without coils, dampers, and filters.
 - c. Outdoor air-handling units with and without coils, dampers, and filters.

B. PART 3 EXECUTION

3.1 CONSTRUCTION CHECKLISTS

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

3.2 CONSTRUCTION CHECKLIST REVIEW

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

3.3 Cx TESTING PREPARATION

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

3.4 Cx TESTS COMMON TO HVAC SYSTEMS

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

3.5 START-UP DOCUMENTATION COMMON TO ALL SYSTEMS

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

3.6 MECHANICAL IDENTIFICATION

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

3.7 MECHANICAL INSULATION

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

3.8 PIPING GENERAL

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

3.9 AC MOTORS

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

3.10 PACKAGED HEATING AND COOLING UNITS

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

3.11 TERMINAL UNITS

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

3.12 FANS

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

3.13 DUCTWORK ACCESSORIES

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

END OF SECTION 23



CONSULTANTS:

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

245000271
VA. CORPORATE NO. 040601357
EXPIRES 12/31/2025

SEAL SIGNATURE:

08/30/2024

NO.	BY	DATE	PERMIT / BID SET	DESCRIPTION
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SHAKE SHACK SHORT PUMP

12170 W BROAD ST
RICHMOND, VA 23233
SHACK #1547

PERMIT / BID SET

MECHANICAL SPECIFICATIONS

DRAWN BY:	Author
CHECKED BY:	Checker
JOB NO:	20240154.00

M592

ROOFTOP UNIT CONTROL MATRIX					
CONTROL FEATURE	UNITS	RTU-1 SETPOINT OR Y/N	RTU-2 SETPOINT OR Y/N	NOTES	
CONTROL STRATEGY					
SPACE TEMPERATURE CONTROL		Y	Y		
HEATING AND COOLING SET POINTS					
COOLING MODE ENABLE - SPACE TEMPERATURE - OCCUPIED SETPOINT	"F DB	75	75		
COOLING MODE ENABLE - SPACE TEMPERATURE - UNOCCUPIED SETPOINT	"F DB	80	80		
COOLING - SUPPLY AIR TEMPERATURE SETPOINT	"F DB	55	55		
HEATING MODE ENABLE - SPACE TEMPERATURE - OCCUPIED SETPOINT	"F DB	70	70		
HEATING MODE ENABLE - SPACE TEMPERATURE - UNOCCUPIED SETPOINT	"F DB	60	60		
HEATING - SUPPLY AIR TEMPERATURE SETPOINT	"F DB	85	85		
DEAD BAND - MINIMUM HEATING AND COOLING TEMPERATURE SETPOINT DIFFERENCE	"F DB	5	5		
DEHUMIDIFICATION SETPOINT HUMIDITY SENSOR FEEDBACK	"RH	50	50		
DEHUMIDIFICATION - REHEAT CONTROL - SUPPLY AIR TEMPERATURE SETPOINT	"F DB	70	70	F	
PROGRAMMED CONTROL FEATURES					
HVAC SYSTEM OCCUPIED/UNOCCUPIED MODE - PROGRAMMABLE THERMOSTAT		Y	Y		B
OPTIMUM START SEQUENCE		Y	Y		
EQUIPMENT COMPONENTS, ACCESSORIES AND CONTROL FEATURES					
COOLING COIL (DX - MODULATING CAPACITY)		Y	Y		K
DEHUMIDIFICATION - MODULATING HOT GAS REHEAT		Y	Y		
HEATING - NATURAL GAS - MODULATING		Y	Y		K
RETURN AIR PATH WITH MOTORIZED RETURN AIR DAMPER FOR UNOCCUPIED OPERATION		Y	Y		D, T
OUTSIDE AIR DAMPER - MOTOR OPERATED		Y	Y		J, T
RELIEF/EXHAUST AIR DAMPER - BAROMETRIC		Y	N		
RELIEF/EXHAUST AIR DAMPER - MOTOR OPERATED		N	Y		W
OUTSIDE SUPPLY AIR AIRFLOW MONITORING		Y	Y		F
REMOTE COMBINATION TEMPERATURE AND HUMIDITY SENSOR		Y	Y		B
INTEGRATED ECONOMIZER - DIFFERENTIAL ENTHALPY ENABLE (OA ENTHALPY < RA ENTHALPY)	BTULB	Y	Y		U
SUPPLY FAN CONTROL METHODS					
ON DURING OCCUPIED MODE		Y	Y		
CYCLE WITH LOADS DURING UNOCCUPIED HOURS		Y	Y		
VARIABLE VOLUME/ STAGED FAN CONTROL IN RESPONSE TO ACTIVE COOLING COIL STAGES		Y	Y		K, V
SAFETIES, INTERLOCKS, AND ALARMS					
GAS VALVE SAFETY		Y	Y		F
RETURN AIR SMOKE DETECTOR - SAFETY SHUTDOWN		Y	Y		E
LOW LIMIT FREEZE/STAT - FREEZE PROTECTION SAFETY SHUTDOWN		Y	Y		F
DIFFERENTIAL PRESSURE SWITCH - FILTER CHANGE ALARM		Y	Y		F
FIRE ALARM CONTROL PANEL - SAFETY SHUTDOWN INTERLOCK		Y	Y		S
OUTSIDE AIR DAMPER END SWITCH - SAFETY SHUTDOWN		Y	Y		S
KITCHEN EXHAUST SYSTEM INTERLOCK		Y	Y		L

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	800	STEEL	EGGCRATE	SURFACE	12x12	30	A B C F G H	
CRG	E.H. PRICE	RETURN GRILLE	800	STEEL	EGGCRATE	LAY-IN	24x24	30	A B C F H	
CSD1	E.H. PRICE	SUPPLY DIFFUSER	SCD	STEEL	SQUARE CONE	SURFACE	12x12	30	A B C F H J K L	
CSD2	E.H. PRICE	SUPPLY DIFFUSER	SCD	STEEL	SQUARE CONE	LAY-IN	24x24	30	A B C F H K	
CSD3	E.H. PRICE	SUPPLY DIFFUSER	PODR	STEEL	PERFORATED	LAY-IN	24x24	30	A B C F H	
WRG	E.H. PRICE	RETURN GRILLE W/ DAMPER	5300	STEEL	LOUVERED FACE	WALL OR DUCT	(SEE PLANS)	30	A B C D F H	
WSR	E.H. PRICE	SUPPLY REGISTER W/ DAMPER	5200	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:

- EQUIPMENT FURNISHED AND INSTALLED PER THE EQUIPMENT RESPONSIBILITY SCHEDULE.
- NECK SIZE SHOWN ON DRAWINGS. PROVIDE BRANCH DUCT TO MATCH NECK SIZE UNLESS OTHERWISE SHOWN ON DRAWINGS.
- DIFFUSERS SHALL BE PREFINISHED TO MATCH CEILING/WALL/EXPOSED DUCT COLOR (COORDINATE WITH ARCHITECT).
- FRONT BLADES PARALLEL TO LONG DIMENSION.
- DOUBLE DEFLECTION BARS SHALL BE ADJUSTABLE.
- FRAME TYPE TO MATCH CEILING/WALL CONSTRUCTION. COORDINATE WITH ARCHITECTURAL REFLECTED CEILING/WALL PLAN.
- PROVIDE OPPOSED BLADE DAMPER ADJUSTABLE FROM FACE OF DEVICE.
- PROVIDE DIFFUSERS, LINEAR SLOTS, AND GRILLES WITH NO EXPOSED MOUNTING SCREWS.
- CONTRACTOR SHALL PROVIDE REMOTE CABLE-OPERATED VOLUME DAMPER BY METROPOLITAN AIR TECHNOLOGIES MODEL RT-260 WITH EXTERNAL WORM GEAR OPERATOR OR EQUIVALENT YOUNG REGULATOR BUTTERFLY DAMPER WITH 230V/275 CONTROLLER. OPERATOR SHALL HAVE A SQUARE DRIVE FOR 1/4" NUT DRIVER. DAMPER ASSEMBLY SHALL INCLUDE GALVANIZED STEEL DUCT WITH ROLLED BEAD STIFFENERS, REINFORCED BLADE, SELF LUBRICATING BEARING AND WORM GEAR MOUNTING PLATE. DAMPER SHALL BE INSTALLED IN BRANCH DUCT NOT INLET OF PLENUM DIFFUSER. (RE: 2M501)
- 4-WAY THROW PATTERN UNLESS OTHERWISE INDICATED BY FLOW ARROWS ON DRAWINGS.
- PROVIDE RAPID MOUNT FRAME FOR INSTALLATION IN HARD CEILING.

PROJECT DESIGN CONDITIONS														
CLIMATE CONDITIONS					BUILDING OPERATING HOURS:					NOTES				
WEATHER STATION: HANOVER COUNTY MUNICIPAL, VA, USA					MONDAY - FRIDAY					TBD BY OWNER				
CLIMATE ZONE: 4A					SATURDAY					TBD BY OWNER				
HEATING (DB): 99.6%					SUNDAY					TBD BY OWNER				
COOLING (DB/MCW): 0.4%					HOLIDAY					TBD BY OWNER				

SPACE / UNIT DESCRIPTION	SET POINTS										SPACE OPERATING HOURS OCCUPIED / UNOCCUPIED			NOTES	
	COOLING / DE-HUMIDIFICATION				HEATING				HUMIDIFICATION		ZONE VENTILATION RESET				
	OCC	UNOCC	MAX	MIN	OCC	UNOCC	MIN	MAX	CONTROL	BASE	MAXIMUM	M-F	SAT		SUN
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
KITCHEN/BOH	75	80	50%	NA	70	60	NA	NA	NA	NA	NA	TBD	TBD	TBD	A,B,C

NOTES:

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

ROOFTOP UNIT SCHEDULE (DX COOLING, NATURAL GAS HEAT)																								
SCHEDULE FOR REFERENCE ONLY. UNITS TO BE PROVIDED BY LANDLORD.																								
MARK	MANUFACTURER	MODEL	NOMINAL TONS	UNIT TYPE	SUPPLY FAN					COOLING COIL					HEAT EXCHANGER					ELECTRICAL	WEIGHT (LBS)	NOTES		
					CFM	ESP (IN)	HP (Y/N)	VFD	TH (MBH)	SH (MBH)	EAT (°F DB) (°F WB)	LAT (°F DB) (°F WB)	REFR TYPE	MIN EFF (IEER)	MIN NO STAGES	MIN OUT (MBH)	NOM INPRT (MBH)	MIN EFF (%)	EAT (°F DB) (°F WB)				LAT (°F DB) (°F WB)	MIN NO STAGES
(E)RTU-1	CAPTIVEAIRE	CAS-HVAC3-1200-24-1ST	15	SINGLE ZONE	4,300	0.8	5	Y	190.1	129.3	81.1	66.8	53.7	52.2	R410A	18.8	3	1300	2083	72	80	NF	2583	A-O
(E)RTU-2	CAPTIVEAIRE	CAS-HVAC3-1300-24-1ST	15	SINGLE ZONE	5,100	0.8	5	Y	194.3	140.0	80.1	66.1	55.2	53.6	R410A	18.8	3	1568	2083	75	90	NF	2860	A-O

*EQUIPMENT FURNISHED AND INSTALLED PER THE RESPONSIBILITY SCHEDULE, REF ARCHITECTURAL DRAWINGS. EQUIPMENT SHALL BE OBTAINED THROUGH SHAKE SHACK NATIONAL ACCOUNT. REFER TO T12 / VENDOR LIST FOR MORE INFORMATION.

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

NOTES:

- REFER TO ROOFTOP UNIT CONTROL MATRIX FOR CONTROL FEATURES, MODULES, AND ACCESSORIES THAT SHALL BE PROVIDED WITH THE EQUIPMENT.
- EQUIPMENT SIZED FOR 100°F AMBIENT TEMPERATURE.
- PROVIDED WITH 2" MERV 8, EFFICIENT PLEATED THROWAWAY AIR FILTERS.
- PROVIDED WITH FACTORY MOUNTED DISCONNECT INSTALLED ON SERVICE SIDE OF UNIT.
- STARTERS FOR ALL MOTORS FURNISHED INTEGRAL WITH UNIT.
- PROVIDED WITH SINGLE POINT POWER CONNECTION.
- COORDINATE SIZE OF CONDUCTOR TERMINATION LUGS WITH CONDUCTOR SIZES SHOWN ON ELECTRICAL DRAWINGS.
- PROVIDED WITH 125 VAC, 20 AMP DUPLEX CONVENIENCE RECEPTACLE MOUNTED TO UNIT READY FOR FIELD WIRING WITH A COVER UL LISTED FOR WET AND DAMPER LOCATIONS WHEN IN USE.
- SPECIFIED FAN ESP ACCOUNTS FOR DUCT LOSSES EXTERNAL TO UNIT.
- PROVIDED WITH MOTOR HORSEPOWER TO OVERCOME INTERNAL UNIT STATIC PRESSURE DROP PLUS SPECIFIED EXTERNAL STATIC PRESSURE DROP. NOMINAL MOTOR HP SHALL BE NO LARGER THAN THE FIRST AVAILABLE NOMINAL MOTOR SIZE GREATER THAN THE REQUIRED BHP.
- PROVIDED WITH INSULATED ROOF CURB WITH MINIMUM HEIGHT REQUIRED TO MAINTAIN BOTTOM OF EQUIPMENT A MINIMUM OF 16 INCHES ABOVE FINISHED ROOF SURFACE. PROVIDE SLOPED CURB IF NEEDED TO MATCH ROOF SLOPE.
- SCHEDULED WEIGHT IS THE MAXIMUM ALLOWABLE OPERATING WEIGHT OF THE EQUIPMENT ONLY.
- COOLING COIL LAT IS LEAVING AIR TEMPERATURE OF COIL.
- PROVIDED WITH GUARDS TO PROTECT CONDENSER COIL FROM HAIL OR OTHER DAMAGE.
- PROVIDED WITH 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.

BUILDING AIR BALANCE SUMMARY NORMAL OPERATION				
UNIT NO.	SUPPLY (CFM)	OUTDOOR (CFM)	EXHAUST (CFM)	PERCENT O/A/S
RTU-1	4,300	1,300	--	30%
RTU-2	5,100	1,300	--	25%
FCU-1	420	40	--	10%
KEF-1	--	--	1,188	--
KEF-2	--	--	860	--
EF-1	--	--	150	--
TOTALS	9,820	2,940	2,198	--

TOTAL AIRFLOW AVAILABLE FOR PRESSURIZATION (CFM) 442

PERCENT POSITIVE PRESSURIZATION 16.7%

BUILDING AIR BALANCE SUMMARY ECONOMIZER MODE				
UNIT NO.	SUPPLY (CFM)	OUTDOOR (CFM)	EXHAUST (CFM)	PERCENT O/A/S
RTU-1	4,300	4,300	--	100%
RTU-2	5,100	5,100	--	100%
FCU-1	420	40	--	10%
KEF-1	--	--	1,188	--
KEF-2	--	--	860	--
EF-1	--	--	150	--
RELIEF RTU-1	--	--	3,500	--
RELIEF RTU-2	--	--	3,300	--
TOTALS	9,820	9,440	8,998	--

TOTAL AIRFLOW AVAILABLE FOR PRESSURIZATION (CFM) 442

PERCENT POSITIVE PRESSURIZATION 4.7%

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 stages 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 to switch each system between occupied and unoccupied operation.

E. AIR CURTAIN CONTROL

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

FAN COIL UNIT SCHEDULE (HEAT PUMP)																							
SCHEDULE FOR REFERENCE ONLY. UNITS TO BE PROVIDED BY LANDLORD.																							
MARK	MFR	MODEL	SUPPLY FAN			COOLING COIL			HEAT PUMP HEATING COIL			MIN O/A CFM	VIPH	MCA	MOCP	DISC TYPE	WEIGHT (LBS)	NOTES					
			CFM	ESP (IN)	NOM HP (MBH)	TH (MBH)	SH (MBH)	EAT (°F DB) (°F WB)	LAT (°F DB) (°F WB)	REFR TYPE	MIN OUT (MBH)								AMBIENT (DB)	EAT (°F DB) (°F WB)			
(E)FCU-1	CARRIER	40MBQ218	420	0.025	0.061	10.6	9.1	76.8	63.9	97.0	55.5	R410A	9.2	13.8	64.6	85	40	208/1	N/A	N/A	NF	45	A-1

*EQUIPMENT SHALL BE OBTAINED THROUGH SHAKE SHACK NATIONAL ACCOUNT. REFER TO T202 / VENDOR LIST FOR MORE INFORMATION.

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

NOTES:

- EQUIPMENT FURNISHED AND INSTALLED PER THE RESPONSIBILITY SCHEDULE, REF ARCHITECTURAL DRAWINGS.
- ASSOCIATED CONDENSING UNIT SHALL BE BY THE SAME MANUFACTURER.
- FOR COOLING, EQUIPMENT SIZED FOR 90°F AMBIENT TEMPERATURE. HEAT PUMP HEATING CAPACITY AS REQUIRED FOR OPERATION OF HEATING AND COOLING CONTROLS.
- PROVIDED WITH UNIT WITH CLEANABLE AIR FILTERS.
- PROVIDED WITH 7-DAY PROGRAMMABLE THERMOSTAT WITH STAGED HEATING AND COOLING CAPABILITY AS REQUIRED FOR OPERATION OF HEATING AND COOLING CONTROLS.
- DISCONNECT SWITCH FURNISHED BY DIVISION 26 CONTRACTOR.
- PROVIDED WITH SINGLE POINT POWER CONNECTION.
- PROVIDED WITH SPRING VIBRATION ISOLATION AND ALL-THREAD HANGING RODS.
- REFERENCE PLUMBING PLANS FOR CONDENSATE DRAIN PIPING FROM UNIT.

HEAT PUMP CONDENSING UNIT SCHEDULE																	
SCHEDULE FOR REFERENCE ONLY. UNITS TO BE PROVIDED BY LANDLORD.																	
MARK	SERVICE	MANUFACTURER	MODEL	REFR TYPE	COOLING CAPACITY			HEATING CAPACITY			MIN O/A CFM	VIPH	MCA	MOCP	DISC TYPE	WEIGHT (LBS)	NOTES
					TH (MBH)	AMBIENT (DB)	MIN EFF (SEER)	CAP (MBH)	AMBIENT (DB)	MIN EFF COP-4°F							
(E)CU-1	(E)FCU-1	CARRIER	38MARBQ18AA3	R410A	10.6	98.0	19.0	9.2	13.8	3.3	18	25	208/1	102.5	A-G		

*EQUIPMENT SHALL BE OBTAINED THROUGH SHAKE SHACK NATIONAL ACCOUNT. REFER TO T202 / VENDOR LIST FOR MORE INFORMATION.

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

NOTES:

- EQUIPMENT FURNISHED AND INSTALLED PER THE RESPONSIBILITY SCHEDULE, REF ARCHITECTURAL DRAWINGS.
- EQUIPMENT CAPACITY SCHEDULED IS MINIMUM CAPACITY THAT MUST BE PROVIDED AT AMBIENT TEMPERATURE INDICATED.
- CONTRACTOR SHALL VERIFY WITH EQUIPMENT SUPPLIER EXACT QUANTITY AND SIZE OF REFRIGERANT PIPING.
- PROVIDED WITH LIQUID LINE FILTER DRYER AND SIGHT GLASS.
- PROVIDED WITH PREFABRICATED EQUIPMENT SUPPORT RAILS.
- DISCONNECT SWITCH FURNISHED BY DIVISION 26 CONTRACTOR.
- STARTERS FOR ALL MOTORS FURNISHED INTEGRAL WITH UNIT.

AIR CURTAIN SCHEDULE									
MARK	SERVICE AREA	MANUFACTURER	MODEL	LENGTH (IN)	MAX. AIRFLOW (CFM)	HEATING CAPACITY (KW)	MOTOR	VIPH/HZ	NOTES
AC-2	MAIN ENTRY	MARS	STD2	72	2680	24	(2) 1/2	208/3	A-G

FAN SCHEDULE														
MARK	SERVICE	MANUFACTURER	MOUNTING	MODEL	CFM	ESP (IN)	DRIVE	MIN. HP (Y/N)	FAN RPM	VFD	ELECTRICAL	NOTES		
													VIPH	DISC.
EF-1	TOILETS	GREENHECK	ROOF	G-097-VG	150	0.5	DIRECT	1/4	1236	N	120/1	NF	N/A	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.

