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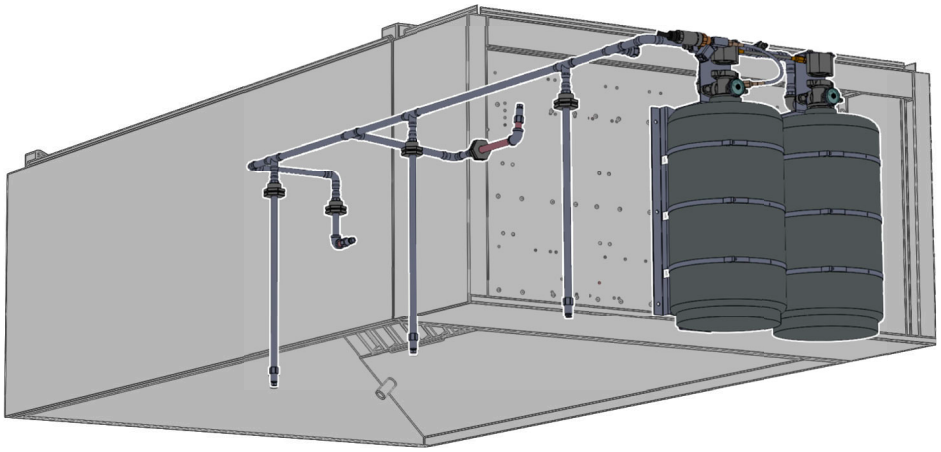
# Senior Services Enrichment Center

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## 23-0000 HVAC O&M

**Model TANK Fire Suppression Extinguishing System**

# Installation, Operation, and Maintenance Manual



TANK Fire Suppression Extinguishing System Typical Hood End Cabinet Installation

**RECEIVING AND INSPECTION**

**Check for any signs of damage upon receipt, and if found, report it immediately to the carrier. Check that all items are accounted for and free of damage.**

**WARNING!**

**The TANK Fire Suppression extinguishing system unit is to be installed, inspected, recharged and maintained in accordance with NFPA 17A, NFPA 96, and the National Fire Code of Canada as applicable.**

**Installation and maintenance of the TANK Fire Suppression extinguishing system must be performed in accordance with this manual by a factory trained distributor. Improper installation poses serious risk of injury due to electric shock and other potential hazards. Read this manual thoroughly before installing or servicing this equipment. ALWAYS disconnect power prior to working on equipment.**

**Save these instructions**. This document is the property of the owner of this equipment and is required for future maintenance. Leave this document with the owner when installation or service is complete.

Part No. A0029342
March 2025 Rev 29

TANK
FIRE SUPPRESSION

# TANK Fire Protection: Quick Start Guide

**WARNING!**
**Read and Understand the Operator's Manual before servicing this unit. This Quick Start Guide is for Trained and Qualified Fire System Technicians.**

## HMI, ECPM03, and CORE Board

The HMI provides access to change settings, view operating information, and displays faults (Figure 1) for the electrical package, exhaust fan, and fire system. The HMI has 4 buttons; the function is displayed adjacent to each button on the screen. For more information on menu navigation, refer to the Demand Control Ventilation (DCV) Manual.

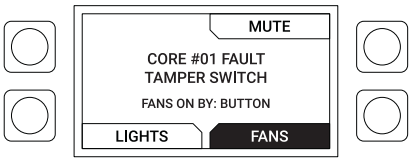



*Figure 1 (HMI Screen Example)*

The ECPM03 also provides access to fire system information. You can view Faults and Last Fire Info. You may also view if the fire system was activated by Firestat or MAD (Manual Activation Device). The Board has 4 buttons; the function is displayed below each button near the LCD screen (Figure 2). For more information on the ECPM03 Board, refer to the DCV Manual.

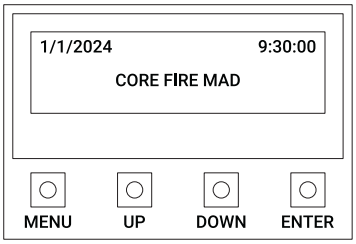



*Figure 2 (ECPM03 LCD Example)*

The CORE Board uses LEDs (Figure 3) for alerts. The LED lamp meanings are:

- A is for Alarm Alerts
- B is for Fire System and/or Supervision Codes
- C is N/A
- D is for Gas Shut Down (Gas is off when the light is on).

## Maintenance

**WARNING: When servicing or cleaning ductwork, all Hood CORE, PCU CORE, and interlocked fire systems must be placed in test mode to prevent accidental discharge.**

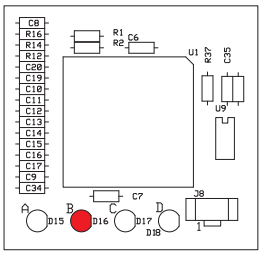


*Figure 3 (CORE Board Example)*

- Verify that the system design and installation are adequate to protect the hazard area and conform to the instructions in the Operation, Installation, and Maintenance (OIM) Manual.
- Hood filters must be maintained on a daily basis to ensure proper airflow and grease extraction. Clean filters per the recommendations in the Hood Installation, Operation, and Maintenance Manual.
- All actuation hoses must be hydrostatically tested (at 500 psi test pressure) or replaced every twelve years in accordance with NFPA 17A.
- Refer to the TANK Maintenance section for 6-Month Inspection Procedure.
- Every two years, you must replace the batteries and inspect all electrical wiring and piping.
- If it should become necessary to disconnect the TANK system from AC power for an extended period of time (more than two days), the batteries should be disconnected to prevent them from being damaged due to complete discharge.
- After a fire; Inspect and/or replace all nozzles, Inspect all piping connections for tightness, Inspect all hood lights for proper seal and security, Inspect all wiring and Hood insulation to ensure all are in good condition.
- Tanks must be replaced every twelve years.

**NOTE: See TANK Operation, Installation, and Maintenance Manual for detailed procedures.**

**Failure to properly maintain equipment will void warranty.**

To order Batteries,
Scan the QR Code:

For support, contact your local Sales Office or Service Representative

## CORE Board Faults

When there are no faults in the fire system, Lamp B will stay solid (An LED indicator is also on the control package). When a fault exists, the LED will flash with a short break. Count the flashes then wait for a short break to determine the fault. For packages with HMIs, refer to the fault displayed on the screen.

**NOTE: CORE Boards with software versions 1.68 and prior will use one brief flash every 3-seconds to indicate there is no fault.**

Test Mode allows the system to be tested with operational appliances without discharging the system. If the system is left in test mode for 15 minutes, the gas valve will be locked out until test mode is deactivated.

| Flashes | Fault Condition | Corrective Action |
|---|---|---|
| **Catastrophic Faults** | | |
| 1 | Invalid Activation* | Check for external voltage being applied at J3-7 and J3-10. |
| 2 | Release Solenoid* | Check solenoid and wiring to solenoid, replace as needed. |
| 3 | Pressure Switch* | Check switch and wiring to switch, replace as needed. |
| 4 | N/A | N/A |
| 5 | Microcontroller Fault* | Replace CORE printed circuit board. |
| **Critical Faults** | | |
| 6 | N/A | N/A |
| 7 | Supervised Loop Fault* | Check the installation of the wiring to all the manual actuation devices (push stations) and firestats. Verify connections are secure and tight. Check for open/short circuits in the wiring. Repair or replace wiring as needed. |
| **Important Faults** | | |
| 8 | Ground Fault | Check the installation of the wiring to all the manual actuation devices (push stations) and firestats. Verify connections are secure and tight. Check for open/short circuits in the wiring. Repair or replace wiring as needed. |
| 9 | N/A | N/A |
| 10 | Battery Voltage Low | The voltage is below the battery threshold. Wait for batteries to recharge if there was a power failure. Replace if the batteries will not hold a charge. |
| 11 | AC Power Failure* | The voltage is below the power supply (PS-02) threshold; approximately 27.18V DC. Check breakers, call power company. |
| 12 | Door Tamper Switch | Close cabinet door. |
| 13 | Test Mode* | Place switch in armed position when testing is complete. |
| 14 | CORE Interlock | Check Dip Switches on all boards and RS-485 network wires connecting boards. |
| 15 | Fault on Hood in Network | Check all hoods in CORE network for faults. |
| 16 | Fault on PCU in Network | Check all PCUs in CORE network for faults. |

**NOTE: The low pressure switch option is not required per product safety listings and standards. The fault is for monitoring purposes. When a Pressure Switch or Supervised Loop fault is present for 24 hours, cooking operations will shut down.**

Faults marked with (*) will shut down Gas/Shunt. During an AC power failure or loss of building power, all 120V AC gas valves/electrical appliances will shut down immediately. For 24V DC gas valves, the valve will stay powered for a few minutes depending on battery voltage (when both an AC Power Failure and Battery Voltage Low fault are present, the valve will shut down).

TANK
FIRE SUPPRESSION

# TANK Fire Suppression: Inspection Report

**Start-up and checks must be performed after install. Warranty will be void without completion of forms. Scan or print these pages during installation or inspection procedures.**

**Job Information:**

| | | | | |
|---|---|---|---|---|
| **Start Date/Time** | | **Type of Inspection: (check mark one)** | **Commissioning** | **Semi-Annual** |
| **Business Name:** | | | | |
| **Business Address:** | | | **Startup after Decommissioning (For systems shutdown for over 2-days)** | |
| **Business Phone:** | | | | |

**Cooking Appliance Locations: Left to Right**

| |
|---|
| |

| **Name Plate and Hood Information** | | | | | |
|---|---|---|---|---|---|
| **Fire System #** | **Hood Model #** | **Job #** | **Volts** | **Hertz** | **Phase** |
| | | | | | |

**TANK System Verification**

| | | | |
|---|---|---|---|
| Verify all nozzles are secure | | Actuators in Ship/Test Position (First Install/Semi Annual Inspections) | |
| Check field piping is complete with approved materials | | Vent limiting orifice is installed in last actuator | |
| Multiple hood connections: Check supply line connections are complete | | Pressure gauge monitoring performed (Nitrogen to PAK Hose) | |
| All appliances properly covered with correct nozzles; Verify correct flows (4FP, 5FP, 6FP) are covering the proper appliance | | No pressure leaks in the manifold. Verify Pro Press fittings are secure. Nitrogen is not leaking through | |
| | | PAK Hose connected and torqued to 15 in-lbs | |
| Duct and Plenum covered with correct nozzles | | Pressure gauge leakage test | |
| Tank cylinders have proper PSI with gauges functioning properly. Pressure is in the green range | | System connections sprayed with coil leak detector | |
| Tanks installed securely with straps and mounting hardware | | All filters are installed | |
| O-ring is installed, and free of damage, in Primary Actuator Hose (PAK Assembly) | | Verify gas valve strainer is installed. Clean out strainer (Gas must be shut off) | |

**Service Notes:**

TANK
FIRE SUPPRESSION

# TANK Fire Suppression: Inspection Report

| Electrical | |
|---|---|
| TANK Control Panel power wired (Wall Mounted Control cabinet only) | |
| Power Supply PS-02 is connected to AC power | |
| Verify all fans are wired to control panel and operate | |
| Shunt Trip Breaker wired (if required) | |
| UDS Appliance Kill Switch (if equipped) wired | |
| Gas valve wired (if 120V AC) = Terminals GAS and N1 | |

| Low Voltage Wiring | |
|---|---|
| All Firestats are wired | |
| Remote Push Station is wired | |
| Supervised loop is run through metallic conduit and not with high voltage wiring | |
| Supervised loop connections secured in terminal blocks, j-boxes, and push-station(s) | |
| Building alarm and trouble relay wired (if required) | |
| Battery connected at connector J1 | |
| Gas valve wired (if 24V DC) = Terminals LGV and N1D | |
| Secondary Release solenoid valve wired (Remote cabinet only) and Pressure switch | |

| Fire System | |
|---|---|
| Record Battery Date Code | |
| Record CORE Board Revision # | |
| Push station cover and tamper seal installed | |
| All nozzles are 35-50” from Hazard Zone<br>Nozzles within 18” from Front/Back of Hazard Zone | |
| Check dedicated appliance coverage (if required) | |
| Record Power Supply (PS-02) output voltage | |
| Verify all CORE Board interlocks are connected (CA, CB, CC) | |
| After testing is complete, the actuator(s) are mounted to the tank(s) | |

| Fire System Activation Method | |
|---|---|
| Manual Activation Device (MAD) | |
| Firestat | |
| 120V AC Only | |
| Battery Backup Only | |
| “Push to Reset” operates | |

| Fire Mode | |
|---|---|
| Release solenoid opens and balloons inflated | |
| All gas and electric appliances shutdown | |
| Fire system light activates | |
| Audible alarm sounds | |
| Actuators deployed (Ship/Test Position) | |
| HMI displays “FIRE” | |

**ALL SYSTEMS MUST BE ARMED AND NO FAULTS SHOULD BE PRESENT BEFORE LEAVING THE SITE. YOU MUST VERIFY THE ACTUATORS ARE MOUNTED TO THE TANKS BEFORE LEAVING THE SITE!**

**Service Contact Information:**

| | |
|---|---|
| **End Date/Time** | |
| **Service Company:** | |
| **Company Address:** | |
| **Company Phone:** | |
| **Contact Name (Printed):** | |
| **Contact Name (Signed):** | |

**Service Notes:**

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## WARRANTY

Model TANK Fire Suppression extinguishing system is warranted to be free from defects in materials and workmanship, under normal use and service, for a period of 60-months from date of shipment. Warranty does not cover consumable products such as batteries and nitrogen. This warranty is null and void if:

1. The system is not installed by a factory trained installer per the MANUFACTURER'S installation instructions shipped with the product.
2. The equipment is not installed in accordance with Federal, State, Local codes, and regulations.
3. The system is misused or neglected, or not maintained per the MANUFACTURER'S maintenance instructions.
4. The system is not installed and operated within the limitations set forth in this manual.
5. The invoice is not paid within the terms of the sales agreement.

The MANUFACTURER shall not be liable for incidental and consequential losses and damages potentially attributable to malfunctioning equipment. Should any part of the equipment prove to be defective in material or workmanship within the 60-month warranty period, upon examination by the MANUFACTURER, such part will be repaired or replaced by MANUFACTURER at no charge. The BUYER shall pay all labor costs incurred in connection with such repair or replacement. Equipment shall not be returned without MANUFACTURER'S prior authorization, and all returned equipment shall be shipped by the BUYER, freight prepaid to a destination determined by the MANUFACTURER.

## CERTIFICATIONS

The Tank Fire Suppression system is ETL Listed in accordance with ANSI/CAN/UL/ULC 300, ULCORD-C1254.6.

The microprocessor-based control board is ETL Listed to UL Standard 864 and CAN/ULC-S527-11.

The Tank Fire Suppression system is acceptable for use in New York City, and is approved per FDNY COA #5870.

## SYSTEM OVERVIEW

The Tank Fire Suppression extinguishing system provides fire protection for commercial cooking appliances and ventilation. The Tank Fire Suppression extinguishing system is electrically released via a 24V DC solenoid valve. Extinguishing system units with electrical detection, activation, and control require the use of a Listed Control Panel, which has been found acceptable for releasing device service and which is compatible with the electrical actuators used on the extinguishing system. In addition, all electrical detectors, notification devices, and push stations are required to be Listed and compatible with the Control Panel.

# COMPONENTS

The following section lists the major components used in the TANK Fire Suppression extinguishing system.

**Figure 1 - Shipping/Test View**

1. Unit is shown in Shipping/Test Position
2. Tank Straps
3. Tank Mounting Bracket (Secured to cabinet with rivets)
4. Cylinder Tanks (Up to four tanks may be installed depending on cabinet size.)

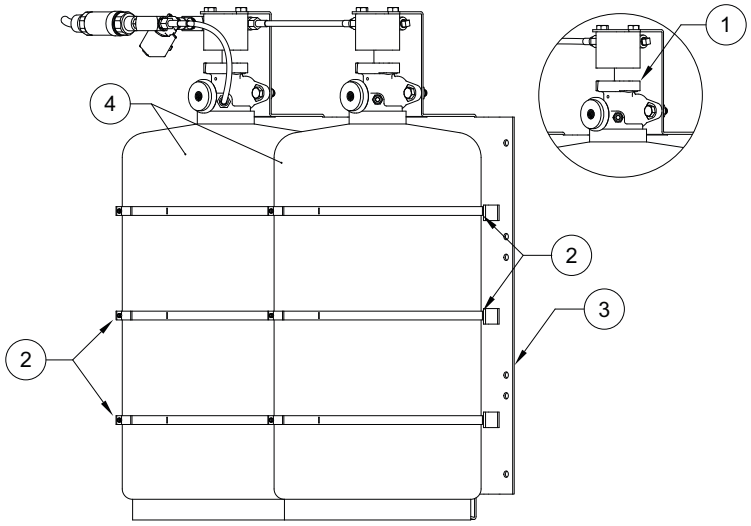
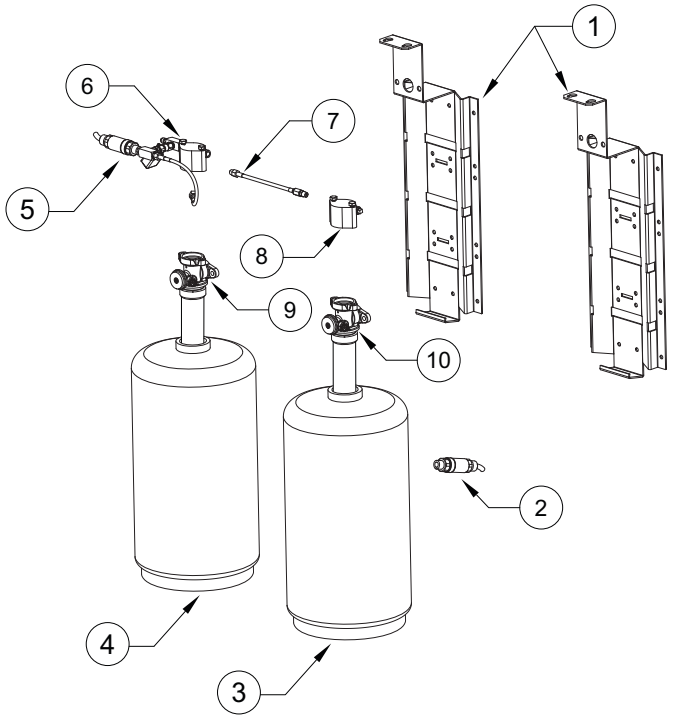



**Figure 2 - Exploded View**

1. Tank Mounting Brackets
2. Secondary Supervisory Pressure Switch (Optional)
3. Secondary Cylinder (Optional)
4. Primary Cylinder
5. Supervisory Pressure Switch
6. Primary Actuator Kit
7. Secondary Actuator Hose (Optional)
8. Secondary Valve Actuator (Optional)
9. Primary Valve with Siphon Tube
10. Secondary Valve with Siphon Tube (Optional)

Tank straps not shown.



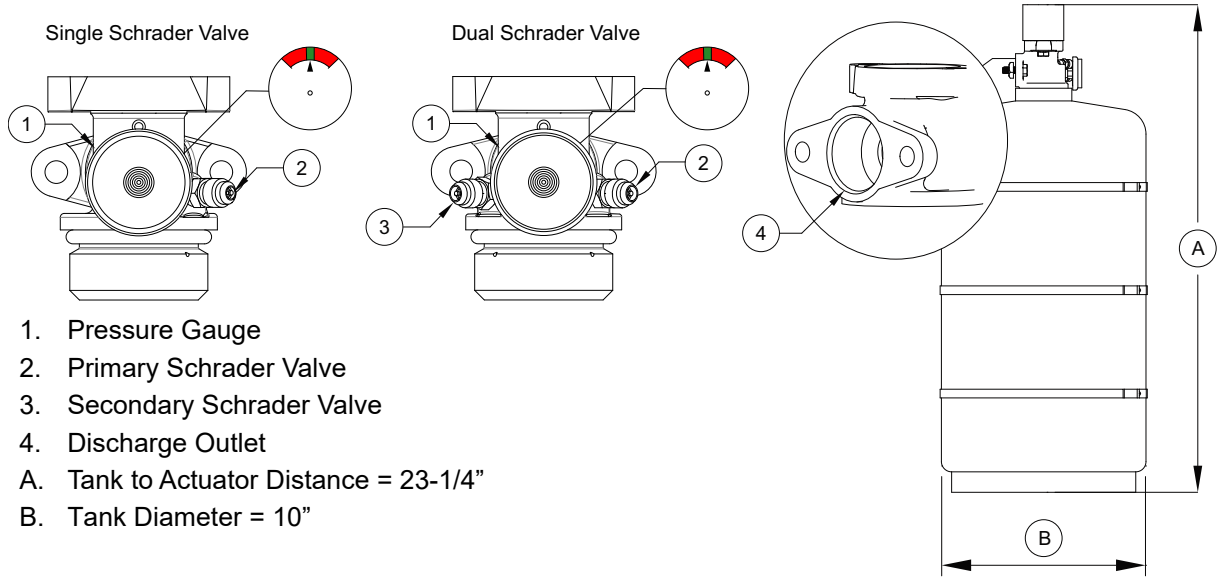

**NOTE: Tanks should never be filled with agent in the field.**

## Cylinder Tank Assembly

The TANK Fire Suppression cylinder assembly (p/n 87-300001-001) uses a mild steel cylinder, conforming to 4BW250 DOT & 4BWM-17 TC specifications, and a nickel-plated brass valve with pressure indicator gauge. Each valve includes a Schrader valve for connection to the primary actuator hose (for primary cylinders) or the supervisory pressure switch (optional for secondary cylinders).

Each cylinder assembly is factory-filled with TANK liquid fire suppressant and pressurized to 200 psig (1379 kPA) at 70°F (21°C). Each cylinder supports up to 5 nozzles for a total of 20 flow points.

**Figure 3 - Cylinder Tank Details**



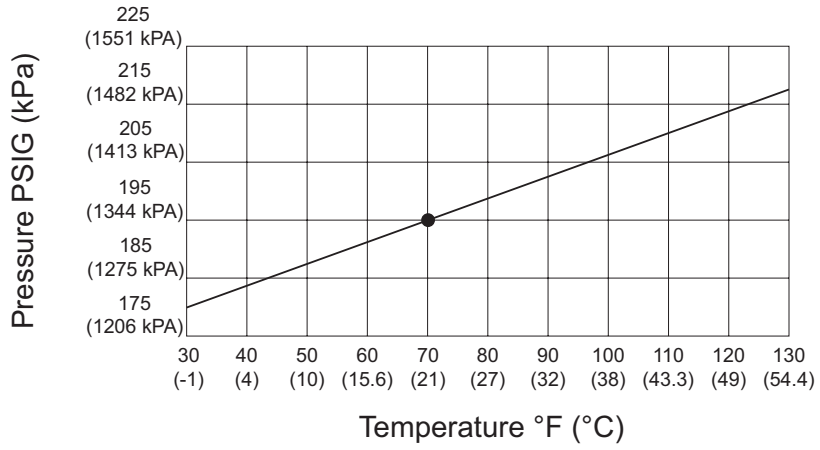

1. Pressure Gauge
2. Primary Schrader Valve
3. Secondary Schrader Valve
4. Discharge Outlet

A. Tank to Actuator Distance = 23-1/4”
B. Tank Diameter = 10”

The pressure of a cylinder will vary with the ambient temperature, as detailed in **Table 1**. The gauge indicator (shown in **Figure 3**) should be in the acceptable ‘green’ range for a cylinder that is properly pressurized and within the listed operating temperature range. For a cylinder at the lowest listed operating temperature of 32°F (0°C), the pressure gauge should read approximately 175 psig (the lower end of the green range). For a cylinder at the highest listed operating temperature of 130°F (54.4°C), the pressure gauge should read approximately 225 psig (the upper end of the green range).

**NOTE: The agent itself may be stored down to -20°F (not operational system temperature).**

**Table 1 - Cylinder Temperature Vs Pressure**

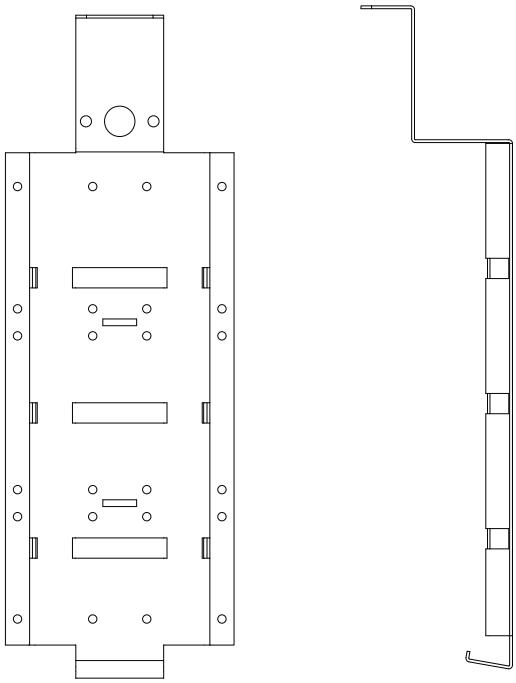


## Cylinder Tank and Actuator Bracket

Each cylinder assembly is secured to a factory-installed cylinder bracket in the cabinet (p/n TFS-UCTANKBRACKET). The cylinder is secured to the cylinder bracket via three (3) stainless steel straps.

The cylinder bracket also includes a platform for securing a primary actuator kit or secondary valve actuator during shipping and maintenance procedures.

**Figure 4 - Cylinder Tank and Actuator Bracket**

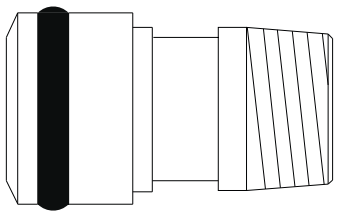


## Discharge Adapter

The discharge adapter (p/n WK-283952-000) is used to connect the TANK Fire Suppression cylinder valve outlet to the agent distribution pipe network. The 1/2-inch NPT internal thread of the discharge adapter outlet is connected to the supply line via an elbow and adapter.

The discharge adapter uses an O-ring (p/n WK-108019-000) at the valve port to eliminate leaks during discharge.

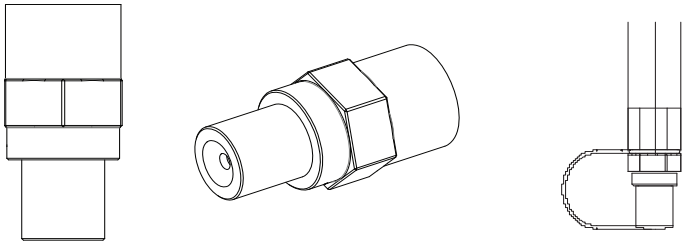
**Figure 5 - Discharge Adapter**



## Nozzles

The Overlapping Female Nozzle(s) (p/n OL-F) are used for plenum, duct, overlapping appliance protection, and dedicated appliance coverage (e.g., salamanders, upright broilers, chain broilers, and appliance with upright obstructions). The nozzles include a cap (p/n 3074-1-1). The cap prevents contamination from entering the pipe network and is designed to pop-off upon system discharge, allowing the agent to flow to the protected hazard area. Refer to **“Duct and Plenum Protection” on page 20**.

**Figure 6 - Fire System Nozzle**



Nozzle P/N: OL-F

Previously P/N 3070-3/8H-10-SS

## Primary Actuator Kit (PAK)

The Primary Actuator Kit (PAK) (p/n 87-300030-001) is installed on each primary cylinder assembly to pneumatically open the cylinder valve and provide actuation pressure for up to three secondary valve actuators. A vent limiting orifice is present to allow easier resetting of SVA pistons during inspections.

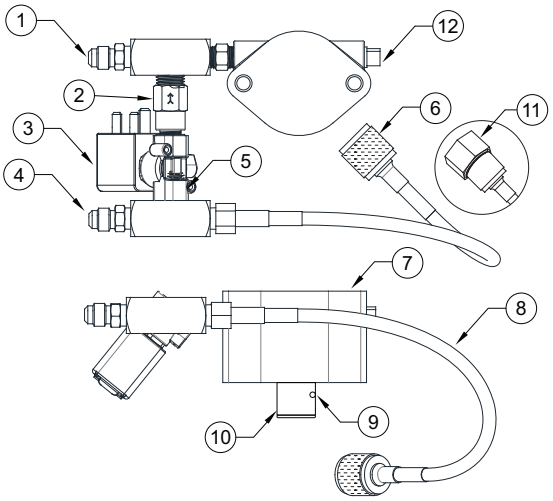
The PAK consists of a pneumatic actuator, 24V DC solenoid valve, solenoid strainer (recommended by the manufacturer), check valve, primary actuator hose, and associated fittings.

When activated, through automatic or manual system actuation, the control panel sends a momentary 24V DC release signal. The solenoid strainer will filter out debris from entering the system. The PAK solenoid will open, allowing pressure from the primary cylinder to pass through the solenoid and check valve. The pressure flows into the primary actuator (actuating the primary cylinder), and into the interconnected secondary valve actuators (actuating the secondary cylinders).

The primary actuator has a 1/8” NPT inlet port for connection to the primary system cylinder, and a 1/8” NPT outlet port for connection to the secondary cylinder actuation line or actuation line vent limiting orifice for single cylinder system. The primary actuator includes a piston with a spring-loaded locking pin which locks the piston in the discharge position, ensuring complete discharge of the cylinder contents. When testing/inspecting, if a component fails inspection, replace the PAK assembly.

**Figure 7 - Primary Actuator Kit**

1. Schrader Service Valve
2. Check Valve
3. Solenoid Valve
4. Supervisory Pressure Switch Connection
5. Solenoid Strainer (internal to assembly)
6. Knurled Fitting
7. Primary Actuator
8. Primary Actuator Hose (Stainless Steel)
9. Locking Pin
10. Piston
11. Hex Fitting
12. Vent Limiting Orifice

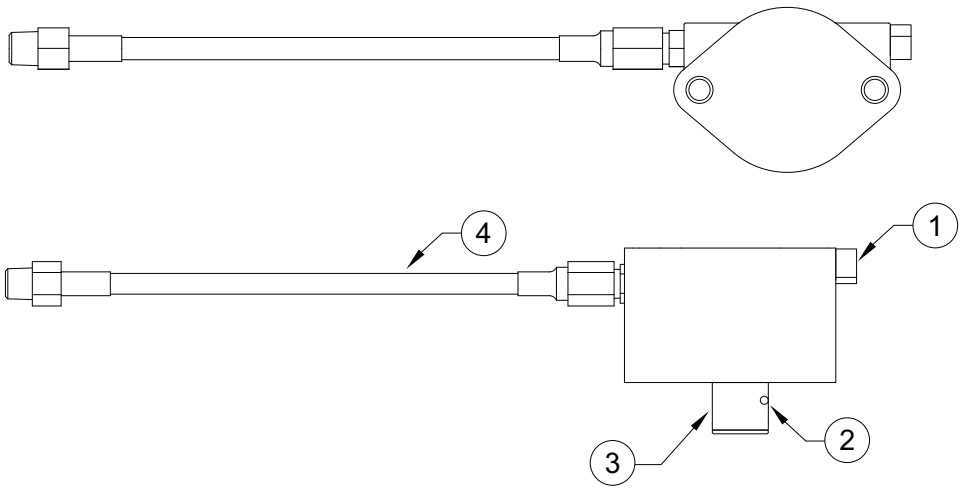



**NOTE: The primary supervisory pressure switch is standard on primary tanks. Secondary supervisory pressure switches are optional on secondary tanks.**

## Secondary Valve Actuator (SVA) and Hose

A Secondary Valve Actuator (SVA) (p/n 87-120042-001) is installed on each secondary cylinder assembly to pneumatically open the cylinder valve(s). The SVA has 1/8” NPT inlet and outlet ports for connection to the system actuation line via the SVA hose. All secondary hoses require a 1” minimum bend radius. The SVA includes a spring-loaded locking pin that locks the actuator piston in the discharge position, ensuring complete discharge of the cylinder contents.