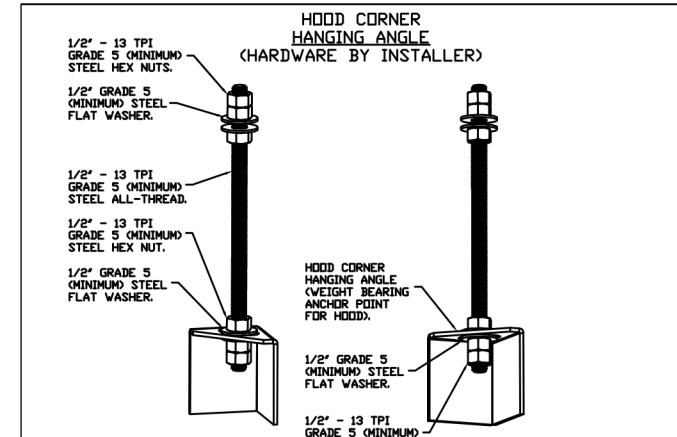
NOTES:

- EQUIPMENT FURNISHED AND INSTALLED PER THE RESPONSIBILITY SCHEDULE, REF ARCHITECTURAL DRAWINGS.
- PROVIDE UNIT PER MANUFACTURERS RECOMMENDATIONS TO FACE OF WALL AND SUPPORT VERTICALLY.
- PROVIDE INTEGRAL STARTER AND DISCONNECT SWITCH.
- REFER TO SEQUENCE OF OPERATION FOR UNIT CONTROLS.
- PROVIDE AIR CURTAIN WITH NORMALLY CLOSED DOOR LIMIT SWITCH FOR INSTALLATION ON DOOR. THE AIR CURTAIN SHALL ENERGIZE WHEN DOOR OPENS.
- PROVIDE WITH DELAY MICROSWITCH WITH ADJUSTABLE DELAY TIMERS PRE MOUNTED IN THE AIR CURTAIN CONTROL PANEL.
- PROVIDE WITH INTEGRAL THERMOSTAT.

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] (PEOPLE)	SYSTEM AVERAGED PEOPLE-BASED OUTDOOR AIR RATE (CFM/PE)	REQUIRED OA INTAKE FLOW [V ₁] (CFM)	REQUIRED DCV OA INTAKE FLOW [V ₂] (CFM)	DESIGN OA INTAKE FLOW [V ₃] (CFM)
		ASSOCIATED VENTILATION ZONE	SINGLE ZONE WORST CASE ZONE AIR DISTRIBUTION EFFECTIVENESS [E _z]	SYSTEM VENTILATION EFFICIENCY [E _v]	SINGLE ZONE WORST CASE ZONE AIR DISTRIBUTION EFFECTIVENESS [E _z]							
RTU-1	MULTIZONE (RTU-1)	-	-	1.00	1.333	0.146	54	7.50	599	N/A	1,300	A,B,C
RTU-2	SINGLE ZONE	KITCHEN	0.80	0.120	1,326	0.120	26.52	7.50	448	N/A	1,300	A,B,C
FCU-1	SINGLE ZONE	OFFICE	0.80	-	70	0.060	2	5.00	18	N/A	40	A,B,C
TOTALS										1,064	0	2,640

GENERAL NOTES:

- VENTILATION CALCULATIONS BASED ON IMC-2021.
- SYSTEM POPULATIONS BASED ON MAX SEATING AND/OR CODE MAXIMUM VALUES.
- SINGLE ZONE SYSTEMS (V₁ + V₂): SYSTEM VENTILATION EFFICIENCY CALCULATION IS NOT REQUIRED FOR SINGLE ZONE SYSTEMS. WORST CASE AIR DISTRIBUTION EFFECTIVENESS BETWEEN HEATING AND COOLING MODES OF OPERATION IS SHOWN IN TABLE.
- 100% ON SYSTEMS (V₁ + 2xV₂ zone V₃): WHEN ONE AIR HANDLER SUPPLIES ONLY OUTDOOR AIR TO ONE OR MORE ZONES, EACH ZONE IS INDIVIDUALLY CALCULATED WITH ITS WORST CASE ZONE AIR DISTRIBUTION EFFECTIVENESS (HEATING/COOLING).
- MULTI-ZONE RECIRCULATING SYSTEMS: CALCULATOR USED TO



HANGING ANGLE DETAILS			
HOOD STYLE / MODEL	450 DEGREES	600 DEGREES	700 DEGREES
	cfm/ft.	cfm/ft.	cfm/ft.
CANOPY NO-2	150	200	250
CANOPY NO-2 W/ END PANELS	105	140	175
SLOPED SHD-2	228	294	-
ISLAND NO-2W	269	300	350
ISLAND NO-2I	346	422	475

ETL HOOD LISTING DETAIL

EXHAUST CFM = LENGTH OF HOOD X CFM/LIN.FT. (LxW)

SUPPLY CFM = EXHAUST CFM X PERCENTAGE REQUIRED

TOTAL DUCT AREA (sq. in.) = 144 x (CFM)²

DUCT LENGTH = TOTAL DUCT AREA / DUCT WIDTH

*CAPTIVEAIRE VENTILATOR DUCT SIZES ARE CALCULATED USING AN EXHAUST VELOCITY OF 1000-1000 FPM AND A SUPPLY VELOCITY OF 300 FPM.

CAPTIVEAIRE UTILIZED

CAPTIVEAIRE HOODS BUILT IN COMPLIANCE WITH:

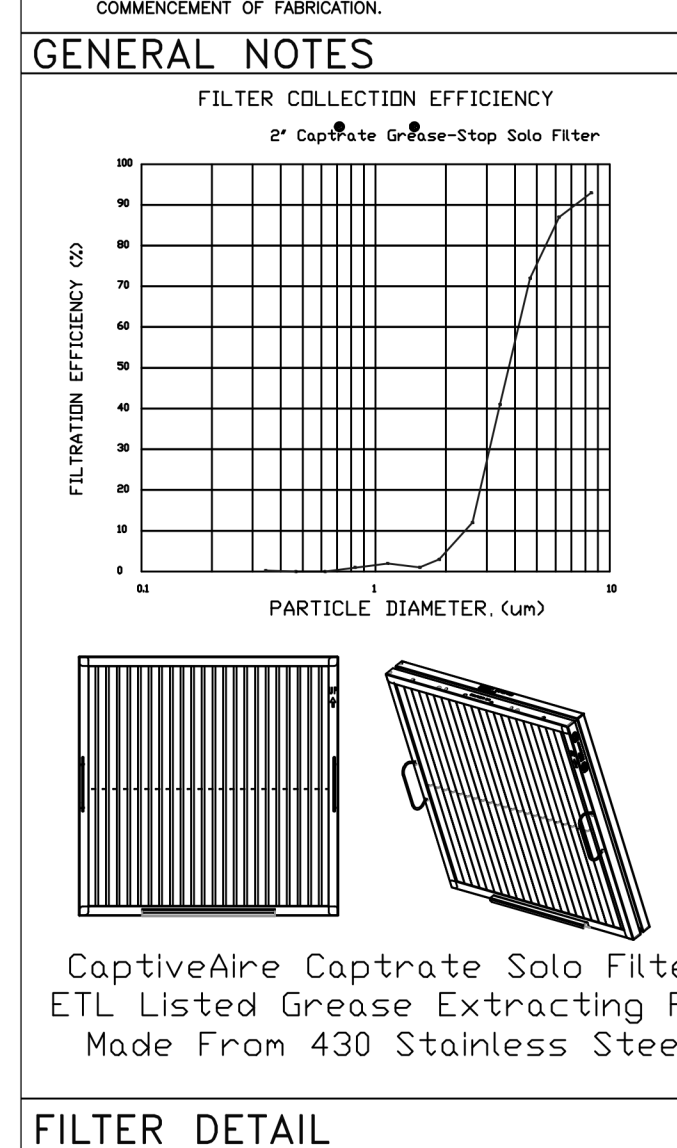
ETL LISTED UNDER ETL File Number 3054804-001/002

BUILDING CODES

CAPTIVEAIRE 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 HANGER MATERIALS PROVIDED BY INSTALLING CONTRACTORS.
 - ALL CONNECTIONS FROM CAPTIVEAIRE HOOD PER MECHANICAL CONTRACTOR'S PLANS.
 - COOKING EQUIPMENT TO SHUT OFF IN EVENT OF FIRE.
 - EXHAUST FANS TO TURN ON IN EVENT OF FIRE.
 - ALL LIGHT FIXTURES SHOWN INSTALLED BY CAPTIVEAIRE ARE FACTORY PREWIRED. INTERCONNECTIONS BETWEEN HOODS AND TO SWITCHES ARE BY ELECTRICAL CONTRACTOR.
 - LAMPS FOR LIGHT FIXTURES BY INSTALLING CONTRACTOR.
 - SEISMIC RESTRAINTS ARE RESPONSIBILITY OF RETAILING CONTRACTOR.
 - INSTALLING CONTRACTORS ASSUME ALL RELATED RESPONSIBILITY FOR VERIFICATION OF DIMENSIONAL DATA CONTAINED ON THESE DOCUMENTS FOR ACCURACY, INTEGRATION, AND ADMINISTRATION OF CODE REQUIREMENTS IN EFFECT PRIOR TO ANY RELEASE FOR PRODUCTION OF EQUIPMENT SHOWN.
- BALANCE**
- KITCHEN HOODS MUST BE BALANCED WITH KITCHEN.
 - KITCHEN SHALL BE NEGATIVE WITH RESPECT TO DRIVING AREA.
 - RESTAURANT SHALL BE POSITIVE WITH RESPECT TO AMBIENT PRESSURE.
- ADDITIONAL**
- WRITTEN HOOD DIMENSIONS HAVE PRECEDENCE OVER SCALE.
 - SCHEMATIC AND "AS SHOWN" COPIES OF THIS DOCUMENT MUST BE REVIEWED BY THE FACTORY PRIOR TO COMMENCEMENT OF FABRICATION.



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

HOOD INFORMATION - JOB#6748687

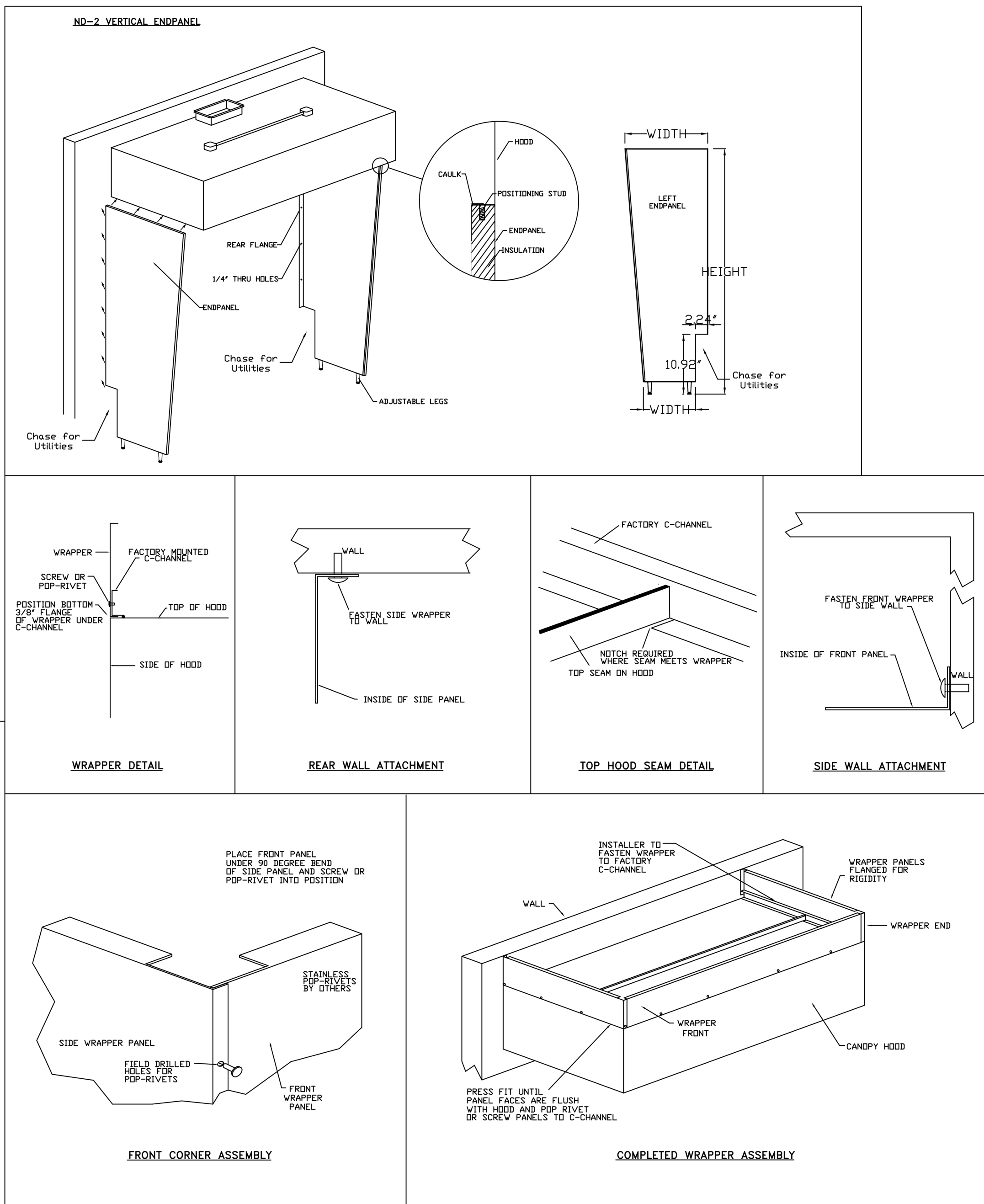
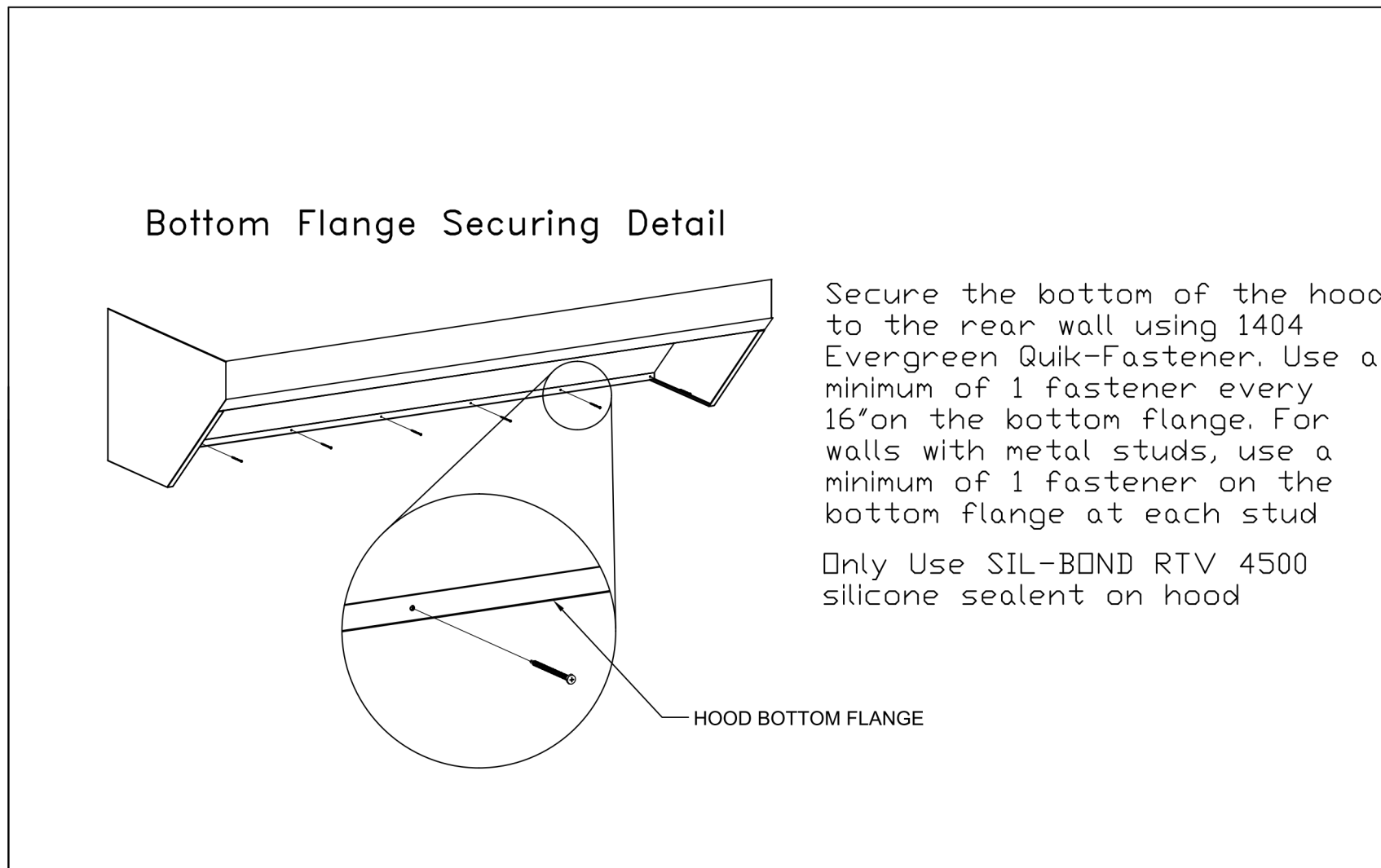
HOOD NO	TAG	MODEL	MANUFACTURER	LENGTH	MAX COOKING TEMP	TYPE	APPLIANCE DUTY	DESIGN CFM/FT	TOTAL EXH CFM	EXHAUST PLENUM RISER(S)			HOOD CONSTRUCTION	HOOD CONFIG	
										WIDTH	LENG	HEIGHT		END TO END	ROW
1	Hood (Grill)	5430 ND-2	CAPTIVEAIRE	7' 11"	450 DEG	I	MEDIUM	150	1188	10"	11"	4'	430 SS WHERE EXPOSED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

HOOD INFORMATION

HOOD NO	TAG	TYPE	FILTER(S)		EFFICIENCY @ 7 MICRONS	QTY	LIGHT(S)		UTILITY CABINET(S)		FIRE SYSTEM	ELECTRICAL	SWITCHES	FIRE SYSTEM HANGING PIPING	HOOD HANGING WEIGHT
			QTY	HEIGHT			LENGTH	TYPE	WIRE GUARD	LOCATION					
1	Hood (Grill)	CAPRATE SOLO FILTER	5	20"	16"	85X SEE FILTER SPEC	2	RECESSED ROUND	NO					YES	484 LBS
2	Hood (Fryer)	CAPRATE SOLO FILTER	3	20"	16"	85X SEE FILTER SPEC	2	RECESSED ROUND	NO	LEFT	12"x54"x30"	TANK FS	4.0/4.0/4.0	SC-32010MA 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. 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 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.
2	Hood (Fryer)	FIELD WRAPPER 12.00' HIGH FRONT, LEFT, RIGHT. 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.



REVISIONS

NO.	DESCRIPTION	DATE:

CAPTIVEAIRE
Eastern PA Mechanical
www.captiveaire.com

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

Shake Shack-1547-Short Pump, VA(Kitchen)
HENRICO, VA, 23233

DATE: 4/18/2024
DWG.#: 6748687
DRAWN BY: Joe.shiiba
SCALE: 3/4" = 1'-0"
MASTER DRAWING

SHEET NO.
1

NOTE:
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CONSULTANTS:

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NO. BY DATE DESCRIPTION

SHAKE SHACK

SHAKE SHACK SHORT PUMP

12170 W BROAD ST
RICHMOND, VA 23233
SHACK #1547

PERMIT / BID SET

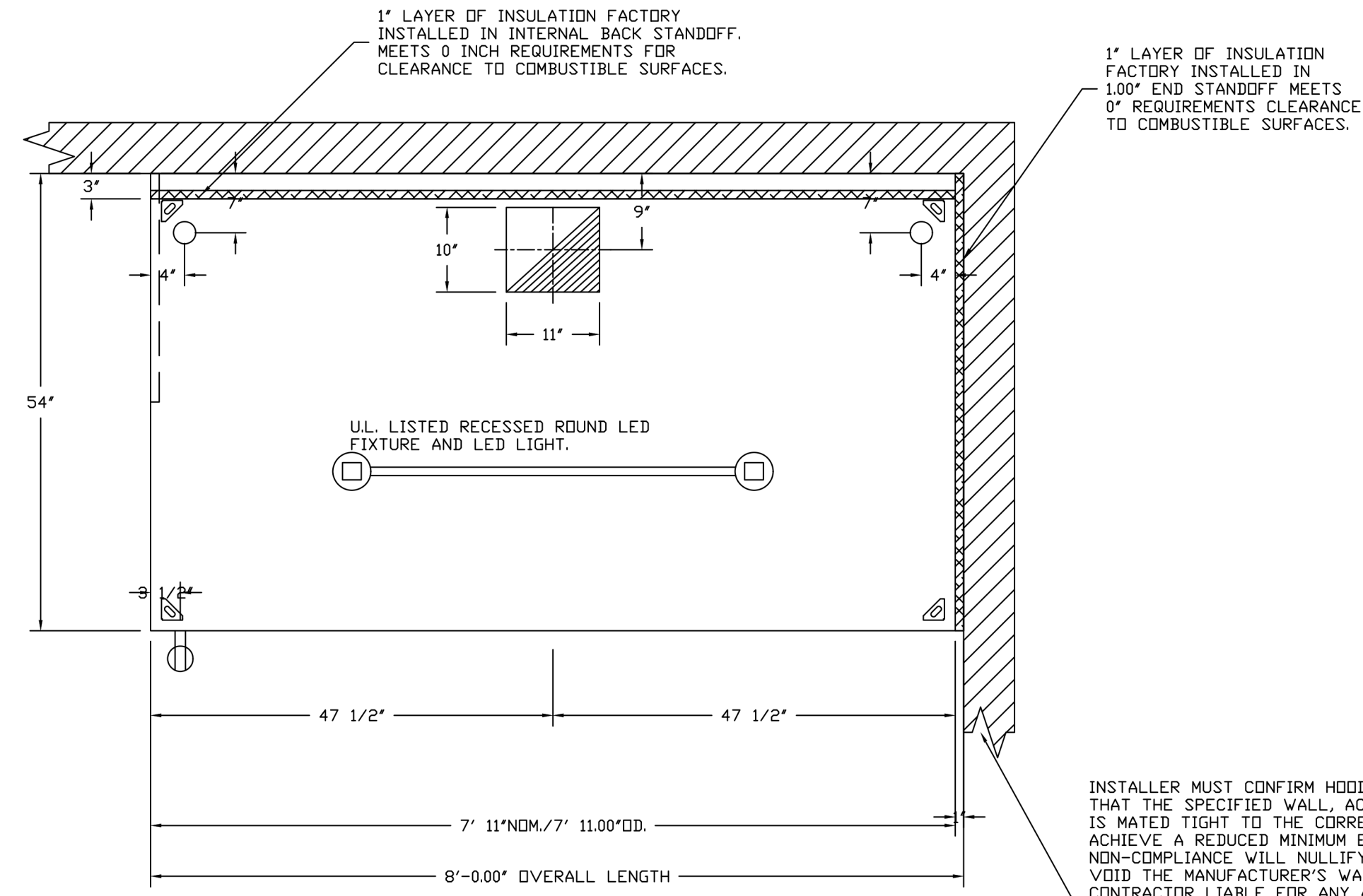
CAPTIVEAIRE DRAWINGS

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CHECKED BY: Checker
JOB NO: 20240154.00

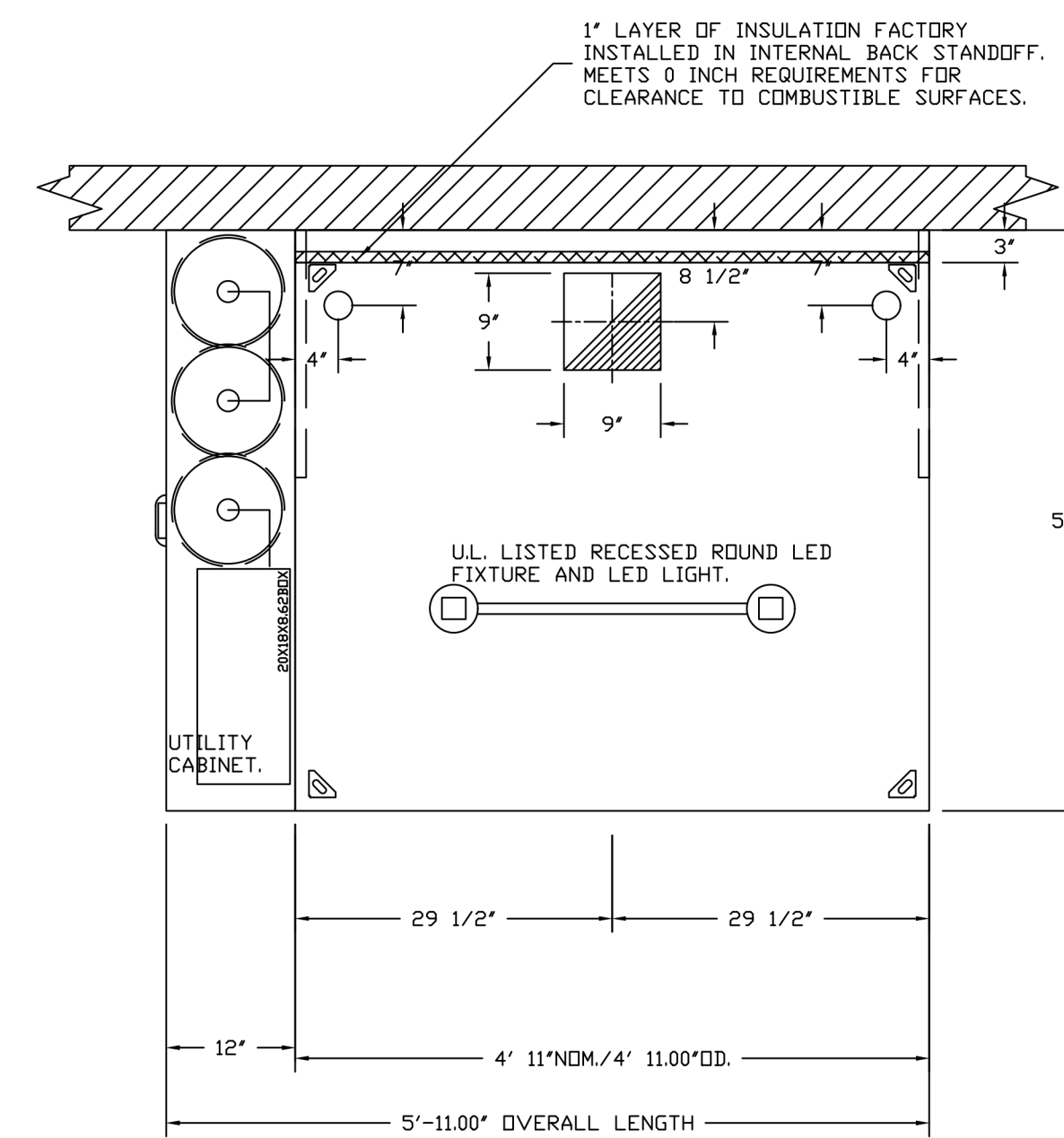
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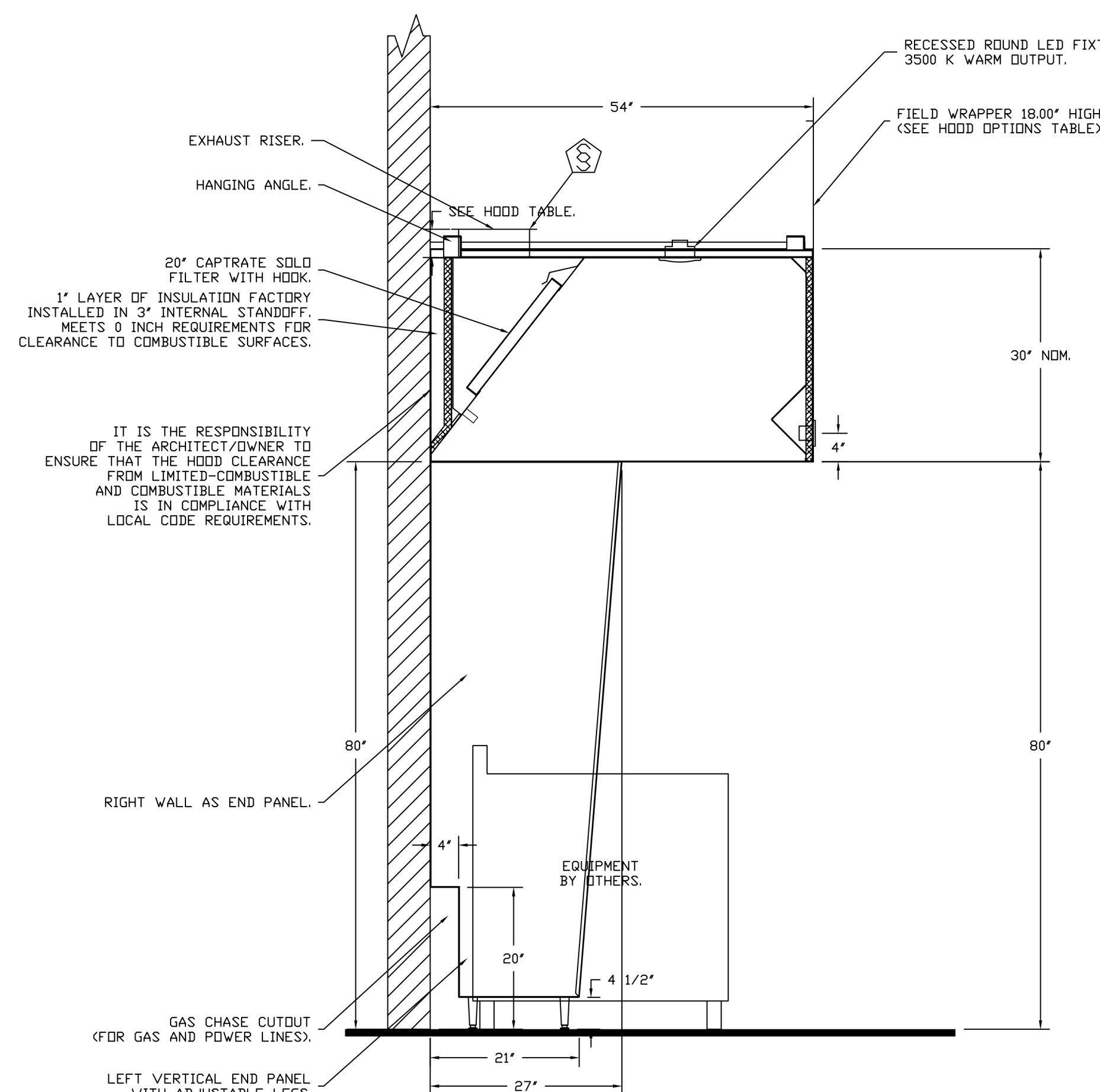


PLAN VIEW - HOOD #1 (Hood (Grill))
7' 11.00\"/>

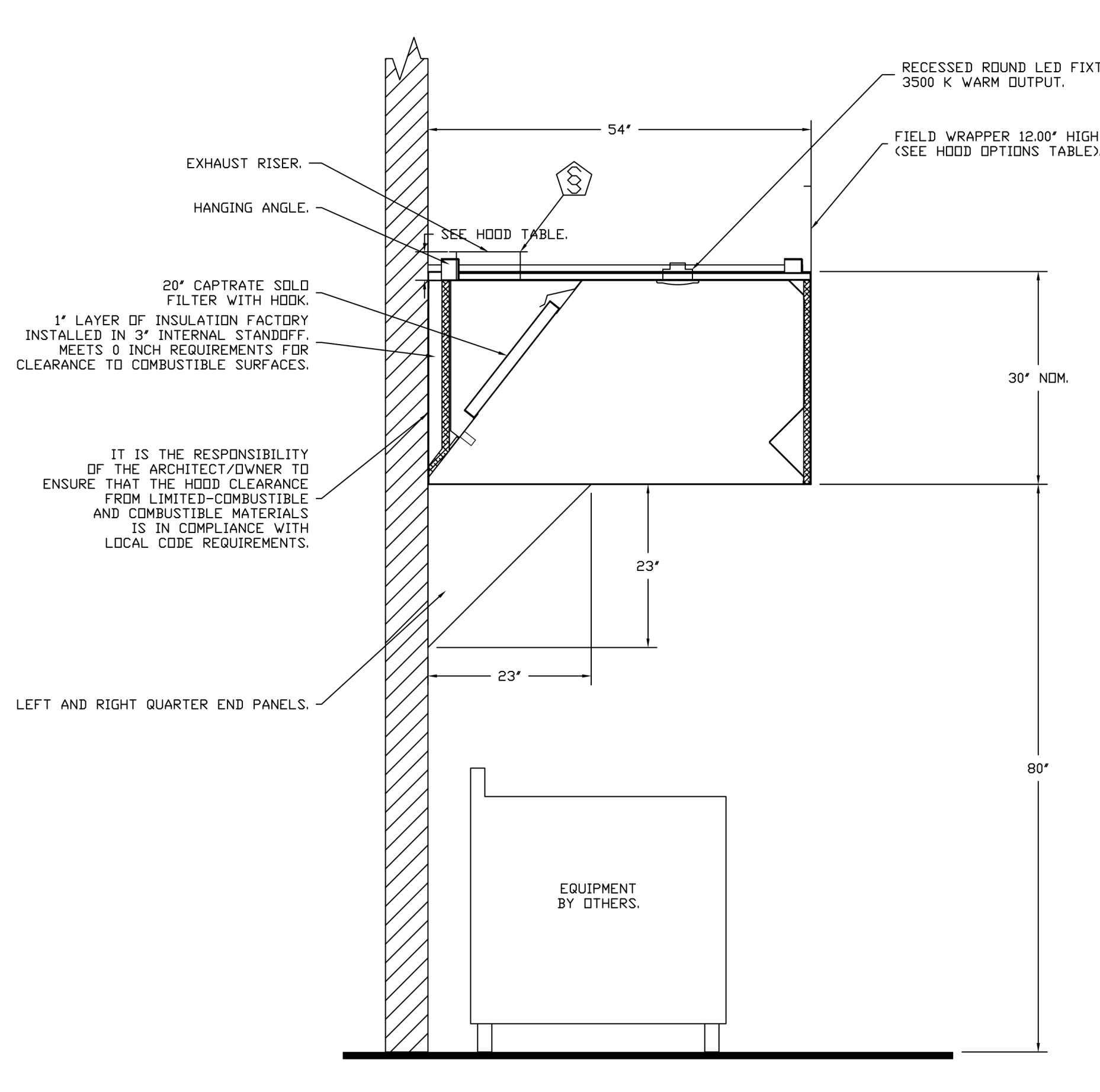


PLAN VIEW - HOOD #2 (Hood (Fryer))
4' 11.00\"/>

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\"/>



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



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

REVISIONS	
DESCRIPTION	DATE

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

Shake Shack-1547-Short Pump, VA(Kitchen)
HENRICO, VA, 23233

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DWG.#: 6748687
DRAWN BY: Joe.shiiba
SCALE: 3/4" = 1'-0"
MASTER DRAWING

SHEET NO. 2

NOTE:
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CONSULTANTS:

SEAL SIGNATURE:

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NO.	BY	DATE	PERMIT / BID SET	DESCRIPTION

SHAKE SHACK SHORT PUMP

12170 W BROAD ST
RICHMOND, VA 23233
SHACK #1547

PERMIT / BID SET

CAPTIVEAIRE DRAWINGS

DRAWN BY: Author
CHECKED BY: Checker
JOB NO: 20240154.00

M702

FIRE SYSTEM INFORMATION - JOB#6748687

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

GAS VALVE(S)

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

NOTES

- FIELD PIPE DROPS AS SHOWN
- PIPING, ELBOWS, TEES, AND NOZZLES SUPPLIED BY CAS.
- FIELD INSTALLED DROP: FACTORY WILL PROVIDE QTY 2 60IN LONG PIECES OF CHROME PLATED PIPING SHIPPED LOOSE TO BE FIELD-INSTALLED.
- SHIP LOOSE DROP: FACTORY WILL PROVIDE THE EXACT CHROME PIPE LENGTH NEEDED SHIPPED LOOSE TO BE FIELD-INSTALLED.
- RELOCATE NOZZLES IF FLOW PATTERN IS BLOCKED BY SHELVING, SALAMANDERS, ETC.
- OVERLAPPING COVERAGE SHALL NOT BE USED ON ANY APPLIANCE WITH AN OBSTRUCTION.
- IF APPLICABLE, EXTENDED PRE-PIPED DROPS ARE SHIPPED LOOSE.
- FACTORY PIPING EXTENDS A MAXIMUM OF 6" ABOVE THE TOP OF THE HOOD.
- APPLIANCE DIMENSIONS LISTED REPRESENT THE COOKING SURFACE SIZE, NOT THE OVERALL APPLIANCE SIZE.
- THIS FIRE SYSTEM COMPLIES WITH U.L. 300 REQUIREMENTS.
- DL-F NOZZLE PART NUMBER REPLACES 3070-3/8H-10-SS

JOB #: 6748566.
JOB NAME: SHAKE SHACK-1543-ST. LOUIS PARK,MN(KITCHEN).