**Figure 8 - Secondary Valve Actuator**



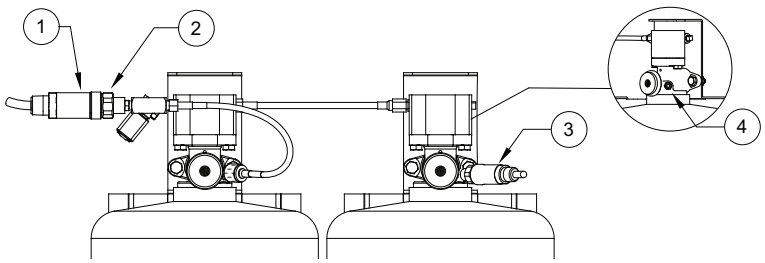

1. Vent Limiting Orifice
2. Locking Pin
3. Piston
4. Secondary Valve Actuator Hose
   - 7.5” hose option (p/n 87-120045-001)
   - 24” hose option (p/n 87-120045-002)
   - 60” hose option (p/n 87-120045-003)

## Supervisory Pressure Switch

The primary and (optional) secondary supervisory pressure switch (p/n 87-300040-001) are preset to alarm at a cylinder pressure of ~10% below the lowest operating system pressure of 175 psig (pressure at the lowest listed operation temperature of 32°F). The supervisory pressure switch uses a diaphragm sensor to detect pressure changes. At the predetermined set point, the unit actuates a SPDT snap-acting switch, converting a pressure signal into an electrical signal. The supervisory pressure switch can be used on primary and/or secondary cylinders. For primary cylinders, the pressure switch is mounted on the primary actuator kit. For secondary cylinders, the pressure switch is mounted on the Schrader fitting installed on the cylinder valve.

**Figure 9 - Supervisory Pressure Switch**

1. Supervisory Pressure Switch (Primary)
2. Wrench Flats
3. Secondary Supervisory Pressure Switch (Optional)
4. Schrader Valve



## Gas Shut-Off Valves

Electric gas shut-off valves are used to shut down the flow of fuel gas to the kitchen appliances upon actuation of the TANK Fire Suppression system. An energized solenoid is used to hold the gas valve in the open position. The solenoid closes the valve when de-energized via the output relay of the control panel. The gas valves are available in 120V AC and 24V DC, ranging from 3/4” to 3” pipe sizes. Refer to **“Gas Shut-Off Valves” on page 40** for more information.

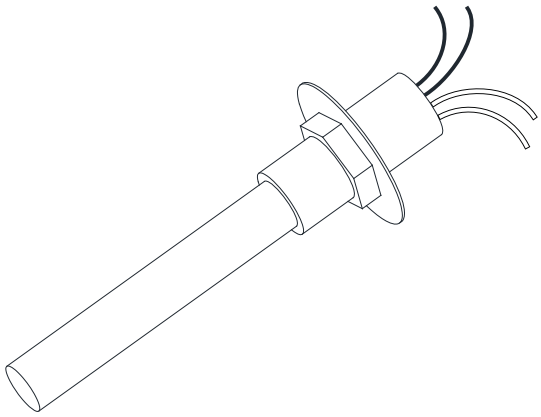
## Electric Remote Manual Release

An electrically operated manual release that is listed must be used with the TANK Fire Suppression extinguishing system. The electric remote manual release is used to actuate the TANK Fire Suppression extinguishing system manually and must be properly located and supervised in accordance with NFPA 17A and NFPA 96.

## Firestat (Heat) Detector

The Firestat (Fenwal Detect-a-Fire) is a listed electric thermal detector available in a variety of temperature settings and used to actuate the TANK Fire Suppression extinguishing system automatically. When a Firestat senses a temperature higher than its setpoint, the Firestat contacts will close and energize the TANK Fire Suppression system via the control panel.

**Figure 10 - Firestat**



# INSTALLATION

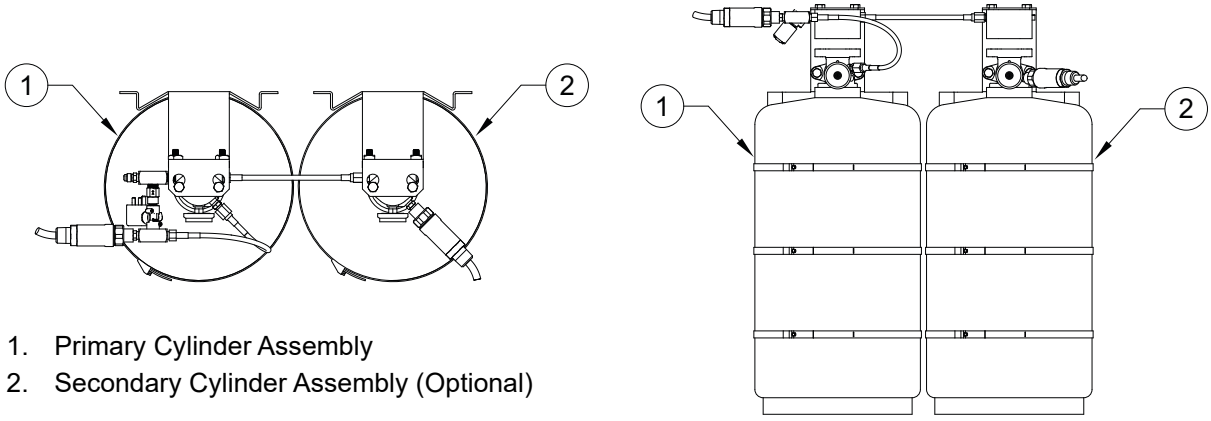
The extinguishing system consists of pressurized agent storage cylinders tanks, agent distribution piping, valve actuators, supervisory pressure switches, and agent discharge nozzles. All primary components and piping are factory-installed. Systems may be comprised of single or multiple cylinders depending on the size and configuration of the protected hazards.

Cylinders can be piped independently, or manifolded. On two-cylinder systems, the cylinders will be in a manifold configuration. Refer to **"Agent Distribution Piping" on page 37** for a two-cylinder system example. On three-cylinder systems, two cylinders will be in a manifold configuration and one independent. On four-cylinder systems, there will be two separate manifolds.

In a fire condition or upon manual actuation, the solenoid valve is opened, allowing pressure from the primary cylinder to flow to the primary and secondary cylinder valve actuators, opening the cylinder valves and discharging liquid fire suppressant to the protected hazard areas.

**WARNING!**
**System must be installed and operated in a conditioned space between 32°F and 130°F.**

**Figure 11 - Cylinder Assemblies**



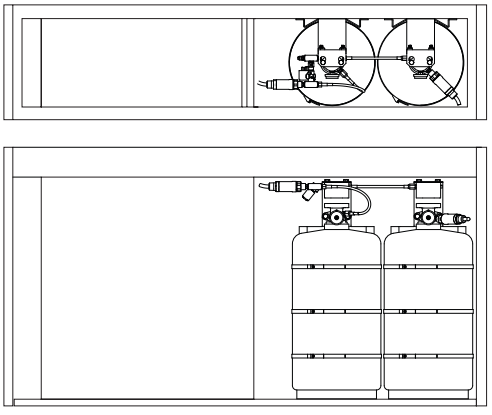

1. Primary Cylinder Assembly
2. Secondary Cylinder Assembly (Optional)

## Cylinder Tanks

Cylinders are typically factory-installed, pressurized, and may be located anywhere within the hood end cabinet.

Additional cylinders may be field installed, as needed, in the additional hood end or wall mount cabinet. **Figure 12** shows a dual cylinder system mounted to the right of the hood control unit. Each cylinder assembly is secured to a factory-installed cylinder bracket in the hood end cabinet. The cylinder is secured to the cylinder bracket via three (3) stainless steel straps.

**Figure 12 - Dual Cylinder Mounted in Cabinet**



Right side cabinet mount shown.

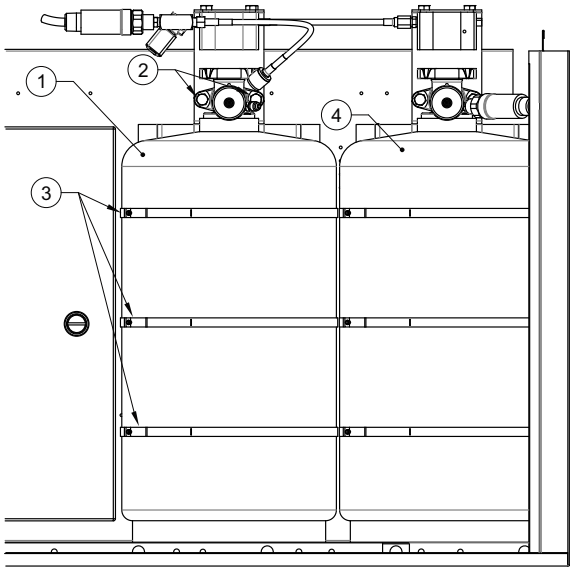
## Removing Full Cylinder Tanks (Optional)

When installing the hood, to reduce weight, you may remove the cylinder(s).

1. Verify the actuators are in the shipped position (**Figure 14**). If the system contains multiple tanks, check all additional actuators.
2. Use a 1/2" and 9/16" box end wrench to remove the two mounting bolts holding the tank on the bracket.
3. Loosen the straps.
4. Remove the tanks. Repeat for additional tanks.
5. Always reinstall tank(s) after the hood is secured. Refer to **"Installing New Cylinder Tank(s)" on page 79**.

**NOTE: When tightening the tank straps, use zip ties to secure excess banding.**

**Figure 13 - Removing Full Cylinders**




1. Cylinder 1
2. Mounting Bolts
3. Cylinder Straps
4. Cylinder 2 (Optional)

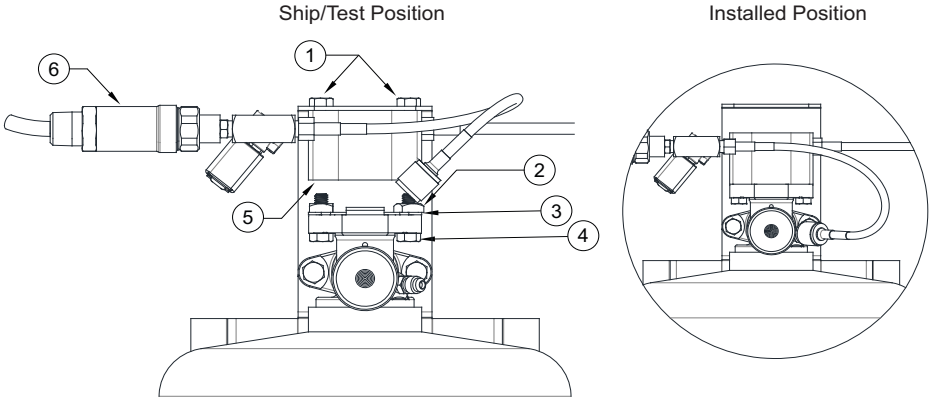
## Primary and Secondary Actuator Installation

**WARNING!**

**Do not complete PAK or secondary valve actuator installation until system test and commissioning are complete. The cylinder bracket includes a platform for securing a primary actuator kit or secondary valve actuator during shipping and maintenance procedures. The system actuators must be in the ship/test position for all commissioning and test procedures. Testing with actuators in place will result in discharge of the agent cylinders.**

**Refer to "START-UP/INSPECTION TEST PROCEDURE" on page 64 for the testing and commissioning unit.**

**Figure 14 - PAK in Ship/Test and Installed Positions**



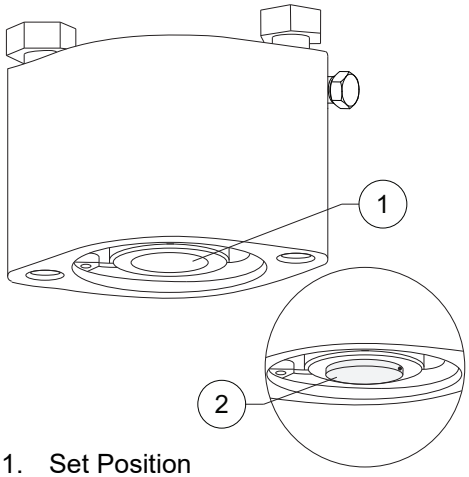

1. Shipping Bolts
2. Nut
3. Valve Protection Plate
4. Mounting Bolts
5. Primary Actuator Kit (In Transport Position)
6. Supervisory Pressure Switch

## Primary Actuator Kit (PAK)

The primary actuator kit is mounted to the primary cylinder bracket during shipment and when testing the system. With the cylinders securely mounted and connected to the system piping, the primary actuator kit can be installed onto the primary cylinder for the final setup.

1. Remove the valve protection plate and nuts. Retain the mounting bolts for installation of the PAK.
2. Ensure the primary actuator piston is in the set position.
3. Loosen the PAK shipping bolts from the top of the bracket, slide the unit back and lower it into position on the valve actuation flange.
4. Insert the mounting bolts through the bottom of the valve flange into the PAK mounting holes and tighten securely.
5. Connect the primary actuator hose to the Schrader valve on the primary cylinder valve. The primary hose requires a 1.5” minimum bend radius.

**Figure 15 - Actuator Valve**




1. Set Position
2. Actuated Position

**WARNING!**

**Installation of the primary actuator hose is the FINAL step performed.**

**Connecting this hose earlier may result in accidental system discharge. Refer to “START-UP/ INSPECTION TEST PROCEDURE” on page 64 for the testing and commissioning procedure.**

**When inspecting the primary actuator hose, replace O-ring. Refer to “TANK FIRE SUPPRESSION SYSTEM PARTS” on page 82.**

**The primary and secondary actuation hoses cannot be interchanged. The primary actuation hose must be used with the PAK.**

## Secondary Valve Actuator (SVA)

With the cylinders securely mounted and connected to the system piping, the secondary valve actuators (SVA) can be installed onto each of the secondary cylinder(s).

1. Remove the valve protection plate and nuts. Retain the mounting bolts for installation of the SVA.
2. Loosen the SVA shipping bolts from the top of the bracket, slide the unit back and lower it into position on the valve actuation flange.
3. Insert the mounting bolts through the bottom of the valve flange into the SVA mounting holes and tighten securely.
4. Ensure the secondary actuator hose is securely connected to the primary actuator output port and SVA input port.

**Key Limitations**

- Total length of secondary actuation flex hose must not exceed 75” of flex hose. Refer to **“Secondary Valve Actuator (SVA) and Hose” on page 13** for secondary hose information.
- Secondary actuator hose(s) require 1” minimum bend radius.
- Maximum number of secondary valve actuators operating from the primary actuator unit is three (3).

**WARNING!**

**The Valve Protection Plate must remain on the valve actuation port until the valve actuator is installed.**

**The primary and secondary actuation hoses cannot be interchanged. The secondary actuation hose (7", 24" or 60" length) must be used with secondary valve actuators.**

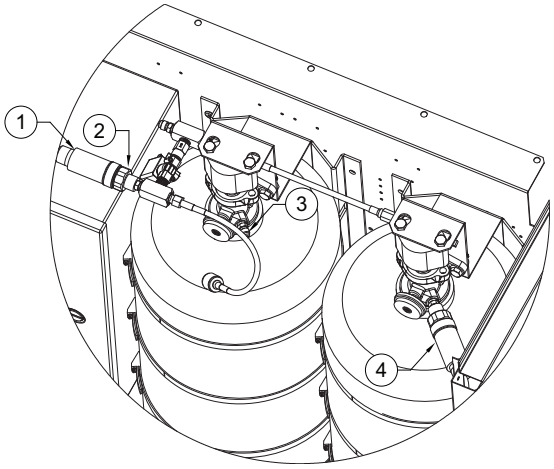
## Supervisory Pressure Switch

A supervisory pressure switch will always be located on the primary cylinder by the Primary Actuator Kit (PAK). For secondary cylinders, this is an optional component that may be added on. For primary cylinders, the pressure switch is mounted on the primary actuator kit. For all secondary cylinders, the pressure switch is mounted on the Schrader fitting on the cylinder valve.

1. Remove cap from applicable Schrader fitting.
2. Thread the switch onto the Schrader using the brass wrench flats only.

**Figure 16 - Supervisory Pressure Switch Installation**

1. Supervisory Pressure Switch (Primary)
2. Wrench Flats
3. Schrader Valve
4. Optional Secondary Supervisory Pressure Switch




**WARNING!**

**Proof pressure (*) limits stated on the nameplate must never be exceeded, even by surges in the system. Occasional operation of unit up to proof pressure is acceptable (e.g., start-up, testing). Continuous operation should not exceed the designated over range pressure (**).**

***Proof pressure - the maximum pressure to which a pressure sensor may be occasionally subjected, which causes no permanent damage (e.g., start-up, testing).**

****Over Range Pressure - the maximum pressure to which a pressure sensor may be continuously subjected without causing damage and maintaining set point repeatability.**

**NOTE: Pressure switches do not contain any field replaceable parts. Refer to applicable control panel manual for wiring of the supervisory pressure switch. Wire in accordance with local and national electrical codes.**

**WARNING!**

**Disconnect all supply circuits before wiring pressure switch. Electrical ratings stated in literature and on nameplate must not be exceeded - overload on a switch can cause failure on the first cycle.**

The electrical rating is rated to 5A resistive and 3A inductive at 30V DC; gold flashing over silver contact for loads down to 1mA at 24V DC.

| Wiring Color Code | Terminals |
|---|---|
| Red | NO (NC under Pressure) |
| Black | NC (NO under Pressure) |
| White | Com |

Supervisory pressure switches are connected in series to the control panel supervisory input.

## Wall-Mount Utility Cabinet (WMUC) Installation

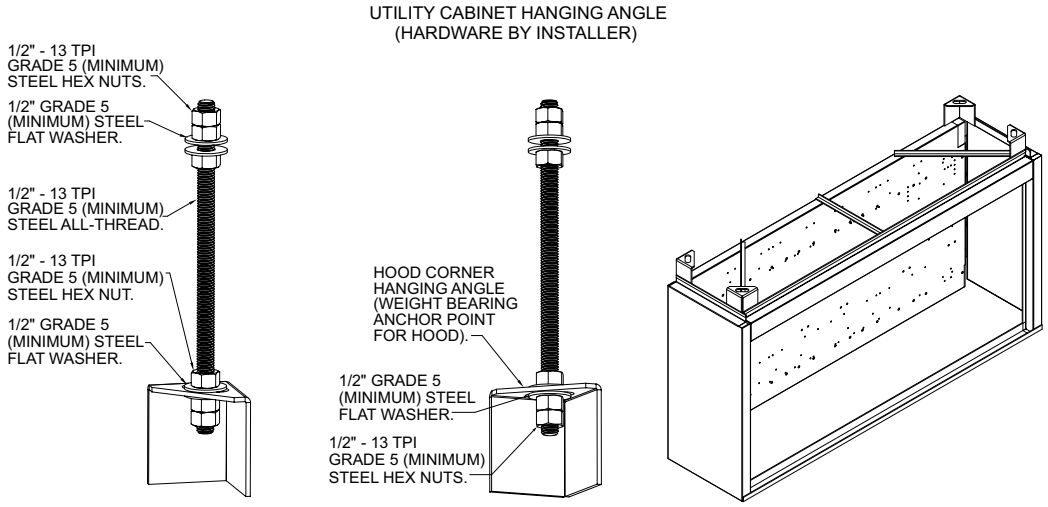
### WMUC Installation with Hanging Angles

The utility cabinet will be field installed by others. Refer to Utility Cabinet Schedule for cabinet size.

The hanging angle must be supported with 1/2”-13 TPI Grade 5 (minimum) All-Thread. Sandwich hanging angles and ceiling anchor points with 1/2” Grade 5 (minimum) steel flat washers and 1/2”-13 TPI Grade 5 (minimum) hex nuts. Refer to **Figure 17**. Hardware provided by others.

1. Must use doubled hex nut configuration beneath utility cabinet hanging angles and above ceiling anchors.
2. Maintain 1/4” of exposed threads beneath bottom hex nut.
3. Torque all hex nuts to 57 ft-lbs.

**Figure 17 - Hanging Angle Mount Details**




### WMUC Wall-Mount Option

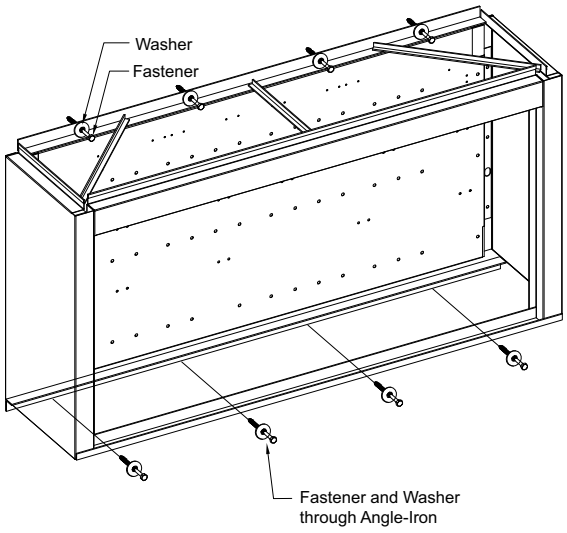
The utility cabinet will be field installed by others. Refer to Utility Cabinet Schedule for cabinet size.

The utility cabinet must be secured to the wall using a minimum of eight (8) fasteners and washers. Use four fasteners/washers on the top of the cabinet, and four fasteners/washers on the bottom. Refer to **Figure 18**.

1. Mark locations in the top and bottom angle-iron of the utility cabinet.
2. Drill pilot holes for fasteners.
3. When installing to the wall:
   - Concrete/Masonry - use 5/16” x 2-1/4” Tapcons.
   - Metal Studs - use 5/16” x 1-1/2” Self Drilling Screws.
   - Wooden Studs - use 5/16” x 3-1/2” Lag Bolts.
   - Drywall (only) - use 5/16” x 4” Long Toggle Bolts.

**NOTE: Wall-mounted utility cabinets up to 48” long, must be secured to 2 studs minimum (top and bottom of the utility cabinet). Wall-mounted utility cabinets over 48” long, must be secured to 3 studs minimum (top and bottom of the utility cabinet).**

**Figure 18 - Wall-Mount Details**



## Duct and Plenum Protection

The TANK Fire Suppression extinguishing system for duct and plenum coverage can be provided by independent fire suppression tanks and piping or integrated with the fire suppression tanks and piping used for protection of the appliances. Max of 5 nozzles per TANK for duct and plenum coverage only. Each duct and plenum nozzle protection is 4 flow points.

### Plenum Protection

The nozzle(s) (**page 12**), are used to protect plenum areas in both single bank and V-bank plenum configurations. The nozzle will protect up to a 4' wide x 10' long plenum section. For larger plenum areas, additional nozzles are added as required, with each nozzle protecting no more than a 4' wide by 10' long plenum section. Nozzles may be installed pointing in the same direction, and/or at opposite ends of the plenum, pointing toward each other. The nozzles must not be installed back-to-back when protecting plenum areas. When positioned at the end of the plenum, nozzles must be installed from 0 to 6" into plenum.

If the riser is not centered on the plenum, the plenum nozzle is placed on the side of the plenum closest to the riser.

The nozzle locations for plenum protection are shown in **Figure 19** and **Figure 20**.

**Figure 19 - Single Bank Filter Plenum**

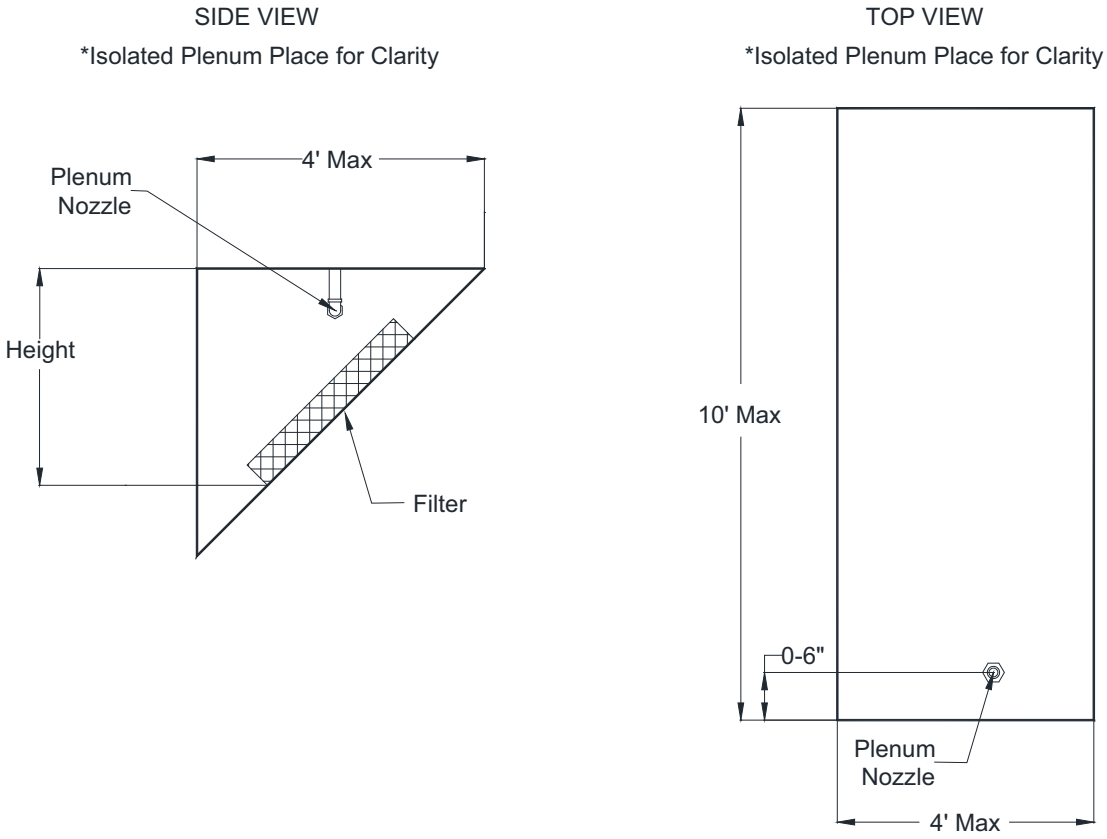
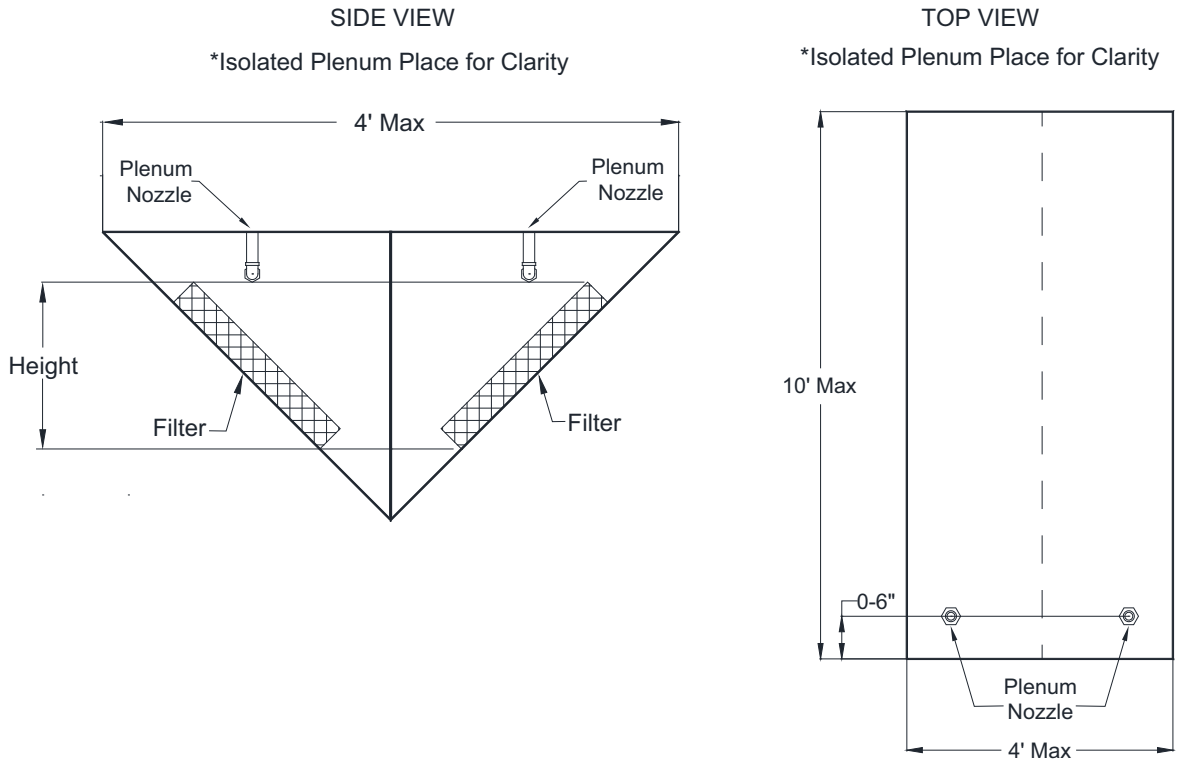


**Figure 20 - Dual V-Bank Filter Plenum**



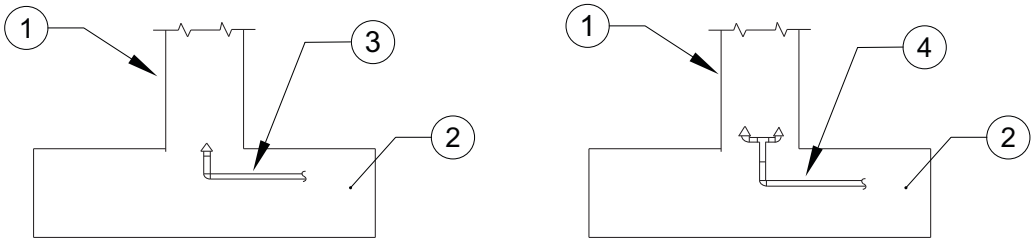

## Duct Protection

The nozzle(s) (**page 12**) is used for the protection of exhaust ductwork and can protect any duct cross-section type (e.g. round, square, or rectangular). A sufficient quantity of nozzles must be provided to ensure that no single nozzle coverage exceeds 75" in perimeter.

A single nozzle will protect a duct up to 75” perimeter (22” nominal diameter) and unlimited length. Two nozzles are required for protection of 75-150” perimeter and unlimited length. A minimum of 3 nozzles is required for protection of ducts exceeding 150" perimeter (36” nominal diameter) and unlimited length.

When using multiple nozzles (modular protection), the coverage area for each nozzle must not exceed 75" perimeter.

**Figure 21 - Nozzle Duct Protection**



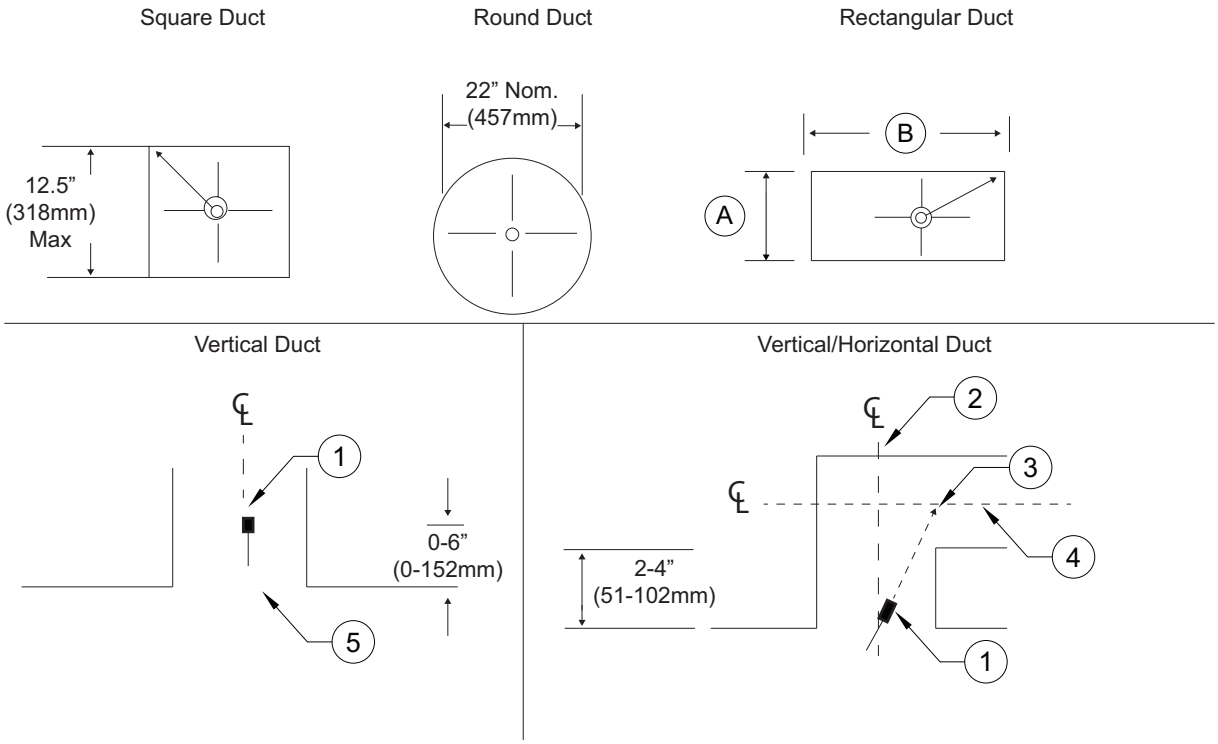

1. Duct
2. Hood
3. Single Nozzle
4. Dual Nozzle

Nozzles must be installed from 0" to 6" into the protected area of the duct. When more than one nozzle is required (modular protection), each nozzle must be located at the center of its protected module area. Additional nozzles are not required for changes in direction*. Duct obstructions and common ductwork must be protected in accordance with this manual, NFPA 17A and NFPA 96.