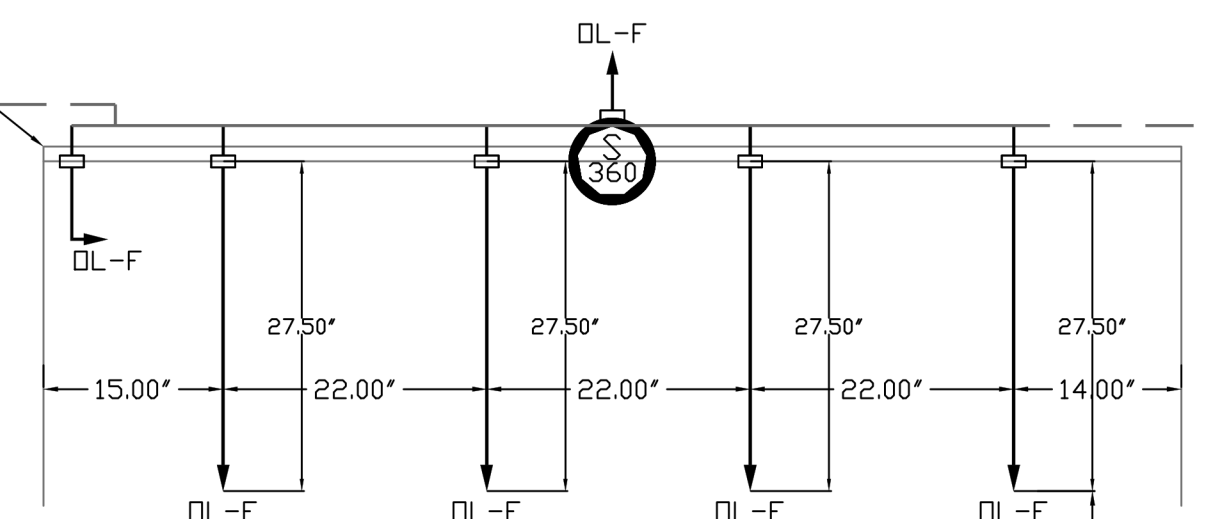
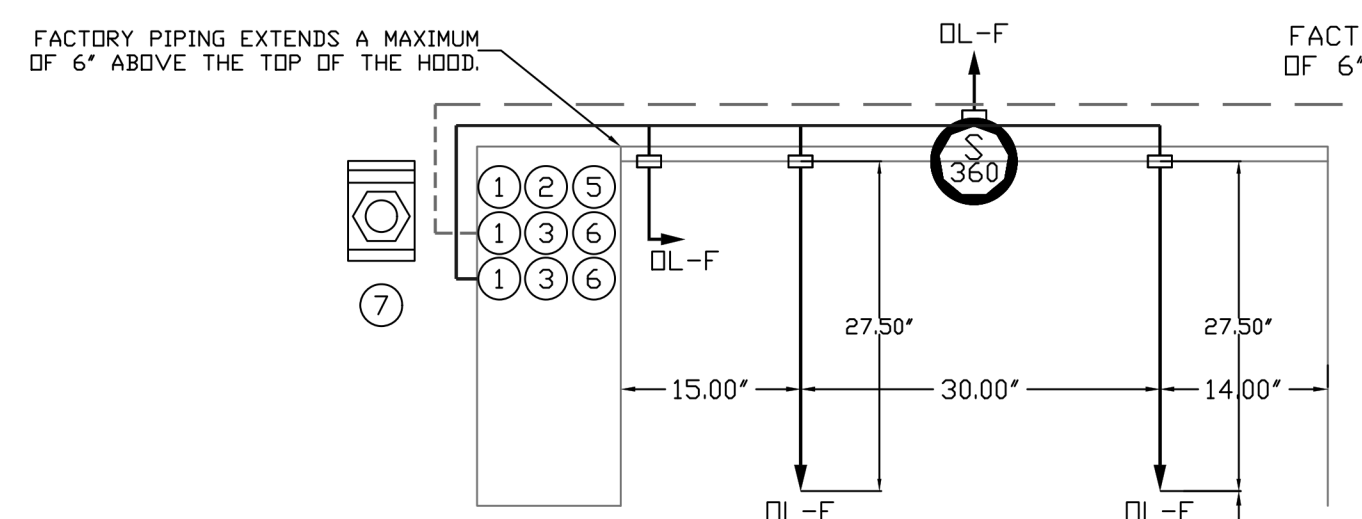
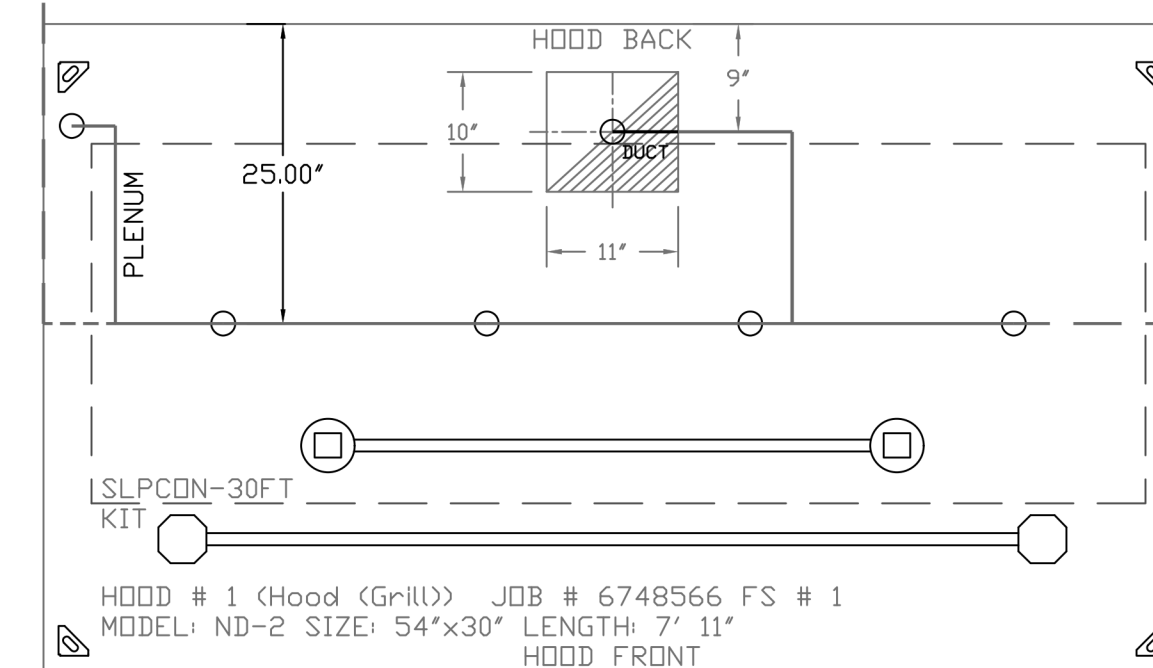
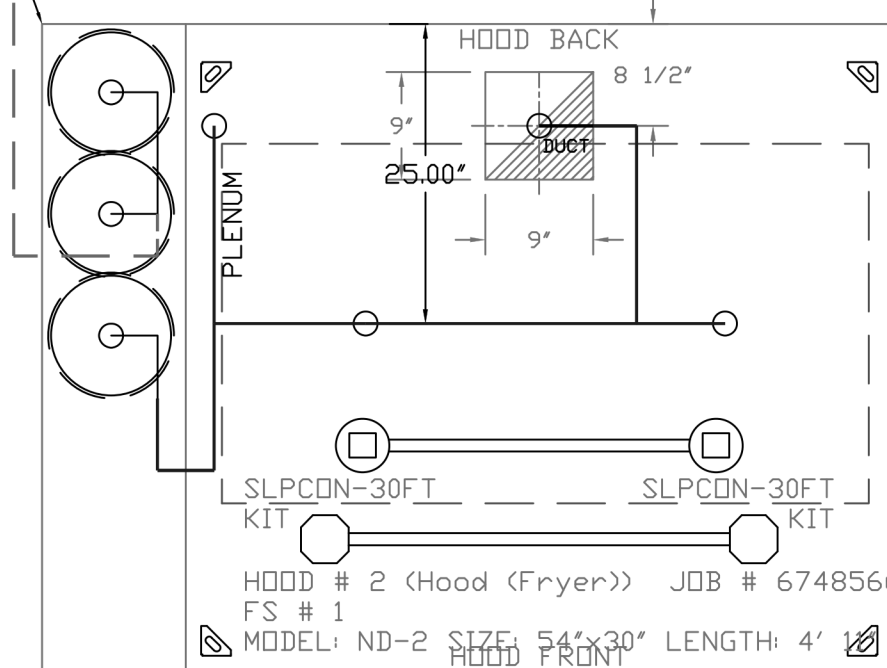
SYSTEM SIZE: TANK-SP-3 DESIGN FP: 46, MAXIMUM FP: 60.
HOOD # 1 7' 11.00" LONG x 54" WIDE x 30" HIGH.
RISER # 1 SIZE: 10" x 11".
HOOD # 1 METAL BLOW-OFF CAPS INCLUDED.
HOOD # 2 4' 11.00" LONG x 54" WIDE x 30" HIGH.
RISER # 1 SIZE: 9" x 9".
HOOD # 2 METAL BLOW-OFF CAPS INCLUDED.

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

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 1.5 FT OF EQUIVALENT LENGTH. SEE MANUAL FOR DETAILS



REVISIONS	
DESCRIPTION	DATE

CAPTIVEAIRE
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Shake Shack-1547-Short Pump, VA(Kitchen)
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DWG.#: 6748687
DRAWN BY: Joe.shiiba
SCALE: 3/4" = 1'-0"
MASTER DRAWING
SHEET NO. 3

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Boston, MA 02210
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CONSULTANTS:
SEAL SIGNATURE:
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HEI | 2024-09-03 | PERMIT / BID SET
NO. BY DATE DESCRIPTION
SHAKE SHACK
SHAKE SHACK SHORT PUMP
12170 W BROAD ST
RICHMOND, VA 23233
SHACK #1547
PERMIT / BID SET
CAPTIVEAIRE DRAWINGS

DRAWN BY: Author
CHECKED BY: Checker
JOB NO: 20240154.00

M703

EXHAUST FAN INFORMATION - JOB#6748687

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	DU8SHFA	CAPTIVEAIRE	1188	1.500	1424	TEAD-ECM	0.750	0.4970	1	208	5.2	376 FPM	90	12.7
2	KEF(FRYER)	1	DU8SHFA	CAPTIVEAIRE	860	1.500	1354	TEAD-ECM	0.750	0.4270	1	208	5.2	272 FPM	90	11.4

FAN OPTIONS

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

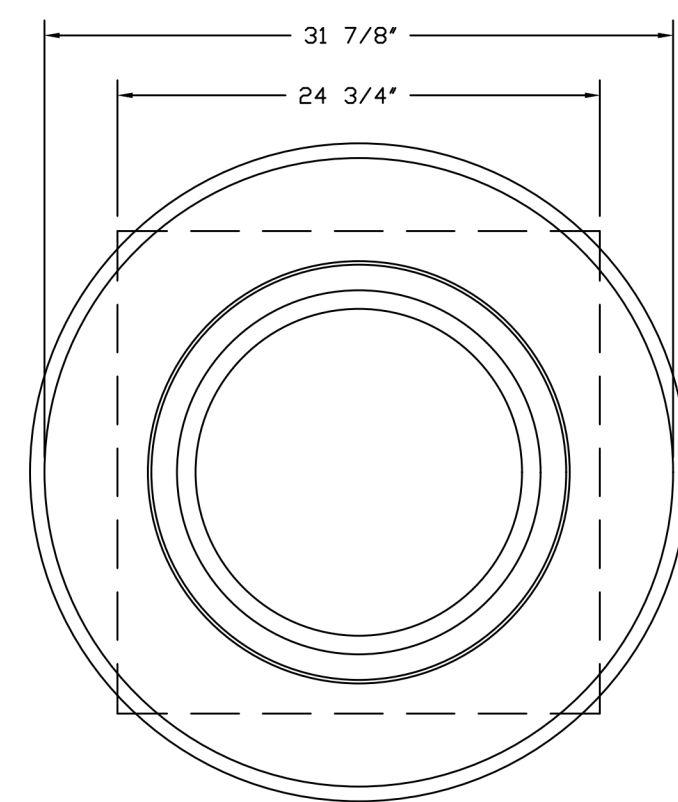
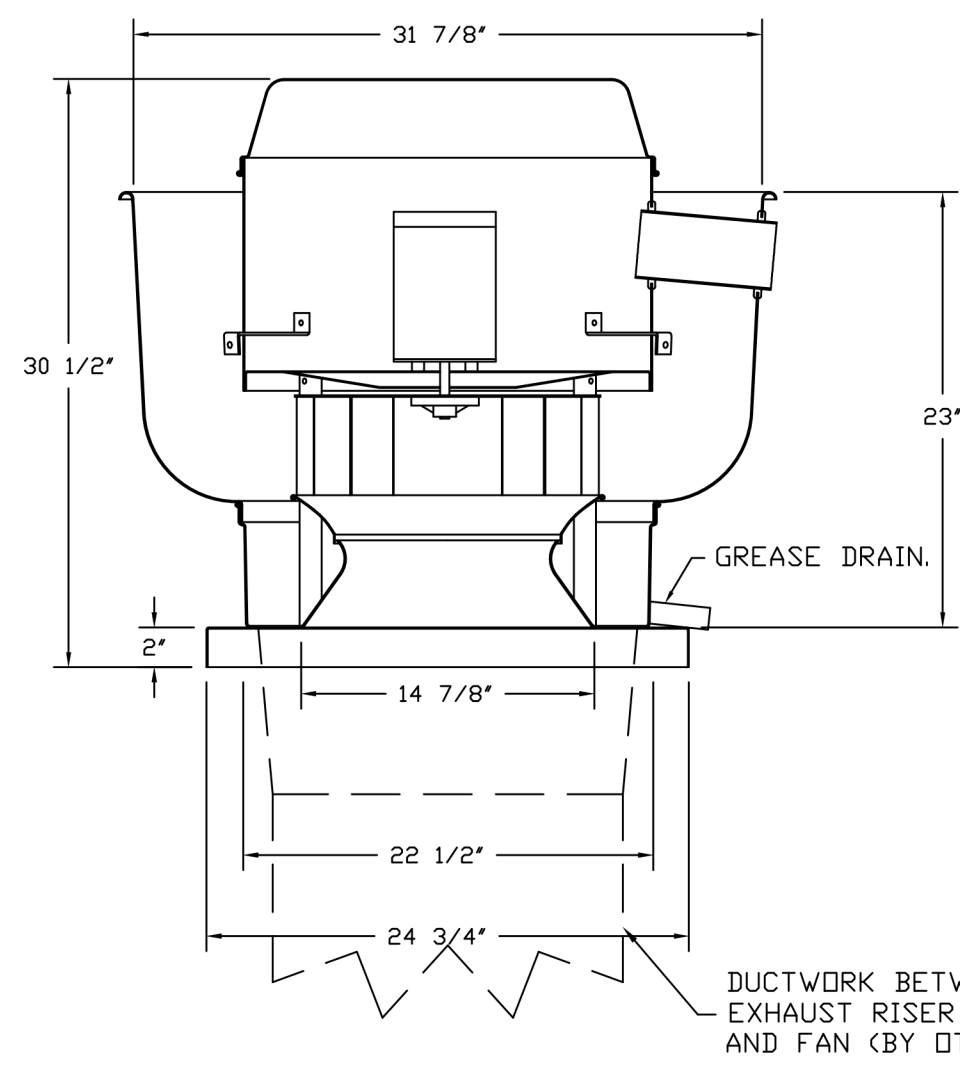
FAN ACCESSORIES

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

CURB ASSEMBLIES

NO	DN 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)) - DU8SHFA EXHAUST FAN



TOP VIEW

FEATURES:

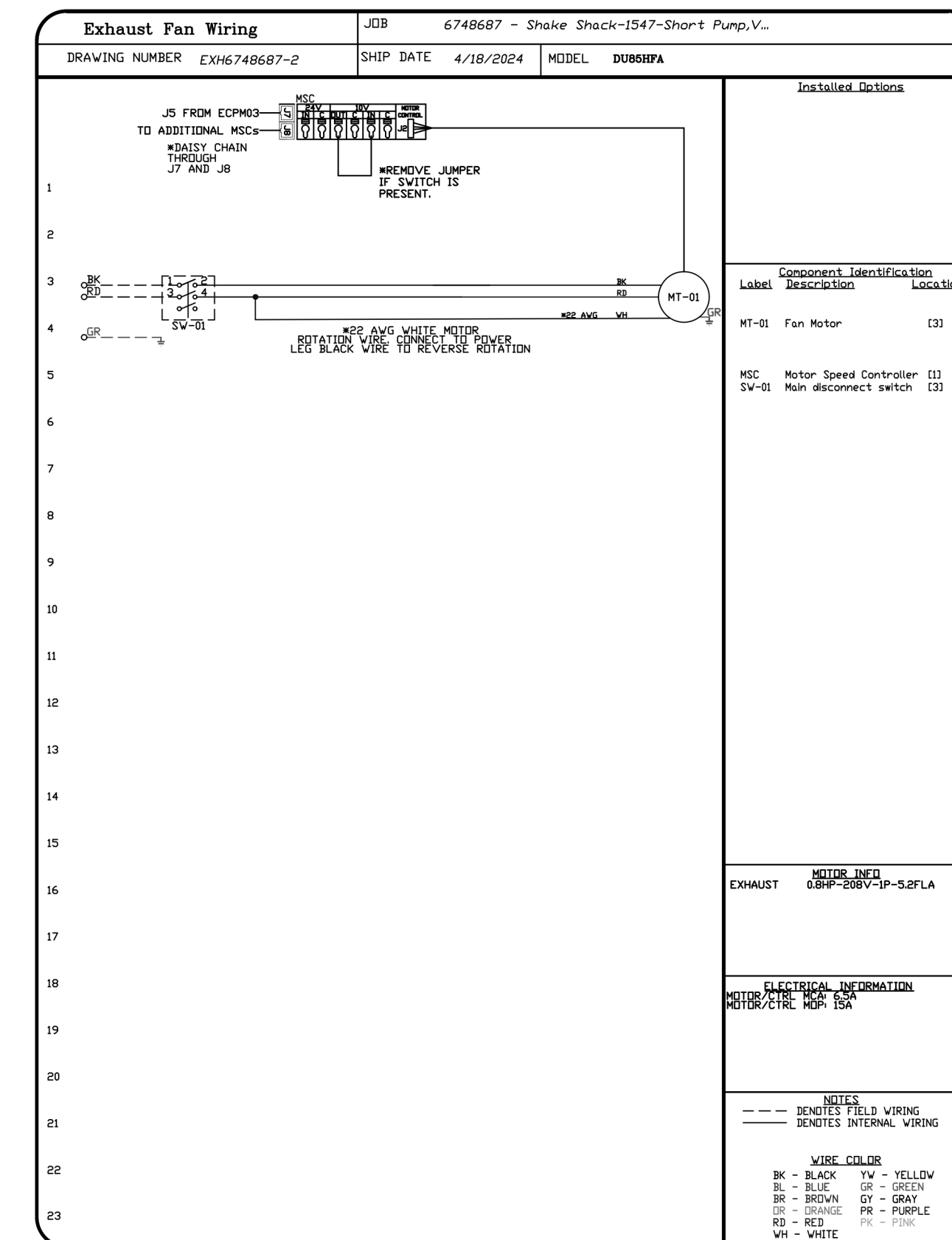
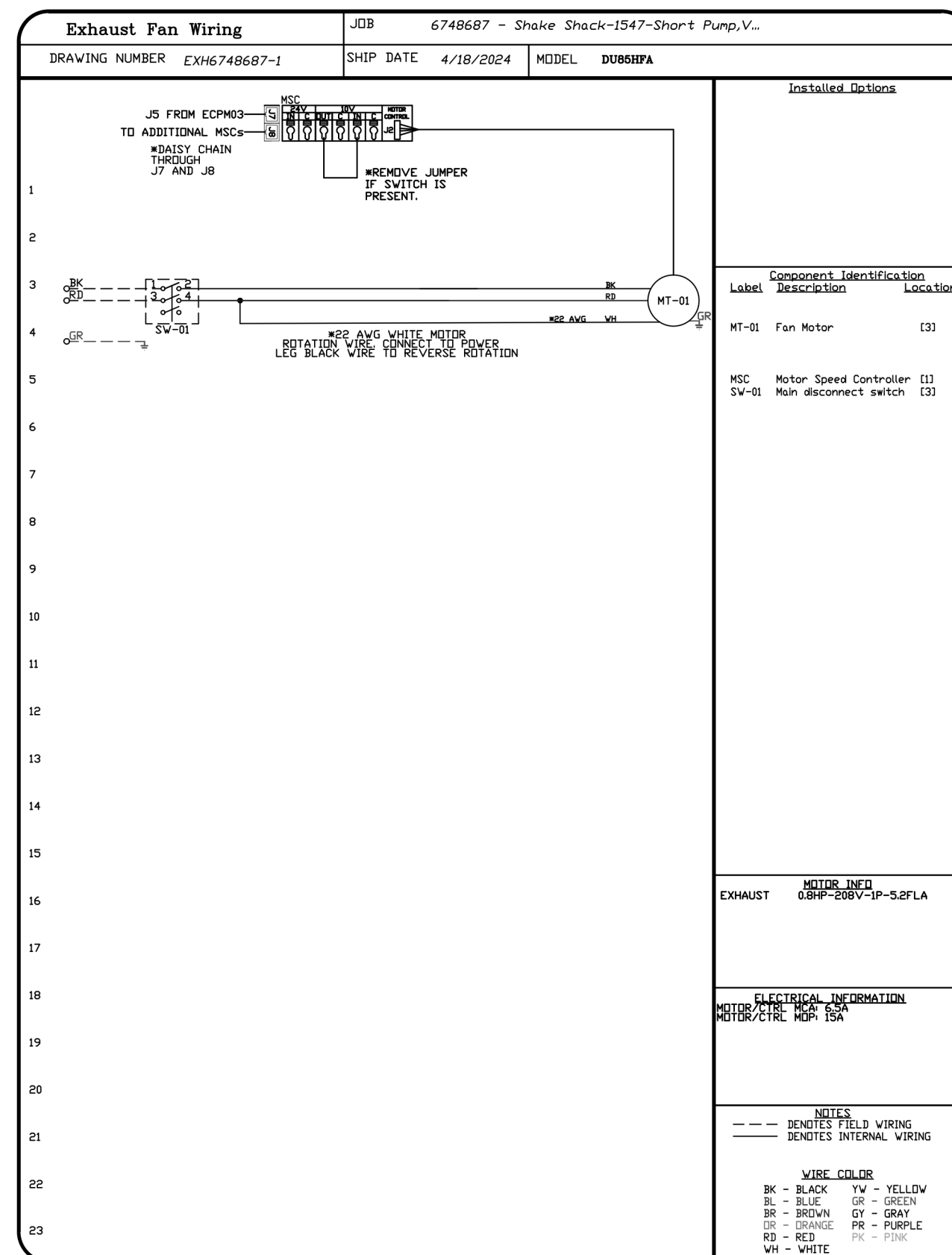
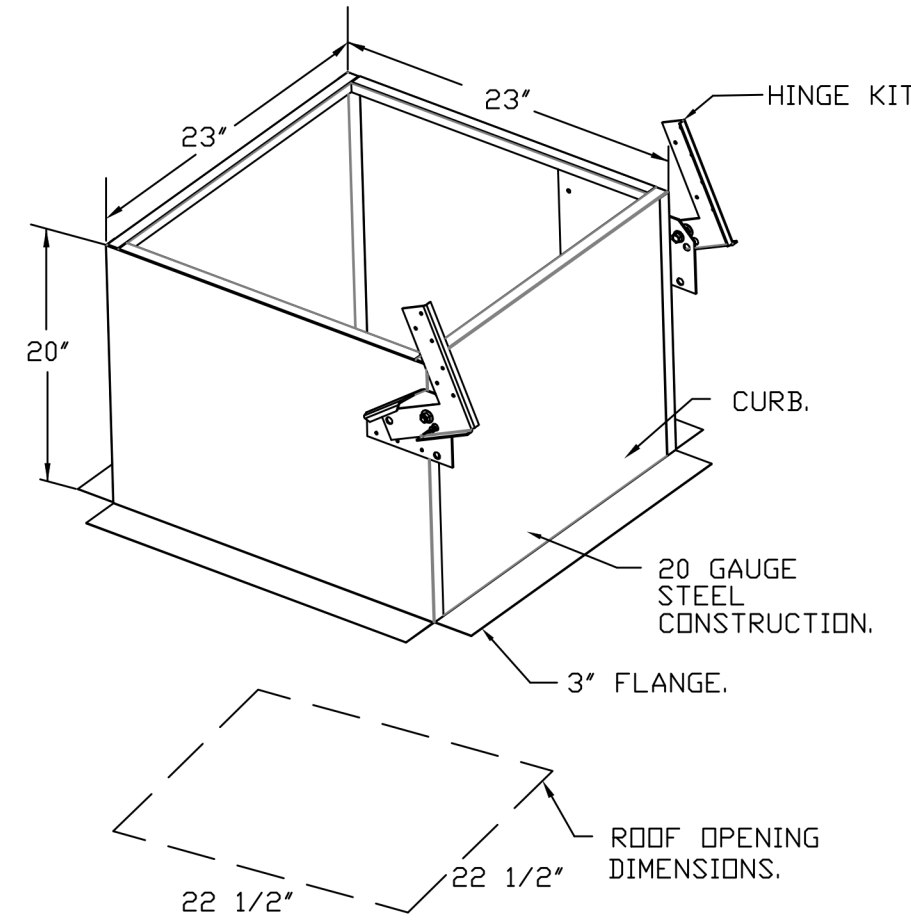
- DIRECT DRIVE CONSTRUCTION (NO BELTS/PULLEYS).
- ROOF MOUNTED FANS.
- RESTAURANT MODEL.
- UL705 AND UL762 AND UL-C-5645
- VARIABLE SPEED CONTROL.
- INTERNAL WIRING.
- THERMAL OVERLOAD PROTECTION (SINGLE PHASE).
- HIGH HEAT OPERATION 300°F (149°C).
- GREASE CLASSIFICATION TESTING.
- NEMA 3R SAFETY DISCONNECT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

NORMAL TEMPERATURE TEST
EXHAUST FAN MUST OPERATE CONTINUOUSLY WHILE EXHAUSTING AIR AT 300°F (149°C) UNTIL ALL FAN PARTS HAVE REACHED THERMAL EQUILIBRIUM, AND WITHOUT ANY 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 - FOR GREASE DUCTS.
- ECM WIRING PACKAGE - EXHAUST - MODBUS CONTROL -MSC- (TELCD), CCW ROTATION.
- 2 YEAR PARTS WARRANTY.