The nozzle location and aim for duct protection are shown in **Figure 22** and **Figure 23**.

*When a change in direction occurs less than 6" from the duct entrance, the nozzle must be aimed as shown in **Figure 22** and **Figure 23**.

**Figure 22 - Single Nozzle Placement (0-75” Perimeter Duct)**

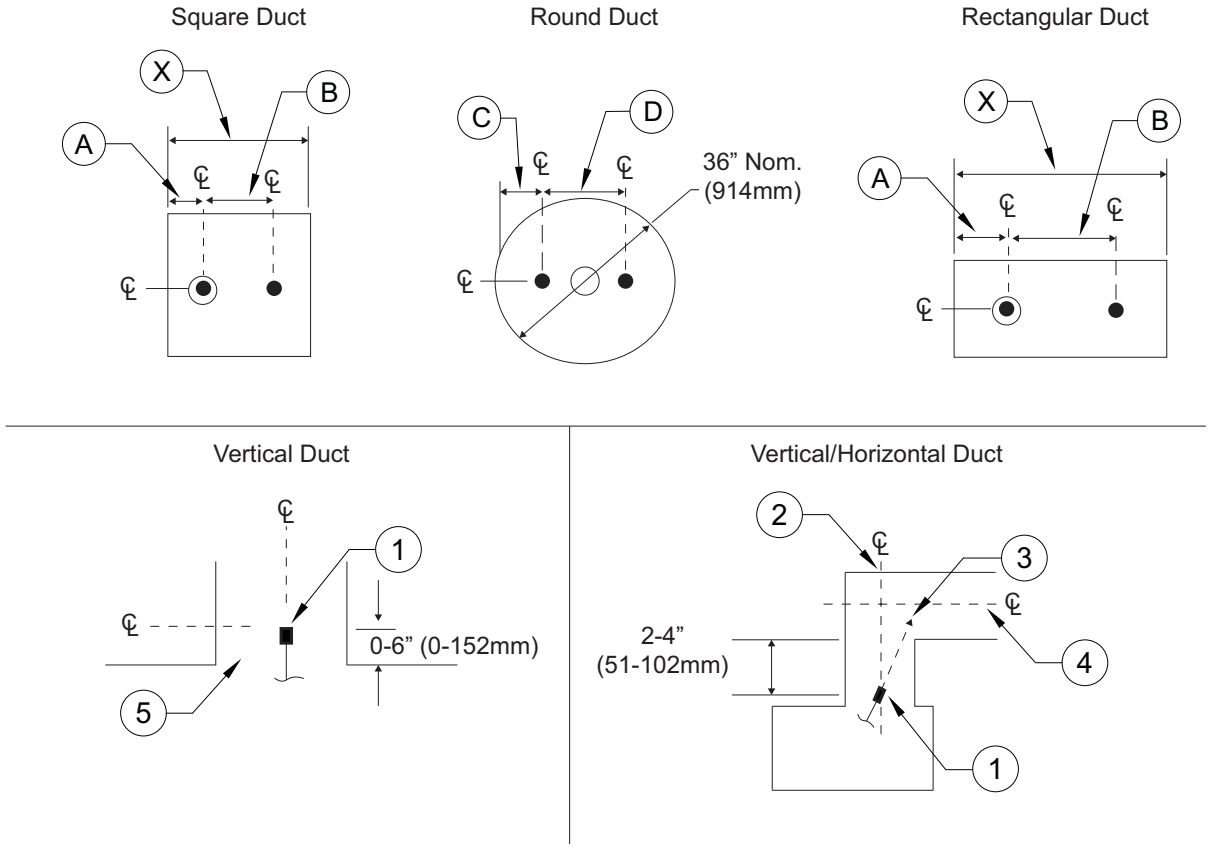



1. Nozzle
2. Horizontal Duct Centerline (CL)
3. Aim Point
4. Vertical Duct Centerline (CL)
5. Duct Entrance

A. Rectangular Duct Width
B. Rectangular Duct Length

- Duct perimeter up to and including 75” (1270mm).
- To determine the perimeter: 2(A) + 2(B) = 75” (1905 mm).

**Figure 23 - Dual Nozzle Placement (75-150” Perimeter Duct)**




1. Nozzle
2. Vertical Duct Centerline (CL)
3. Aim Point
4. Horizontal Duct Centerline (CL)
5. Duct Entrance

A. 1/4 of dimension X
B. 1/2 of dimension X
C. 1/4 of Duct Diameter
D. 1/2 of Duct Diameter

## Ventilation Exhaust and Dampers

The TANK Fire Suppression extinguishing system can be used with the exhaust fan either on or off when the system is discharged. It is recommended that the exhaust fan remain on at the time of discharge to aid in the removal of smoke, gases, and other airborne materials from the hazard area in the event of a fire. If the Authority Having Jurisdiction (AHJ) requires that the damper closes in the event of a fire system discharge, the system designer shall provide for protection downstream of the damper in compliance with NFPA 96, local codes, and/or as approved by the AHJ.

## Electrostatic Precipitators (ESP)

An Electrostatic Precipitator (ESP) is designed to remove smoke and other airborne contaminants from the air flowing through the exhaust ductwork as a means of pollution control. Exhaust ductwork using ESPs requires Overlapping Male nozzle(s) (p/n OL-M [previously 3070-3/8HH-10-SS]) upstream, before the ESP. Distribution piping to the nozzles must not interfere with the function of the ESP unit.

A Pollution Control Unit (PCU) and/or Electrostatic Precipitator (ESP) covered with this fire system can utilize up to 12 nozzles per tank.

## Appliance Protection

The TANK Fire Suppression system utilizes both overlapping and dedicated nozzle appliance coverage, depending on the type of cooking appliance(s) requiring protection. The Hazard Zone consists of the cooking surface of each appliance underneath each hood. For dedicated and overlapping nozzle information, refer to **“Nozzles” on page 12**.

Overlapping appliance coverage allows a given area under the hood, defined as the hazard zone, to be protected by overlapping nozzles. Nozzles are evenly spaced at the same height and alignment (front-to-back) relative to the hazard zone.

Dedicated appliance protection utilizes a nozzle, or nozzles, for protection of an individual appliance.

Overlapping, dedicated appliance, plenum, and duct protection may be incorporated in a single pipe network on the TANK Fire Suppression extinguishing system, as long as the number of nozzles per tank does not exceed five.

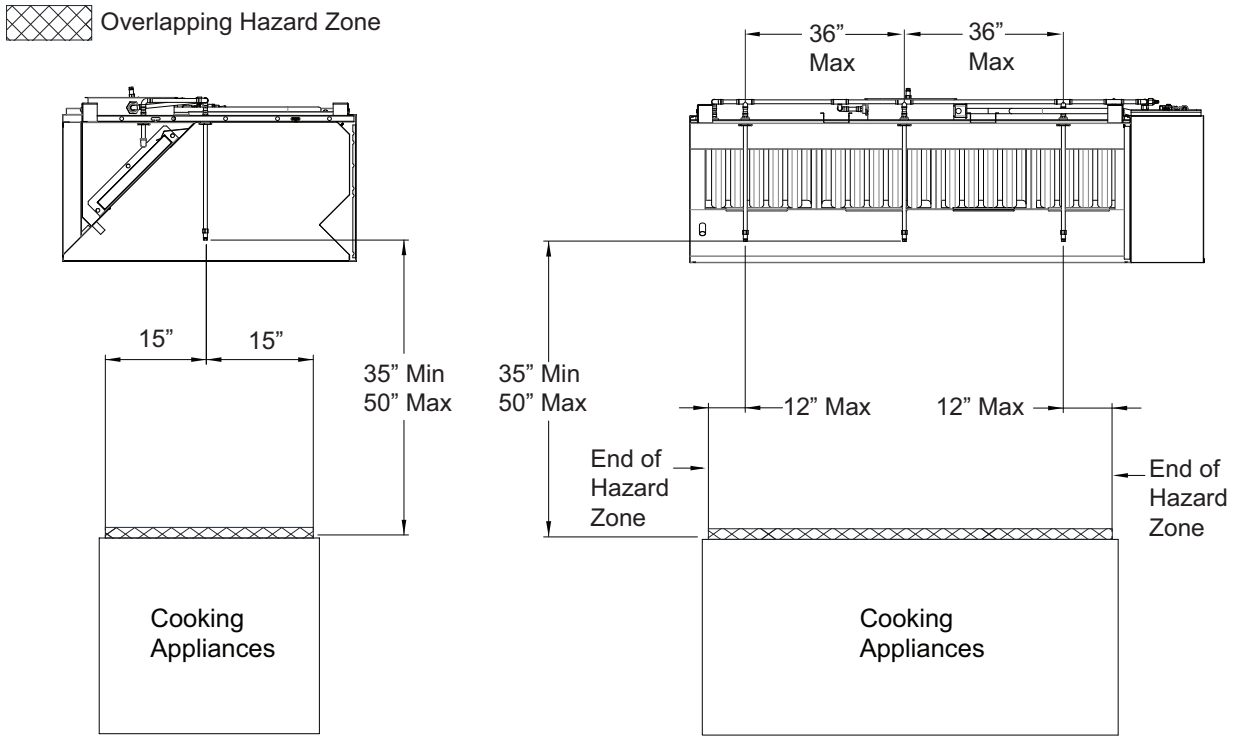
The following sections detail the different nozzle coverage and placement parameters for overlapping and dedicated nozzle appliance protection methodologies. Double row coverage is allowed for TANK.

### Overlapping Appliance Protection

A single hazard zone utilizing overlapping coverage is 30” deep, by the total length of the hazard zone for the protected appliances. The cooking surface of all appliances protected by overlapping nozzles must be located within the defined hazard zone area. Cooking appliances eligible for overlapping protection are outlined in **Table 2 on page 25**. The lowest and highest cooking surface will determine the height of the fire suppression nozzles. All overlapping nozzles must be mounted at the same height in a single hazard zone.

For applications where overlapping protection cannot be used, such as an upright boiler, dedicated appliance protection must be used.

**Figure 24 - Overlapping Protection Option**



## Appliance Coverage

**Table 2** displays the maximum permitted hazard zone dimensions of each appliance that can be protected within a single overlapping zone. It is important to note that the hazard zone (area requiring protection) is different than the total appliance size. **Figure 24** illustrates the placement of nozzles for TANK Fire Suppression overlapping protection.

**Table 2 - Standard Overlapping Protection 5 nozzles per tank (20 flow points), 36” max nozzle spacing**

| Hazard | Fuel Source | Maximum Depth of Hazard Zone | Maximum Length of Hazard Zone | Maximum Height of Fuel |
|---|---|---|---|---|
| Multi/Single Vat Fryer (with or without Drip-board) (3) (7) | Gas or Electric | 30” deep | Unlimited | N/A |
| Split Vat Fryer (with or without Drip-board) (3) (7) | Gas or Electric | 30” deep | Unlimited | N/A |
| Griddle | Gas or Electric | 30” deep | Unlimited | N/A |
| Gas/Electric Radiant Charbroiler (with or without Ceramic/Lava Rock) | Gas or Electric | 30” deep | Unlimited | N/A |
| Upright Broiler/Chain Broiler/Salamander (8) | Gas or Electric | 30” deep | Unlimited | N/A |
| Appliance without Shelf/Obstruction (8) | Gas or Electric | 30” deep | Unlimited | N/A |
| Range without Shelf/Obstruction (8) | Gas or Electric | 30” deep | Unlimited | N/A |
| Wok | Gas or Electric | 11-24” diameter | 11-24” diameter | 6-3/4” deep |

**Notes:**

1. All dimensions shown are based on overlapping protection.
2. All dimensions and areas shown reference the hazard zone of the appliance, which is typically smaller than the outside dimensions of the appliance itself.
3. For multi-vat fryers, no single fryer module (vat & drip board) can exceed the above limitations. Nozzle height(s) for fryers should be taken from the fryer’s maximum level indicator. When no maximum level indicator is present, nozzle height(s) should be taken from the top of the vat to no more than 3” below.
4. All appliance hazard surfaces must be located within the hazard zone.
5. Smaller appliances can be positioned anywhere in the zone (e.g., moved left, right, forward, or backward, provided the cooking hazard does not extend beyond the perimeter of the zone).
6. When the depth of the appliance exceeds maximum cooking hazard dimensions, a second row of nozzle coverage should be added.
7. Deep Fat and Industrial Fryers over 14” wide, a vat area of 196 $in^2$, or oil capacity of 50 lbs will need to refer to **Table 4 on page 26** for coverage information. Max oil capacity: 192.5 lbs.
8. Any appliance that may be obstructed (e.g. shelf, salamander, etc.), requires dedicated coverage. Refer to **“Upright Broiler/Salamander Protection” on page 30**, **“Appliance with Shelf” on page 31**, and **“Overhead Obstruction/Salamander Protection” on page 34** for coverage information.
9. For information on Tilt Skillets/Braising Pan coverage, refer to **Table 3 on page 26**.
10. Appliances not covered in **Table 2** through **Table 6,** refer to **“Other Appliance Coverage” on page 27**.

**Table 3 - Overlapping Protection 5 nozzles per tank (20 flow points), 30” max nozzle spacing**

| Hazard | Fuel Source | Maximum Depth of Hazard Zones | Maximum Length of Hazard Zones | Maximum Height of Fuel |
|---|---|---|---|---|
| Tilt Skillet/Braising Pan | Gas or Electric | 30” deep | Unlimited | N/A |

Tilt skillets and braising pans should be placed at the back of the hazard zone. Tilt skillet coverage must not interfere with the edge of the nozzle discharge pattern.

Nozzles may need to be moved forward and angled back to avoid the tilt skillet lid. Refer to **“Overhead Obstruction/Salamander Protection” on page 34** for nozzle coverage.

**Table 4 - Overlapping Protection 4 nozzles per tank (20 flow points), 30” max nozzle spacing**

| Hazard | Fuel Source | Maximum Depth of Hazard Zones | Maximum Length of Hazard Zones | Maximum Height of Fuel |
|---|---|---|---|---|
| Deep Fat/Industrial Fryers (with or w/o Drip-board) | Gas or Electric | 34” deep | Unlimited | N/A |
| Pressure Fryers* | Gas or Electric | 34” deep | Unlimited | N/A |
| Wok | Gas or Electric | Greater than 24”, up to 30” diameter | 30 inch diameter | 9-1/2” deep |

Deep Fat, Industrial and Pressure Fryers Max oil capacity: 192.5 lbs.

Nozzle height(s) for fryers should be taken from the fryer’s maximum level indicator. When no maximum level indicator is present, nozzle height(s) should be taken from the top of the vat to no more than 3” below.

For more information on Tandoor oven coverage, refer to **“Other Appliance Coverage” on page 27**.

*Henny Penny fryer models 690, 691, 692, PXE-100, and similar rail type lidded pressure fryers are allowed with standard 30” max nozzle spacing as long as the nozzle flow pattern is not obstructed by the lid while in the fully open position. A nozzle is required on both sides of the lid. Refer to Hinged Lid/Rail Type Pressure Fryers on **page 27** for more information.

**Table 5 - Appliances using 3 nozzles per tank, 24” max nozzle spacing**

| Hazard | Fuel Source | Maximum Depth of Hazard Zones | Maximum Length of Hazard Zones | Maximum Height of Fuel |
|---|---|---|---|---|
| Natural Charcoal Broiler | Charcoal | 30” deep | Unlimited | 4” |
| Solid Fuel Charbroiler | Mesquite or Hardwood | 30” deep | Unlimited | 6” |

**Table 6 - Appliance with Shelf 4 nozzles per tank (20 flow points), 36” max nozzle spacing**

| Hazard | Fuel Source | Maximum Depth of Hazard Zones | Maximum Length of Hazard Zones | Maximum Height of Fuel |
|---|---|---|---|---|
| Less than 12” Back Shelf | Gas or Electric | 30” deep | Unlimited | N/A |
| 12” Back Shelf | Gas or Electric | 30” deep | Unlimited | N/A |

Shelves/protrusions from appliances measuring 6” or less are not considered obstructions. Standard overlapping coverage applies. Refer to **Table 2 on page 25**.

Shelves/obstructions greater than 6” and up to 12” require 4 nozzles per tank, 36” max nozzle spacing.

Shelves exactly at 12” depth require 35” distance from nozzle tip to cooking surface. Shelves less than 12” may use nozzle distance from cooking surface of 35” to 50”, every effort should be taken to minimize nozzle spray pattern obstruction with the shelf. Refer to **“Appliance with Shelf” on page 31** for more information.

## Other Appliance Coverage

Appliances that are not covered in the UL300 Standard should use the following manufacturer's recommendations.

- **Enclosed electric rotisserie ovens** - Appliance protection is generally not needed unless required by the Authority Having Jurisdiction (AHJ).
- **Enclosed gas rotisserie ovens** - Standard overlapping protection with 36" max spacing is recommended to direct suppressing agent onto the top of the appliance and into the flue. Refer to **Table 2 on page 25**.
- **Open front gas/electric rotisseries** - Standard 36" overlapping coverage (4 FP per nozzle) is recommended. Follow Upright Broiler information located on **page 25**.
- **Open top gas/electric rotisseries** - Standard 36" overlapping coverage (4 FP per nozzle) is recommended. Follow Radiant Broiler information located on **page 25**.
- **Clamshell Griddle** - Standard 36" overlapping coverage (4 FP per nozzle) is recommended. Follow Griddle information located on **page 25**.
  - Nozzles should be positioned to avoid obstruction of nozzle flow.
  - If the upper platen obstructs the nozzle flow/overlapping coverage, either all nozzles within the same zone will be moved forward (in front of the upper platen) and angled back to the cooking surface; Or a separate overlapping coverage zone will be used for the equipment and the nozzles in that zone will be moved forward (in front of the upper platen) and angled back to the cooking surface.
  - Nozzle position should follow the 35-50" nozzle to cooking surface requirement of other overlapping coverages.
- **Vertical/Gyro Broilers** - Standard 36" overlapping coverage (4 FP per nozzle) is recommended for vertical/gyro broilers. Nozzles should be positioned to avoid obstruction of nozzle flow. Follow Gas Electric Radiant Charbroiler information located on **page 25**.
  - Nozzle position should follow the 35-50" nozzle to cooking surface, the Gyro Broiler cooking surface should be the grease collection drip pan.
- **Round Fry Vats** - Standard 36" overlapping coverage (4 FP per nozzle) is recommended for vats up to 14" in diameter. Follow Multi Vat/Single Vat/Split Vat Fryer information located on **page 25**.
  - Larger diameters up to 34" should be protected using 30" overlapping coverage (5 FP per nozzle). Follow Deep Fat/Industrial Fryers (with or w/o Drip-board) information in **Table 4 on page 26**.
- **Hinged Lid/Rail Type Pressure Fryers** - Overlapping coverage, appropriate to the size of the fry vat, can be used if the lid opens automatically once it is unlatched from the normal cooking position, is fully out of the way, and does not obstruct the nozzle flow.
  - Standard 36" overlapping coverage (4 FP per nozzle) is recommended for vats up to 14" wide. Follow Multi Vat/Single Vat information located on **page 25**. Deep Fat and Industrial Fryers over 14" wide, a vat area over 196 $in^2$, or oil capacity over 50 lbs will need to refer to **Table 4 on page 26** for coverage information. Max oil capacity: 192.5 lbs.
- **Smoker with Eyebrow Hood** - Recommended protection for eyebrow hoods is based on solid fuel charbroiler coverage as outlined in **Table 5 on page 26**, which includes overlapping appliance nozzles spaced no more than 24" apart and no more than 12" from the edge of the coverage zone with each nozzle counting as 6 FP each.
  - The coverage zone shall be defined as a 12" deep area spanning the oven horizontal opening. The center of the coverage zone shall be defined as 6" in front of the opening.
  - Single row coverage shall suffice.
- **Tandoor Ovens** - Standard 36" overlapping coverage (4 FP per nozzle) is recommended for Gas Radiant or Electric Tandoor Ovens having an opening of 14" diameter or smaller. Refer to Gas/Electric Radiant Charbroiler (with or without Ceramic) information on **page 25**. Gas Radiant or Electric Tandoor Ovens having an opening over 14" diameter must use (5 FP per nozzle) 30" overlapping coverage. Refer to **Table 4 on page 26**.
  - **NOTE: All wet chemical fire systems risk cracking clay tandoor ovens in the event of a fire system activation.**

## Overlapping Protection

Standard overlapping protection is 5 nozzles (20 flow points) at 36” max spacing, refer to **Table 2 on page 25**. All overlapping nozzles must be spaced no more than 12” from each end of the appliance, and located at the centerline of the 30” hazard zone (front to back), at the same height, and aimed straight down. The nozzle height must be 35” to 50” above the appliance cooking surface, except for woks, where the height is measured 3 inches below the top rim of the wok. The nozzles must be positioned along the total hazard zone length to allow protection of each appliance in the hazard zone.

Exceptions to standard overlapping protection: Refer to **Table 3 through Table 6 on page 26** for more information.

- Large/Industrial fryers over 14” wide, 4 nozzles at 30” max nozzle spacing per tank.
- Woks larger than 24 inch diameter, 4 nozzles at 30” max spacing per tank.
- Appliance with shelves, 4 nozzles at 36” max spacing per tank.
- Solid Fuel Appliances, 3 nozzles at 24” max spacing per tank.

Refer to **Table 4** through **Table 6 on page 26** for more information.

## Overlapping Coverage - Group Protection

Overlapping protection provides coverage for a continuous hazard zone, with all nozzles at consistent position (i.e., zone centerline), spacing, and height.

When there is an area within a hazard zone for which continuous overlapping coverage is not applicable, the overlapping protection zone may be ended, and a new zone started for the new group of appliances. Examples where continuous protection may be interrupted include (but not limited to) a counter, storage or prep area, appliance not requiring protection (e.g., enclosed electric oven) or an appliance requiring dedicated appliance coverage.

The examples on **page 29** provide details of group overlapping protection for interrupted zones. This section illustrates the methodology for defining when a new hazard zone is required, as described above. For appliance specific overlapping coverage parameters (e.g., nozzle spacing and height requirements), refer to **page 30** through **page 36**.

**NOTE: Overlapping nozzle spacing and height requirements are based on the appliances protected for each individual zone. Nozzles must always be located at the start and end of each zone, no more than 12" from the end of the hazard zone (edge of 1st/last cooking appliance surface). Refer to "Overlapping Appliance Protection" on page 24. Zones cannot overlap.**

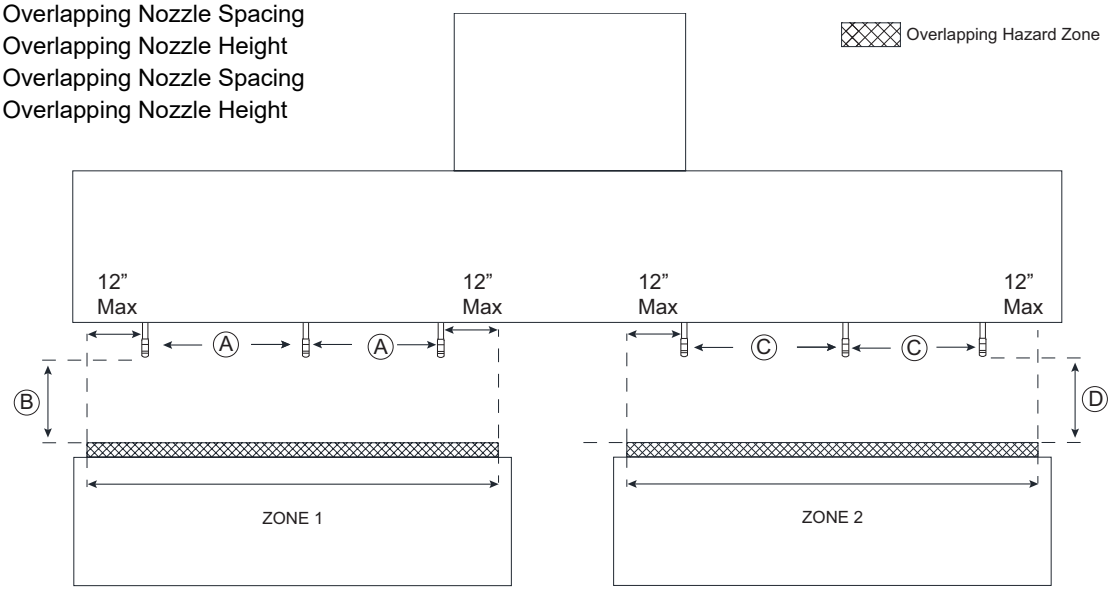
**NOTE: All hazard surfaces in a zone must be within 35"-50" of the nozzles in that zone.**

**Group Protection Example 1** - Appliance line separated by unprotected space.

End nozzles must be located 12" or less (horizontally) from the end of the hazard zone. Standard overlapping nozzles must be spaced no further than the maximum allowed interval 36" on center. Refer to **"Appliance Coverage" on page 25** for more details on coverage information.

**Figure 25 - Example 1**

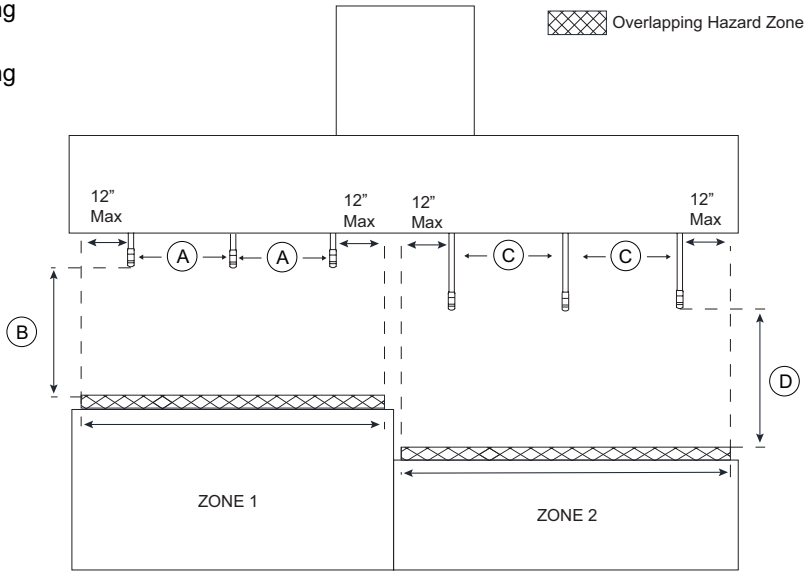
A. Zone 1 Overlapping Nozzle Spacing
B. Zone 1 Overlapping Nozzle Height
C. Zone 2 Overlapping Nozzle Spacing
D. Zone 2 Overlapping Nozzle Height




**Example 2** - Appliance lines with overlapping nozzles at different heights

**Figure 26 - Example 2**

A. Zone 1 Overlapping Nozzle Spacing
B. Zone 1 Overlapping Nozzle Height
C. Zone 2 Overlapping Nozzle Spacing
D. Zone 2 Overlapping Nozzle Height



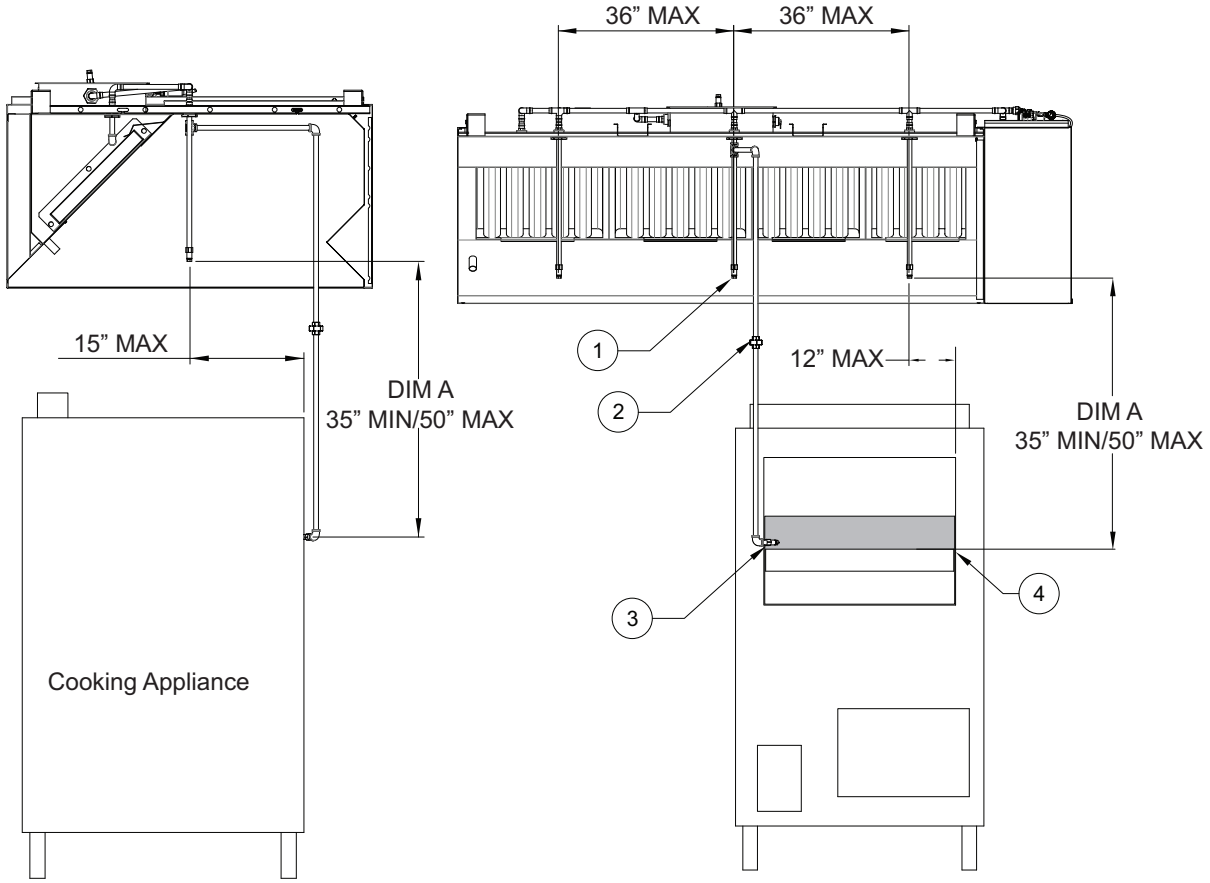
## Upright Broiler/Salamander Protection

Upright broilers, chain broilers, and cheesemelters have specific coverage requirements. Unlike appliances with an exposed flat cooking surface, these appliances have an internal cooking surface and only have a small opening in the face or end of the appliance.

To cover internal hazards posed by these appliances, an Overlapping Female (OL-F) nozzle (previously 3070-3/8H-10-SS) must be placed at the opening and aimed at the opposite rear corner of the appliance. This nozzle must be branched off one of the nozzle drops and piped to the appliance opening. **No more than 2 nozzles per drop.** The drawing below illustrates how this should be accomplished. Should the cooking surface of the appliance exceed 1,050 $in^2$, an additional nozzle will be required on the opposite of the appliance for added fire protection. Refer to **Figure 27** for details.

1. Pipe and fittings above the hood will be 1/2” copper pipe/Pro-Press, Grade L copper tubing and copper Pro-Press fittings.
2. Pipe and fittings inside the hood capture volume will be 3/8” NPT stainless steel or chrome-plated black iron. No sleeving permitted.
3. Appliance coverage piping that is field piped - unions, elbows, and nozzles factory provided.
4. Install union in pipe leading to nozzle to allow for appliance removal and cleaning.
5. Nozzle heights above cooking surface (DIM A).
6. In addition to Standard Overlapping Protection, additional nozzles may be utilized for supplemental appliance specific protection. No more than two (2) nozzles may be used on a single drop.
7. Appliance drop fittings may be sealed with pipe dope or Teflon tape. Drops must be installed with an internal pipe wrench or other no-marring pipe tool.

**Figure 27 - Broiler/Salamander Protection**




1. Overlapping Nozzle (OL-F)
2. Union in Pipe
3. Broiler/Salamander Protection Nozzle (OL-F)
4. Internal Cooking Surface.

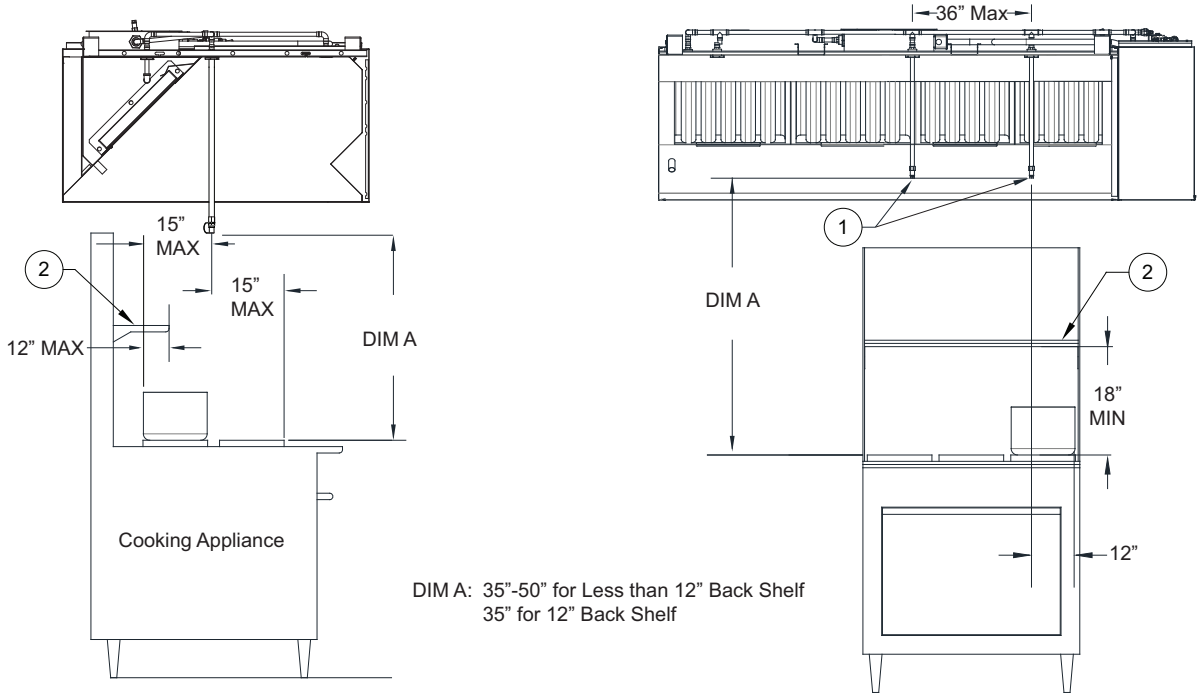
## Appliance with Shelf

An Overlapping Female (OL-F) Nozzle (previously 3070-3/8H-10-SS) is used for Appliance Top Cooking equipment protection. This type of cooking equipment is available with multiple burner assemblies. Some appliances are equipped with shelving behind the appliance for additional storage. **Figure 28** illustrates the shelf cannot overhang the appliance more than 12” from the back of the cooking surface.

All dimensions fixed unless otherwise noted (e.g., min/max).

1. Pipe and fittings above the hood will be 1/2” copper pipe/Pro-Press, Grade L copper tubing/fittings.
2. Pipe and fittings inside the hood capture volume will be 3/8” NPT stainless steel or chrome-plated black iron. No sleeving permitted.
3. Appliance coverage piping that is field piped - unions, elbows, and nozzles factory provided.
4. Nozzle heights above cooking surface (DIM A).
5. Appliance drop fittings may be sealed with pipe dope or Teflon tape. Drops must be installed with an internal pipe wrench or other no-marring pipe tool.
6. Shelves or protrusions from appliances measuring 6” or less are not considered obstructions. Standard overlapping coverage applies. Refer to **“Appliance Coverage” on page 25**.

**Figure 28 - Appliance with Shelf**



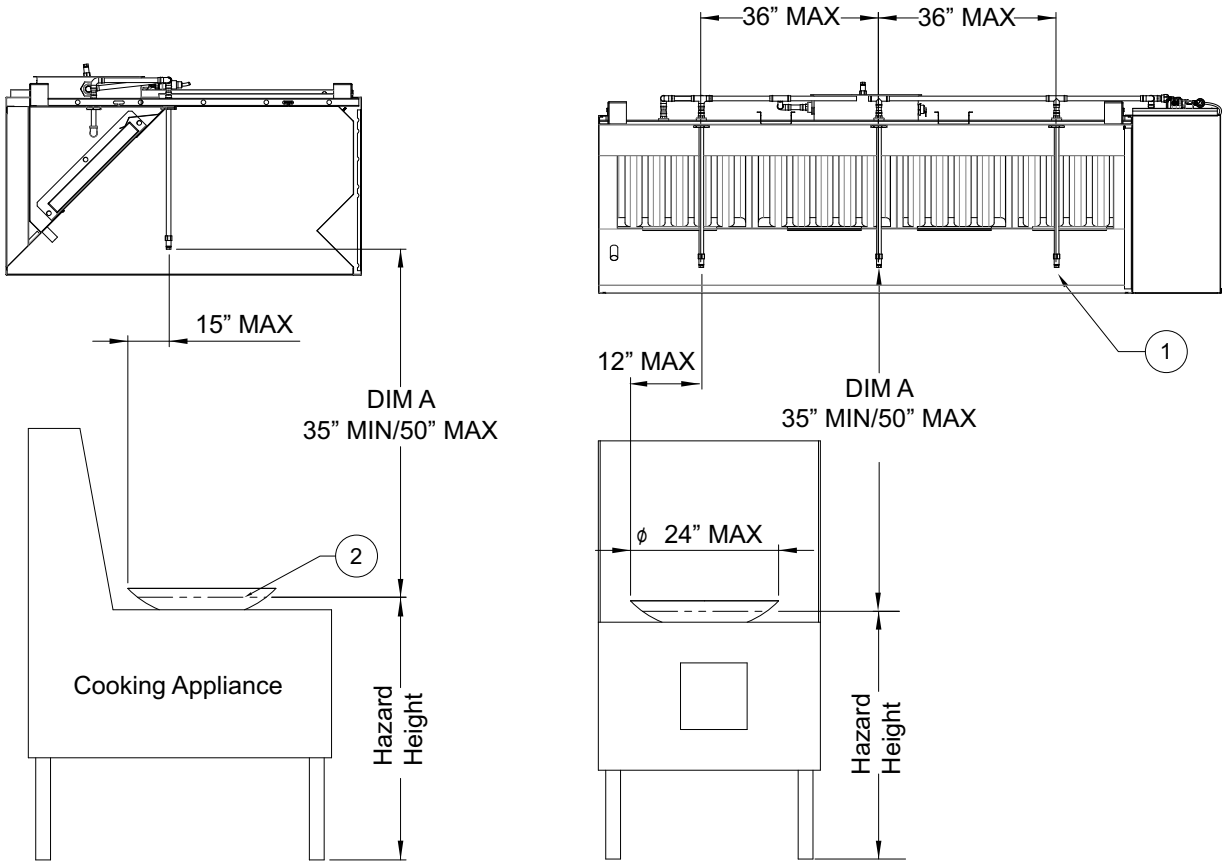

1. Overlapping Nozzle (OL-F)
2. Shelf - 12” maximum distance from the rear edge of the cooking hazard to the front edge of the shelf.

## Wok Protection

An Overlapping Female (OL-F) Nozzle (previously 3070-3/8H-10-SS) is used for Wok protection. The nozzle must be located within 12” from the left or right of the Wok and 15” from the front or back of the Wok. The Wok diameter range for protection is 11” to 24” diameter. For woks that exceed the 24” diameter, refer to **“Large Wok Protection” on page 33**.

1. Pipe and fittings above the hood will be 1/2” copper pipe/Pro-Press, Grade L copper tubing/fittings.
2. Pipe and fittings inside the hood capture volume will be 3/8” NPT stainless steel or chrome-plated black iron. No sleeving permitted.
3. Nozzle heights above cooking surface (DIM A).
4. Appliance coverage piping that is field piped - unions, elbows, and nozzles factory provided.
5. Install drops at 36” maximum spacing.
6. Appliance drop fittings may be sealed with pipe dope or Teflon tape. Drops must be installed with an internal pipe wrench or other no-marring pipe tool.

**Figure 29 - Wok Diameter Protection (up to 24”)**



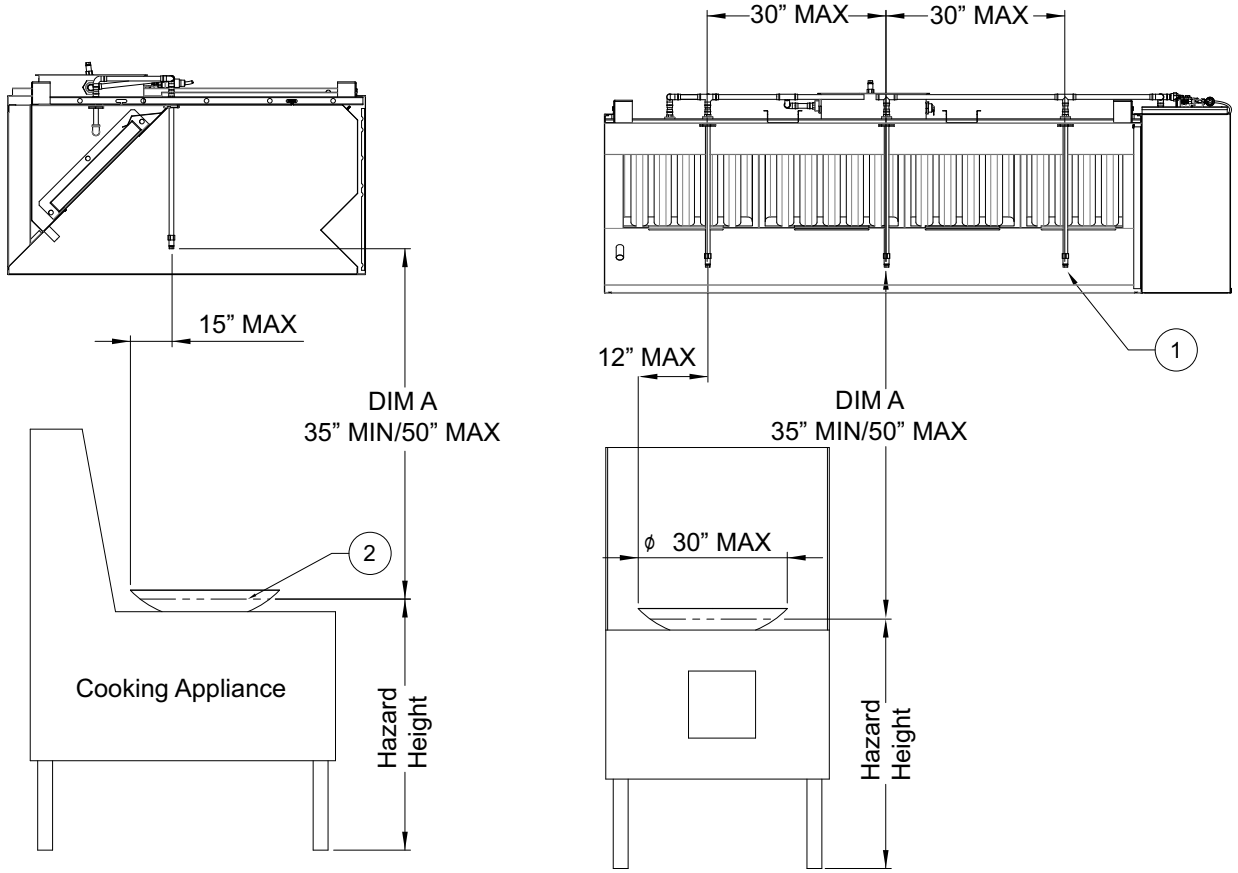

1. Overlapping Nozzle (OL-F)
2. UL300 defines the wok cooking surface as 3” below the rim of the wok.

## Large Wok Protection

An Overlapping Female (OL-F) Nozzle (previously 3070-3/8H-10-SS) is used for Wok protection. The nozzle must be located within 12” from the left or right of the Wok and 15” from the front or back of the Wok. The Wok diameter range for protection is 30” diameter. 4 nozzles per tank, 30” max nozzle spacing.

1. Pipe and fittings above the hood will be 1/2” copper pipe/Pro-Press, Grade L copper tubing/fittings.
2. Pipe and fittings inside the hood capture volume will be 3/8” NPT stainless steel or chrome-plated black iron. No sleeving permitted.
3. Appliance coverage piping that is field piped - unions, elbows, and nozzles factory provided.
4. Nozzle heights above cooking surface (DIM A).
5. Install drops at 30” maximum spacing.
6. Appliance drop fittings may be sealed with pipe dope or Teflon tape. Drops must be installed with an internal pipe wrench or other no-marring pipe tool.

**Figure 30 - Wok Diameter Protection (up to 30”)**




1. Overlapping Nozzle (OL-F)
2. UL300 defines the wok cooking surface as 3” below the rim of the wok.

## Overhead Obstruction/Salamander Protection

Salamanders/Cheesemelters have specific coverage requirements, unlike appliances with an exposed flat cooking surface, these appliances have an internal cooking surface and only have a small opening in the face or end of the appliance. **Dedicated nozzles are not required when the overhead obstruction is not an appliance**.

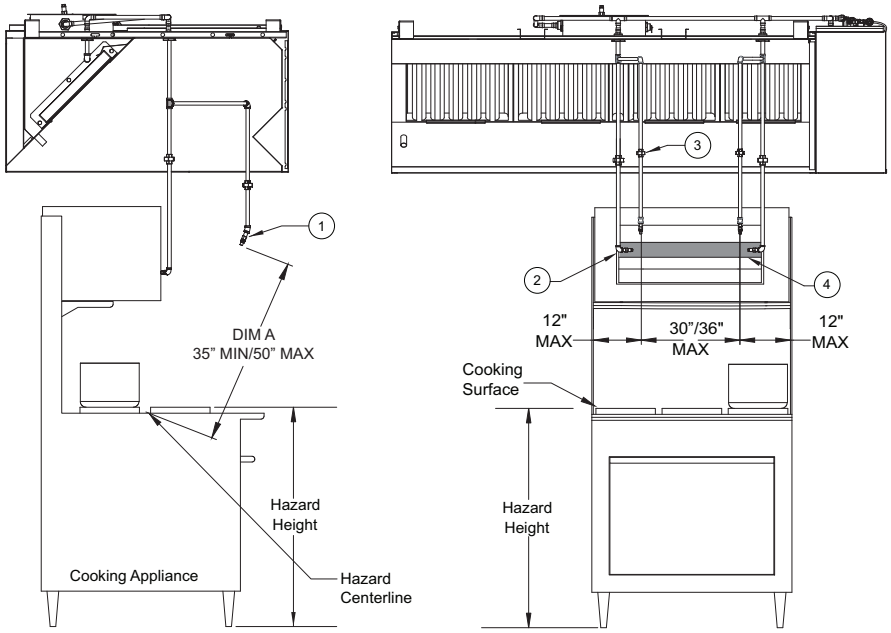
To cover internal hazards posed by these appliances, an Overlapping Female (OL-F) nozzle (previously 3070-3/8H-10-SS), is placed at the opening and aimed at the opposite rear corner of the appliance. The nozzle may be branched off one of the nozzle drops with a tee or have a dedicated nozzle drop and piped to the appliance opening. No more than two nozzles can be utilized for a single drop. Should the cooking surface of the appliance exceed 1050 $in^2$, an additional nozzle will be required on the opposite side of the appliance for added fire protection, refer to **Figure 31**.

Additional nozzles may be piped from nozzle drops nearest the appliance, or have a dedicated nozzle drop to cover the hazard underneath the obstruction/salamander. The nozzles are aimed at the centerline of the cooking surface, a minimum of 35”-50” away (DIM A). **Overlapping coverage is required for the appliance below the obstruction, nozzles may need to be moved forward and angled back to avoid the obstruction.**

All dimensions fixed unless otherwise noted (e.g., min/max).

1. Pipe and fittings above the hood will be 1/2” copper pipe/Pro-Press, Grade L copper tubing/fittings.
2. Pipe and fittings inside the hood capture volume will be 3/8” NPT stainless steel or chrome-plated black iron. No sleeving permitted.
3. Appliance coverage piping that is field piped - unions, elbows, and nozzles factory provided.
4. Install union in pipe leading to nozzle to allow for appliance removal and cleaning.
5. In addition to Standard Overlapping Protection, additional nozzles may be utilized for supplemental appliance specific protection. No more than two (2) nozzles may be used on a single drop.
6. Appliance drop fittings may be sealed with pipe dope or Teflon tape. Drops must be installed with an internal pipe wrench or other no-marring pipe tool.
7. Shelf/obstruction that extends more than 10-12” from the rear edge of the cooking hazard to the front edge of shelf/obstruction.
8. The spacing between nozzles will be either 36” or 30” maximum, based on the overlapping protection required for the appliance hazard below the obstruction.

**Figure 31 - Appliance with Upright Obstruction**




1. Overlapping Nozzle (OL-F)
2. Broiler/Salamander Protection Nozzle (OL-F)
3. Union in Pipe
4. Internal Cooking Surface

## Pizza Ovens

Pizza ovens have specific coverage requirements, unlike appliances with an exposed flat cooking surface, these appliances have an internal cooking area and only have a small opening in the face or end of the appliance. When installing the appliance, make sure the nozzle does not obstruct cooking operations.

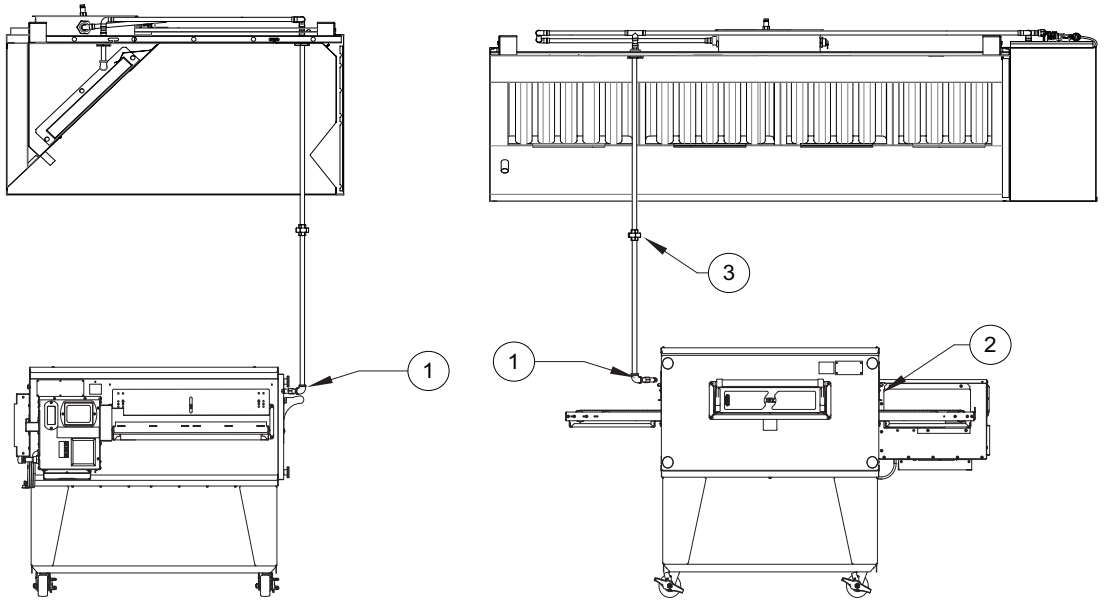
To cover the internal hazard posed by these appliances, an Overlapping Female (OL-F) nozzle (previously 3070-3/8H-10-SS) must be placed at the opening and aimed at the opposite rear corner of the appliance. No more than two nozzles can be utilized for a single drop. Refer to **Figure 32** for single stack ovens. **Figure 33** and **Figure 34 on page 36** show dual and three stack oven installation examples. Should the cooking area of the appliance exceed 1200 $in^2$, an additional nozzle will be required on the opposite side of the appliance for added fire protection. Each nozzle can cover 1200 $in^2$.

Hard piping is typically used to cover conveyor style pizza ovens, but a agent distribution hose is available for order (part number DISFLEXHOSE). This hose and restraining cable kit may be used when covering a conveyor pizza oven. The flexible hose allows for mounting directly to the pizza oven. When the hose is positioned such that the nozzle is pointed to the opposite corner of the pizza oven, it will provide similar coverage as a hard piped fire system drop.

All dimensions fixed unless otherwise noted (e.g., min/max).

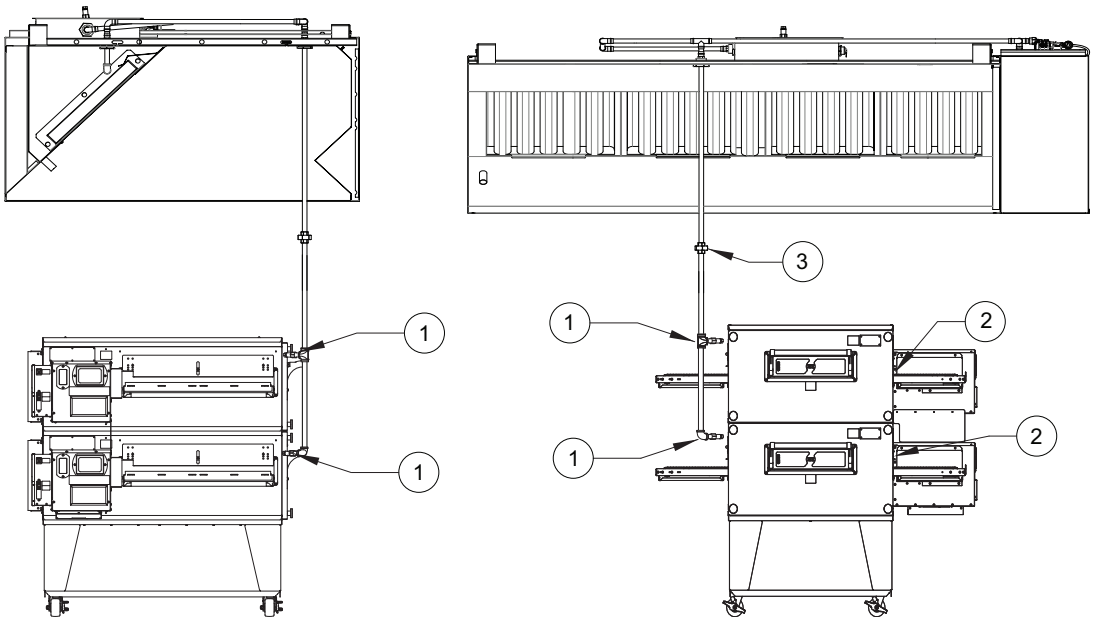
1. Pipe and fittings above the hood will be 1/2” copper pipe/Pro-Press, Grade L copper tubing/fittings.
2. Pipe and fittings inside the hood capture volume will be 3/8” NPT stainless steel or chrome-plated black iron. No sleeving permitted.
3. Appliance coverage piping that is field piped - unions, elbows, and nozzles factory provided.
4. No more than two (2) nozzles may be used on a single drop.
5. Appliance drop fittings may be sealed with pipe dope or Teflon tape. Drops must be installed with an internal pipe wrench or other no-marring pipe tool.

**Figure 32 - Single Stack Pizza Oven**



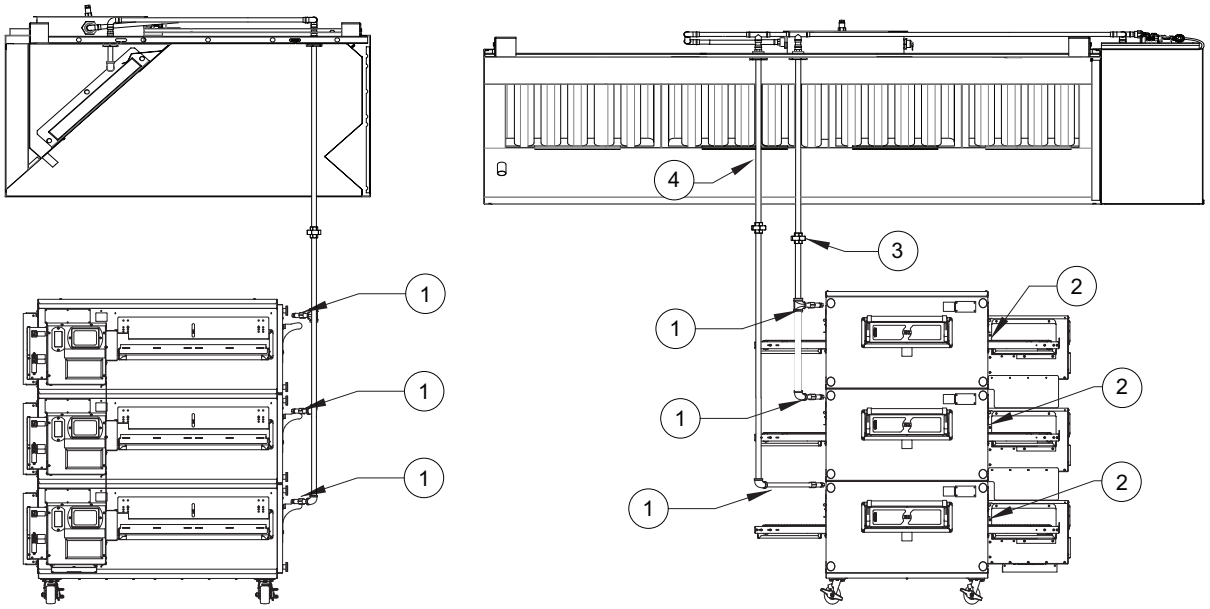

1. Overlapping Nozzle (OL-F)
2. Conveyor Opening
3. Install union in pipe leading to nozzle to allow for appliance removal and cleaning.

**Figure 33 - Double Stack Pizza Oven**




1. Overlapping Nozzle (OL-F)
2. Conveyor Opening
3. Install union in pipe leading to nozzle to allow for appliance removal and cleaning.

**Figure 34 - Triple Stack Pizza Oven**




1. Overlapping Nozzle (OL-F)
2. Conveyor Opening
3. Install union in pipe leading to nozzle to allow for appliance removal and cleaning.
4. Additional drop for third nozzle. No more than two nozzles are allowed per drop.

## Agent Distribution Piping

The agent distribution piping shall be 3/8” NPT Schedule 40 black iron, 3/8” NPT Schedule 40 stainless steel, or 1/2” copper pipe (Grade L) and Pro-Press fittings. Fittings shall be minimum class 150. Nozzle drops cannot be sleeved in steel but can be made from polished stainless steel, or polished chrome-plated black iron.

Galvanized pipe or fittings must not be used. Pipe thread or compound should be used to help seal fittings.

Distribution piping can be run in single cylinder or dual cylinder manifold configurations. Refer to **page 39** for single cylinder and dual cylinder configuration details.

The distribution network consists of a supply line and all applicable branches depending on the protected hazards. Branch lines include the plenum branch, duct branch, overlapping nozzle appliance branch, and dedicated nozzle appliance branch.

The supply line is defined as the run of all pipe and fittings from the tank outlet to the last branch line, including fittings at the start of all branch lines. All branch lines start at the outlet of the applicable supply line fitting and do not include the supply tee.

A plenum branch is defined as the run of all pipe and fittings from the supply line tee outlet to the plenum nozzle(s).

A duct branch is defined as the run of all pipe and fittings from the supply line tee outlet to the duct nozzle(s). Duct branch lines on risers greater than 75 inch perimeter can have a “tee” installed. Two separate duct branch lines are not required.

An overlapping nozzle appliance branch is defined as the run of all pipe and fittings from the supply line tee outlet to the nozzle.

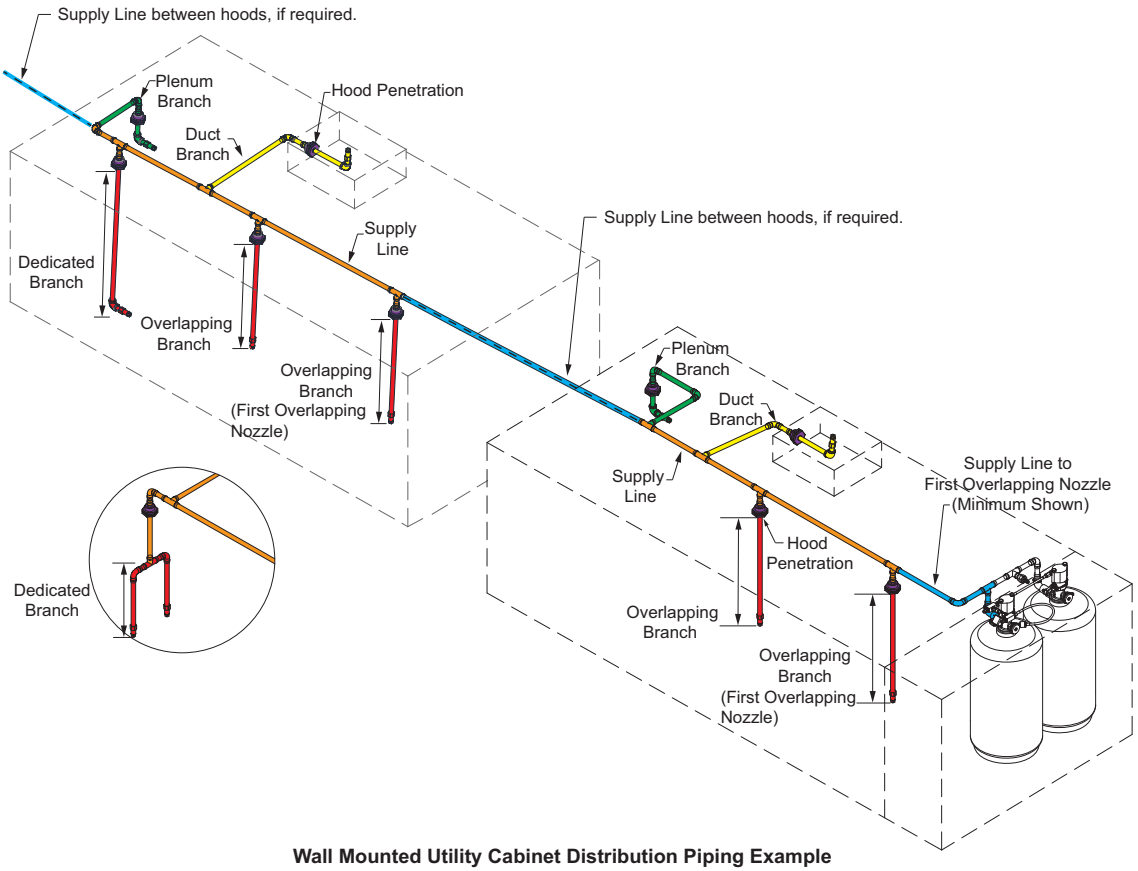
A dedicated nozzle appliance branch is defined as the run of all pipe and fittings from the supply line tee outlet to the nozzle.

Refer to **page 38** and **page 39** for Supply Line, Plenum Branch, Duct Branch, Overlapping Nozzle Appliance, and Dedicated Nozzle Appliance information.

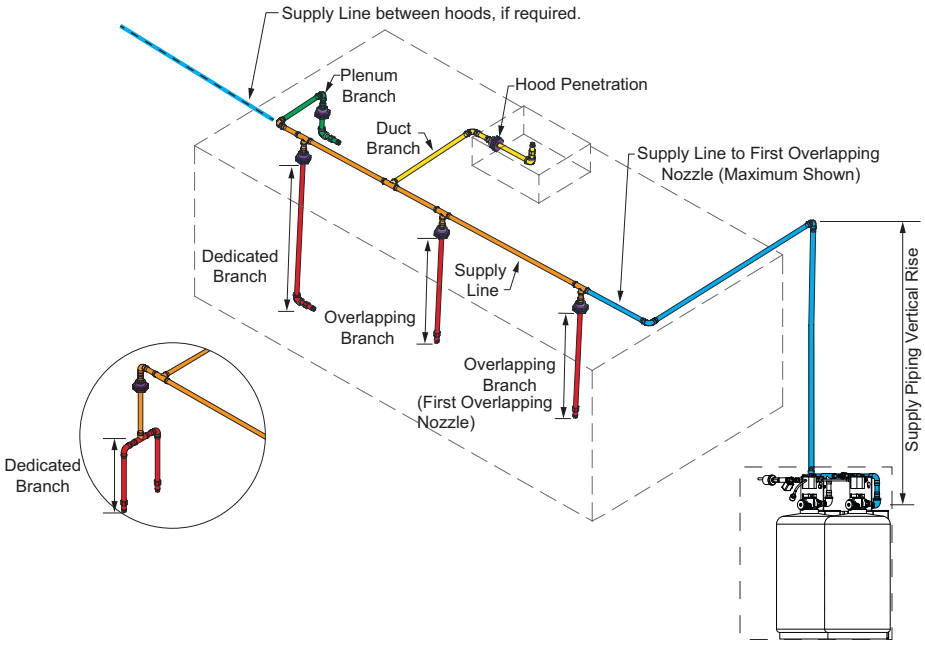
Refer to **“Cylinder Nozzle and Piping Parameters” on page 39** for supply line and branch piping limitations.