REVISIONS

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CAPTIVEAIRE

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HENRICO, VA, 23233

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DWG.#: 6748687
DRAWN BY: Joe.shiiba
SCALE: 3/4" = 1'-0"
MASTER DRAWING

SHEET NO.
4

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SHAKE SHACK

SHAKE SHACK SHORT PUMP

12170 W BROAD ST
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SHACK #1547

PERMIT / BID SET

CAPTIVEAIRE DRAWINGS

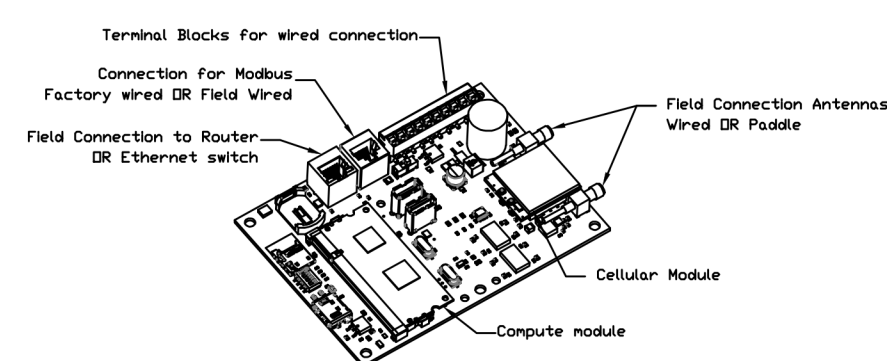
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M704

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ELECTRICAL PACKAGE - JOB#6748687

NO	TAG	PACKAGE #	LOCATION	SWITCHES		OPTION	FANS CONTROLLED					
				LOCATION	QUANTITY		FAN TAG	TYPE	#	HP	VOLT	FLA
1		SC-320110MA	UTILITY CABINET LEFT	UTILITY CABINET LEFT HOOD # 2	1 LIGHT 1 FAN	SMART CONTROLS THERMOSTATIC CONTROL W/ Relay IN/OUT WITH SUPPLY	KEF(Grill)	EXHAUST	1	0.750	208	5.2
							KEF(Fryer)	EXHAUST	1	0.750	208	5.2

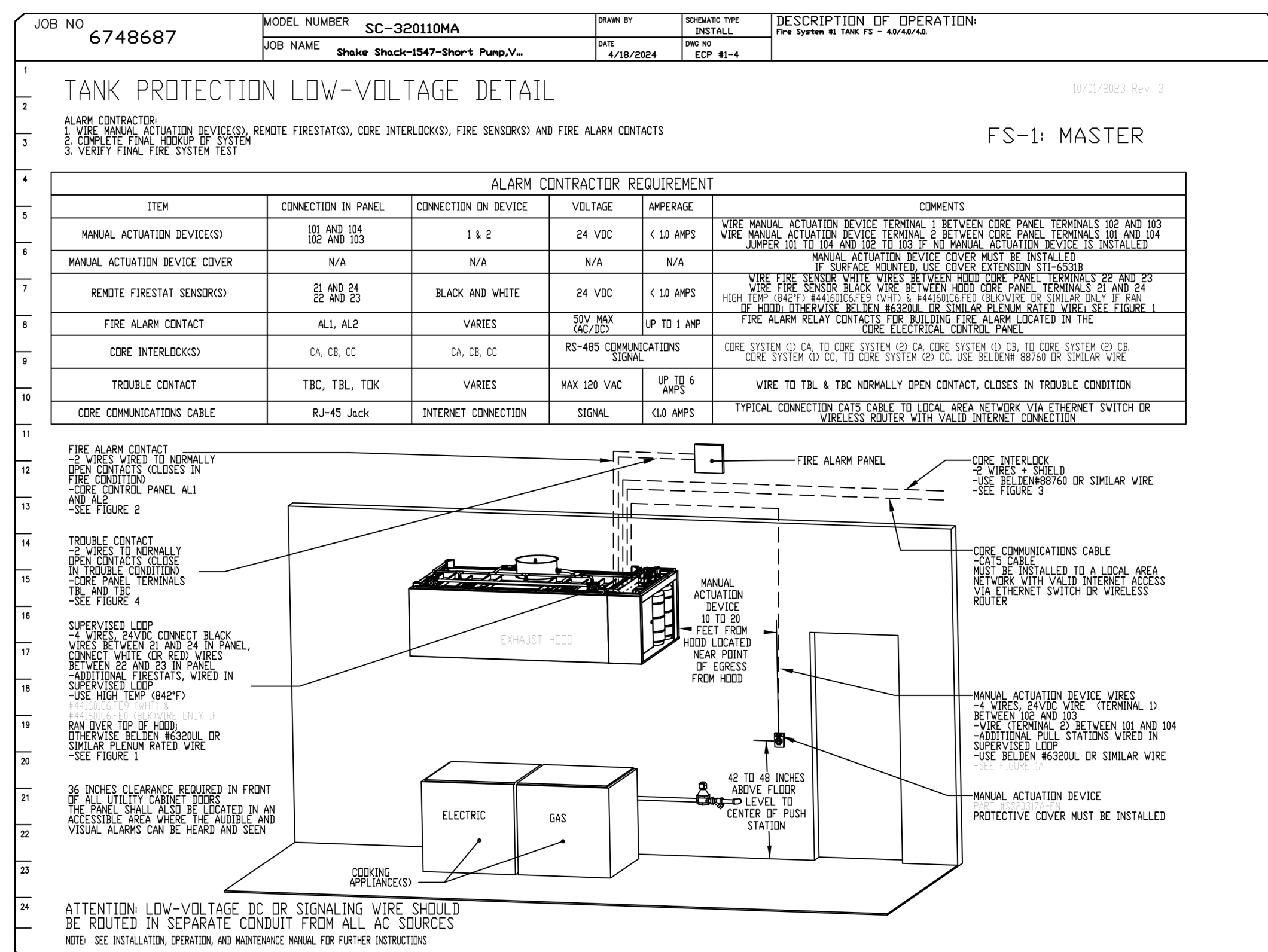
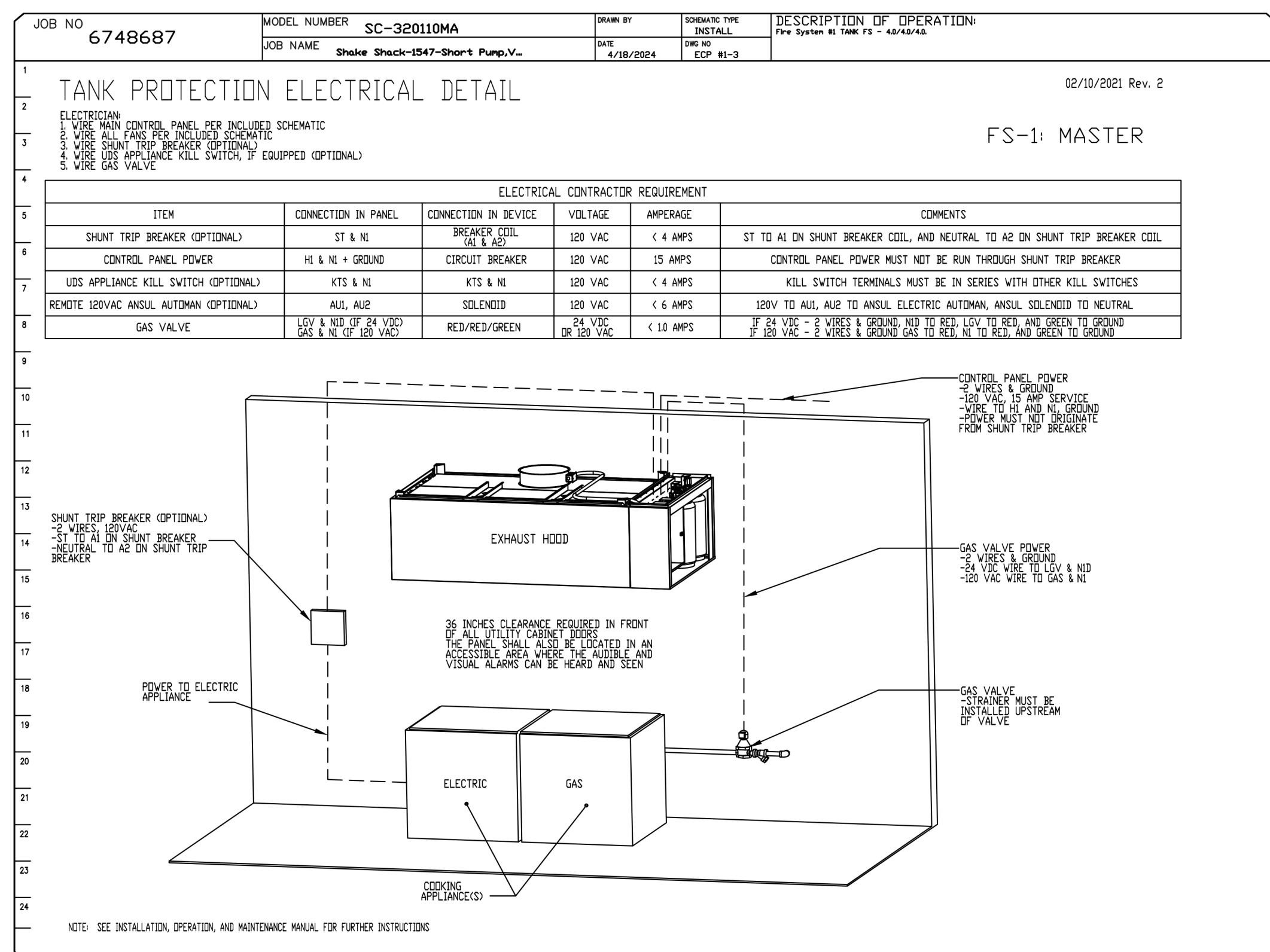
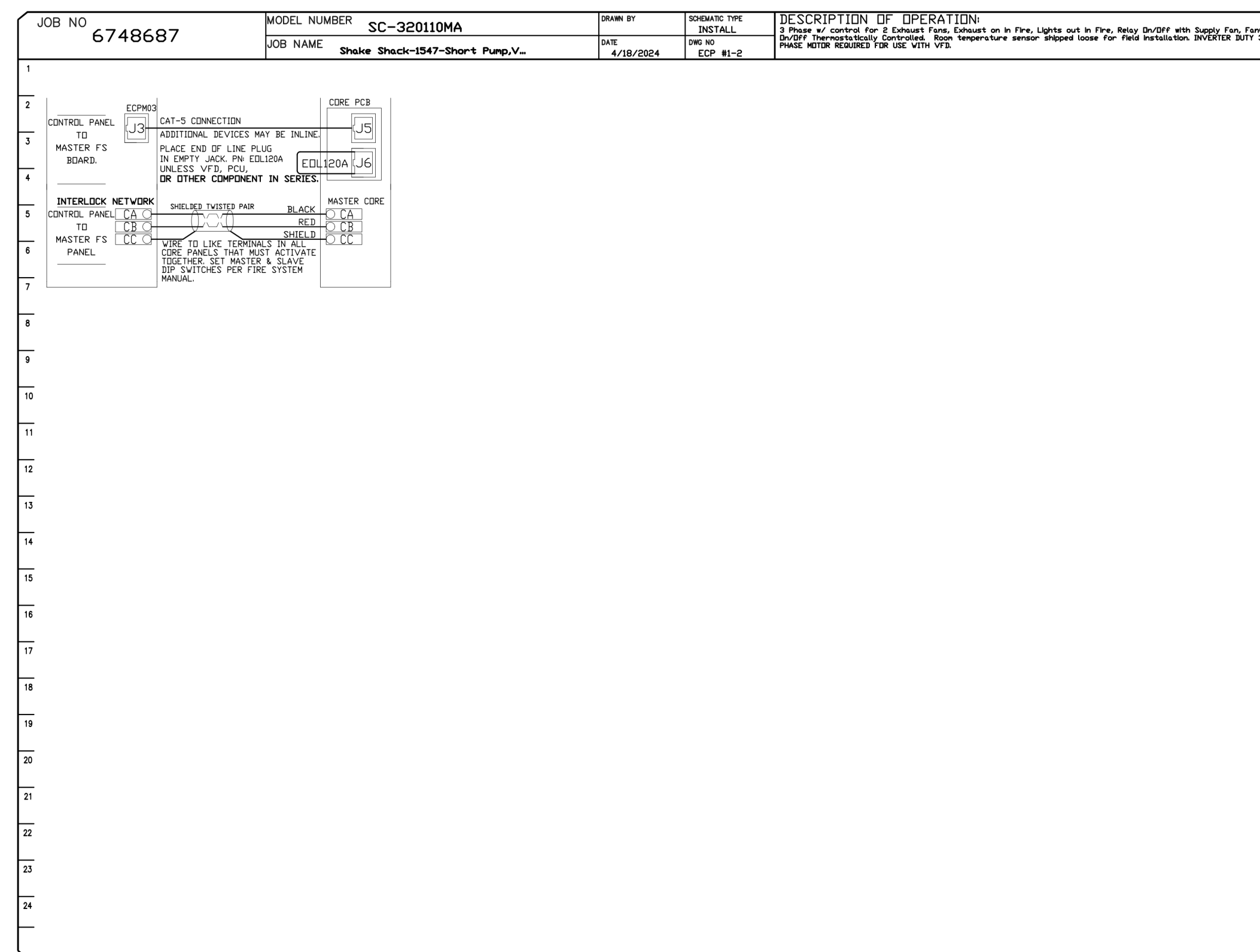
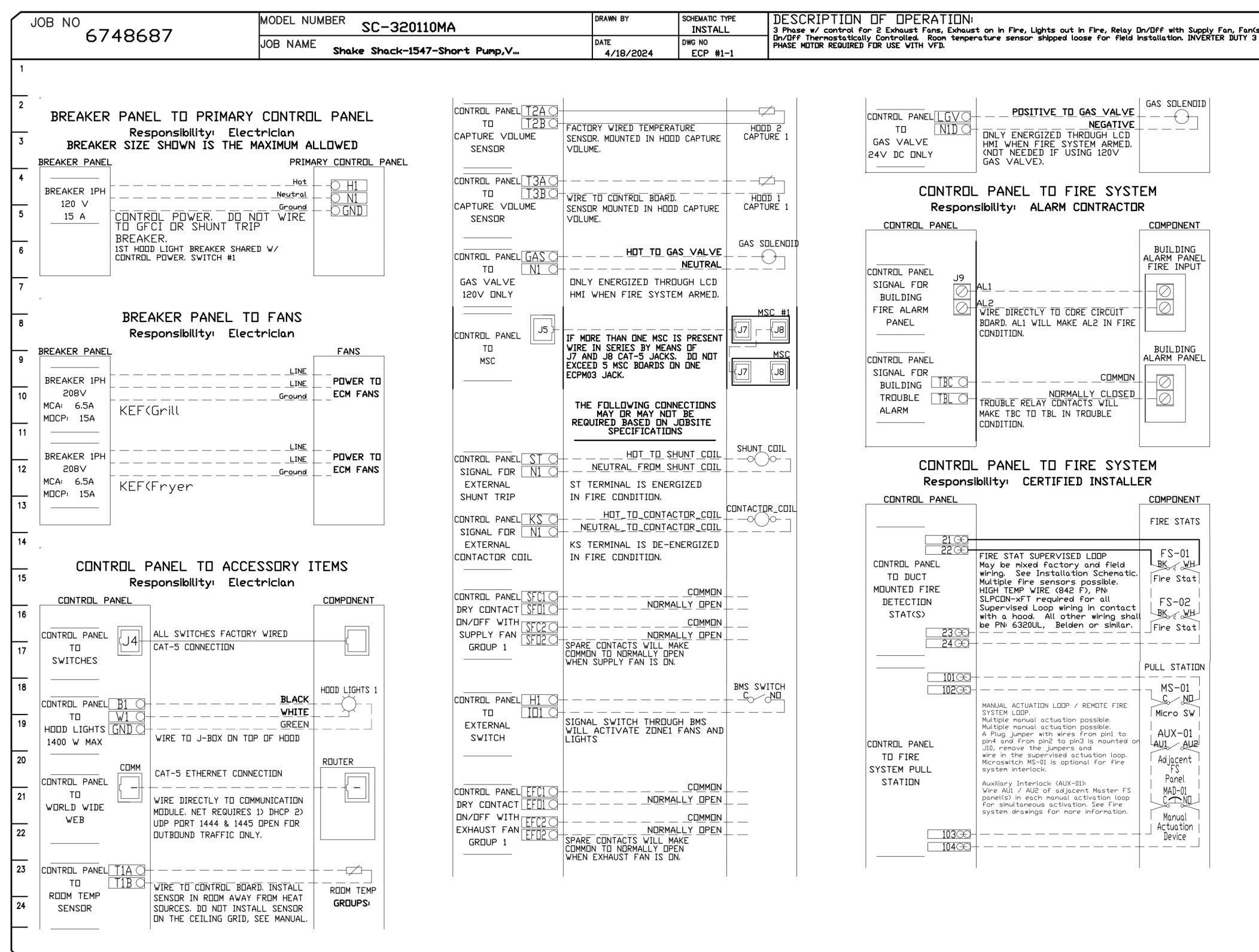


GASlink Monitor and Control

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

MONITORING AND CONTROL POINTS LIST

DCV Packages	Function	DC Packages	Function
Room Temperature	MONITOR	Room Temperature(s)	MONITOR
Roof Temperature(s)	MONITOR	Roof Temperature(s)	MONITOR
Water RTU Discharge Temperature	MONITOR	Water RTU Discharge Temperature	MONITOR
Fan Speed	MONITOR	Condenser Fan(s)	MONITOR
Fan Discharge	MONITOR	Fan Discharge	MONITOR
Fan Power	MONITOR	Fan Power	MONITOR
Condenser Fan(s)	MONITOR	Fan Power Chg Percentage	MONITOR
Fan Status	MONITOR	Fan Condition	MONITOR
Fan Power Chg Percentage	MONITOR	Building Pressure	MONITOR
Flow Condition	MONITOR	Fan Discharge(s)	MONITOR & CONTROL
CO2E Flow System	MONITOR	Flash Button(s)	MONITOR & CONTROL
Building Pressure	MONITOR		
Prog Time Button	MONITOR & CONTROL		
Fans Button	MONITOR & CONTROL		
Light Button	MONITOR & CONTROL		
Flash Button	MONITOR & CONTROL		



REVISIONS

NO	DESCRIPTION	DATE
1		
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CAPTIVE