**Figure 35 - Distribution Piping**

**Hood Mounted Utility Cabinet Distribution Piping Example**




**Wall Mounted Utility Cabinet Distribution Piping Example**



## Cylinder Nozzle and Piping Parameters

A single cylinder supports up to 5 nozzles, 20 flow points. Max supply line up to 42 feet to the first overlapping nozzle.

A dual cylinder system supports up to 40 flow points and 10 nozzles. Dual cylinder systems can be piped in series or parallel. Max supply line up to 42 feet to the first overlapping nozzle.

**Table 7 - Agent Distribution Piping Limitations**

| Pipe Section | Max Pipe Length (ft) |
|---|---|
| Max Supply Line to First Overlapping Nozzle | 42 |
| Overlapping Nozzle Appliance Branch | 10 |
| Dedicated Nozzle Appliance Branch | 10 |

**Notes:**

1. One (1) tee allowed per appliance drop.
2. No more than two nozzles can be utilized for a single appliance drop.
3. Additional elbows are permitted on branch lines and horizontal supply piping, provided linear pipe length is reduced by corresponding equivalent length (1.3 ft per 90° elbow, 0.6 ft per 45° elbow).

*For example: a 3/8" steel elbow has an equivalent length of 1.3 ft. An appliance branch may use 4 elbows, provided the total linear pipe is reduced by 1.3 ft (e.g., from 5 ft to 3.7 ft). Additional pipe cannot be added in lieu of fittings, as pipe volume limits could be exceeded.*

4. Maximum 6 ft vertical rise of supply line above cylinder outlet.
5. Minimum 7 ft. of supply line to first overlapping nozzle.
6. If hoods are piped to the same tank, the sum of piping between hoods plus distance to first overlapping nozzle should NOT exceed 42 feet.

## Nozzle Installation

Distribution piping and nozzles are factory-installed. Verify that the nozzles and distribution network are installed in accordance with the design and installation parameters for all protected hazards, as set forth in this manual.

**NOTE: The TANK Fire Suppression extinguishing system design must be reviewed if any hazard changes have been made, including (but not limited to): appliance type, appliance sizes, appliance location, factory pre-piping or nozzles, plenum size or configuration, and duct size or configuration.**

1. Ensure nozzles are securely installed. DO NOT OVERTIGHTEN.

**NOTE: Do not over-tighten or nozzles may be damaged.**

2. Ensure all nozzle types, placement, and aim are in accordance with the limitations in this manual. Nozzles can be used to achieve proper aim on dedicated appliance protection nozzles only.
3. Refer to **"Nozzles" on page 12** for details on nozzle(s).

## Gas Shut-Off Valves

The electric gas valve is held open in the energized state, and closes when de-energized via the output relay of the control panel. A listed manual reset relay is required to ensure manual reset prior to fuel being restored in accordance to NFPA17A.

Gas valves (**Figure 36**) are designed to shut off the flow of gas to the kitchen appliances in the event of fire system activation. Electric gas shutoff valves must be installed with an upstream strainer to prevent debris from prohibiting gas valve function. New pipe, properly reamed and cleaned of metal burrs, should be used. Proper care is needed to ensure that the gas flow is in the same direction as indicated on the gas valve and strainer. Do not over-tighten pipe connections. Apply pipe dope to the male threads only.

If necessary, install a drip leg in the gas line in accordance with the Authority Having Jurisdiction (AHJ).

- **120V AC** gas valves 3/4” - 2” can be mounted with the solenoid in any position above horizontal. The gas pipe may be vertical or horizontal.
- **120V AC** gas valves 2-1/2” - 3” must be mounted with the solenoid vertical and upright. The gas pipe must be horizontal.
- All **24V DC** gas valves must be mounted with the solenoid vertical and upright. The gas pipe must be horizontal.

Proper clearance must be provided in order to service the strainers. A minimum of 4” clearance distance must be provided at the base of the strainer.

**Figure 36 - Electric Gas Valve**

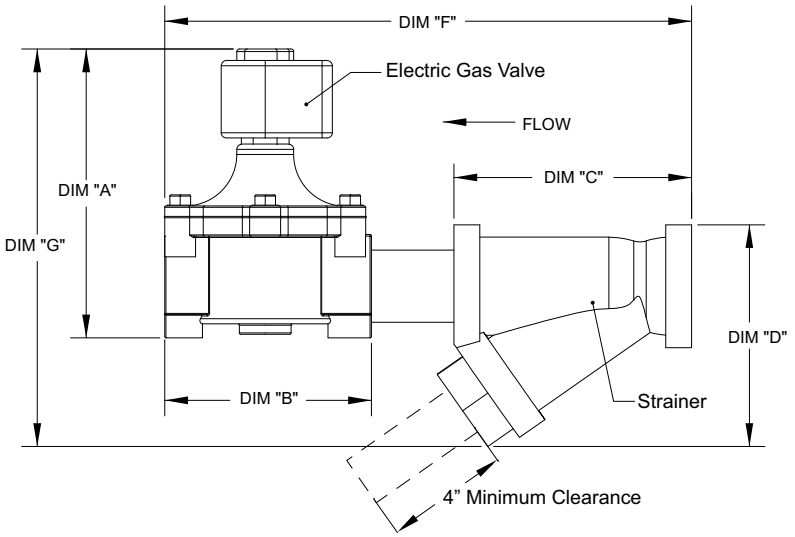
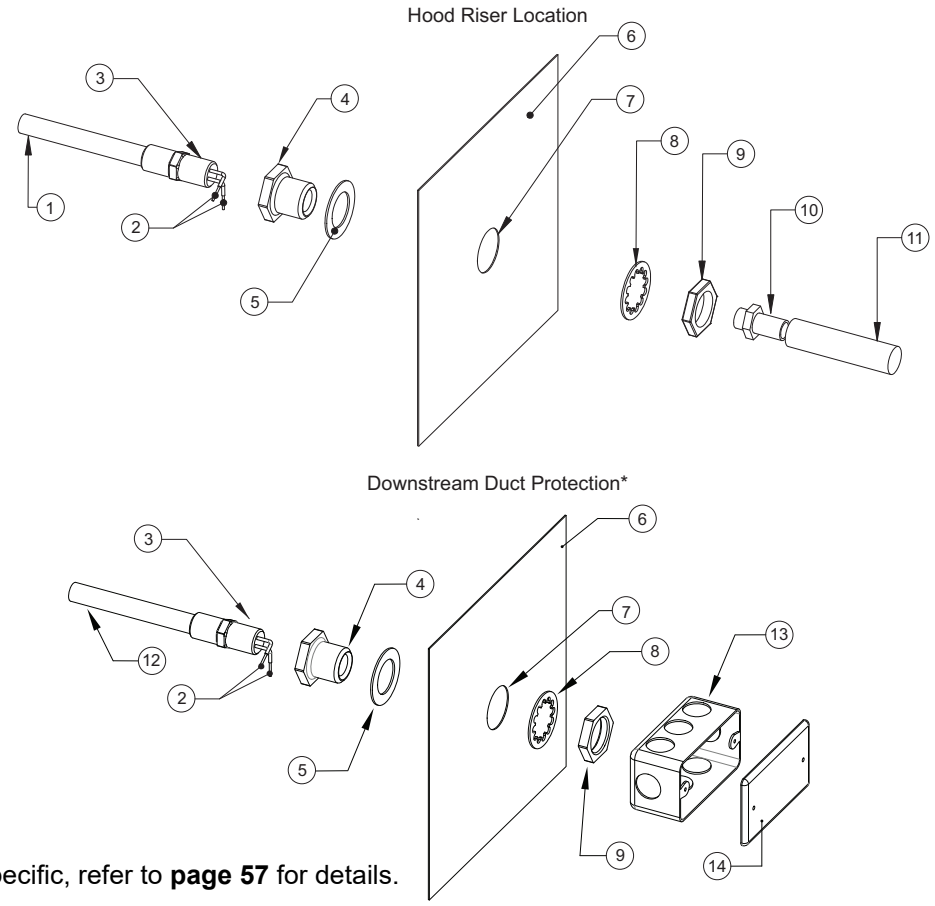



**Table 8 - Gas Valve Details**

| 120V AC Gas Valve | 24V DC Gas Valve | Size | DIM “A” | DIM “B” | DIM “C” | DIM “D” | DIM “F” | DIM “G” |
|---|---|---|---|---|---|---|---|---|
| 8214235 | 8214G236-24VDC | 3/4” | 6-15/16” | 5-15/16” | 4” | 4-1/2” | 11-15/16” | 9-7/8” |
| 8214250 | 8214G251-24VDC | 1” | 6-15/16” | 5-15/16” | 4-7/8” | 5-3/16” | 12-13/16” | 10-11/16” |
| 8214265 | 8214G266-24VDC | 1-1/4” | 7-5/8” | 6-3/8” | 5-1/8” | 5-15/16” | 13-1/2” | 12-1/16” |
| 8214275 | 8214G276-24VDC | 1-1/2” | 7-5/8” | 6-3/8” | 5-3/4” | 6-3/16” | 14-1/8” | 12-5/16” |
| 8214280 | 8214G281-24VDC | 2” | 7-5/8” | 6-3/8” | 7-1/4” | 7-13/16” | 15-5/8” | 13-15/16” |
| 8214290 | - | 2-1/2” | 10-5/16” | 8-1/16” | 8-7/8” | 9-7/8” | 18-15/16” | 18-5/8” |
| 8214240 | - | 3” | 10-5/16” | 8-1/16” | 10” | 10-15/16” | 20-1/16” | 19-11/16” |

A gas strainer is supplied with the unit and recommended to be installed.

**Figure 37 - Firestat Installation Details**




* Application specific, refer to **page 57** for details.

**Firestat Components**

1. Hood Riser Firestat
   - Fenwal Part Number - 12-F28021-32144-OT-360 - Normally Open, Close on Rise @ 360°F
   - Fenwal Part Number - 12-H28021-12144-OT-600 - Normally Open, Close on Rise @ 600°F
2. Wiring - 2 black wires/2 white wires.
3. Seal threads with Teflon Tape before installation
4. 1/2” NPT Quick Seal (Adapter Body) - Part Number Kit 32-00002
5. 1/2” NPT Quik Seal (Gasket) - Part Number Kit 32-00002
6. External Surface of hood/duct.
7. 1 1/8” - 1 1/4” diameter hole.
8. 1/2” NPT Quik Seal (Lock Washer) - Part Number Kit 32-00002
9. 1/2” NPT Quik Seal (Nut) - Part Number Kit 32-00002
10. 1/2” flex conduit connector - Part Number A009088
11. Flex metallic conduit to ECP junction box (closest to the hood) - Part Number A0005719
12. Duct Protection Firestat
    - Fenwal Part Number 12-F28021-005360 - Normally Open, Close on Rise @ 360°F
    - Fenwal Part Number 12-H28021-005-0T-600 - Normally Open, Close on Rise @ 600°F
13. Extension Ring - Part Number 59361-1/2
14. Extension Ring Cover - Part Number 100-BW

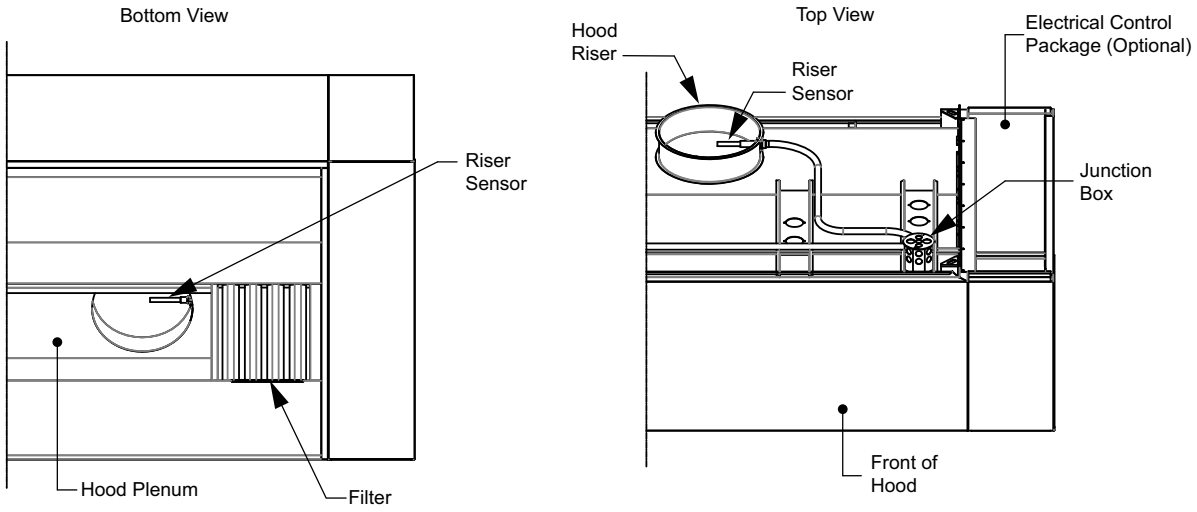
## Hood Riser Sensor Replacement

The following instructions are for replacing a hood duct stat or fire stat located in the riser.

**NOTE: Make sure the fire system is deactivated and all controls are powered down before servicing the unit. Service should only be performed by trained personnel.**

1. Locate faulty sensor in hood riser. Remove the hood filters to access from the hood plenum.
2. Determine the location of the sensor's lead ends. This will either be on the top of the hood, in the junction box which has conduit routed to the riser, or in the electrical control package that is mounted on the hood (if it is a stand-alone hood).
3. Access the sensor's lead ends and remove Wago connectors. Attach a fish tape (or pulling rope) to the lead ends.
4. Unscrew the sensor from the quick seal in hood plenum. Pull leads completely out, pulling the fish tape until exposed.
5. Attach replacement sensor to fish tape and pull back through conduit until lead ends are back in the original location.
6. Replace Wago connectors on the new sensor's lead ends.
7. Twist new sensor counterclockwise, 2-1/2 turns to pre-tension wires. Thread sensor in riser quick seal (using Teflon tape on threads).
8. Replace hood filters.
9. Power up the system to test functionality.

**Figure 38 - Sensor Replacement**



## Fire Protection Manual Actuation Device

The push/pull station (**Figure 39**) is a remote manual actuation device to activate the fire system. This remote manual actuation device (push/pull station) contains one set of normally open contacts and mounts to any standard single gang junction box. When the front button is pressed, the electrical connection to the fire system is completed, thus activating the fire system.

The remote manual actuation device (push/pull station) should be mounted at a point of egress and positioned at a height determined by the Authority Having Jurisdiction (AHJ). This position is usually 10 to 20 feet from hood and 42 to 48 inches above the floor. Multiple remote manual actuation devices (push/pull stations) are acceptable to use in the fire system and are wired in parallel per the electrical schematic. The remote manual actuation device (push/pull station) is reset by twisting the push-button clockwise until the internal latch is released.

The clear protective cover must be installed to protect the device from accidental activations. This cover is provided as part of the manual actuation device. Refer to **Table 9** for device part numbers and replacement parts.

**NOTE: When connecting the wires to the push/pull station, do not twist the wire ends together. Insert each wire on the opposite side of the screw.**

**Figure 39 - Manual Activation Device**

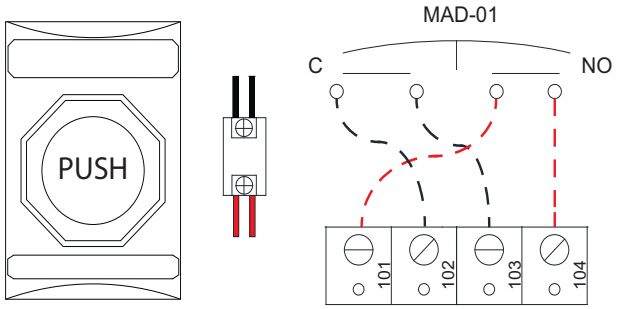



**Table 9 - Activation Device Part Numbers**

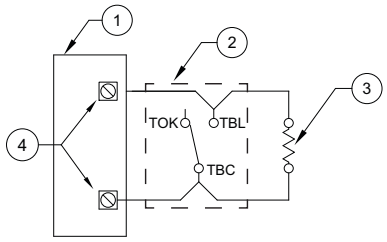
| Part Description | Part Number |
|---|---|
| Push-Button with Clear Cover | SS2031ZA-EN |
| Push-Button with Clear Cover and Horn | SS2041ZA-EN |
| Red Junction Box with Deep Back for Surface Mount | STI-KIT71101AR |
| Normally Open Contact | STI-10196 |
| Contact Housing Assembly | SF-10197H |

## Trouble Input Wiring

Trouble contacts and supervision switches from each device may be connected to the optional trouble input of the building fire alarm panel to indicate a trouble condition.

**Figure 40 - Optional Wiring Connection for Trouble Contact**

1. Building Fire Alarm
2. CORE Control Panel Trouble Contact
3. End of Line Device
4. Building Fire Alarm - Trouble Input Wiring



## Fire Protection System Printed Circuit Board

The fire protection system printed circuit board (PCBCORE) is a microprocessor-based controller that provides all the necessary monitoring, timing, and supervision functions required for the reliable operation of the fire system.

Under normal conditions, the “Fire System Activated” light is on. This indicates the system is armed and active. If a fault is detected anywhere in the system, an audible alarm will periodically sound, and the “Fire System Activated” light will flash a fault code to indicate the fault that was detected. The HMI, located on the hood or Electrical Control Package (ECP), will display the fault text to explain where the issue is located in the system. Refer to **“CORE Board Faults” on page 59.**

**NOTE: CORE Boards with software version 1.68 and prior will use one brief flash every 3-seconds to indicate there are no faults in the fire system.**

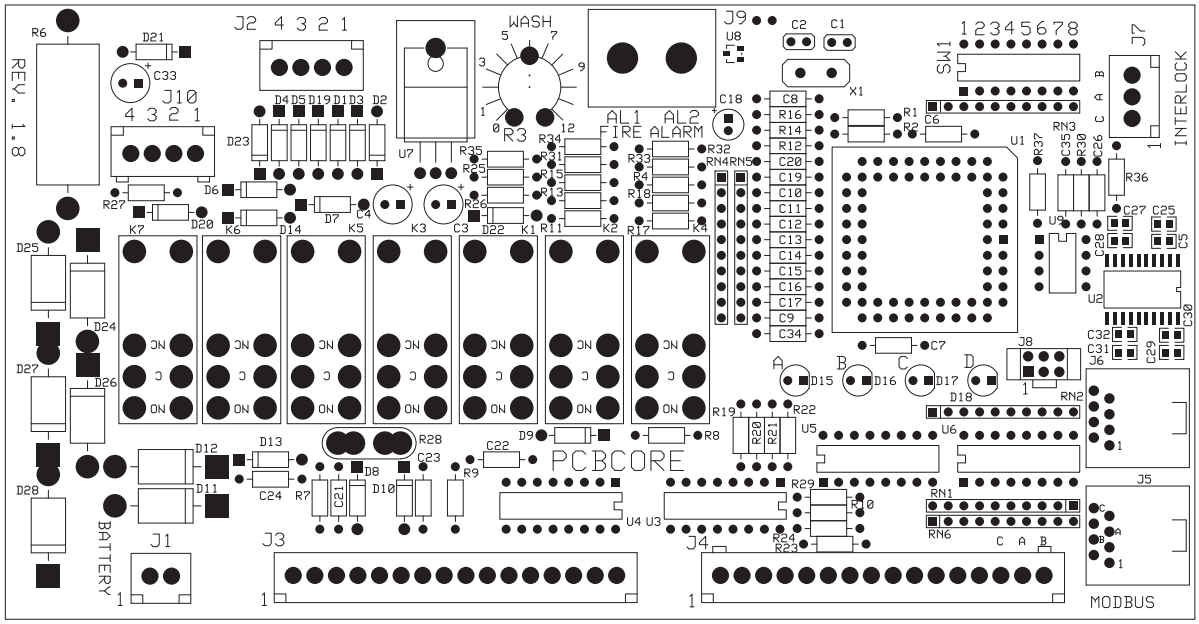
When viewing the CORE Board, if a series of flashes followed by a pause exists, there is a fault in the system. Count the number of flashes between the pauses and refer to **“CORE Board Faults” on page 59**. Any fault is extremely important and must be corrected and rectified immediately to ensure proper operation of the fire system.

The optional connections for building fire panels are located at AL1 and AL2 as dry contacts.

For remote mounted Ansul Automans, use terminals AU1 and AU2. This will provide a dry contact connection point to provide power for activating the Ansul Automan.

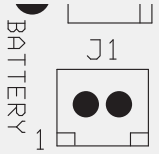
**NOTE: When a CORE board is connected to an ECPM03 board, if a fire condition happens, the “Last Fire Info” will be stored on the ECPM03 screen. “Last Fire Info” will be available on CASLINK as well.**

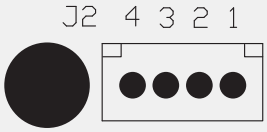
**Figure 41 - Printed Circuit Board**

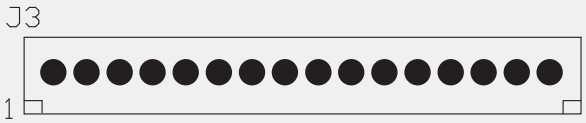


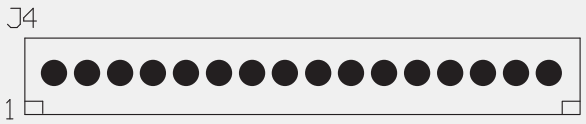
**Connector Descriptions**

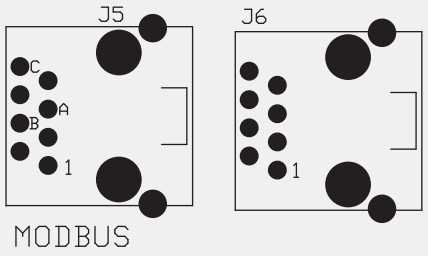
**Note: Some connections may not be used dependent on system configurations.**

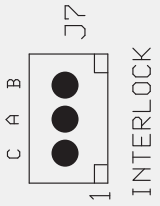
| | |
|---|---|
| Connector J1 contains battery pack connections for battery charging and monitoring. |  |
| Pin 1 – Battery Positive | Pin 2 – Battery Negative |

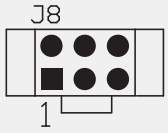
| | |
|---|---|
| Connector J2 contains Supervised Sensor Loop connections |  |
| Pin 1 – Start Positive Loop<br>Pin 2 – Start Negative Loop | Pin 3 – Finish Negative Loop<br>Pin 4 – Finish Positive Loop |

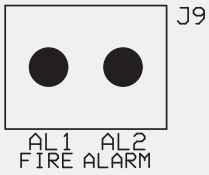
| | |
|---|---|
| Connector J3 contains Power Supply and Device connections |  |
| Pin 1 and Pin 2 – Positive Input, Power Supply<br>Pin 3 and Pin 4 – Negative Input, Power Supply<br>Pin 5 – Positive Output, Gas Valve Solenoid<br>Pin 6 – Positive Output, Surfactant Pump<br>Pin 7 – Positive Output, Release Valve Solenoid<br>Pin 8 and Pin 9 – 24V DC Input, Shutoff Valve Supervision | Pin 10 – N/A<br>Pin 11 – Drive Output, Fire Relay<br>Pin 12 – Drive Output, 100% Relay<br>Pin 13 – Drive Output, Trouble Relay<br>Pin 14 – Drive Output, Wash Relay<br>Pin 15 – Drive Output, Spare Relay<br>Pin 16 – Drive Output, Auto-Man Relay |

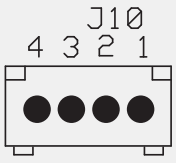
| | |
|---|---|
| Connector J4 contains Power Supply and Device connections |  |
| Pin 1 – Positive Input, Power Supply<br>Pin 2 – Output, Panel Mounted Audible Alarm<br>Pin 3 – Output, Panel Mounted LED Fire/Fault Indicator<br>Pin 4 – N/A<br>Pin 5 – Drive Output, Cooking Equipment Disable Relay<br>Pin 6 – Negative Input, Power Supply<br>Pin 7 – N/A | Pin 8 – Input, Pump Prime/Reset Push Button<br>Pin 9 – Input, Gas Cartridge/Pressure Switch<br>Pin 10 – Input, Fan Switch<br>Pin 11 – Input, Gas Valve Reset Push Button<br>Pin 12 – Input, Door/Tamper Switch<br>Pin 13 – Input, Test Mode<br>Pin 14 – Modbus Network, Common Signal (C)<br>Pin 15 – Modbus Network, Negative Signal (A)<br>Pin 16 – Modbus Network, Positive Signal (B) |

| | |
|---|---|
| Connector J5 and J6 is for RJ-45 connections |  |
| These two connections are for the Modbus Network. This network may be used by non-fire system related equipment to monitor operating conditions of the electrical (PCBCORE) board. | |

| | |
|---|---|
| Connector J7 Interlock Network connections |  |
| Pin 1 – Interlock Network, Common Signal (C)<br>Pin 2 – Interlock Network, Negative Signal (A) | Pin 3 – Interlock Network, Positive Signal (B) |

| | |
|---|---|
| Connector J8 Interlock Network connections |  |
| Factory Use Only | |

| | |
|---|---|
| Connector J9 is for Building Fire Alarm connections. A set of optional normally open dry contacts are available for signaling a building fire alarm panel if a fire condition is present. |  |
| Pin 1 – Dry Contact Closure | Pin 2 – Dry Contact Closure |

| | |
|---|---|
| Connector J10 contains Supervised Sensor Loop connections |  |
| Pin 1 – Start Positive Loop<br>Pin 2 – Start Negative Loop | Pin 3 – Finish Negative Loop<br>Pin 4 – Finish Positive Loop |

## Electrical

**WARNING!**

**Disconnect power before installing or servicing control. High voltage electrical input is needed for this equipment. A qualified electrician should perform this work.**

Before connecting power to the control package, read and understand the entire section of this document. As-built wiring diagrams are furnished with each control package from the factory and are either attached to the door of the unit or provided with the paperwork packet.

Electrical wiring and connections must be made in accordance with local ordinances and the National Electric Code, ANSI/NFPA70. Verify the voltage and phase of the power supply, and the wire amperage capacity is in accordance with the unit's nameplate.

**ATTENTION: LOW-VOLTAGE DC OR SIGNALING WIRE SHOULD BE ROUTED IN SEPARATE CONDUIT FROM ALL AC VOLTAGE SOURCES.**

1. Always **disconnect power** before working on or near this equipment. Lock and tag the disconnect switch or breaker to prevent accidental power-up.
2. **There are multiple electrical connections** required for this control. **120V AC** should be wired to terminals **H1** and **N1**. If the hood is equipped with a separate light circuit, **120V AC** should power this circuit per the as-built schematic. **H1** and **N1** should not be connected to a shunt trip breaker.
3. Verify that the power source is compatible with the requirements of your equipment. The system wiring schematic identifies the **proper phase and voltage** of the equipment.
4. Before connecting the control package to a power source, verify power source wiring is de-energized.
5. Secure the power cable to prevent contact with sharp objects.
6. Do not kink power cable and never allow the cable to come in contact with oil, grease, hot surfaces, or chemicals. Solenoid cables **must not** come in contact with hood surfaces.
7. **The supervised loop must be run through metallic conduit.** Do not run wiring with high voltage wires. Verify all supervised loop wires are free from damage/stress. All supervised loop wires must be terminated in terminal blocks, junction boxes, and push-stations.
8. If the system contains additional firestats, they must be wired into the supervised loop.
9. If the control package is a **wall-mount system**, a duct mounted temperature sensor will need to be wired. The temperature sensor must be wired to terminal blocks, as indicated on the wiring schematic.
10. If the control package is a **wall-mount system,** the hood lights wiring will need to be wired to terminals "B" and "W." Verify connections on wiring schematic.
11. Before powering up the system, make sure that the interior of the control package is free of loose debris or shipping materials.
12. The battery must be plugged in at connector J1 on the electrical board (PCBCORE) after wiring is complete.
13. All gas appliances under the hood must shut down in the event of an AC power loss. All electric appliances will shut down on building power loss.
14. If any original internal wire supplied with the system must be replaced, use type THHN wire or equivalent.
15. All field-supplied wire for the optional fire system release solenoid or firestat must be high temp wire rated for **842°F** minimum (#441601C6.FE9 White and #441601C6.FE0 Black) for on hood connections.
16. Use Belden #6320UL,18 Gauge, plenum-rated wire or similar, for the optional fire system release solenoid or supervised loop that does not come in contact with the hood.
17. Use Belden #88760 or similar for the fire system interlock network and CAT-5 for Modbus communications.
18. All exterior wiring connections to the PCU must be run inside liquid tight conduit. This includes the supervised loop and airflow switch wiring.

**IMPORTANT!: The battery backup for the fire protection system produces output power even when main power is disconnected from system. When performing major electrical service to the control, the battery backup must be disconnected then reconnected before commissioning.**

## Wire Ampacity Rating

The load current rating and the over-current protection for conductor types shall not exceed 15 amperes for 14 AWG, 20 amperes for 12 AWG, and 30 amperes for 10 AWG aluminum and copper-clad aluminum after any correction factors for ambient temperature and number of conductors have been applied. Refer to **Table 10**.

**Table 10 - Copper Wire Ampacity @ 75°C**

| Wire Size AWG | Maximum Amps |
|---|---|
| 14 | 15 |
| 12 | 20 |
| 10 | 30 |
| 8 | 50 |
| 6 | 65 |
| 4 | 85 |

## Distance Limitations

Wiring connections to remote fire protection system(s) must use shielded twisted pair wire. The maximum length of this connection is 1000 feet.

Wire size is an important consideration when making the connections between the fire protection system control package and a gas valve. Refer to **Table 11** for maximum wiring distance between the system and remote gas valve.

**Table 11 - Wiring Maximum Distance**

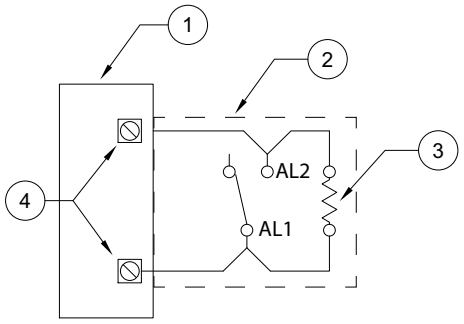
| Wire Gauge | Distance (Feet) |
|---|---|
| 12 | 1049 |
| 14 | 660 |
| 16 | 414 |
| 18 | 260 |
| 20 | 164 |
| 22 | 103 |
| 24 | 64 |

## Fire Alarm Contacts

The fire protection system is equipped with optional normally open contacts (terminals **AL1** and **AL2**) for building applications that connect to the premise Fire Alarm Control Panel (FACP). Refer to **Figure 42** for wiring reference. During a fire condition, the contacts will close and trigger the premise FACP to initiate a general fire alarm.

**Figure 42 - Fire Alarm Reference**

1. Building Fire Alarm
2. Control Panel Fire Alarm Contact
3. End of Line Device
4. Alarm Input



## Fire Group

Fire Groups are for the purpose of using multiple CORE controlled fire systems and grouping specific fire systems together. This will allow the user the ability to assign different zones for independent activation.

In order to set a fire group, you will need to set the CORE board DIP switches as shown in **Table 12**.

**Table 12 - Fire Group DIP Switch Position**

| 6 | 7 | Fire Group Number |
|---|---|---|
| Off | Off | 1 |
| On | Off | 2 |
| Off | On | 3 |
| On | On | 4 |

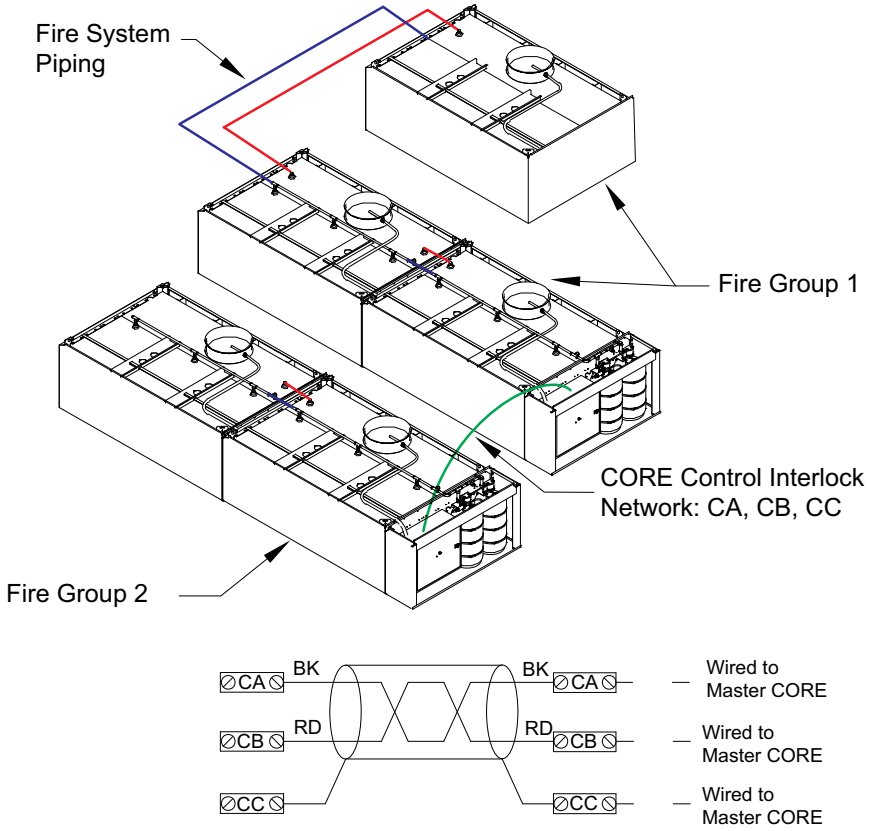
**Note: Every panel with matching fire group settings (DIP switches 6 and 7) will activate simultaneously in a fire condition.**

**Figure 43** shows an example of different zones on separate fire groups, but still connected via the interlock network. In the example, when 2 Fire groups (01 and 02) are assigned on the CORE boards, and if a fire condition exists in any one group, it will NOT activate the other fire group. However, both are connected to the same interlock network.

- Fire Group 01 CORE board DIP switch setting will be set to: Switch 6 Off and Switch 7 Off.
- Fire Group 02 CORE board DIP switch setting will be set to: Switch 6 On and Switch 7 Off.

Refer to **“DIP Switch Settings” on page 62** for setting multiple CORE controlled fire systems.

**Figure 43 - Fire Group Reference**



## Fire Protection System Supervised Loops

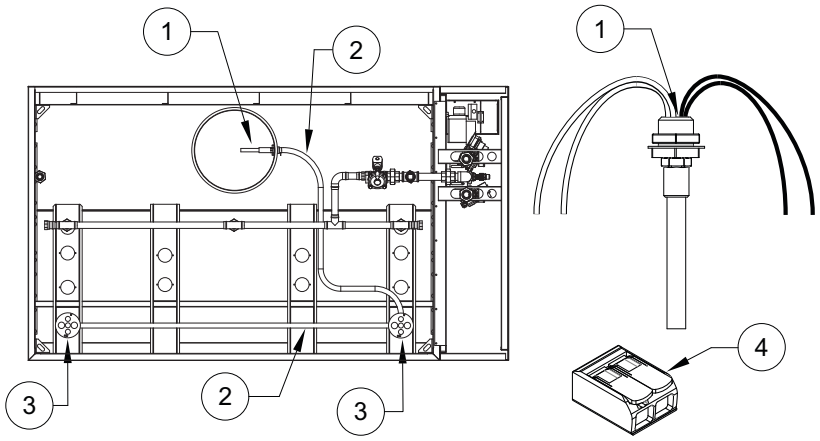
The supervised loops are integral to proper operation and activation of the Fire Protection System. All systems have two supervised loops; each loop consists of two conductors, one positive and one negative. One loop is dedicated to all sensors, while the other is dedicated to all manual actuation devices (push/pull stations). The supervised loop connections are located at the front edge of the hoods for accessibility. Connections beyond the hood, like the connections at the manual actuation device, must be made with a plenum-rated wire. It is recommended to use a two-conductor Belden 6320UL, 18 AWG, wire, or similar for these connections. Refer to **Figure 44** for supervised loop details.

**The supervised loop must be run through metallic conduit.** Do not run wiring with high voltage wires. Verify all supervised loop wires are free from damage/stress. All supervised loop wires must be terminated in terminal blocks, junction boxes, and push-stations.

- Connections to the firestat will use two Wago connectors. One for an incoming loop and one for an outgoing loop.
- Flexible metallic conduit is used to route the wiring that connects the firestat to the remote loop junction box. Secure conduit to hood hat channel when possible.

**Figure 44 - Supervised Loop Connections**

1. Firestat
2. Conduit
3. Junction Box
4. Wago Connector




For connections on or above the hood, use Type MG or MGT wiring with Wago connectors. A Supervised Loop Connection kit is available to connect back to back or end to end hoods. This kit will come with the necessary hardware and wire.

**Table 13 - Supervised Loop Components**

| Connection Kit Part Number | Length | Location |
|---|---|---|
| SLPCON-03 | 3 Feet | End to End Hoods |
| SLPCON-05 | 5 Feet | End to End Hoods |
| SLPCON-10 | 10 Feet | End to End and Back to Back Hoods |
| SLPCON-15 | 15 Feet | End to End and Back to Back Hoods |
| SLPCON-20 | 20 Feet | End to End and Back to Back Hoods |

| High Temperature Supervised Loop Components | Part Number |
|---|---|
| Type MG Wire, White, 16 AWG | 441601C6.FE9 |
| Type MG Wire, Black, 16 AWG | 441601C6.FE0 |
| Wago Connectors | 221-412 |

## Supervised Loop Electrical Details

**NOTE: Place the panel in test mode when checking the supervised loop circuit.**

Before checking the supervised loop circuit (**Figure 45**), verify all CORE power supplies (PS-02) are set to 27.5V +/- 0.1V DC. Check all supervised loop connections. Verify wiring is properly connected and secure. If any of the readings in **Table 14** are out of range or other faults are present, there is an issue with that loop or associated components/wiring. Refer to **page 61** for troubleshooting.

**Figure 45 - Wiring for Supervised Loop**

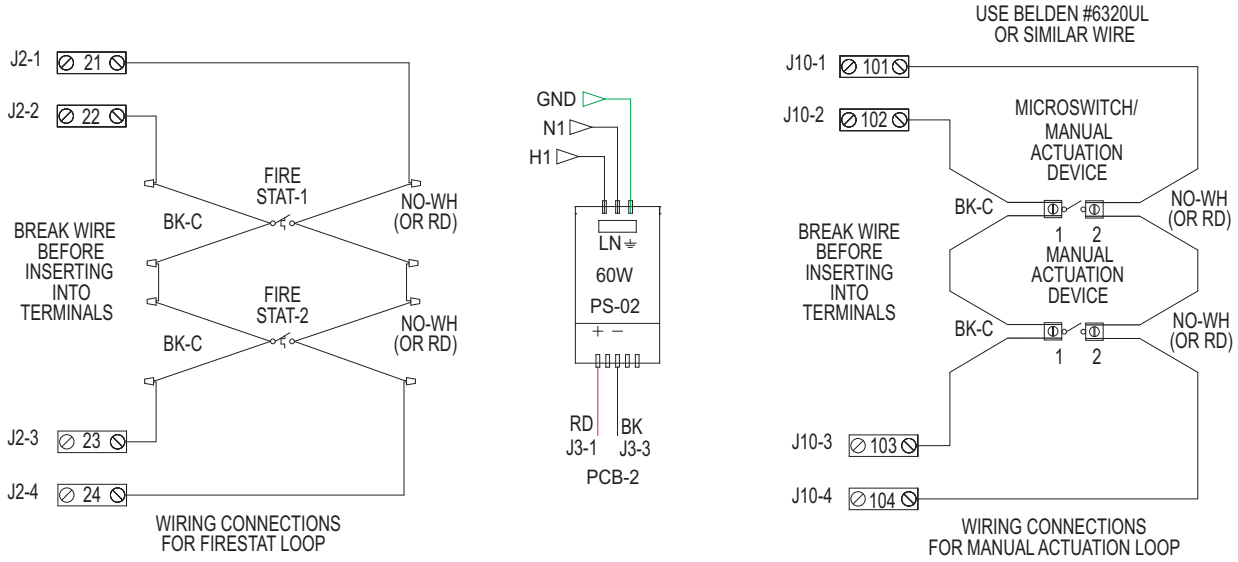



**Table 14 - Supervised Loop Circuit Readings**

| Component Check | Procedure: Check for continuity between terminals. Place the breaker off. Disconnect the batteries at connector J1 | Expected Readings |
|---|---|---|
| Firestat(s) | Terminals 21 and 24; Terminals 22 and 23 | Continuity |
| | Terminals 21 and 22; Terminals 21 and 23<br>Terminals 24 and 23; Terminals 24 and 22 | No Continuity |
| Manual Activation Device (MAD) | Terminals 101 and 104; 102 and 103 | Continuity |
| | Terminals 101 and 102; Terminals 101 and 103<br>Terminals 104 and 103; Terminals 104 and 102 | No Continuity |
| **Component Check** | **Procedure: Measure voltage between terminals. Place the breaker on. Reconnect the batteries at connector J1** | **Expected Readings** |
| Power Supply | PS-02 (DC+) and PS-02 (DC-) | 27.5 +/- 0.1V DC |
| Firestat(s) | PS-02 (DC-) and Terminal 21; PS-02 (DC-) and Terminal 24<br>Terminal 21 and Terminal 22; Terminal 23 and Terminal 24 | 26.5 +/- 0.2V DC |
| | PS-02 (DC-) and Terminal 22; PS-02 (DC-) and Terminal 23 | 0 +/- 0.2V DC |
| | Terminal 24 and Chassis Ground | 1.8 +/- 0.2V DC |
| Manual Activation Device (MAD) | PS-02 (DC-) and Terminal 101; PS-02 (DC-) and Terminal 104<br>Terminal 101 and Terminal 102; Terminal 103 and Terminal 104 | 26.5 +/- 0.2V DC |
| | PS-02 (DC-) and Terminal 102; PS-02 (DC-) and Terminal 103 | 0 +/- 0.2V DC |
| | Terminal 104 and Chassis Ground | 1.8 +/- 0.2V DC |

## PCU Fire System

Pollution Control Units require a fire system to be installed for Type 1 applications. Current International Mechanical Code (IMC) requires that the fire system be installed by the manufacturer (2018 IMC). CORE and EWC fire systems are available for the PCU. PCU fire systems use electric sensors set at 360°F to activate the fire system. Outdoor EWC Systems require a climate controlled utility cabinet to ensure that the fire system does not drop below 32°F and does not exceed 130°F. See below for more information about outdoor installations. It is highly recommended that the PCU fire system be interlocked to the corresponding hood fire system so that if the hood system activates, the PCU system activates. Reverse activation requirements are determined by local code or at the discretion of the Authority Having Jurisdiction, but are recommended for safety.

In the event that the fire system is accidentally activated, all disposable filters must be replaced and the pre-filter cleaned. The water or chemical agent used in the fire system can cause the filters to fail prematurely.

In the event that a fire occurs in the ductwork leading to the PCU or inside the PCU, the following must be completed.

- The unit must be cleaned of all fire suppression chemicals and grease.
- The filters must be replaced, this includes the pre-filter.
- If an ESP module is present, the ESP cells must be removed, and cleaned in warm soapy water. Wash cells until all chemical residue is removed. ESP pre and post filters must be replaced. When re-installing cell(s), make sure to install with the **airflow in the correct direction** as indicated on the cell.
- If any of the gasketing is damaged, replace the gasketing between modules and between the doors.
- If any of the components that make-up the Pollution Control Unit are damaged by fire, then that component must be replaced and inspected by factory trained service personnel.

**Installation, commissioning, or resetting of the fire system must be done by a licensed fire system installer. Use the guidelines set forth by the appropriate fire system manual; PCU with CORE Fire Suppression System manual, Model TANK (Electric Wet Chemical) Extinguishing System, or other fire system manufacturer.**

For electric wet chemical fire systems for PCU, external piping that connects the PCU fire system nozzles to the fire system tanks is factory-installed using Grade L 1/2” copper tubing and pro-press fittings. If a remote (wall mount) EWC fire system is utilized, distribution piping shall be Grade L 1/2” copper tubing and pro-press fittings or 3/8” NPT Schedule 40 black iron, chrome-plated, or stainless-steel pipe and fittings. If distribution piping is exposed to an outdoor environment it must be Grade L 1/2” copper tubing and pro-press fittings or 3/8” NPT Schedule 40 stainless-steel pipe and fittings.

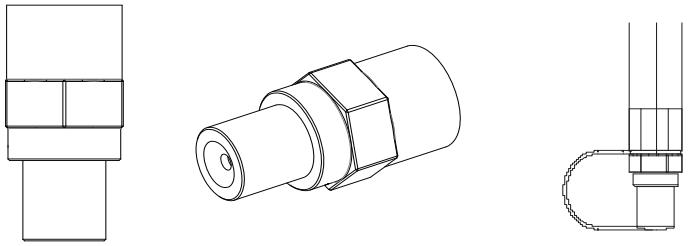
## PCU Fire System Nozzles

The Overlapping Male Nozzle(s) (p/n OL-M) are used to protect the PCU.

The nozzles include a cap (p/n 3074-1-1).

Refer to **Figure 46**. The cap prevents contamination from entering the pipe network and is designed to pop-off upon system discharge, allowing the fire system to flow to the protected hazard area.

**Figure 46 - Fire System Nozzle**



Nozzle P/N: OL-M

Previously P/N: 3070-3/8HH-10-SS

**Table 15** provides details on PCU size, modules, and nozzle quantity per unit. Pollution Control Units (PCU) covered by a TANK Fire System can utilize up to 12 nozzles per tank.

PCU Fire System type “REFS” is covered by TANK.

**Table 15 - PCU Fire System Chart**

| Unit Nozzle Count (OL-M) | | | | | | Duct Nozzle Count (OL-M) Last Module Only |
|---|---|---|---|---|---|---|
| PCU Size | 1 Module | 2 Modules | 3 Modules | 4 Modules | 5 Modules | |
| 1 | 4 | 8 | 12 | 16 | 20 | 2 |
| 2 | 4 | 8 | 12 | 16 | 20 | 4 |
| 3 | 5 | 10 | 15 | 20 | 25 | 4 |
| 4 | 6 | 12 | 18 | 24 | 30 | 4 |
| 5 | 7 | 14 | 21 | 28 | 35 | 4 |
| 6 | 7 | 14 | 21 | 28 | 35 | 6 |
| 7 | 11 | 22 | 33 | 44 | 55 | 6 |

Example:

Model - PCU-PF-HE-ESP-OC-XXXX-5

Modules Fire System PCU Size

Number of Modules - 4
PCU Size - 5
Number of OL-M Unit Nozzles - 28
Number of OL-M Duct Nozzles - 4
Total Nozzles - 32

# OPERATION

The TANK Fire Suppression extinguishing system is electrically operated via the applicable fire alarm control panel. The system can be activated automatically via an electric thermal detector or manually via a remote manual actuator. The extinguishing system is electrically operated via the PCBCORE control board. The system can be activated automatically via a Firestat or manually via a remote manual actuator. Since the TANK Fire Suppression extinguishing system is electrically operated, the applicable fire alarm control panel requires AC input power with a battery backup system. Reference the applicable control panel manual for wiring and compatibility.

When one of the system's Firestat(s) detectors senses a temperature hotter than its internal set-point (e.g., in the event of a hood fire), or when a remote manual actuation device (push/pull station) is pushed, an electric signal is sent to the tank-based fire protection release solenoid via the fire alarm control panel releasing circuit. The electric release solenoid is energized, allowing pressurization of the pneumatic actuator(s). The actuator's plunger(s) will depress into the tank valve body, releasing agent to flow to the hood duct, plenum, and appliance nozzles.

When the fire extinguishing system is activated, the applicable fire alarm control panel simultaneously shuts down all gas and electric appliances under the protected hood(s), shuts down make-up air and/or exhaust where applicable, and activates the building fire alarm where applicable.

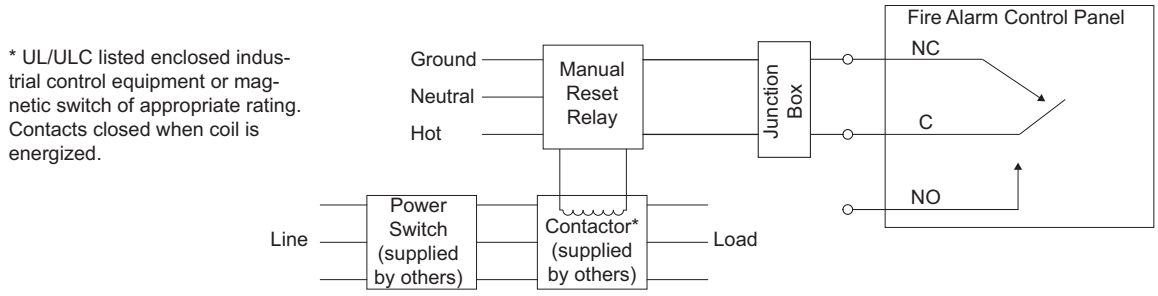
The electrically operated fire system requires a battery backup system. In the event of a loss of building electrical power, all gas and electric appliances under the hood must be electrically interlocked to shut off. This is achieved via a gas valve relay and/or a shunt trip breaker. The battery backup will automatically energize upon a loss of power. The battery backup will monitor the fire system circuit for up to 24 hours and be able to operate the fire system circuit for a minimum of 30 minutes. Once power is restored, the battery will automatically recharge.

A means of manual reset is required for shut-off devices to ensure manual reset prior to fuel or power being restored in accordance with NFPA 17 and NFPA 96. The electric gas shut-off valve is used in conjunction with a UL/ULC listed manual reset relay, refer to **"Gas Shut-Off Valves" on page 40**.

Appliance and electrical shut down is achieved via the applicable fire alarm control panel relay, in conjunction with UL/ULC listed enclosed industrial control equipment or magnetic contactors of appropriate rating. These must be used in conjunction with a UL/ULC listed manual reset relay, refer to **Figure 47**. All wiring is to be in accordance with the applicable manufacturer's instructions for the fire alarm control panel, gas shut-off valve, manual reset relay, and contractor supplied shut-off devices. All wiring must be in accordance to NFPA 70 and the Authority Having Jurisdiction (AHJ).

The TANK Fire Suppression System is not required to be interlocked to a building's fire alarm control panel to function. When a building fire alarm system is present, the fire alarm control panel may be connected such that the actuation of the TANK Fire Suppression extinguishing system also activates the fire alarm. Reference the applicable control panel manual for wiring and compatibility.

**Figure 47 - Reset Relay**



## Test Mode Overview

The fire protection system has an integrated option for testing. When in test mode, the release solenoid is disabled and will prevent the fire extinguishing agent from spraying on the appliances. For testing purposes, this will allow the activation of the fire system, audible alarm, shunt trip breaker (if applicable), and shut down of appliances via gas valve reset relay.

All additional PCBCORE controlled packages that are attached to the system must be in “Test” mode. This includes additional fire protection systems, Pollution Control Unit with CORE, and other hood-mounted CORE controlled protection systems.

Please note that the appliances must be started before test mode is entered on any PCBCORE protection package for proper demonstration of this function. If the fire protection system is left in “Test” mode for more than 15 minutes, the appliances will shut down. This is to prevent cooking operations from occurring while the appliances and ventilation system are not protected.

**ATTENTION: All interlocked PCBCORE controlled packages must be placed into “Test” mode before cleaning the hood, Pollution Control Unit (PCU), or any other interlocked units.**

## Reset Overview

There are multiple actions required to reset the fire system. **The following must be completed by a Certified Fire System Technician**.

1. The duct firestat must be cooled below its internal set point.
2. The remote manual actuation device (push/pull station) must be reset by twisting the button clockwise until it resets.
3. Press the “Push To Reset Fire System” button.
4. Reset the pneumatic actuators (PAK, SVA), refer to **“Re-arming System” on page 68**.

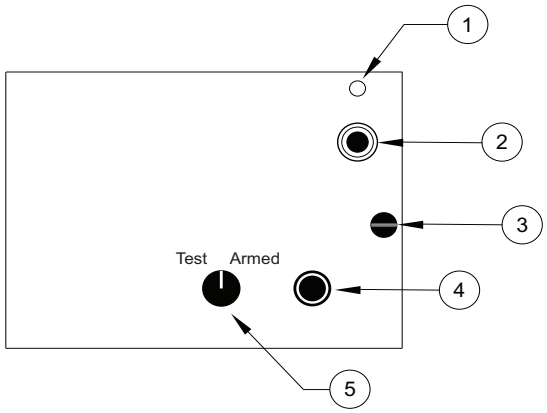
**Note: The firestat must be cool, and the remote manual actuation device (push/pull station) must be reset for this button to work.**

The fire system must be re-commissioned per the manufacturer’s recommendations and guidelines by an authorized fire system distributor and/or authorized service agent.

**WARNING:** In the event of an actual fire, further inspections are required after the fire has been extinguished to verify the integrity of the hood, ductwork, fire sensors, fan, and fire suppression system has not been compromised. With approval from the Authority Having Jurisdiction (AHJ) or the Fire Department, proceed to restarting the fire system.

**Figure 48 - Fire System Reset**

1. LED Indicator
2. Alarm Speaker
3. Panel Latch
4. Reset Button
5. Test Mode/Fire System Armed Switch

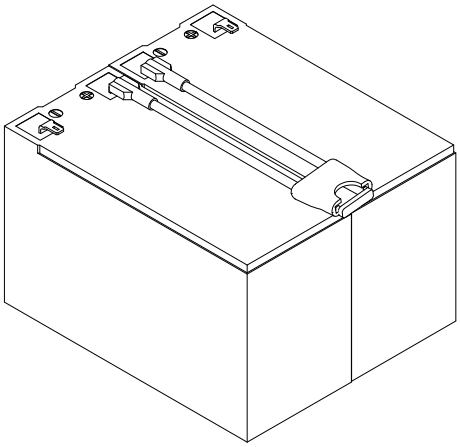


## Battery Backup

**Important!**

**The battery backup system requires that the batteries be changed every 2 years, from the date of fire system commissioning, maximum. Failure to do this will result in a void in product reliability and may cause severe damage to facility due to loss of fire protection.**

**Figure 49 - Battery Backup**



The fire protection system contains a battery backup. During a power loss, the “Fire System Activated” light will flash 11 times between pauses indicating the power loss.

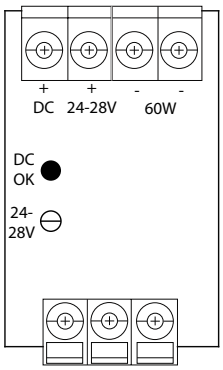
The batteries must be replaced every 2 years, from the date of fire system commissioning. Part number PS-1270-F2, two are required. Although the batteries are hot-swappable, which means they can be replaced while there is input power to the control, for your safety, all sources of power must be removed from the control before replacing the batteries. To replace the batteries, unplug the battery cable from the J1 connector on the electrical board (PCBCORE). Then remove the retaining strap holding the batteries in place. Remove the batteries from the cabinet. Transfer the fuse and cable set from the old batteries to the new batteries being extremely careful to observe the RED and BLACK lead and terminal colors. Reinstall the batteries in the cabinet and reconnect the battery plug to J1. The batteries are lead-acid type and are recyclable; **please dispose of the old batteries properly**.

During extended periods of inactivity where the fire protection system will be without AC power for more than 2 days, such as a shutdown or natural disaster, it is best to decommission the fire system by disconnecting the batteries. This will prevent any damage to the batteries through complete discharge. When the system becomes active again, commission the system by reconnecting the batteries and allow the batteries to charge for 48 hours.

*The fire protection system is supplied with 14-amp hours of backup battery capacity. Per NFPA 72 10.5.6.3, the system requires 1.66 amp hours of battery capacity.*

## Power Supply Adjustment

**Figure 50 - Power Supply**




To properly charge the batteries, the power supply must be adjusted to output 27.5V DC. This can be checked with an accurate digital voltmeter placed across Terminals H1D and N1D. To adjust the output voltage, place a small flat-bladed screwdriver into the yellow dial. Turn the dial clockwise, this will increase the voltage.

## Fire Protection System Firestat

The Firestat (**page 41**) is a device installed in the riser of the hood, at the duct connection, that measures temperature. One sensor shall be installed in each exhaust riser. Secondary downstream detectors in the duct are not required except as outlined in the **Non-Solid Fuel Appliances** and **Solid Fuel Appliances** section. Sensors are not required above each appliance or in the hood grease plenum. The standard temperature setting is 360°F. Depending on heat produced by appliance, a higher rated temperature Firestat will be required. If a temperature higher than the setpoint is sensed, the Firestat contacts will close and energize the electrical control board. The fire system will activate.

**The supervised loop must be run through metallic conduit.** Do not run wiring with high voltage wires. Verify all supervised loop wires are free from damage/stress. All supervised loop wires must be terminated in terminal blocks, junction boxes, and push-stations.

The Firestat has 2 black wires and 2 white wires. These wires must be connected to the supervised loop. Use high-temperature wiring when installing Firestat components. Wago connectors (part number: 221-412) must be used.

Multiple sensors are wired in parallel in the supervised loop. The Firestat may be installed on the opposite side of the quick seal for access in the duct.

### Non-Solid Fuel Hood/Appliances (Rated 450°F)

Light and Medium duty, non-solid fuel appliances with a cooking surface temperature rated for 450°F will not require additional firestats, regardless of the configuration and length of ductwork.

### Non-Solid Fuel Hood/Appliances (Rated 600°F)

Heavy duty, non-solid fuel appliances with a cooking surface temperature rated for 600°F will require downstream detection if the duct run contains any horizontal section over 25 feet in length. Downstream detection should be installed at the end of a horizontal section. Duct layouts that include less than 25 feet of horizontal ductwork will not require additional detection.

### Solid Fuel Hood/Appliances (Rated 700°F)

Extra Heavy duty, solid fuel appliances with a cooking surface temperature rated for 700°F will require 600°F rated Firestats, and SOLO filters. Exhaust fan(s) used with solid fuel appliances must use a steel wheel.

Solid fuel produces effluents that can accumulate inside the duct, especially in long horizontal duct runs. Sparks from solid fuel cooking can travel into the ductwork and create fires that occur beyond the point where the hood riser Firestat can detect them. Additional downstream Firestats ensure that these duct fires are detected and the fire system actuates.

In addition to the 600°F rated Firestat, located in the hood riser, a second Firestat is required at the duct discharge for solid fuel applications when the ductwork exceeds 10 feet in length or contains horizontal runs. Even if the entire duct run is inaccessible, this additional Firestat is still needed. Mounting a Firestat in the fan may be an option. On duct runs longer than 50 feet, a third Firestat will be required somewhere in the duct run, ideally at the end of a horizontal run, if present. Duct runs longer than 100 feet will require additional Firestats, **contact your local sales office for more information**.

**NOTE: When additional Firestats are required, install in an accessible location near an access door, hood riser, or fan. The door will provide access to install, clean, and replace the Firestat when needed. If a PCU is equipped with electronic detection, PCU Firestats can serve as downstream detectors, if present. The temperature rating of the Firestat in the duct must always match the temperature rating of the Firestat in the riser.**

# TROUBLESHOOTING

**Table 16** lists out causes and corrective actions for possible problems with the system. Review this list prior to consulting the manufacturer.

**Table 16 - Fire Protection System Troubleshooting**

| Problem | Potential Cause | Corrective Action |
|---|---|---|
| Exhaust Fan is On and Supply Fan will not Start | Broken supply fan belt | Replace fan belt. |
| | Fire system not armed | Fire system distributor must arm fire system. |
| Fire System Activated Light On | Fire system is activated | Verify fire is out and reset fire system. |
| Audible Alarm is On | Fire system is activated | Verify fire is out and reset fire system. |
| A fault code is flashing on the “Fire System Activated” light | A fault has been detected in the Fire Protection System | Count the flashes and refer to **“Appliance Shutdown in Fault Conditions” on page 60**. |
| Gas Valve does not Close | Debris on gas valve seal | Fully clean gas valve and strainer. |
| Fire System will not Turn Off | Duct sensor is hot | Heat has activated the duct sensor. Remove heat source or let the system extinguish the fire. Once heat source or problem is resolved, press reset button on the face of the electrical control package. |
| | Remote Manual Actuation Device has been pushed | Reset remote push station once fire is out and press reset button on the face of the electrical control package. Reset remote push station by twisting clockwise until reset. |

## CORE Board Faults

When there are no faults in the fire system, Lamp B will stay solid (An LED indicator is also on the control package). When a fault exists, the LED will flash with a short break. Count the flashes then wait for a short break to determine the fault. For packages with HMIs, refer to the fault displayed on the screen. For fault operation in shut down, refer to **"Appliance Shutdown in Fault Conditions" on page 60.**

**NOTE: CORE Boards with software versions 1.68 and prior will use one brief flash every 3-seconds to indicate there is no fault.**

Test Mode allows the system to be tested with operational appliances without discharging the system. If the system is left in test mode for 15 minutes, the gas valve will be locked out until test mode is deactivated.

| Flashes | Fault Condition | Corrective Action |
|---|---|---|
| **Catastrophic Faults** | | |
| 1 | Invalid Activation* | Check for external voltage being applied at J3-7 and J3-10. |
| 2 | Release Solenoid* | Check solenoid and wiring to solenoid, replace as needed. |
| 3 | Pressure Switch* | Check switch and wiring to switch, replace as needed. |
| 4 | N/A | N/A |
| 5 | Microcontroller Fault* | Replace CORE printed circuit board. |
| **Critical Faults** | | |
| 6 | N/A | N/A |
| 7 | Supervised Loop Fault* | Check the installation of the wiring to all the manual actuation devices (push stations) and firestats. Verify connections are secure and tight. Check for open/short circuits in the wiring. Repair or replace wiring as needed. |
| **Important Faults** | | |
| 8 | Ground Fault | Check the installation of the wiring to all the manual actuation devices (push stations) and firestats. Verify connections are secure and tight. Check for open/short circuits in the wiring. Repair or replace wiring as needed. |
| 9 | N/A | N/A |
| 10 | Battery Voltage Low | The voltage is below the battery threshold. Wait for batteries to recharge if there was a power failure. Replace if the batteries will not hold a charge. |
| 11 | AC Power Failure* | The voltage is below the power supply (PS-02) threshold; approximately 27.18V DC. Check breakers, call power company. |
| 12 | Door Tamper Switch | Close cabinet door. |
| 13 | Test Mode* | Place switch in armed position when testing is complete. |
| 14 | CORE Interlock | Check Dip Switches on all boards and RS-485 network wires connecting boards. |
| 15 | Fault on Hood in Network | Check all hoods in CORE network for faults. |
| 16 | Fault on PCU in Network | Check all PCUs in CORE network for faults. |

**NOTE: The low pressure switch option is not required per product safety listings and standards. The fault is for monitoring purposes. When a Pressure Switch or Supervised Loop fault is present for 24 hours, cooking operations will shut down.**

Faults marked with (*) will shut down Gas/Shunt. During an AC power failure or loss of building power, all 120V AC gas valves/electrical appliances will shut down immediately. For 24V DC gas valves, the valve will stay powered for a few minutes depending on battery voltage (when both an AC Power Failure and Battery Voltage Low fault are present, the valve will shut down).

## Appliance Shutdown in Fault Conditions

The system is equipped to shut down the appliances if a fault condition is present. **Table 17** displays fault conditions that affect the appliances' fuel and power sources, alarm muting, and local trouble relay.

**NOTE: CORE Boards with software version 1.68 and prior will use one brief flash every 3-seconds to indicate there are no faults in the fire system.**

**Table 17 - Appliance Fault Conditions**

| Number of Flashes | Fault Condition | Gas Valve Shutdown | | Shutdown Shunt Trip Breaker and UDS Kill Switch | | Mute Local Alarm 4 Hour Reset | Local Trouble Relay |
|---|---|---|---|---|---|---|---|
| | | Local System | Networked System | Local System | Networked System | | |
| **Catastrophic Faults** | | | | | | | |
| 1 | Invalid Activation* | X | X | X | X | | X |
| 2 | Release Solenoid* | X | X | X | X | | X |
| 3 | Pressure Switch* | X | X | X | X | | X |
| 4 | N/A | - | - | - | - | - | - |
| 5 | Microcontroller Fault* | X | X | X | X | | |
| **Critical Faults** | | | | | | | |
| 6 | N/A | - | - | - | - | - | - |
| 7 | Supervised Loop Fault | X | X | X | X | | X |
| **Important Faults** | | | | | | | |
| 8 | Ground Fault | | | | | X | |
| 9 | N/A | - | - | - | - | - | - |
| 10 | Battery Voltage Low | | | | | X | X |
| 11 | AC Power Failure* | X | X | X | X | | X |
| 12 | Door Tamper Switch | | | | | X | |
| 13 | Test Mode* | X | X | X | X | | |
| 14 | CORE Interlock | | | | | X | |
| 15 | Fault on Hood in Network | | | | | X | |
| 16 | Fault on PCU in Network | | | | | X | |

**NOTE: The low pressure switch option is not required per product safety listings and standards. The fault is for monitoring purposes. When a Pressure Switch or Supervised Loop fault is present for 24 hours, cooking operations will shut down.**

Faults marked with (*) will shut down Gas/Shunt. During an AC power failure or loss of building power, all 120V AC gas valves/electrical appliances will shut down immediately. For 24V DC gas valves, the valve will stay powered for a few minutes depending on battery voltage (when both an AC Power Failure and Battery Voltage Low fault are present, the valve will shut down).