Eastern PA Mechanical
PO Box 2520, 1 Union Ave, Balla Clynard, PA 19004 PHONE: (287) 504-4100 EMAIL: reg108@captiveaire.com

Shake Shack-1547-Short Pump, VA(Kitchen)
HENRICO, VA, 23233

DATE: 4/18/2024
DWG.#: 6748687
DRAWN BY: Joe.shiiba
SCALE: 3/4" = 1'-0"
MASTER DRAWING

SHEET NO.
5

NOTE:
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CONSULTANTS:

SEAL SIGNATURE:

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HEI | 2024-09-03 PERMIT / BID SET
NO. BY DATE DESCRIPTION

SHAKE SHACK

SHAKE SHACK SHORT PUMP

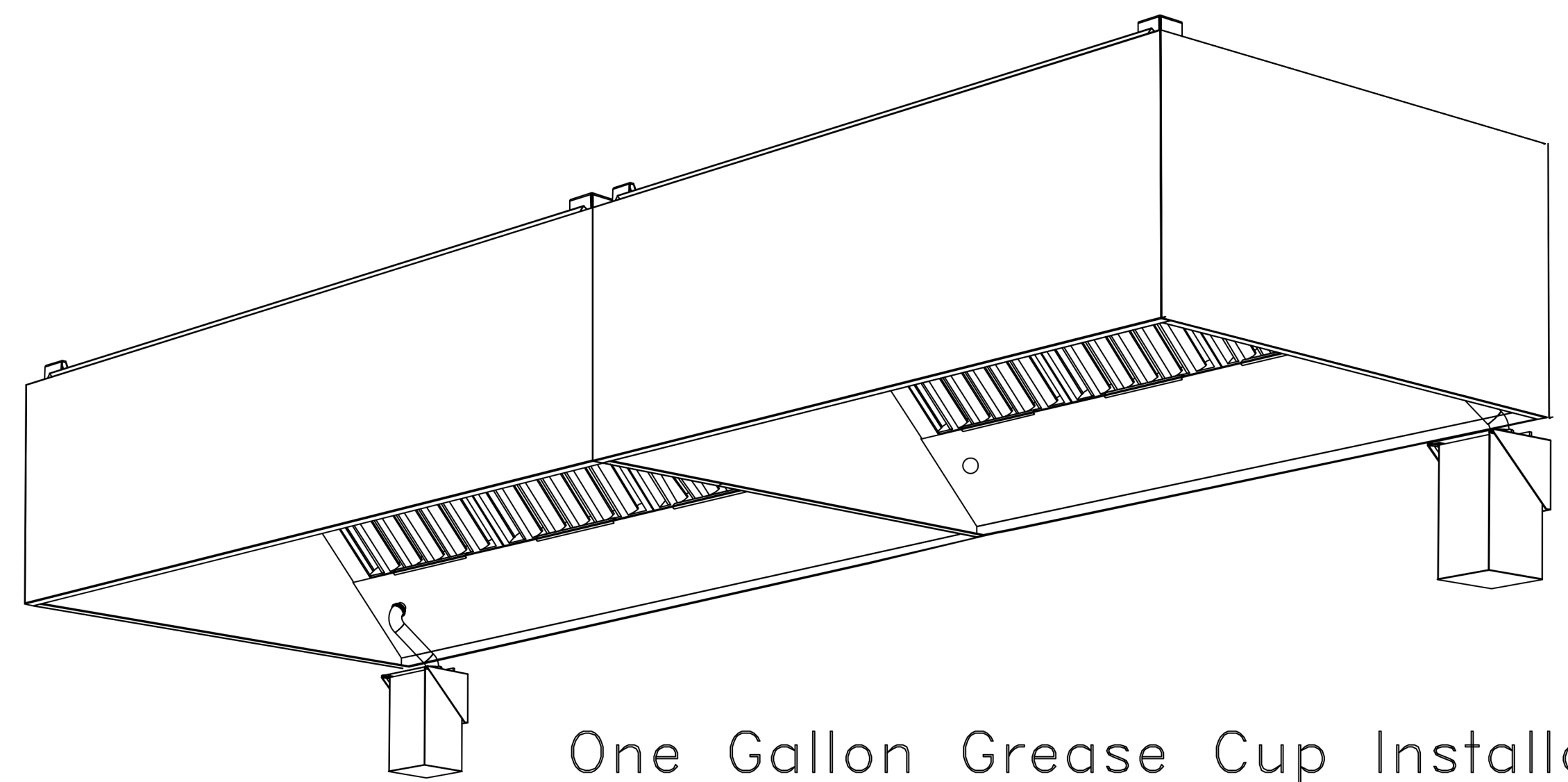
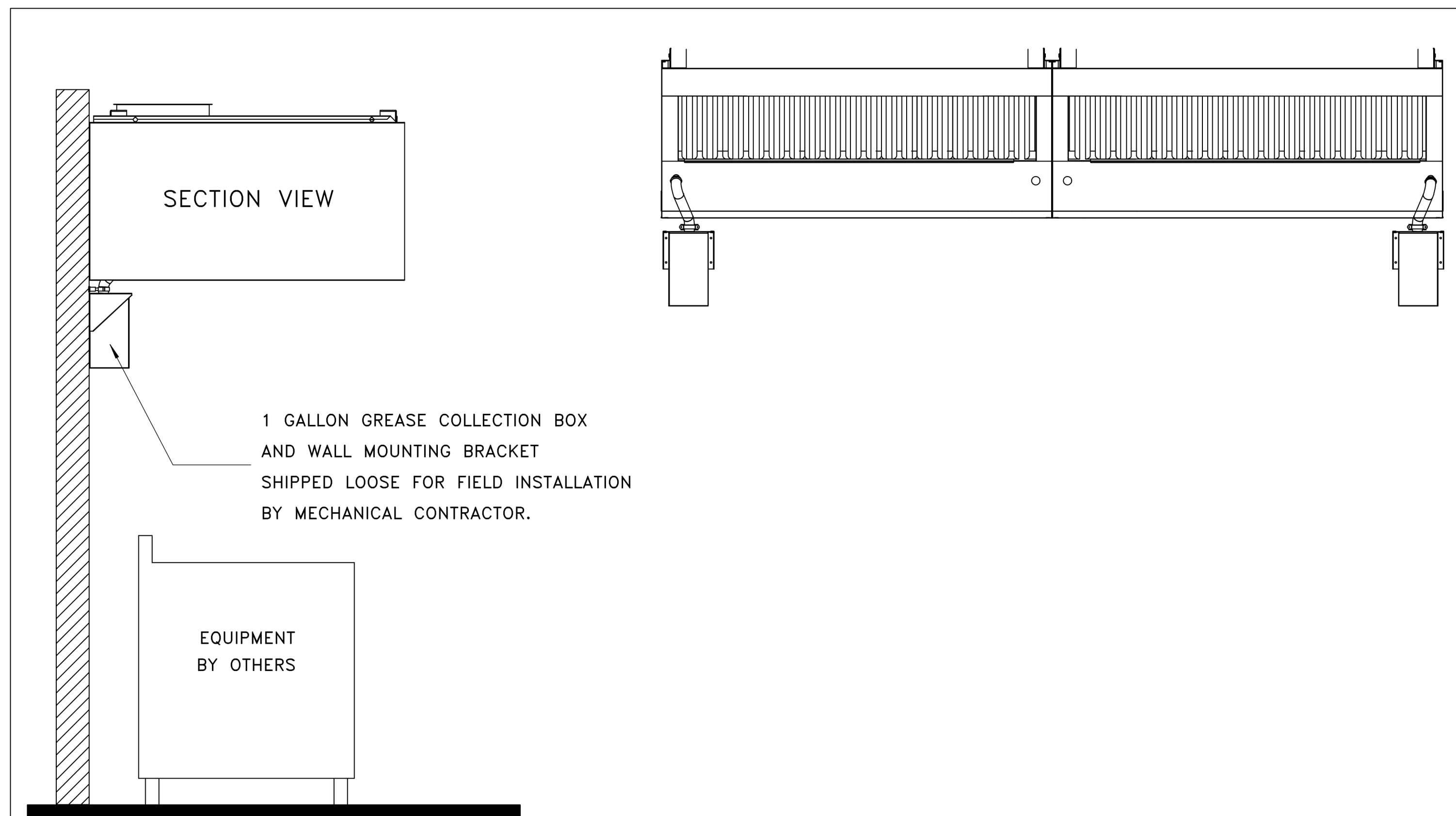
12170 W BROAD ST
RICHMOND, VA 23233
SHACK #1547

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CAPTIVEAIRE DRAWINGS

DRAWN BY: Author
CHECKED BY: Checker
JOB NO: 20240154.00

M705

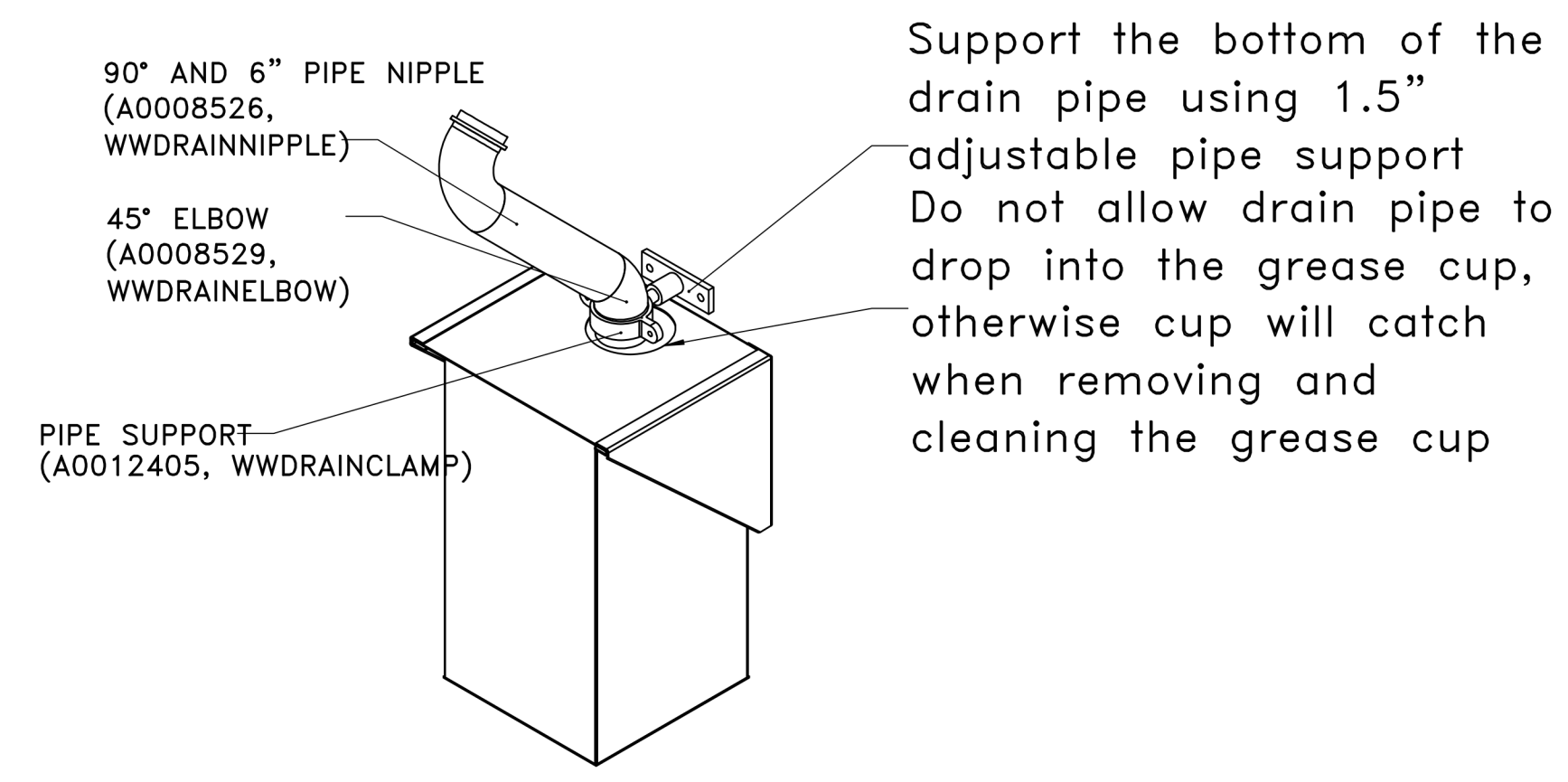
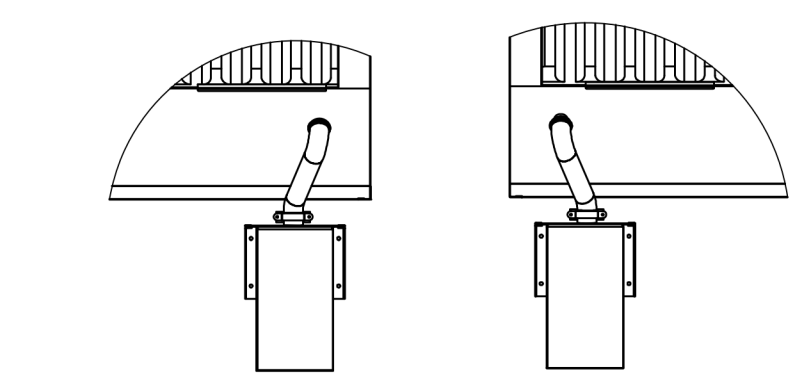
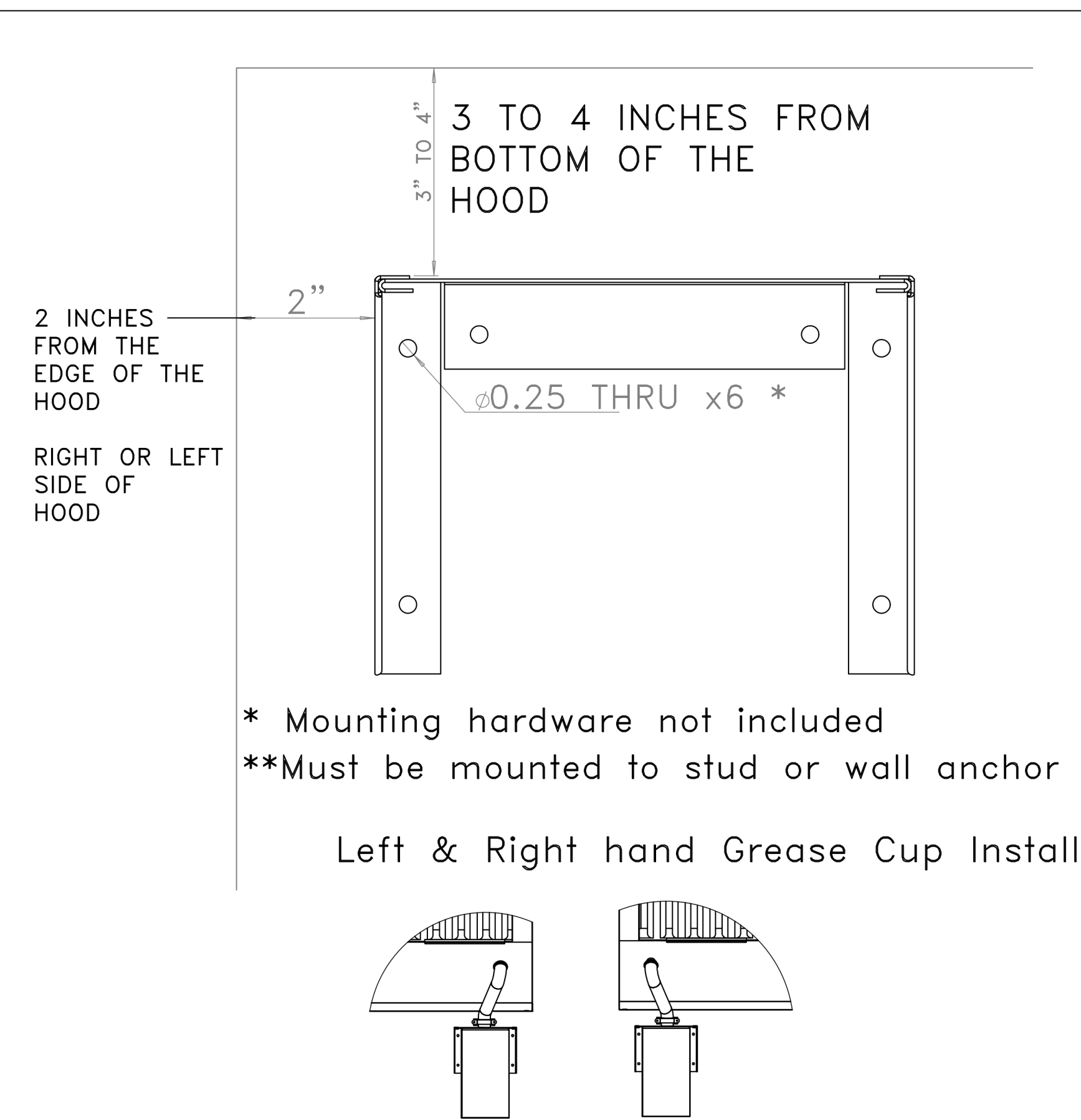


One Gallon Grease Cup Installation

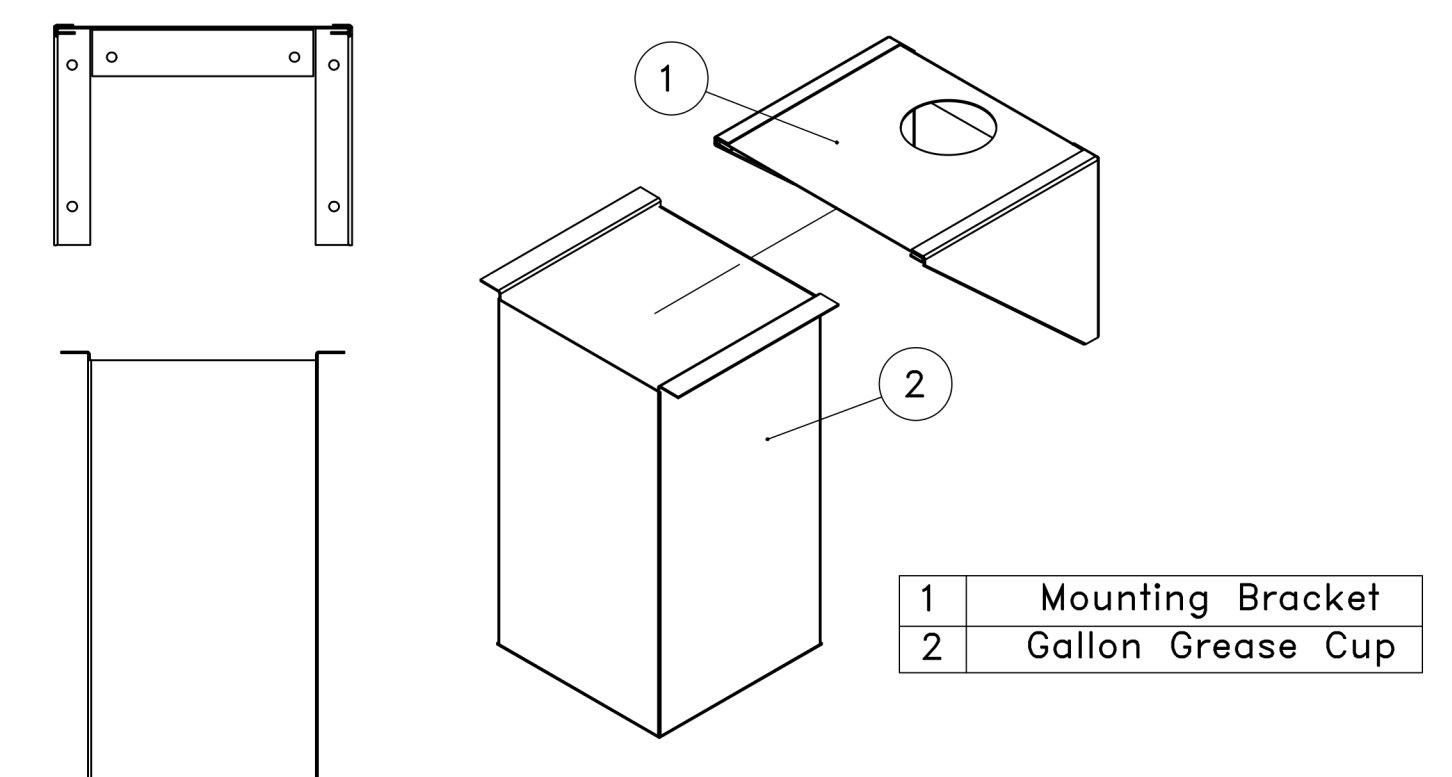
Instructions below outline single, or dual, one gallon grease cup installation for ND-2 hood models.