### Local Alarm Muting

Pressing the fire system reset button can mute the local alarm. This will disable the sounder for 4 hours under specific conditions. **Table 17** shows which faults can be muted. It should be noted that the fault will not clear until the fault condition is corrected.

### Test Mode

Test Mode allows the system to be tested with operational appliances without discharging the system on the appliances. Once the appliances are started, test mode can be entered without the appliances shutting down for 15 minutes. However, once the fire system is activated, the shunt trip (electric appliances) and the gas valve will be locked out until test mode is deactivated.

## Supervised Loop/Power Supply Troubleshooting

**NOTE: Place the panel in test mode during diagnostic testing.**

Before troubleshooting, verify all power supplies (PS-02) are set to 27.5V DC. Verify all circuit checks from **"Supervised Loop Electrical Details" on page 51**. If any readings are not in range, there is an issue with that loop or associated components/wiring. Refer to **Table 18** for troubleshooting.

**Table 18 - Common Wiring Troubleshooting Chart**

| Problem | Potential Cause | Expected Results +/- 0.2 | Corrective Action |
|---|---|---|---|
| Supervised Loop Fault | Open Supervised Loop between Terminals 21 and 24. | • Terminal 21 to PS-02 (DC-) = 26.5V DC<br>• Terminal 21 to Terminal 22 = 26.5V DC<br>• Terminal 24 to PS-02 (DC-) = 26.5V DC<br>• Terminal 24 to Ground = 1.8V DC | Locate and repair faulty wiring in the 21-24 supervised loop. |
| | Open Supervised Loop between Terminals 22 and 23. | • Terminal 22 to PS-02 (DC-) = 0V DC<br>• Terminal 23 to PS-02 (DC-) = 0V DC<br>• Terminal 23 to Terminal 24 = 26.5V DC | Locate and repair faulty wiring in the 22-23 supervised loop. |
| | Open Supervised Loop Push-Station (Terminals 101 and 104) | • Terminal 101 to PS-02 (DC-) = 26.5V DC<br>• Terminal 101 to Terminal 102 = 26.5V DC<br>• Terminal 104 to PS-02 (DC-) = 26.5V DC<br>• Terminal 104 to Ground = 1.8V DC | Locate and repair faulty wiring in the 101-104 supervised loop. |
| | Open Supervised Loop Push-Station (Terminals 102 and 103) | • Terminal 102 to PS-02 (DC-) = 0V DC<br>• Terminal 103 to PS-02 (DC-) = 0V DC<br>• Terminal 103 to Terminal 104 = 26.5V DC | Locate and repair faulty wiring in the 102-103 supervised loop. |
| Ground Fault | Terminals 22 or 23 are shorted to chassis ground. *24V DC PS-02 (DC-) Wiring or Components. | Chassis Ground to PS-02 (DC-) = 24.4V DC | Locate and repair shorted wiring between 22-23 supervised loop and ground. |
| | Terminals 21 or 24 are shorted to chassis ground. **24V DC PS-02 (DC+) Wiring or Components. | Chassis Ground to PS-02 (DC+) = 2.7V DC | Locate and repair shorted wiring between 21-24 supervised loop and ground. |
| | Interlock Network Issue | Check battery voltage and supervised loop wiring with other packages that are interlocked in the network. | Locate and repair faulty wiring in the circuit.<br>Replace batteries. |
| AC Power Failure | 120V AC Input Power Supply Interrupted. | H1 to N1 = 110V to 125V AC | Verify constant input power between H1 and N1. Check wiring to L/N terminals on PS-02. Locate and repair faulty wiring in the circuit. |
| Battery Voltage Low | Faulty Battery or Power Supply (PS-02). | J1-1 to J1-2 = 23.5V to 24.5V DC | Verify there is 12V DC to each battery connection. Locate and repair faulty wiring in the circuit. Replace batteries. |
| | Interlock Network Issue. | Check battery voltage and supervised loop wiring with other packages that are interlocked in the network. | Locate and repair faulty wiring in the circuit.<br>Replace batteries. |
| Release Solenoid | Solenoid wiring incorrect. | Check RS to N1D when:<br>• Wire removed from RS terminal = 15.5DC V +/- 2V<br>• RS terminal wired, connector removed = 6.5DC V +/- 2V<br>• RS terminal wired, connector installed = 0.2-0.4DC V | Check wiring at terminals. Locate and repair faulty wiring in the circuit. |
| | Connector is not secured to solenoid. | | Verify the connector is secured to the valve. |

*** Components that may cause this fault are: Gas Valve, Surfactant Pump, Water Solenoid(s), Release Solenoid(s).**

**** Components that may cause this fault are: 24V Relays, Trouble Relay (when energized), 24V LED Lights.**

**NOTE: If an abnormal reading is present, disconnect potential components/wiring one at a time, while continuing to take readings, to locate the source of the ground fault.**

## DIP Switch Settings

When a network contains a single CORE Board, DIP switches 1, 5, and 8 are in the On (Closed) positions and 2, 3, 4, 6, 7 are in the Off (Open) positions (**Figure 51**). This is the default positions and should not be changed. **Table 19** provides DIP switch settings for CORE Boards interlocked in a network.

**Figure 51 - Single CORE Board Network DIP Switch Settings**

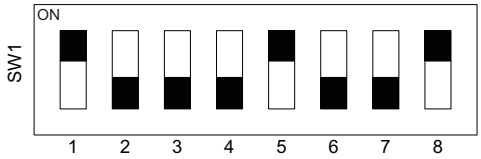


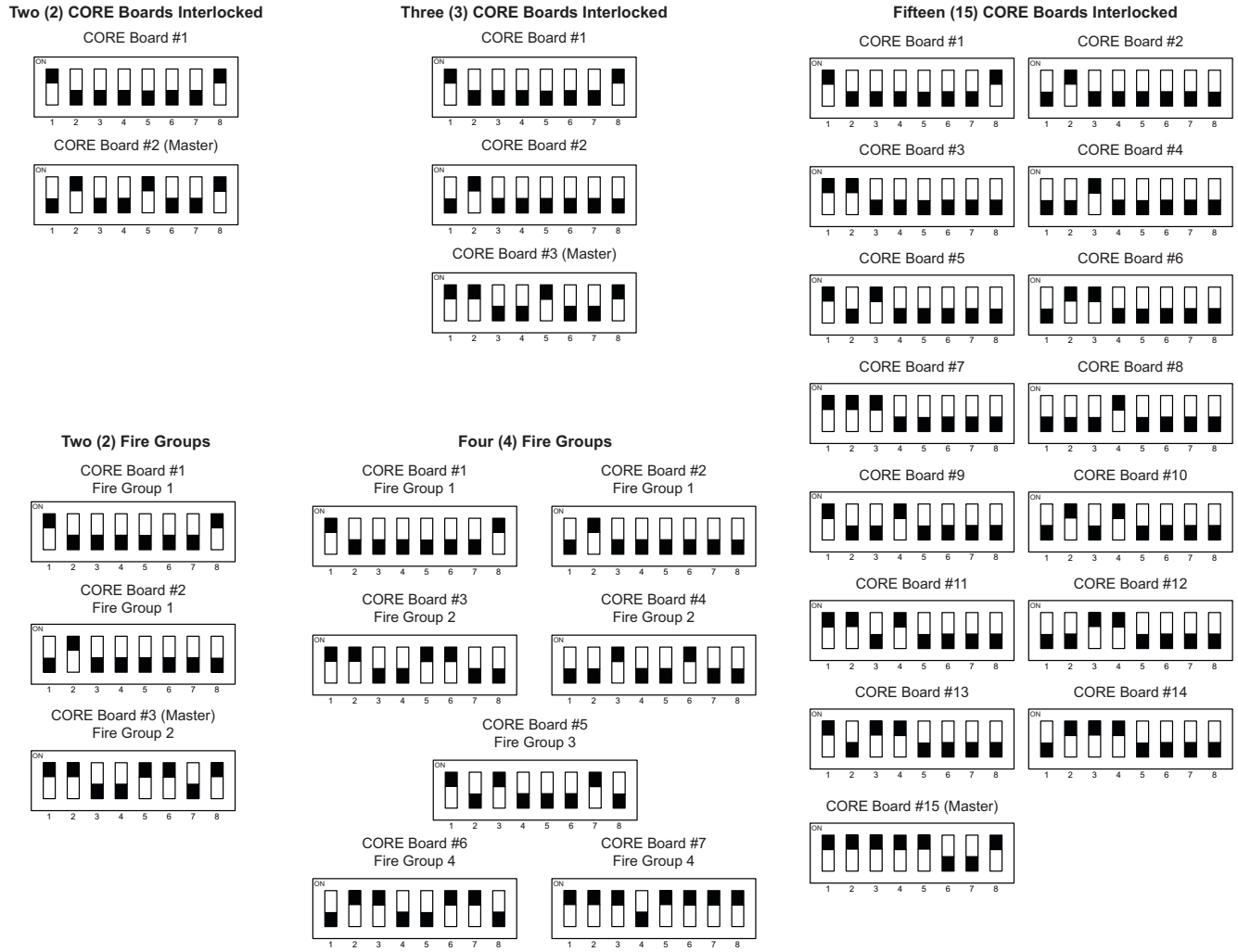

**Table 19 - DIP Switch Settings**

| Interlock Board Address # | DIP 1 | DIP 2 | DIP 3 | DIP 4 |
|---|---|---|---|---|
| 1 | On | Off | Off | Off |
| 2 | Off | On | Off | Off |
| 3 | On | On | Off | Off |
| 4 | Off | Off | On | Off |
| 5 | On | Off | On | Off |
| 6 | Off | On | On | Off |
| 7 | On | On | On | Off |
| 8 | Off | Off | Off | On |
| 9 | On | Off | Off | On |
| 10 | Off | On | Off | On |
| 11 | On | On | Off | On |
| 12 | Off | Off | On | On |
| 13 | On | Off | On | On |
| 14 | Off | On | On | On |
| 15 | On | On | On | On |
| Each unit has a unique address based on the DIP switch 1-4 settings, 15 units max on a network. If address is 0 (all switches off), the unit will not accept or send any network traffic | | | | |
| **DIP 5** | | | | |
| DIP Switch 5 sets the Master Board when this is set to On (Closed). The Master Board must be the highest address on the interlocked network. Otherwise, this switch must be Off (Open). The Master CORE Board must be the only CORE Board connected to an ECPM03 Board via a CAT-5 cable. Refer to **Figure 53**. | | | | |
| **Fire Group #** | **DIP 6** | **DIP 7** | | |
| 1 | Off | Off | | |
| 2 | On | Off | | |
| 3 | Off | On | | |
| 4 | On | On | | |
| DIP Switches 6 and 7 set the Fire Group. You may only have four Fire Groups. Refer to **page 49** for more information on fire groups. | | | | |
| **DIP 8** | | | | |
| Setting switch 8 to the On (Closed) position connects a 120 Ohm terminating resistor to the interlock network. This switch must be On if this unit is at either physical end of the interlock network cable. Otherwise, it must be Off (Open). | | | | |

- When DIP switch 5 is On, this will be the “Master” board. It will be in charge of polling all the units in the network and waiting for a reply. The lack of 3 replies in a row will cause a fault. All units will be polled in a burst every 3 seconds.
- Non-master units, the lack of being polled for 10 seconds will cause a fault.
- A fire condition will broadcast the notification once every second for as long as the condition persists.
- When the Fire condition is cleared, 10 notifications will be sent, one every second.
- Any unit detecting a supervisory fault will broadcast the notification every 2 seconds until the fault is cleared.
- When the supervisory fault condition is cleared, 10 notifications will be sent, one every 2 seconds.

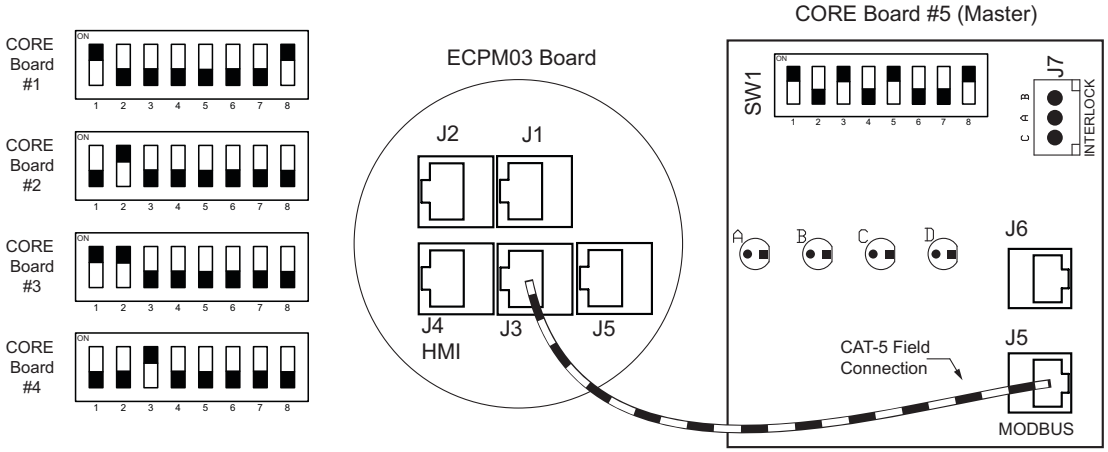
**NOTE: CORE Boards with a Red DIP Switch block use Open/Closed positions. When verifying switch configurations; On = Closed/Off = Open.**

**Figure 52 - Interlocked DIP Switch Examples**




The Master CORE Board must be the only CORE Board connected to an ECPM03 Board via a CAT-5 cable. All other CORE Boards in the interlocked network will be field wired to terminals CA, CB, CC.

**Figure 53 - ECPM03 Connection to CORE Board**



# START-UP/INSPECTION TEST PROCEDURE

**NOTE: This service procedure covers a single manifold system however a duplicate manifold and tank setup is possible. If you have a two manifold system, a second service kit will be required along with fittings to connect it properly. Refer to Table 23 on page 82 for service parts**.

**Required Tools:**

- Precision Slotted Screwdriver
- Heat Gun (field supplied) and Heat Gun Deflector (Part# 33M674 or 33M679)
- Nitrogen Service Kit - single manifold only
- Balloons
- Warm Soapy Water
- 1/4" SAE Tee Connector with cap and valve core. 1/4" female knurl and 1/4" SAE male connections. Used for multiple manifold systems only.
- Micro Leak Detector
- In-Line Filter
- Digital Pressure Gauge

**CAUTION!: Never use magnetic tools or cause excessive vibration when the actuators are bolted to the cylinder(s).**

**Parts:**

- Supervised Loop Wiring: Black Wire - Part #: 441601C6.FE0 & White Wire - Part #: 441601C6.FE9
- Push Station Wiring: Belden Wire - Part #: 6320UL (or similar)
- WAGO connectors - Part #: 221-412
- Replacement PAK O-rings

## Fire System Wiring Connections

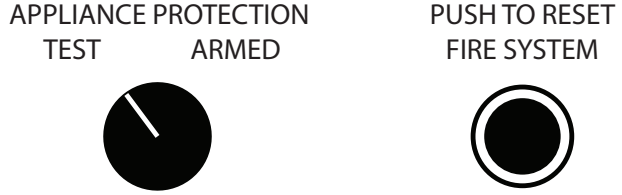
- Connect the Manual Activation Device (MAD) using Belden #6320UL, 18 Gauge plenum rated wire.
- Connect all Firestats using Belden #6320UL (or similar), 18 Gauge plenum high temperature rated wire. Single hood systems with a hood mounted utility cabinet may not have any additional stats.
- **The supervised loop must be run through metallic conduit.** Do not run wiring with high voltage wires. Verify all supervised loop wires are free from damage/stress. All supervised loop wires must be terminated in terminal blocks, junction boxes, and push-stations.
- Install the 24V DC or 120V AC gas valve.
- Verify that all solenoid wires and electrical control panel wiring are secured. Any supervised loop wiring within 18 inches of the top of the hood must be high-temp wire, type MG or MGT with WAGO connectors (Part # 221-412). Type MG White (Part # 441601C6. FE0), Type MG Black (Part # 441601C6.FE9).

## Preparing System for Test

- **Place all building alarm systems in test mode. Place the electric control panel in "Test" mode. Refer to Figure 54. Verify there are no supervision faults on the HMI**.
- Verify that the hood, duct, and kitchen appliances have not changed (including type, dimensions, and location) from the approved design. **Appliance drops must be between 35-50 inches from the hazard surface.**
- Verify that all cylinder discharge outlets are connected to the system.
- Verify that all cylinders are secured in their bracket(s).
- Verify that a valve cap or supervisory pressure switch (optional) is installed on each secondary cylinder Schrader valve.
- Verify that nozzle caps are installed.

**NOTE: If this is the first service after installation, the PAK hose should be disconnected, and the primary and secondary valve actuators should be in the ship/test position. Refer to Figure 55 on page 65.**

**Figure 54 - Electric Control Panel "Test" Mode**



## Connecting Service Test Kit

**WARNING!**
**If the PAK or SVAs are installed on the cylinder valve during the test, the cylinders will discharge.**

**CAUTION!: Supplied Nitrogen Pressure Shall Not Exceed 250 psig Maximum.**

**NOTE: The PAK hose is shipped disconnected, and the PAK/SVA(s) are shipped in the Ship/Test position**

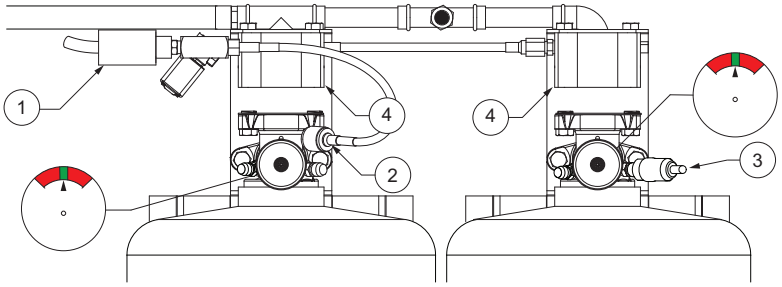
- Check the quantity of Schrader valves on the tank cylinder assembly.
  - Tank assemblies with one Schrader valve:
    - Quickly disconnect the PAK hose to minimize nitrogen loss. Verify a Supervisory Pressure Switch is active on the HMI. If the electrical package is interlocked, the HMI will show “Test Mode.”
  - Tank assemblies with dual Schrader valves:
    - **If this is the first installation/start-up procedure, confirm a Supervisory Pressure Switch fault is active.** Then, connect the PAK hose to the tank Schrader valve after the PAK/SVA actuators are confirmed in the ship/test position.
    - **NEVER DISCONNECT the PAK hose from the tank during normal 6-month inspections**. **The primary tank secondary Schrader valve will be utilized for servicing the system**. A Supervisory Pressure Switch fault should not be active on the HMI.

**NOTE: PAK hoses with knurled fitting must ONLY be tightened by hand and not with a tool. If the PAK hose with a hex fitting was loosened for any reason, this fitting must be torqued to 15 in-lbs.**

- Remove the PAK and any Secondary Valve Actuators (SVA) from their cylinder. Place PAK and SVAs in the ship/test position. Verify that the PAK and SVAs are securely mounted to the bracket. Refer to **Figure 55**.

**Figure 55 - System Preparation**

1. Primary Supervisory Pressure Switch
2. PAK Hose Disconnected
3. Secondary Supervisory Pressure Switch (optional)
4. PAK/SVA in the Ship/Test Position




- Connect the Nitrogen Service Cylinder via the 1/4” refrigerant test hose with an inline filter. If the filter has a directional airflow arrow, verify correct orientation. Refer to **Figure 56 on page 66**.
  - For a single Schrader valve, connect the PAK hose to the inline filter.
  - For dual Schrader valves, connect a secondary 1/4” refrigerant test hose to the open secondary tank Schrader valve. Connect the end of the hose to the filter.
- Verify that the pistons in the PAK and SVAs are in the set position. The plunger is not actuated. Refer to **Figure 58 on page 67**.
- Connect a 1/4” pressure gauge to the Schrader service valve of the PAK assembly. Verify the pressure reads 0 psi. Refer to **Figure 56**.
- Verify all secondary actuator hoses are connected to the appropriate PAK/SVAs. Tighten connections.
- Verify the actuation line vent limiting orifice is installed and tight in the last actuator on the system (last SVA or PAK if there are no secondary cylinders). **Do not use pipe dope or tape on the orifice**.
- Verify that the Primary Supervisory Pressure Switch is installed securely on the PAK. **Torque to 75 in-lbs**.
  - Optional Feature: Secondary tanks may also have Supervisory Pressure Switches installed, verify all switches are properly secured to all secondary tanks. **Torque to 75 in-lbs**.
- Verify the PAK solenoid is de-energized.
  - Open the Nitrogen Cylinder. Adjust the pressure to 225 psig.
  - Monitor the pressure gauge on the PAK. The pressure must not read above 0.5 psi for 15 minutes. This indicates the primary actuator solenoid is in the de-energized state and will not let pressure through as intended. The gauge may fluctuate between 0 and 0.5 psi.

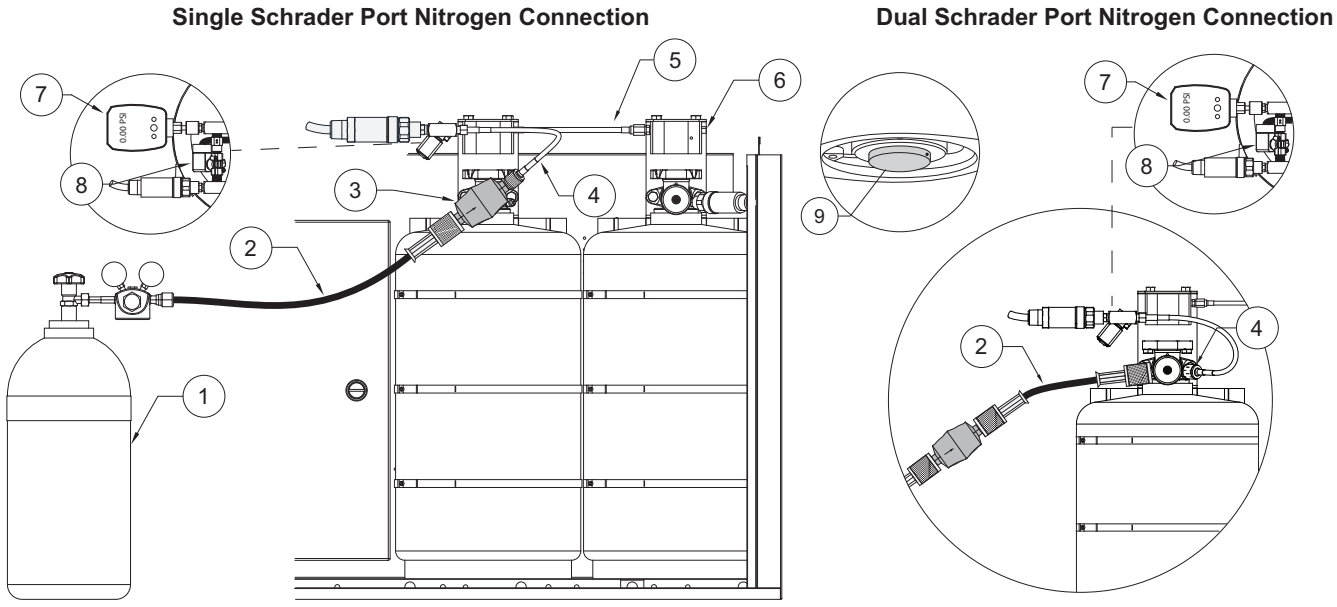
**CAUTION!: If pressure reads above 0.5 psi. Submit a ticket to through technical support. Refer to “Technical Support Information” on page 84.**

- Place the system in “Armed” mode.
- Lift the cover to the manual activation device and “push” to activate the fire system.
- Verify all PAK and all SVAs have actuated. The piston should be fully extended and in a locked position. Refer to **Figure 56**.
- Verify that there are no leaks in the actuation line. Nitrogen will pass through the vent limiting orifice.
- Verify that the solenoid is in the energized state.
  - Monitor the pressure gauge on the PAK. When the fire system is activated, the pressure should be 185 psi or higher. This indicates the system is functioning and will let pressure through as intended.

**CAUTION!: If pressure reads under 185 psi. Submit a ticket to through technical support. Refer to “Technical Support Information” on page 84.**

- If all of the above is confirmed, reset the control panel. The manual activation device can be reset by twisting the push button in a clockwise motion. Press the “Push To Reset” button. Place system in “Test” mode.
- Reset plungers in the PAK and SVAs to their set position.
- Close the Nitrogen Cylinder.
- Remove the pressure gauge on the PAK.

**Figure 56 - Service Test Tank Details**




1. Nitrogen Service Cylinder with regulator attached
2. 1/4” Refrigerant Test Hose (Long)

**Additional hoses/lengths required for servicing.**

3. 1/4” Male to Male Inline Filter
4. PAK Hose Connection
5. Secondary Actuator Hose
6. Vent Limiting Orifice
7. Digital Pressure Gauge
8. Primary Actuator Solenoid
9. Solenoid Actuated

**NOTE: Pressure gauge minimum requirements; 1/4” female flare, 0-250 psi, resolution 0.5 psi, accuracy +/- 1% FS. The inline filter minimum requirements; 1/4” male flare, 40 micron, 250 psi.**

## Balloon Test Procedure

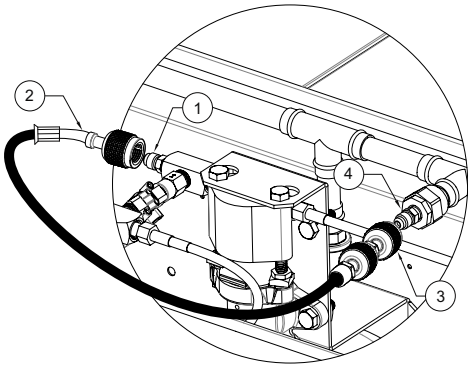
**NOTE: The following should be tested with battery power only (A/C power disconnected) and then tested with A/C power connected.**

- Connect an additional 1/4” refrigerant test hose from the service Schrader valve of the PAK assembly (45° depressor connection) to the distribution piping service port (low-loss fitting threaded into hose straight connection). Refer to **Figure 57**.
- Check that the pistons in the PAK and SVAs are still in the set position.
- Remove the nozzle caps from the nozzles.
- Remove hood filters. This will expose the Firestat(s) and the duct and plenum drops.
- Place testing balloons over all nozzles (appliance, duct, and plenum).
- Open the Nitrogen Service Cylinder. Adjust the pressure to 200 psig.

**CAUTION!: Supplied Nitrogen Pressure Shall Not Exceed 250 psig Maximum.**

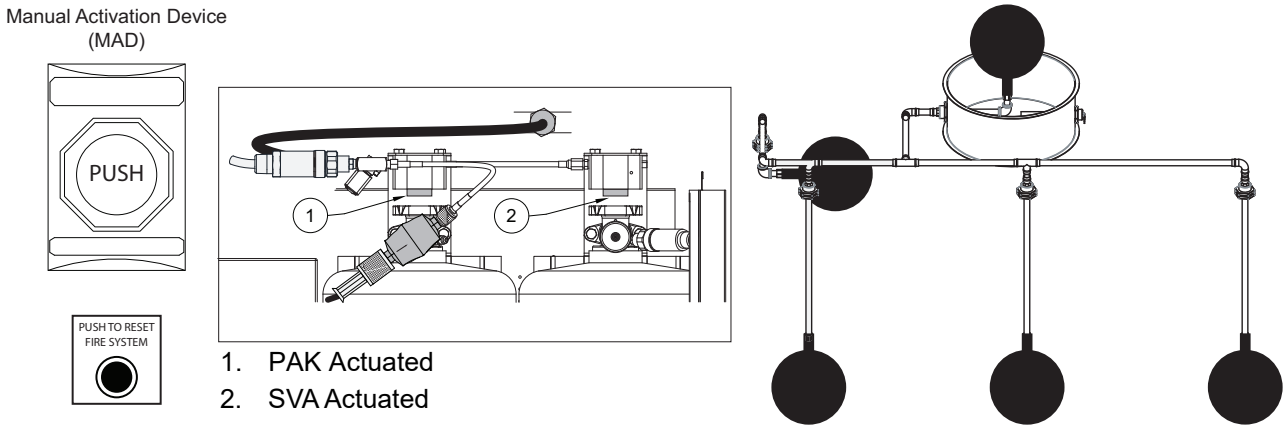
- Place the system in “Armed” mode.
- Lift the cover to the manual activation device and “push” to activate the fire system. Refer to **Figure 58**.
- When testing with A/C power, verify the Electrical Control Package (ECP) has activated. The audible alarm will sound, and the system is in a fire condition. The HMI will flash FIRE on the screen.
- Verify the PAK and all SVAs have actuated. The piston should be fully extended and in a locked position. Refer to **Figure 58**.
- Verify that there are no leaks in the actuation line, except through the vent limiting orifice.
- Verify that the solenoid is in the energized state.
- Verify all balloons are filled.
- Verify fuel to all appliances under the protected hood has shut off.
- Verify the makeup air supplied to the hood has shut off.
- If all of the above is confirmed, reset the control panel. The manual activation device can be reset by twisting the push button in a clockwise motion. Press the “Push To Reset” button. Refer to **“Reset Overview” on page 55**.
- Close the Nitrogen Cylinder. Remove all balloons from the nozzles.

**Figure 57 - Additional 1/4” Test Hose**




1. Schrader service valve of the PAK assembly
2. 1/4” Refrigerant Test Hose (Short) **Additional hoses/lengths required for servicing.**
3. Low-loss Fitting Straight Adapter
4. Distribution Piping Service Port

**Figure 58 - Balloon Test**




1. PAK Actuated
2. SVA Actuated

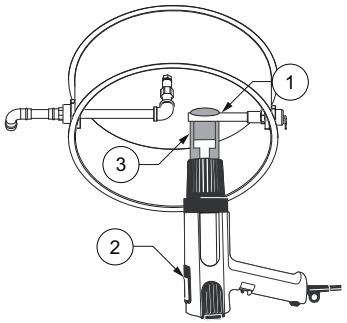
## Firestat Test Procedure

**NOTE: The following should be tested with battery power only (A/C power disconnected) and then tested with A/C power connected.**

**ATTENTION: You do not need nitrogen for this test.**

**CAUTION!: The use of a torch or flame is strictly prohibited.**

**Figure 59 - Firestat Riser Location**




1. Firestat
2. Heat Gun
3. Deflector

- Use a portable heat source to apply heat to the duct Firestat in accordance with the manufacturer's instructions. Please refer to applicable detector manufacturer's manual. Refer to **Figure 59**.
- When the Firestat's heat set point is reached, the fire system will activate. Some residual nitrogen from the test cylinder may release.
  - When performing this test with battery power only, check the COREboard fire status light.
  - When performing this test with A/C power, the exhaust fan will activate. Depending on the hood lights activation setting, they will turn on or off.
- Check all Firestats in the system.
- After the system is tested, install nozzle caps, and install hood filters.

## Disconnecting Service Cylinder Tank

- Place the TANK fire system into "Test" mode.
- Relieve pressure from the Nitrogen Cylinder.
  - Cylinder assemblies with one Schrader valve:
    - Slowly disconnect the inline filter from the PAK hose.
  - Cylinder assemblies with dual Schrader valves:
    - Check all cylinder gauges to confirm proper pressure is within the "green" range. If pressure is low, refer to **"Adding Nitrogen to Tank(s)" on page 73**.
    - Slowly disconnect the test hose with inline filter from the tank cylinder.
- Relieve pressure in the actuation line. Slowly disconnect the test hose from the PAK service valve.
- Disconnect the test hose from the fire system distribution piping service port. Remove low-loss fitting adapter.