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

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



Gallon Grease Cup Assembly



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

REVISIONS	
DESCRIPTION	DATE

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Eastern PA Mechanical
PO Box 2520, 1 Union Ave, Bala Cynwyd, PA 19004 PHONE: (267) 504-4106 EMAIL: reg108@captivemechanical.com

Shake Shack-1547-Short Pump, VA(Kitchen)
HENRICO, VA, 23233

DATE: 4/18/2024
DWG.#: 6748687
DRAWN BY: Joe.shiiba
SCALE: 3/4" = 1'-0"
MASTER DRAWING

SHEET NO. 6

NOTE:
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NO.	BY	DATE	PERMIT / BID SET	DESCRIPTION

SHAKE SHACK SHORT PUMP

12170 W BROAD ST
RICHMOND, VA 23233
SHACK #1547

PERMIT / BID SET

CAPTIVEAIRE DRAWINGS

DRAWN BY: Joe.shiiba Author
CHECKED BY: Joe.shiiba Checker
JOB NO: 20240154.00

M706

DOAS/RTU FAN SCHEDULE - JOB#6974874										FAN INFORMATION										ELECTRICAL INFORMATION										COOLING INFORMATION										REHEAT INFORMATION										GAS HEAT INFORMATION										NOTES									
FAN UNIT NO.	TAG	QTY	DOAS/RTU MODEL #	MANUFACTURER	BLOWER	RETURN AIR CFM	MAX OUTSIDE AIR CFM	TOTAL CFM	WEIGHT (LBS)	ESP	HP	PHASE	VOLTS	MCA	MDCP	DB	WB	DB	WB	DB	WB	DB	WB	DP	TOTAL	SENS.	TEER	ISMRE	DB	WB	DESIRED	MAX	MOISTURE REMOVAL RATE	GAS TYPE	INPUT BTUH	OUTPUT BTUH	TEMP RISE	REQUIRED INPUT GAS PRESSURE																															
1	RTU-KIDNING	1	CAS-HVAC3-1200-24-15T	CAPTIVEAIRE	24MF-3-RTU	3000	1300	4300	2583	0.800	5.00	3	208	71.9A	80A	94.9°F	75.3°F	81.1°F	66.8°F	50.2°F	50.1°F	50.1°F	210.3 MBH	144.5 MBH	18.8	5.7	74.0°F	62.0°F	115 MBH	129.6 MBH	50.5 LBS/HR	NATURAL	187935	152827	32°F	7 IN. W.C. - 14 IN. W.C.	1,2,3,4,5,6,7,8,9,10,11,12,13,14,15,16,17																																
2	RTU-RKITCHEN	1	CAS-HVAC3-1300-24-15T	CAPTIVEAIRE	24MF-3-RTU	3800	1300	5100	2660	0.800	5.00	3	208	75.2A	90A	94.9°F	75.3°F	80.1°F	66.1°F	52.4°F	52.2°F	52.1°F	210.3 MBH	154.1 MBH	18.8	5.7	70.0°F	61.2°F	100.5 MBH	129.6 MBH	50.5 LBS/HR	NATURAL	207873	168377	30°F	7 IN. W.C. - 14 IN. W.C.	1,2,3,4,5,6,7,8,9,10,11,12,13,14,15,16,17,18																																

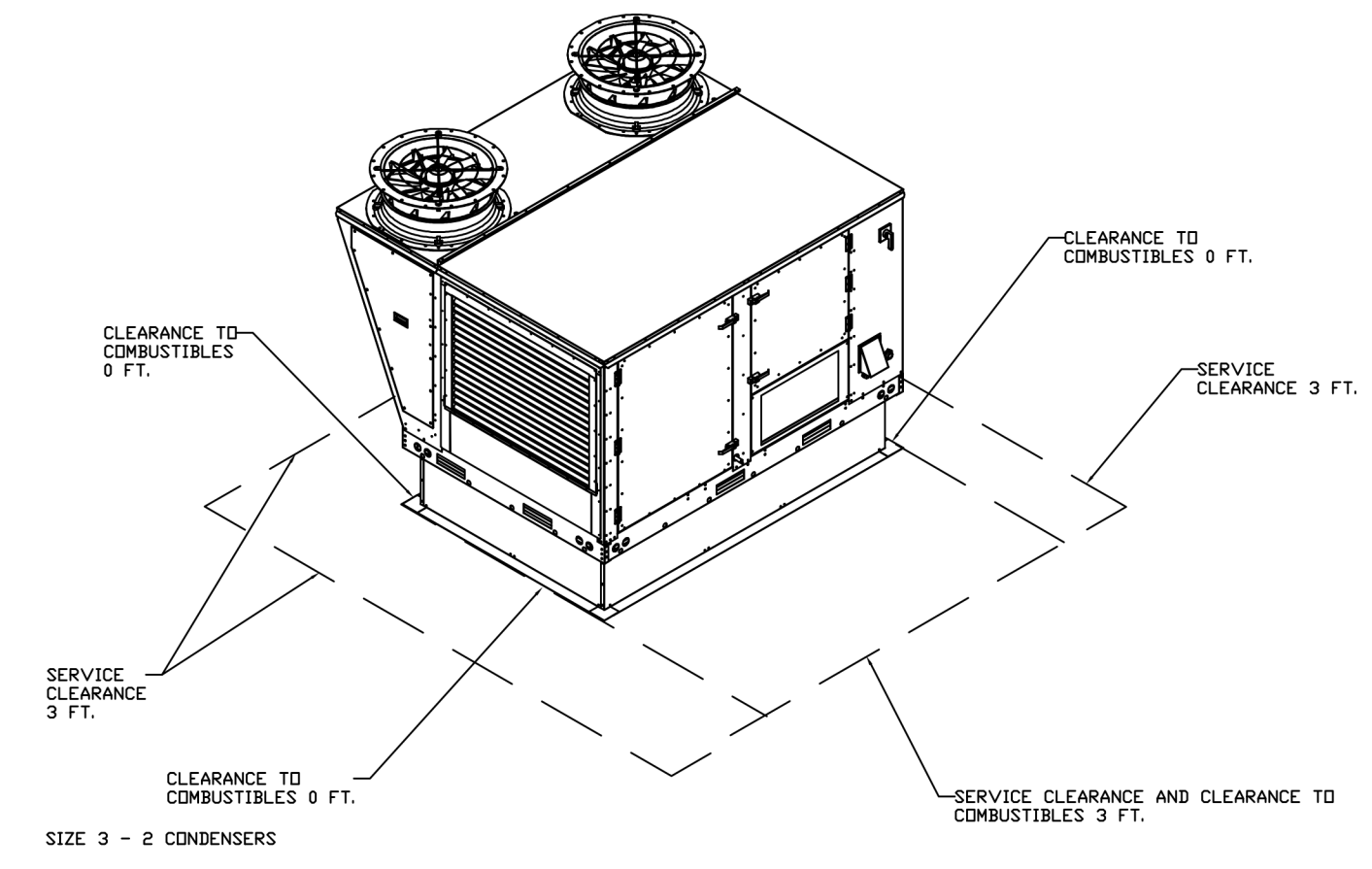
- NOTES:**
- INVERTER SCROLL COMPRESSOR WITH INTEGRATED OIL SENSOR. DIGITAL OR STAGED SCROLL NOT AN APPROVED EQUAL.
 - DIRECT DRIVE PLENUM BLOWER. BELT DRIVEN BLOWERS ARE NOT ACCEPTABLE.
 - INTEGRATED MONITORING VIA CELLULAR CONNECTION BY MANUFACTURER.
 - REFRIGERATION PRESSURE MONITORING ON HIGH AND LOW PRESSURE SIDE OF SYSTEM INCLUDED THROUGH DIGITAL INTERFACE.
 - EC MOTOR CONDENSING FANS.
 - ELECTRONIC EXPANSION VALVE. TXV NOT ACCEPTABLE.
 - SUCTION LINE ACCUMULATOR.
 - FACTORY COMMISSIONING WITH 5 YEAR PARTS WARRANTY, 25 YEAR WARRANTY ON STAINLESS STEEL HEAT EXCHANGER.
 - AVERAGING INTAKE EXHAUST AND DISCHARGE TEMPERATURE SENSORS DISCHARGE SENSOR TO BE FACTORY MOUNTED WITHIN UNIT.
 - 8" EXTERIOR DUAL-WALL CONSTRUCTION W/ R-13 INSULATION-MINIMUM 80GA EXTERIOR W/ 14GA BASE.
 - 80% EFFICIENT FURNACE, WITH MODULATING INDUCER TO MAINTAIN CONSTANT COMBUSTION EFFICIENCY ACROSS FIRING RANGE. 6:1 TURNDOWN WITH NG AND 5:1 TURNDOWN WITH LP.
 - SUPPLY CFM MONITORING INTEGRAL TO UNIT WITH CFM MEASUREMENT INCLUDED THROUGH DIGITAL INTERFACE.
 - FULLY MODULATING REHEAT GAS HEATER.
 - 15 DEGREE LOW AMBIENT OPERATION.
 - HAIL GUARD FOR CONDENSING COIL.
 - RTU ECONOMIZER WITH DIFFERENTIAL ENTHALPY CONTROL.
 - DOWN DISCHARGE/DOWN RETURN.

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

FAN UNIT NO.	TAG	QTY	DESCRIPTION
1	RTU-KIDNING	1	INLET PRESSURE GAUGE, 0-35"
		1	MANIFOLD PRESSURE GAUGE, 0 TO 10" W.C. 1 FURNACE
		1	TOTAL CFM MONITORING
		1	INTAKE FIRESTAT SET TO 135°F
		1	FREEZESTAT
		1	DISCHARGE FIRESTAT SET TO 240°F
		1	SHIP LUDGE GAS STRAINER 3/4"
		1	SINGLE POINT ELECTRICAL CONNECTION FOR RTU. 750VA TRANSFORMER USED, IF A NON-DCV PREVIRE CONTROLS THIS UNIT, THE #88, #47, "MAX" OR "EP" PREVIRE OPTION MUST BE SELECTED. DOES NOT PROVIDE SUPPLY STARTER IN PREVIRE.
		1	CASLINK BUILDING MONITORING SYSTEM - INTERNET OR CELLULAR CONNECTION REQUIRED
		1	RTU3 DOWN DISCHARGE
		1	2" MERV 13 FILTERS FOR RTU3 (QTY. 4)
		1	2" MERV 8 FILTERS FOR RTU3 (QTY. 4)
		1	OVERHEAT STAT
		1	VFD FACTORY MOUNTED AND WIRED IN RTU COMMERCIAL CONTROL VESTIBULE
		1	15 TON MODULATING COOLING OPTION, 208/230V, R410A REFRIGERANT, VARIABLE SPEED COMPRESSOR, ECM CONDENSING FANS
		1	15 TON MODULATING REHEAT OPTION - SPACE DEWPOINT CONTROL - R410A
		1	RTU3 CURB DUCT HANGER
		1	120V FIRE INPUT
		1	COMMERCIAL SMOKE DETECTOR/ALARM INTERLOCK - ALARM SUPPLIED BY OTHERS
		1	OCCUPIED SCHEDULING
		1	LDW AMBIENT COOLING OPERATION - DOWN TO 0F AMBIENT
		1	CLOGGED FILTER SWITCH - NOTIFICATION ON HMI
		1	RTU3 CONVENIENCE OUTLET (GFCD), 15 AMP - REQUIRES SEPARATE 120V CONNECTION
		1	INCLUDES RECEPTACLE, COVER AND J-BOX
		2	RTU-RKITCHEN
1	RTU3 HAIL GUARD		
1	VAV PACKAGE W/ MANUAL/BDC CONTROL (S7) VFD INCLUDED		
1	LOAD REACTOR MOUNTED IN FAN		
1	RTU3 DOWN RETURN		
1	5 YEAR ENTIRE UNIT PARTS WARRANTY, 10 YEAR ENTIRE UNIT PARTS WARRANTY WITH REMOTE MONITORING AND CAPTIVEAIRE SERVICE CONTRACT, 25 YEAR STAINLESS STEEL FURNACE PARTS WARRANTY (SEE ADDITIONAL DETAILS)		
1	EXTERIOR GAS CONNECTION PROVIDED BY FACTORY WITH QUICK SEAL AND ANTI-ROTATION BRACKET		
1	INLET PRESSURE GAUGE, 0-35"		
1	MANIFOLD PRESSURE GAUGE, 0 TO 10" W.C. 1 FURNACE		
1	TOTAL CFM MONITORING		
1	INTAKE FIRESTAT SET TO 135°F		
1	FREEZESTAT		
1	DISCHARGE FIRESTAT SET TO 240°F		
1	SHIP LUDGE GAS STRAINER 1"		
1	SINGLE POINT ELECTRICAL CONNECTION FOR RTU. 750VA TRANSFORMER USED, IF A NON-DCV PREVIRE CONTROLS THIS UNIT, THE #88, #47, "MAX" OR "EP" PREVIRE OPTION MUST BE SELECTED. DOES NOT PROVIDE SUPPLY STARTER IN PREVIRE.		
1	CASLINK BUILDING MONITORING SYSTEM - INTERNET OR CELLULAR CONNECTION REQUIRED		
1	RTU3 DOWN DISCHARGE		
1	2" MERV 13 FILTERS FOR RTU3 (QTY. 4)		
1	2" MERV 8 FILTERS FOR RTU3 (QTY. 4)		
1	OVERHEAT STAT		
1	VFD FACTORY MOUNTED AND WIRED IN RTU COMMERCIAL CONTROL VESTIBULE		
1	COMMERCIAL SMOKE DETECTOR/ALARM INTERLOCK - ALARM SUPPLIED BY OTHERS		
1	120V FIRE INPUT		
1	OCCUPIED SCHEDULING		
1	CLOGGED FILTER SWITCH - NOTIFICATION ON HMI		
1	RTU3 CONVENIENCE OUTLET (GFCD), 15 AMP - REQUIRES SEPARATE 120V CONNECTION		
1	INCLUDES RECEPTACLE, COVER AND J-BOX		
1	RTU ECONOMIZER - DIFFERENTIAL ENTHALPY CONTROL		
1	RTU3 ECONOMIZER BAROMETRIC RELIEF		
1	RTU INTAKE/RETURN DAMPER - MANUAL CONTROL VIA HMI		
1	2" DIA. POKERED EXHAUST FOR RTU3 - MANUAL CONTROL. 3000 CFM MAX AT 0"		
1	RTU3 DOWN RETURN		
1	RTU3 HAIL GUARD		
1	VAV PACKAGE W/ MANUAL/BDC CONTROL (S7) VFD INCLUDED		
1	LOAD REACTOR MOUNTED IN FAN		
1	LDW AMBIENT COOLING OPERATION - DOWN TO 0F AMBIENT		
1	RTU3 CURB DUCT HANGER		
1	15 TON MODULATING COOLING OPTION, 208/230V, R410A REFRIGERANT, VARIABLE SPEED COMPRESSOR, ECM CONDENSING FANS		
1	15 TON MODULATING REHEAT OPTION - SPACE DEWPOINT CONTROL - R410A		
1	5 YEAR ENTIRE UNIT PARTS WARRANTY, 10 YEAR ENTIRE UNIT PARTS WARRANTY WITH REMOTE MONITORING AND CAPTIVEAIRE SERVICE CONTRACT, 25 YEAR STAINLESS STEEL FURNACE PARTS WARRANTY (SEE ADDITIONAL DETAILS)		
1	EXTERIOR GAS CONNECTION PROVIDED BY FACTORY WITH QUICK SEAL AND ANTI-ROTATION BRACKET		

NO.	FN	TAG	WEIGHT	ITEM	SIZE
1	# 1	RTU-KIDNING	193 LBS	CURB	59.500"W X 91.000"L X 22.000"H INSULATED 16 GAUGE.
2	# 2	RTU-RKITCHEN	193 LBS	CURB	59.500"W X 91.000"L X 22.000"H INSULATED 16 GAUGE.

UNIT NUMBER	HMI #	UNIT	IN UNIT	TEMP AVERAGING	MODBUS ADDRESS
FAN #1	HMI #1	UNIT	IN UNIT	NOT AVERAGED	55
FAN #1	HMI #2	SPACE		AVERAGED	56
FAN #2	HMI #1	UNIT	IN UNIT	NOT AVERAGED	55
FAN #2	HMI #2	SPACE		AVERAGED	56



REVISIONS

NO.	DESCRIPTION	DATE

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Eastern PA Mechanical
225 E City Line Avenue, Suite #103, Bala Cynwyd, PA, 19004 PHONE: (267) 504 - 4126 EMAIL: reg108@captveaire.com

Shack Shack-1547-Short Pump VAV(HVAC)-R2
HENRICO, VA, 23233

DATE: 8/13/2024
DWG.#: 6974874
DRAWN BY: Joe.shiiba
SCALE: 1/2" = 1'-0"
MASTER DRAWING

SHEET NO. 1

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NO. BY DATE DESCRIPTION

SHAKE SHACK

SHAKE SHACK SHORT PUMP

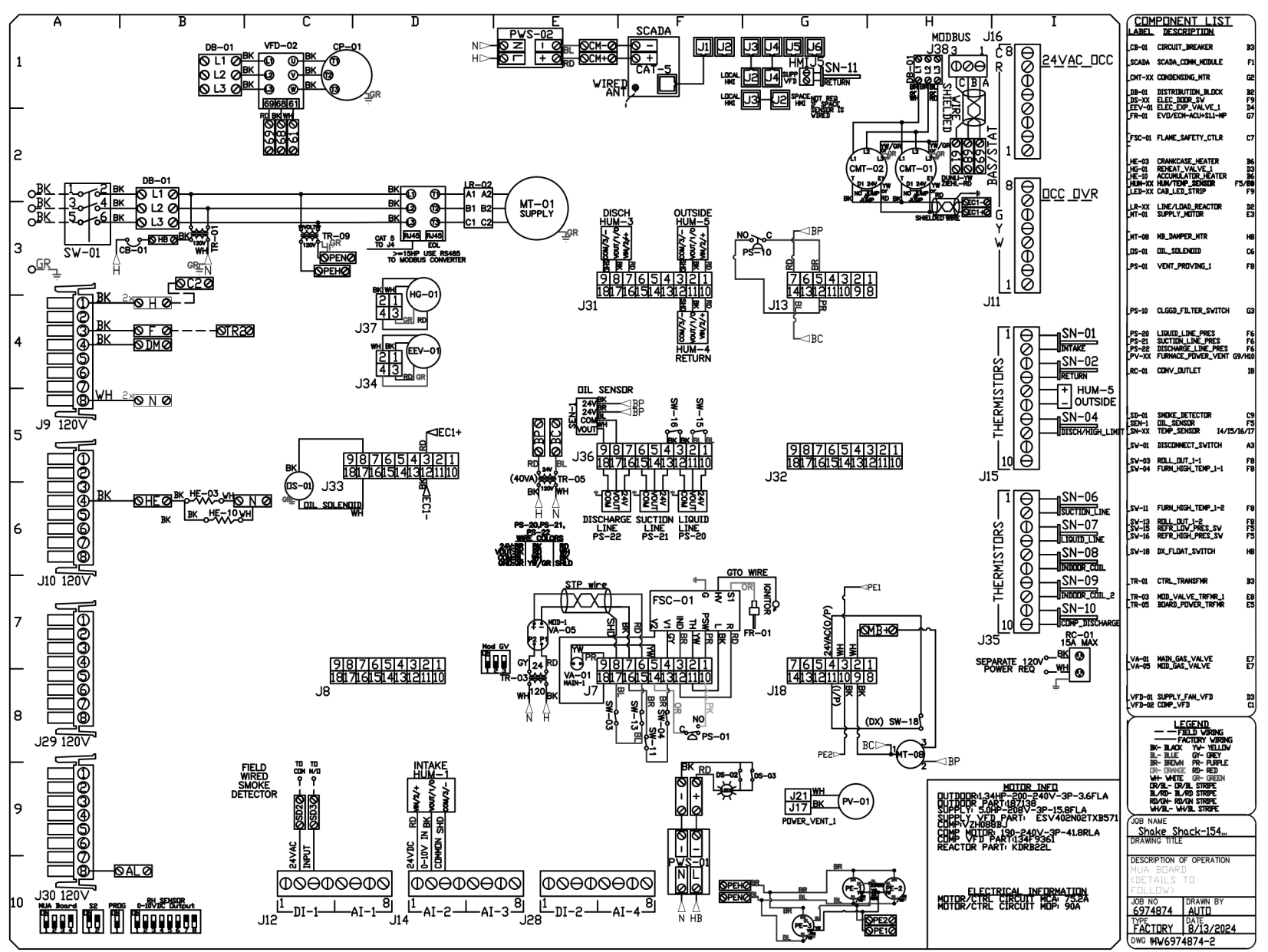
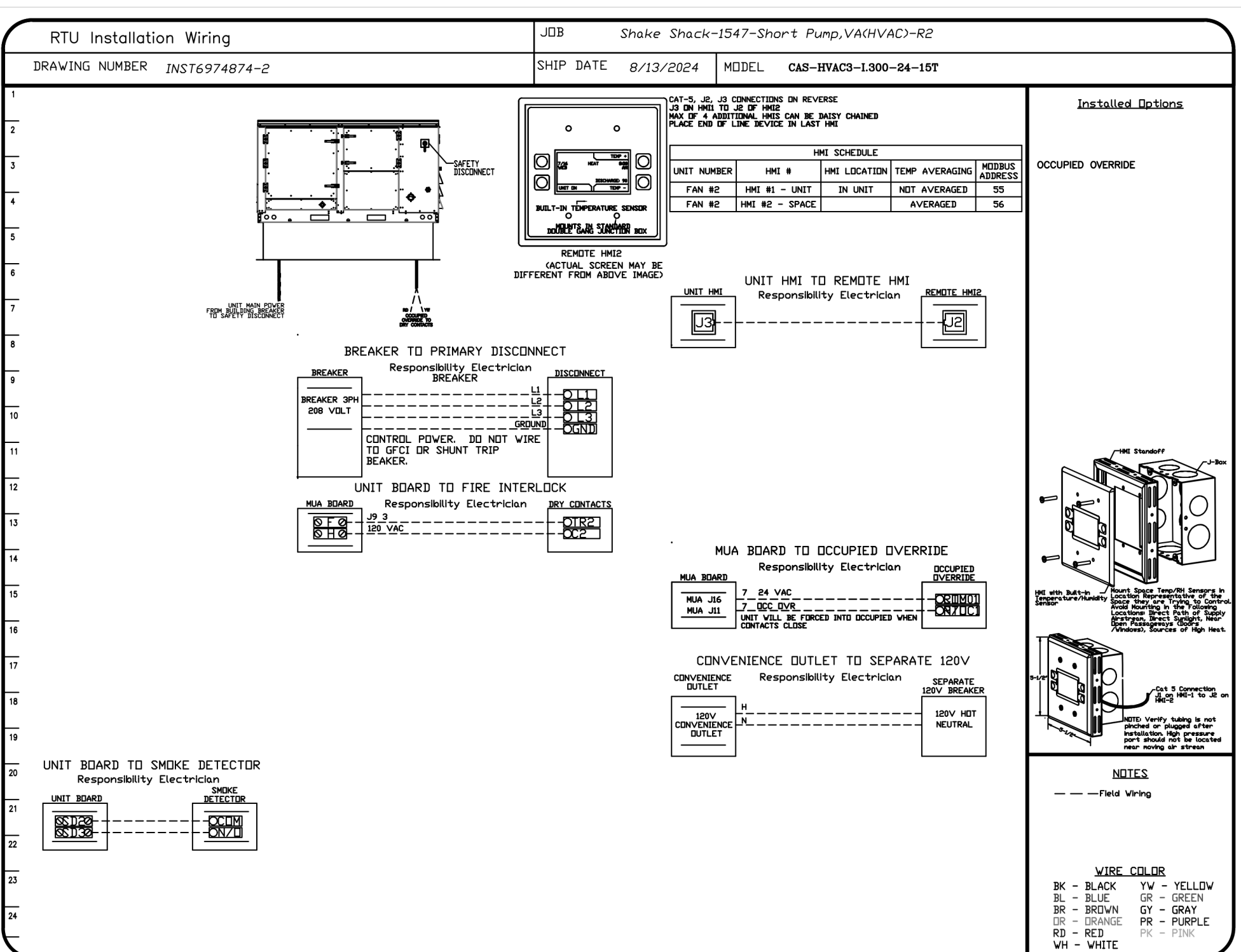
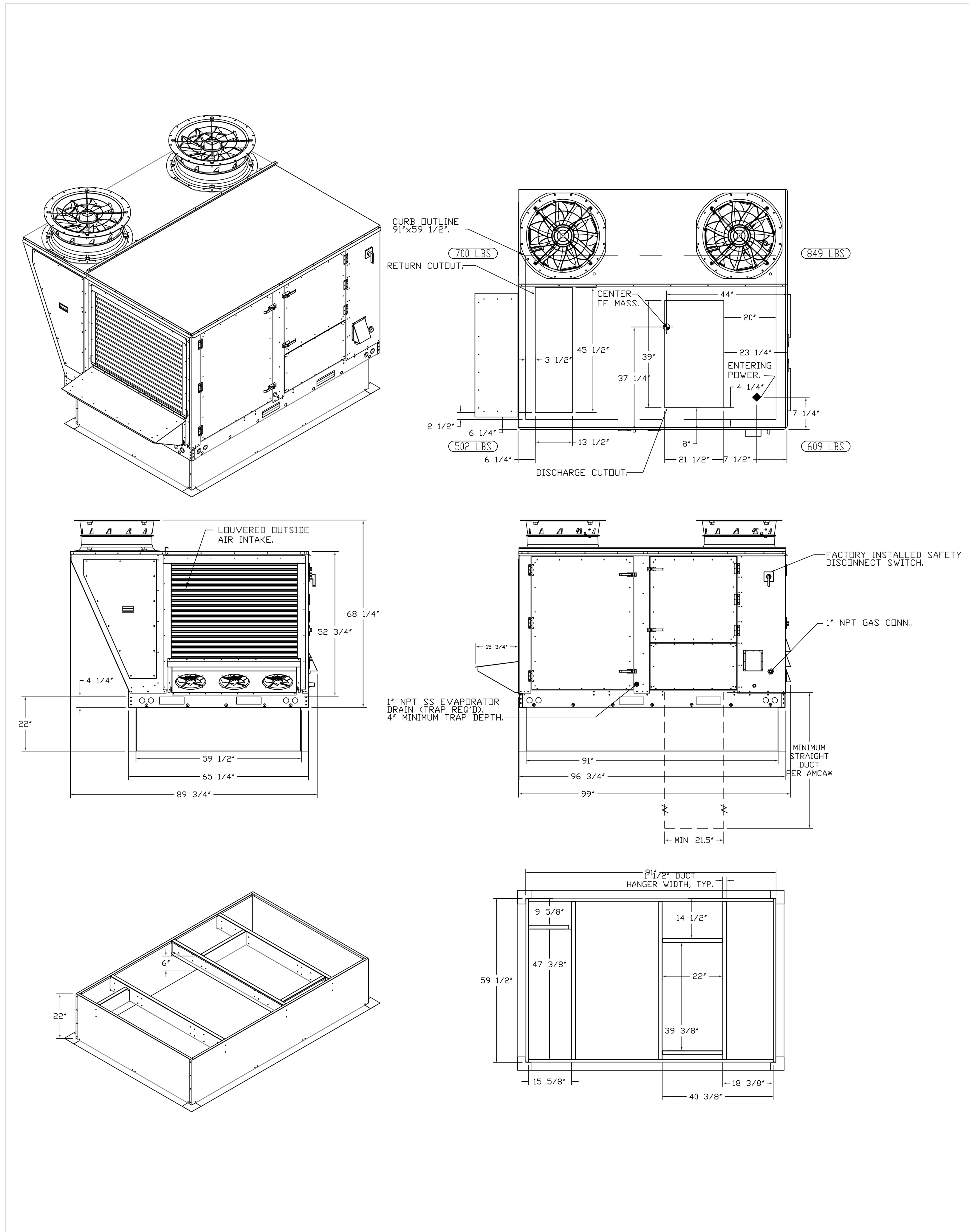
12170 W BROAD ST
RICHMOND, VA 23233
SHACK #1547

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CAPTIVEAIRE DRAWINGS

DRAWN BY: Author
CHECKED BY: Checker
JOB NO: 20240154.00

M707



FAN #2 CAS-HVAC3-1300-24MF-15T - HEATER (RTU-2(KITCHEN))

NOTES:

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

REVISIONS

NO.	DESCRIPTION	DATE

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Shake Shack-1547-Short Pump, VA(HVAC)-R2
HENRICO, VA, 23233

DATE: 8/13/2024

DWG.#: 6974874

DRAWN BY: Joe.shiiba

SCALE: 1/2" = 1'-0"

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SHEET NO. 3

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LA: 800 South Figueroa St., Los Angeles, CA 90017, 213.337.1090

CO: 875 N High St., Columbus, OH 43215, 617.542.1025

BCS: 51 Shaper St., Boston, MA 02210, 386.900.8887

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SHAKE SHACK

SHAKE SHACK SHORT PUMP

12170 W BROAD ST
RICHMOND, VA 23233
SHACK #1547

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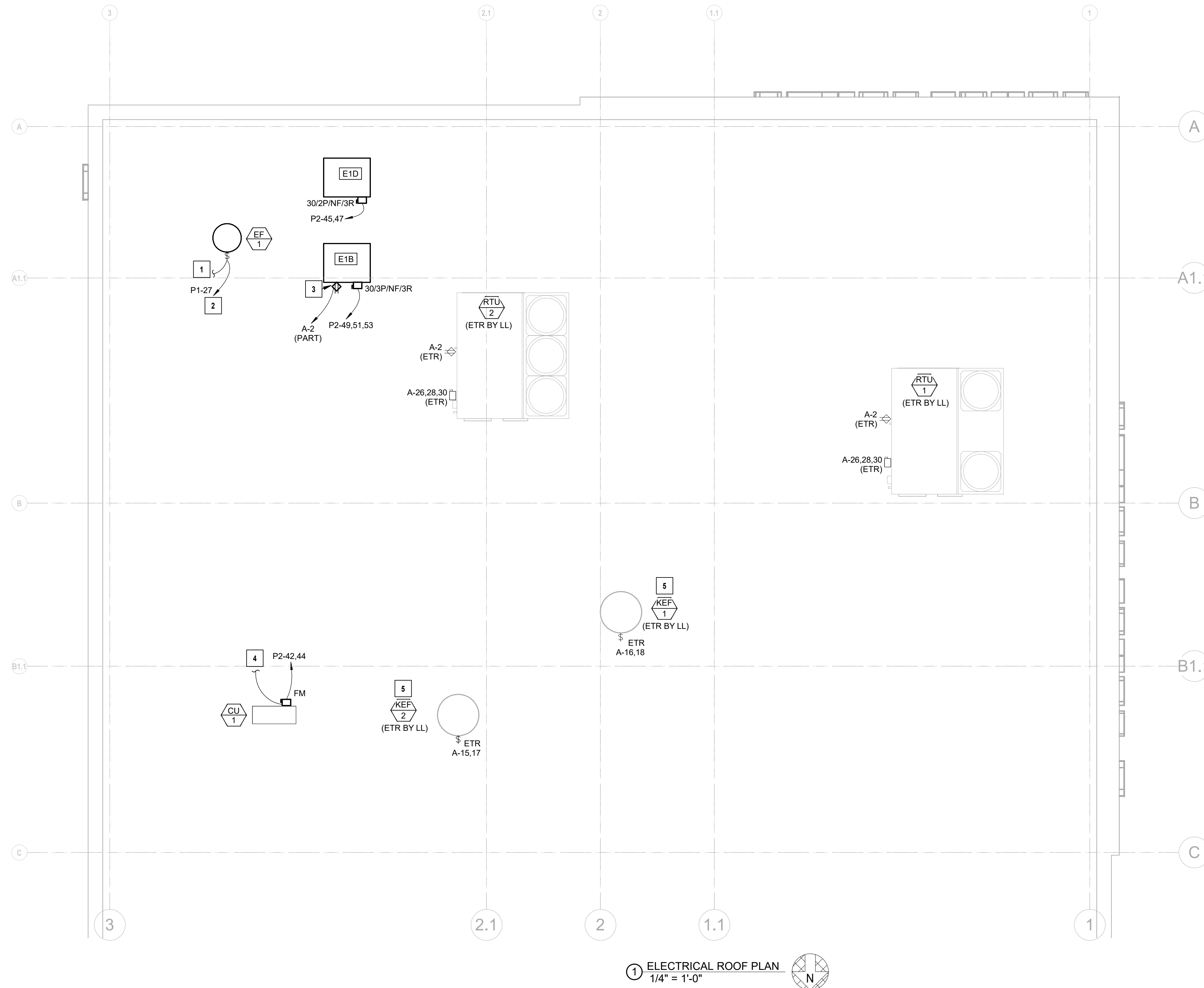
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DRAWN BY: Author

CHECKED BY: Checker

JOB NO: 20240154.00

M709



GENERAL ELECTRICAL ROOF PLAN NOTES:

- MECHANICAL EQUIPMENT LOCATIONS ON THIS SHEET HAVE BEEN ADJUSTED FOR CLARITY. REFER TO MECHANICAL ROOF PLAN, SHEET M150 AND TO ARCHITECTURAL ROOF PLAN, SHEET A150 FOR EQUIPMENT LOCATIONS.
- COORDINATE ALL ROOF PENETRATIONS WITH REFRIGERATION PIPING. REFER TO ARCHITECTURAL ROOF PLAN, SHEET A150 FOR ADDITIONAL REQUIREMENTS.

ELECTRICAL ROOF PLAN NOTES:

- CONNECT TO MOTORIZED DAMPER SERVING OUTSIDE AIR FOR OFFICE. REFER TO SHEET M101 FOR LOCATION.
- PROVIDE TIME SWITCH LOCATED NEAR ELECTRICAL PANELBOARDS FOR CONTROL OF RESTROOM EXHAUST FAN AND MOTORIZED OUTSIDE AIR DAMPER SERVING OFFICE. SET FAN AND DAMPER TO OPERATE DURING OCCUPIED HOURS.
- EXTEND CONNECTION TO EXISTING ROOFTOP RECEPTACLE CIRCUIT IN THE AREA A-2.
- CONNECT TO INDOOR UNIT BELOW. REFER TO MANUFACTURER'S WIRING DIAGRAMS FOR CONNECTION REQUIREMENTS AND TO SHEET M101 FOR INDOOR UNIT LOCATION.
- PROVIDE CONNECTION BETWEEN EXHAUST FAN AND HOOD CONTROL PANEL FOR CONTROL WIRING. REFER TO MECHANICAL SHEETS FOR MORE INFORMATION.

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800 South Figueroa St.
Los Angeles, CA 90017
213.337.1090
www.bergmeyer.com

CO
875 N High St.
Los Angeles, CA 90017
386.900.8887

BCS
Shelton St.
Boston, MA 02210
617.542.1025

CONSULTANTS:

HENDERSON
ENGINEERS
8345 LENEZA DRIVE, SUITE 300
LENEZA, KS 66214
TEL 913.742.5000 FAX 913.742.5001
WWW.HENDERSONENGINEERS.COM
245002071
VA CORPORATE NO. 0405001357
EXPIRES 12/31/2025

SEAL SIGNATURE:

ANGELA E. FAUGHT
Lic. No. 0402067627
PROFESSIONAL ENGINEER
08/30/2024

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HE1		2024-09-03	PERMIT / BID SET	



SHAKE SHACK SHORT PUMP

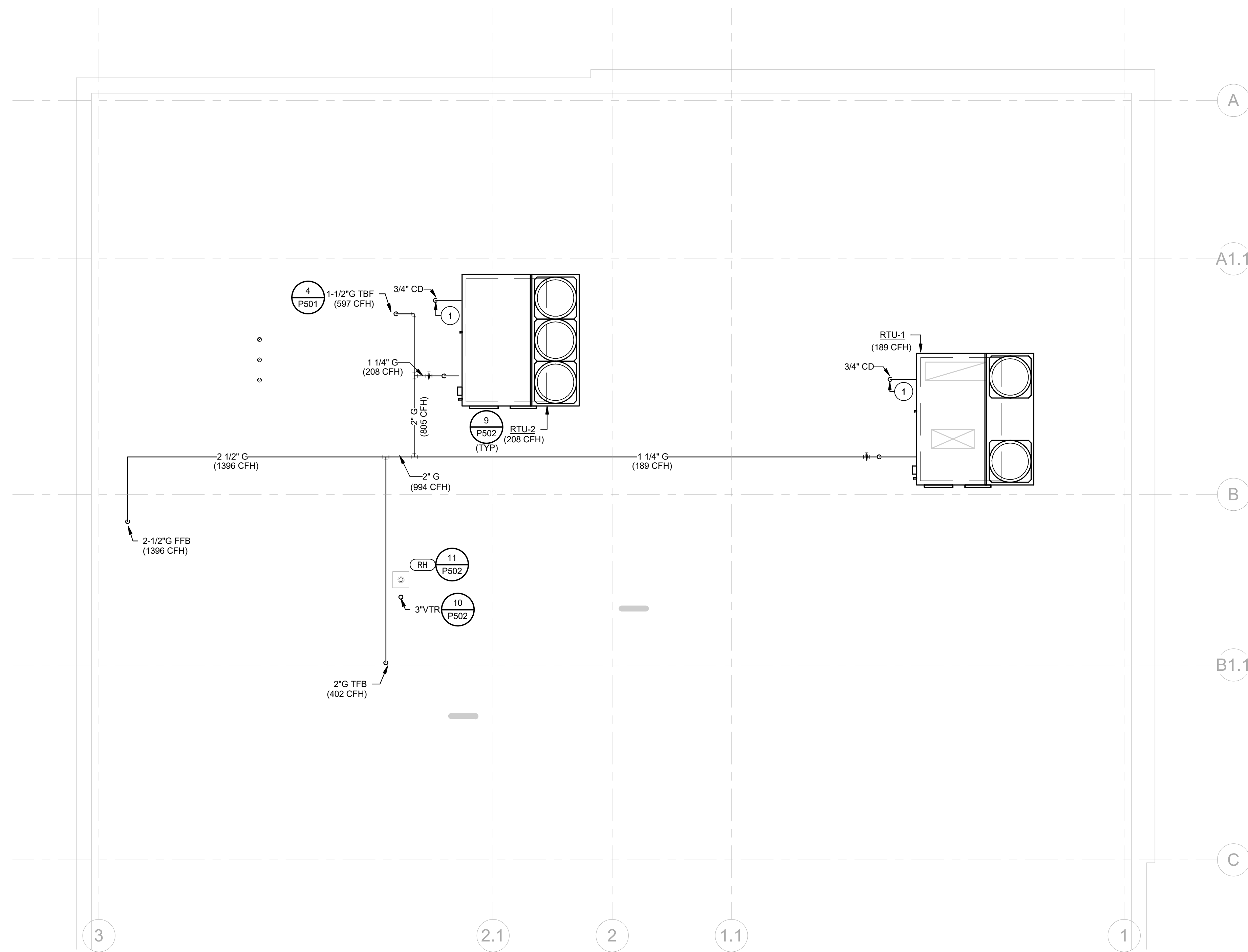
12170 W BROAD ST
RICHMOND, VA 23233
SHACK #1547

PERMIT / BID SET

ELECTRICAL ROOF PLAN

DRAWN BY:	NLD
CHECKED BY:	BLM
JOB NO:	20240154.00

E150



① PLUMBING ROOF PLAN
1/4" = 1'-0"

○ PLUMBING PLAN NOTES:

1. INSTALL HVAC CONDENSATE DRAIN WITH P-TRAP. EXTEND 3/4" DRAIN LINE AWAY FROM WORKING AREA OF UNIT.

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100 Shaver St.
Boston, MA 02210
617.542.1025

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875 N High St.
Columbus, OH 43215
380.900.8867

LA
800 South Figueroa St.
Los Angeles, CA 90017
213.337.1090

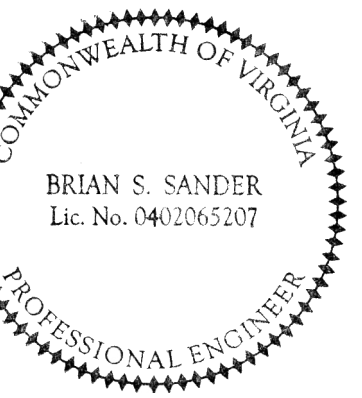
www.bergmeyer.com

CONSULTANTS:

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

245002071
VA. CORPORATE NO. 0405001357
EXPIRES 12/31/2025

SEAL SIGNATURE:



08/30/2024

NO.	BY	DATE	PERMIT SET	DESCRIPTION
	HEI	9/3/2024	PERMIT SET	



SHAKE SHACK SHORT PUMP

12170 W BROAD ST
RICHMOND, VA 23233
SHACK #1547

PERMIT SET

PLUMBING ROOF PLAN

DRAWN BY:	Author
CHECKED BY:	Checker
JOB NO:	20240154.00

P150