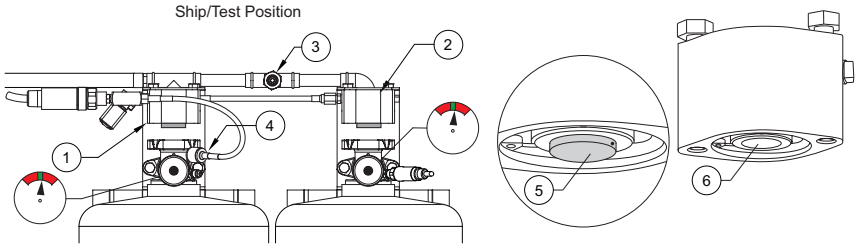
## Re-arming System

- Reset each PAK and any SVAs by pushing the spring-loaded pin on the piston. Press the piston into the body of the actuator.
- Verify residual pressure is relieved at Schrader valve.

**NOTE: If a PAK/SVA fails to operate or cannot be properly reset, the unit must be replaced. Refer to page 72 for replacement procedures.**

- Verify all of the actuation lines between the PAK and SVA(s) are secure and tight. Place Schrader valve cap on the fire system distribution piping service port.
- Check all cylinder gauges to confirm proper pressure is within the "green" range. If pressure is low, add nitrogen. Refer to **"Adding Nitrogen to Tank(s)" on page 73**.
- Re-arm the control panel by placing the package in "Armed" mode.

**Figure 60 - Resetting PAK/SVA(s)**




1. PAK in Ship/Test Position
2. SVA in Ship/Test Position
3. Distribution Piping Service Schrader Valve
4. Primary Actuator Hose
5. Actuator Activated
6. Actuator Set Position

**NOTE: Tanks should never be filled with agent in the field.**

## Leakage Testing

- Connect a 1/4” pressure gauge to the Schrader service valve of the PAK assembly. Verify the pressure reads 0 psi. Refer to **Figure 61**.
- Prepare the tank cylinder assembly for leakage testing.
  - Cylinder assemblies with one Schrader valve:
    - Inspect the PAK hose O-ring. Replace O-ring if damaged or deformed. Refer to **“TANK FIRE SUPPRESSION SYSTEM PARTS” on page 82**.
    - Quickly connect the PAK hose to the Schrader valve on the primary cylinder to minimize nitrogen loss.
  - Cylinder assemblies with dual Schrader valves:
    - Place Schrader cap back on the tank cylinder secondary Schrader valve.

**NOTE: PAK hoses with knurled fitting must ONLY be tightened by hand and not with a tool. If the PAK hose with a hex fitting was loosened for any reason, this fitting must be torqued to 15 in-lbs.**

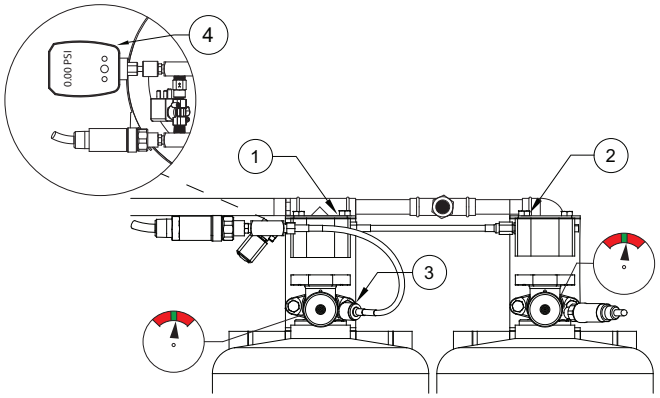
- Monitor the pressure gauge on the PAK. The pressure must not read above 0.5 psi for 15 minutes. This indicates the solenoid is in the de-energized state and will not let pressure through as intended. The gauge may fluctuate between 0 and 0.5 psi.

**CAUTION!: If pressure reads above 0.5 psi, immediately remove the primary actuator hose from the primary tank. Submit a ticket to through technical support. Refer to “Technical Support Information” on page 84.**

- Verify that the pistons in the PAK and SVAs are in the set position and not actuated. Refer to **Figure 60 on page 68**.

**Figure 61 - Leakage Test Setup**

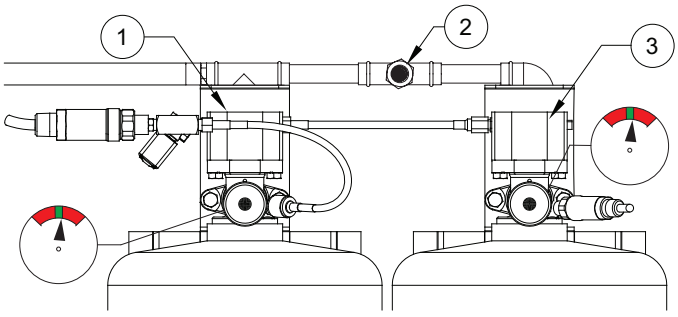
1. PAK Reset and in the Ship/Test Position
2. SVA Reset and in the Ship/Test Position
3. PAK Hose Connected to Tank
4. Digital Pressure Gauge




- Install the PAK and any SVAs onto their respective cylinders. Refer to **Figure 62**.
- Remove the pressure gauge on the PAK. Place the Schrader valve cap back onto the service port of the PAK assembly. Tighten the cap.
- Spray the primary charge hose connection with a micro leak detector to check for leaks.
- Verify that the Supervisory Pressure Switches have reset per the control panel manual instructions.
- The system should be in the “Armed” position, and no faults should be active on the HMI when finished testing.

**Figure 62 - PAK/SVA(s) Installed**

1. PAK Installed
2. Schrader Cap
3. SVA Installed



# MAINTENANCE

**NOTE: It is the responsibility of the system installer to review system operation and owner obligations, and to provide any necessary literature to the owner at the time of system installation.**

This section contains the inspection and maintenance instructions for the TANK Fire Suppression extinguishing system. These procedures must be performed in accordance with NFPA 17A and the National Fire Code of Canada as applicable. If problems arise, corrective action must be taken.

## Every Month (System Owner)

Refer to the cylinder nameplate for proper inspection and maintenance instructions. Inspections are required to ascertain that the system is operable and that no changes have occurred, which would compromise the effectiveness of the system. A record of the monthly inspection is to be kept reflecting the date inspected, initials of the person performing the inspection, and any corrections required. If any discrepancies are noted while making this inspection, **DO NOT CONTINUE OPERATING COOKING APPLIANCES**. Immediately contact a factory trained distributor for service and/or repair.

The following procedure is to be performed by the Owner of the system on a monthly basis:

**Table 20 - Owner's Monthly Maintenance**

| Checkbox | Procedure |
|---|---|
| | Verify the extinguishing system is in its proper location. |
| | Inspect all system components, agent distribution pipe, and conduit runs for physical damage and/or displacement. |
| | Inspect all nozzles caps are in place and intact. Check for possible obstructions to the discharge of the wet chemical. |
| | Inspect each Cylinder and Valve Assembly. The indicator on the pressure gauge should be in the "green" range (200 psig). The cylinder should not show evidence of corrosion or damage. |
| | Verify that manual release stations are unobstructed and in clear view and are labeled for intended use. |
| | Verify all tamper seals are intact, and the system is in a ready condition. |
| | Verify the inspection tag or certificate is in place and current. |
| | Verify the hood, duct, and protected cooking appliances have not been replaced, modified, or relocated. |

## Every Six Months (Factory Trained Distributor)

All systems shall be inspected and serviced semi-annually by a factory trained distributor.

1. Place the control panel in “Test” mode and ensure there are no supervision faults, refer to **“Reset Overview” on page 55**.
2. Verify that the system design and installation are adequate to protect the hazard area and conform to the instructions in this manual. Check the following:
   - All equipment requiring fire protection within the hazard area is protected.
   - There have been no unauthorized alterations to the protected area or equipment, or to the wet chemical system.
   - All cylinder mounting brackets are securely fastened to the hood.
   - Verify all cylinders are pressurized within the “green” range.
   - Check hose connections with soapy water to check for leaks.
   - All nozzles are properly aimed, secured, and located within the proper distance from the protected equipment. Each nozzle should be clean and equipped with a cap.
   - All piping joints and pipe supports are securely fastened.
   - The pipe lengths, sizes, fittings, and material are as specified in this manual.
   - All wiring is in compliance with local codes.
   - All field wiring is free of ground fault or short-circuit conditions.
   - All system components and installation material are as specified in this manual.
3. Perform Start-up/Test Procedure. Refer to **“START-UP/INSPECTION TEST PROCEDURE” on page 64**.

**NOTE: For Pollution Control Units (PCU) with a TANK Fire Suppression system, a balloon test is not required. When actuating the system, to verify the system discharges properly, listen or feel for the flow of nitrogen through all the nozzles in the in the PCU.**

## Every Two Years

1. Replace batteries. The replacement battery part number is PS-1270-F2; two are required. Once the battery is disconnected, the connected equipment is not protected from power outages. The new battery must be installed immediately. Refer to the replacement battery installation guide for more details.
2. Inspect the condition of all wires and plumbing. Plumbing should be free of corrosion, and wire insulation must be in good condition.

## Every Twelve Years

The 12-year maintenance is typically done in conjunction with the semi-annual maintenance. These procedures shall be performed in addition to the tests conducted at Semi-Annual intervals. Refer to “Every Six Months (Factory Trained Distributor)”.

## Decommissioning

If it should become necessary to disconnect the CORE system from AC power for an extended period of time (more than 2 days), the batteries should be disconnected to prevent them from being damaged due to complete discharge.

### Agent Cylinder Tanks

Each cylinder must be replaced every 12 years. For information on replacing cylinders, refer to **“POST-DISCHARGE MAINTENANCE” on page 74**.

### Actuation Hoses

All actuation hoses must be hydrostatically tested (at 500 psi test pressure) or replaced every 12 years in accordance with NFPA 17A.

## Conditional Maintenance

### Replacing A Primary Actuation Kit

If a PAK fails to operate during system testing, follow these steps to replace the PAK:

1. Ensure the primary actuation hose is not connected to the primary cylinder or a nitrogen pressure supply system.
2. Remove the supervisory pressure switch installed on the PAK.
3. If applicable, disconnect the secondary actuation hose from the PAK.
4. Loosen the PAK shipping bolts from the top of the bracket, slide the unit back and remove it from the bracket.
5. Loosen the shipping bolts on the new PAK. Slide the unit into the bracket. Tighten the shipping bolts to ensure the PAK is held firmly but can still be slid back for installation to the cylinder valve.
6. If applicable, remove the side vent limiting orifice on the PAK and install in the secondary actuation hose.
7. Install the supervisory pressure switch onto the new PAK.

### Replacing A Secondary Valve Actuator

If an SVA fails to operate during system testing, follow these steps to replace the SVA:

1. Ensure the primary actuation hose is not connected to the primary cylinder or a nitrogen pressure supply system.
2. Disconnect any secondary actuation hose connecting the SVA to the PAK or other SVAs.
3. Loosen the SVA shipping bolts from the top of the bracket, slide the unit back and remove it from the bracket.
4. Loosen the shipping bolts on the new SVA. Slide the unit into the bracket. Tighten the shipping bolts to ensure the SVA is held firmly but can still be slid back for installation to the cylinder valve.
5. If applicable, remove the side vent limiting orifice(s) on the SVA and connect the SVA to any applicable secondary actuation hoses.

## Adding Nitrogen to Tank(s)

**NOTE: Verify the pressure loss is not due to a discharge or unknown issue. Spray the pressurized PAK, SVA, and tank cylinder assemblies (PAK hose connection and pressure switches) at all fittings with a micro leak detector. Repair or replace components that show signs of leaking/damage.**

**Table 23 on page 82** provides all required components/part numbers to service low pressure tank(s). Refer to **Figure 63** for assembling service kit. After the low pressure condition is identified and fixed, follow these steps to add nitrogen.

- Place the system in “Test” mode.
- Unbolt PAKs/SVAs from tank(s) and secure to tank bracket.
- Determine TANK Schrader valve ports. Refer to Refer to **Figure 63**.
  - Cylinder assemblies with one Schrader valve, disconnect the PAK hose from the primary Schrader valve, if already connected.
  - Cylinder assemblies with dual Schrader valves, remove Schrader cap from the secondary Schrader valve.
- Connect a Nitrogen Service Cylinder via the 1/4” refrigerant test hoses with an inline filter to the 1/4” to the Schrader valve fill port.
- If the filter has a directional airflow arrow, verify correct orientation. Arrow should be pointing away from the nitrogen tank and toward the fire system tank.

**CAUTION!: Supplied Nitrogen Pressure Shall Not Exceed 250 psig Maximum.**

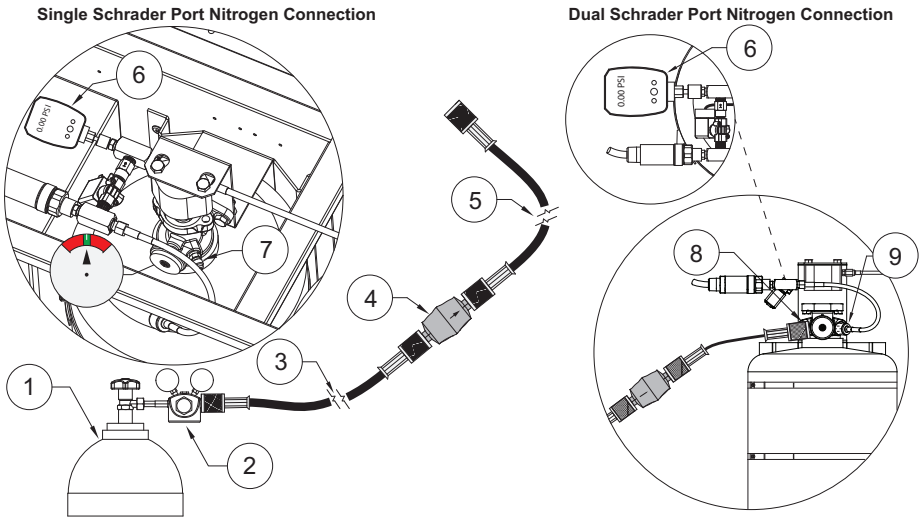
- Open the Nitrogen Service Cylinder. Adjust the pressure to 225 psig.
- Pressurize the tank to 200 psig. The green indicator range is 175 to 225 psig.
- Close the Nitrogen Service Cylinder.
- Remove test hoses from the Schrader valve.
- Prepare tanks for final connections.
  - Cylinder assemblies with one Schrader valve, connect the PAK hose to the primary Schrader valve.
  - Cylinder assemblies with dual Schrader valves, place the Schrader cap on the secondary Schrader valve.
- Verify PAK/SVA are still in the set position.
- Remove PAKs/SVAs from the tank bracket and secure to the tanks. Tighten hardware.
- Connect a 1/4” pressure gauge to the Schrader service valve of the PAK assembly. Pressure should read 0 psi.
- Spray the pressurized system components and fittings with micro leak detector. Monitor the pressure gauge on the PAK. The pressure must not read above 0.5 psi for 15 minutes. Pressure may fluctuate between 0 - 0.5 psi.

**CAUTION!: If pressure reads above 0.5 psi. Submit a ticket to through technical support. Refer to “Technical Support Information” on page 84.**

- Place the system in “Armed” mode.
- Finalize Start-up/Test procedure. Continue to **“START-UP/INSPECTION TEST PROCEDURE” on page 64**.

**Figure 63 - Service Kit Set-up**

1. Nitrogen Service Cylinder
2. Pressure Regulator
3. 1/4” Refrigerant Test Hose (60” Long)
4. 1/4” Male to Male Inline Filter
5. 1/4” Refrigerant Test Hose (36” Long)
6. Digital Pressure Gauge
7. Primary Schrader Valve (Single Schrader Port)
8. Secondary Schrader Valve (Dual Schrader Port)
9. PAK Hose (Connected to TANK)



# POST-DISCHARGE MAINTENANCE

## General Information

Liquid Fire Suppressant, the Aqueous Potassium Carbonate (APC) base wet chemical used in the TANK Fire Suppression extinguishing system, is non-toxic. However, any food or cooking oils that have been contaminated with wet chemical agent should be discarded. Refer to Safety Data Sheet (SDS).

After any system discharge, it is best to clean the area as soon as it is safe to do so. Prolonged exposure of equipment to wet chemical can result in localized corrosion due to moisture in the air. Clean up should be completed within 24 hours of any system discharge.

TANK Fire Suppression cylinders need to be replaced every 12 years, and after any system discharge.

## Appliance Cleanup

No unusual cleanup procedure is required. The reaction of the wet agent and the grease is one of saponification, and it produces a foam that can be wiped off. After the appliances have completely cooled, the residue from the discharge may be cleaned up using a wet cloth or sponge. Ensure that all fuel and electric power to the area has been shut down. Wear rubber gloves and eye protection while cleaning. If skin or eyes come in contact with the agent, flush thoroughly with water.

**WARNING!**

**Do not disturb the foam until the cooking appliances, plenum, and duct have cooled sufficiently. Do not put water on hot grease as this will cause violent steaming and spattering.**

**WARNING!**

**APC wet agent is electrically conductive. To avoid electrical shock, de-energize all electric circuits to appliances, outlets, and wiring by disconnecting or turning off the electric power at the main fuse or circuit breaker box. Do not cleanup APC wet agent or touch electric appliances, outlets, power cords, or other wiring with electric power on.**

## Cleaning Distribution System

The TANK Fire Suppression extinguishing system must have all discharge piping and nozzles flushed out with water after any discharge, as detailed in the following procedures.

## Cleaning Nozzles

1. Remove all nozzles from the system.
2. Inspect each nozzle & filter and remove any debris.
3. Clean nozzle and vane by flushing thoroughly with warm soapy water. Remove any foreign matter that could impede flow.
4. Run water through the nozzle tip to ensure the orifice is not clogged.
5. Thoroughly dry nozzles with dry air or nitrogen and set aside.

## Flushing the Distribution Pipe Network

Before starting the flushing procedure, inspect the complete piping network, and replace any pipe or fittings that have been subjected to direct flame or excessive heating. The following procedure describes flushing the pipe network with a spare/test cylinder. The pipe network can also be flushed utilizing an external water supply if available.

## Flushing Procedure with Spare/Test Cylinder

- Check the pressure gauge on each cylinder to ensure it has been depressurized.
- Clean the area with warm soapy water, and rinse with water. Dry thoroughly with dry air or nitrogen.
- Disconnect the Primary Actuator Kit (PAK) stainless steel hose from the primary cylinder valve.
- Remove all cylinders from the system. Refer to **“Removing a Cylinder Tank (Empty or Storage)” on page 78**.
- Fill test cylinder(s) with water and pressurize.
- Install a test cylinder for each removed cylinder. Refer to **“Installing New Cylinder Tank(s)” on page 79**.
- Attach a suitable container (or hose to a container or other point of disposal) at each pipe outlet where a nozzle was installed to collect the water discharge.
- Install the PAK and SVAs onto their respective cylinders.
- Re-arm the control panel by placing the package in “Armed” mode.
- Connect the primary actuator hose securely to the Schrader valve on the primary cylinder.

**NOTE: PAK hoses with knurled fitting must ONLY be tightened by hand and not with a tool. If the PAK hose with a hex fitting was loosened for any reason, this fitting must be torqued to 15 in-lbs.**

- Activate the system using the manual activation device.
- Once the system is fully discharged of water, reset the system. Refer to **“Reset Overview” on page 55**.
- Remove containers or hoses from all nozzle location pipe outlets.
- Remove test cylinders.
- Connect a nitrogen service tank to system piping service port and blow out the discharge piping to remove all excess water. Disconnect the nitrogen service tank. Refer to **“Dry the Lines” on page 77**.
- Install new cylinders at each location. Refer to **“Installing New Cylinder Tank(s)” on page 79**.
- Re-install nozzles, ensuring that all nozzles are in the correct location and properly aimed.
- Complete the Start-up/Test Procedure. Refer to **“START-UP/INSPECTION TEST PROCEDURE” on page 64**.

**NOTE: Tank cylinder(s) should never be filled in the field with agent.**

## Flushing Procedure with an External Water Supply

The procedure is used for flushing out the fire system piping after a fire system discharge. **Tank cylinder(s) must be in place when flushing the system.** Refer to **Figure 64** for testing setup.

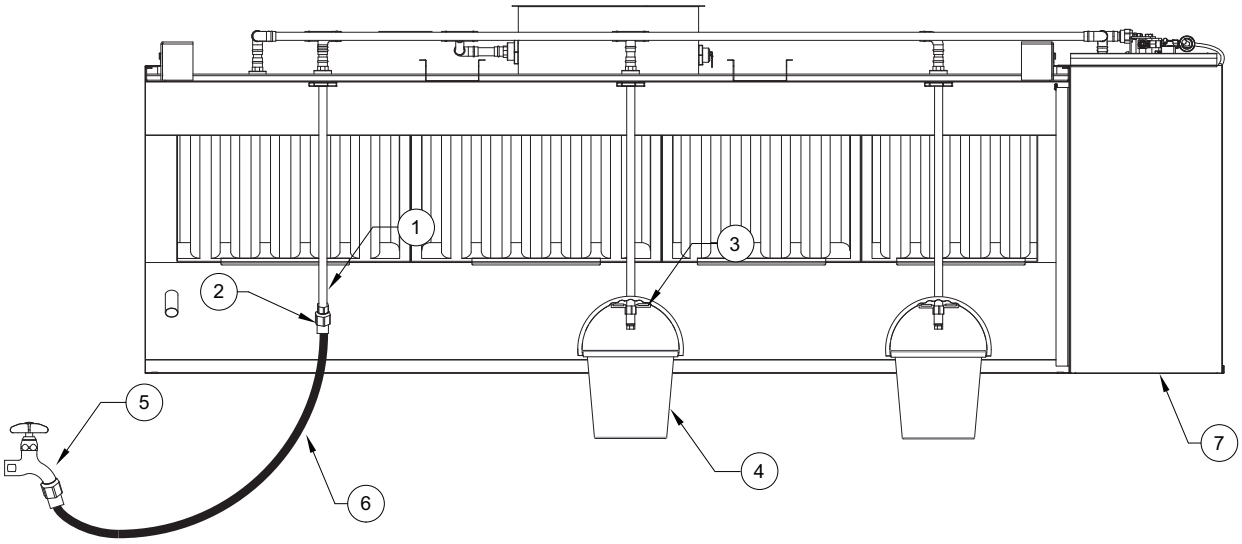
**Parts:**

- Tank Flushing Adapter
- Bucket Support Bracket
- Buckets
- Water Hose
- Nitrogen Service Kit
- Silicone Lubricant
- 1/4" SAE Tee Connector with cap and valve core. 1/4" female knurl and 1/4" SAE male connections. Used for multiple manifold systems only.

### Flush the System

- Remove the appliance nozzle that is furthest away from the utility cabinet.
- Use a 3/8” to 3/4” flushing adapter to attach the hose to the nozzle drop. Attach a water hose to the flushing adapter and the other end to a water source.
- Hang the bucket support brackets and buckets on the applicable drops. If possible, connect a hose to the grease spout and route the hose to the nearest floor drain.
- Flush with water for a minimum of one minute. Larger systems will take longer than a minute.

**Figure 64 - Flushing System with External Water Supply**



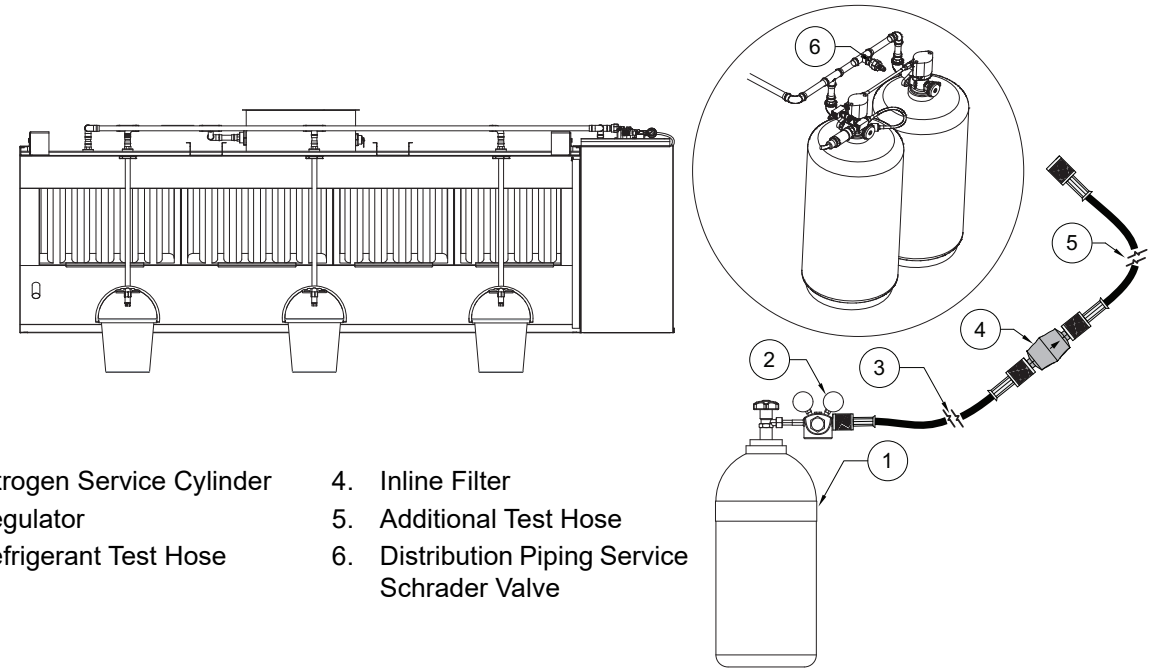

1. Nozzle Furthest from Utility Cabinet
2. 3/8” to 3/4” Tank Flushing Adapter
3. Bucket Support Bracket
4. Buckets
5. External Water Supply
6. Water Hose
7. Utility Cabinet

- Remove flushing adapter. Reinstall the nozzle and hang a bucket.
- When reinstalling nozzles, ensure that all nozzles are in the correct location and properly aimed.

## Dry the Lines

- Connect the nitrogen line directly to the distribution piping service Schrader valve on the manifold line. Refer to **Figure 65**.
- Set your pressure regulator to 100 psi and blow down the lines for a minimum of 30 seconds. Larger systems may take longer.

**Figure 65 - Connecting Nitrogen to Dry Lines**




1. Nitrogen Service Cylinder
2. Regulator
3. Refrigerant Test Hose
4. Inline Filter
5. Additional Test Hose
6. Distribution Piping Service Schrader Valve

- Remove nitrogen line from the distribution piping service Schrader valve.
- Remove all hoses and buckets.
- Install nozzle caps on nozzles.

## Cylinder Tank Maintenance

TANK Fire Suppression cylinders need to be replaced every 12 years, and after any system discharge.

**WARNING!**

**Never assume that a cylinder is unpressurized. Handle all cylinders as if they are pressurized until verified otherwise. Pressurized cylinders are extremely hazardous.**

**When performing any cylinder maintenance procedure, the cylinder must be properly secured to a rigid structure capable of withstanding the full thrust that would result if the valve were to open inadvertently.**

**Any time a cylinder assembly is unsecured, the anti-recoil plate must be installed on the valve outlet to provide a safe, controlled discharge in the event of accidental actuation.**

**Failure to take proper precautions could result in death, serious personal injury and/or property damage.**

### Removing a Cylinder Tank (Empty or Storage)

- Unbolt the actuators from the tanks and bolt into shipped position. Repeat for all additional actuators.
- Disconnect the PAK hose.

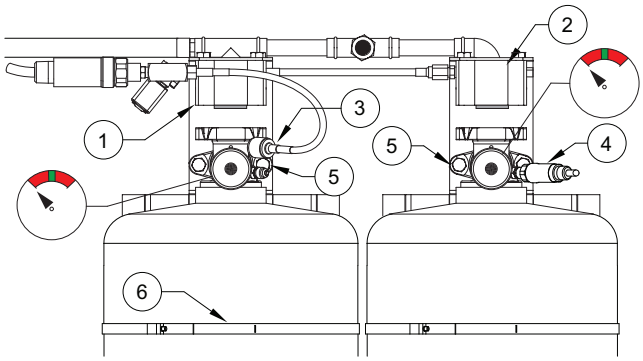
**IMPORTANT: If tank(s) will be stored for an extended period, you must prevent debris from entering the system. Cover the discharge outlet (tank) and discharge adapter (system piping). Install the Valve Protection Plate and Anti-recoil Plate onto the cylinder.**

- Use a 1/2” and 9/16” box end wrench to remove the cylinder mounting bolts from the bracket.
- Loosen the tank straps, and remove the tank. Repeat for additional tanks.
- For each secondary cylinder, perform the following before moving to the next cylinder:
  - Remove the Supervisory Pressure Switch from the cylinder valve if applicable.
  - Loosen the cylinder bolts holding the valve to the discharge adapter and cylinder bracket.
  - Loosen the tank straps holding the cylinder in place.
- Pull the cylinder out from the bracket. Refer to **Figure 66**.

**Figure 66 - Tank Removal Process**

1. PAK in Ship/Test Position
2. SVA in Ship/Test Position
3. PAK Hose
4. Secondary Supervisor Pressure Switch (Optional)
5. Cylinder Mounting Bolts
6. Tank Straps

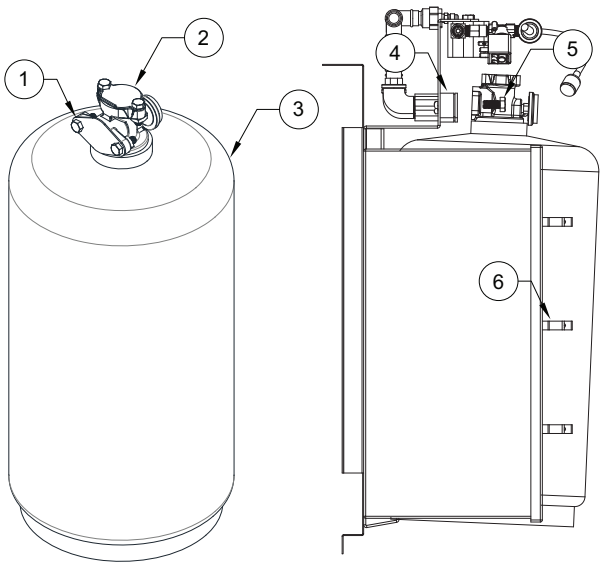
**NOTE: Tanks should never be filled with agent in the field.**



## Installing New Cylinder Tank(s)

- Remove the anti-recoil and valve protection plates.
- Install the tank by fully inserting the tank into the adapter.
- Apply silicone lubricant to the adapter and O-ring to ensure a smooth installation.
- Install and tighten the hardware that hold the tank onto the bracket. The square nut can be tightened with a 9/16" box end wrench; the bolt head can be tightened with a 1/2" box end wrench.
- Tighten the middle tank strap to help support the weight of the tank and to assist in lining up the bolts.
- Tighten all 3 straps.
- Repeat for all other tank cylinder(s) in the system.
- After installing new cylinder, follow **“START-UP/INSPECTION TEST PROCEDURE” on page 64** procedures to complete an inspection of the system.

**Figure 67 - Installing Tank**




1. Anti-Recoil Plate
2. Valve Protection Plate
3. Cylinder Assembly
4. Discharge Adapter
5. Cylinder Mounting Bolts
6. Tank Straps

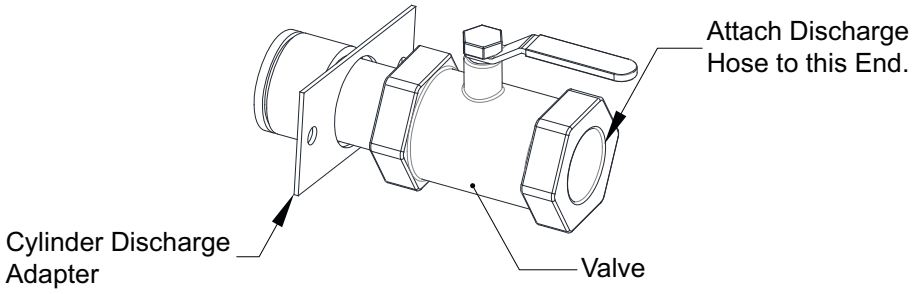
## Depressurizing a Cylinder Tank

**WARNING!**

**Failure to correctly secure the hose could result in death, serious bodily injury, and/or property damage.**

1. Secure the cylinder in a chain vice, strap vice, or similar device.
2. Prepare high-pressure discharge hose with a spare nozzle on the end.
3. Remove the anti-recoil plate from the cylinder outlet and install the discharge adapter.
4. Install a ball valve onto the discharge adapter outlet. Refer to **Figure 68**.
5. Attach the discharge hose with nozzle to the ball valve outlet.
6. Attach the hose and discharge adapter assembly to the cylinder valve outlet.
7. Insert the opposite end of the hose into an appropriate container for the wet chemical agent.
8. Ensure that the hose is secure and will not come loose or separate from the container.
9. Install a Secondary Valve Actuator (SVA) onto the cylinder valve.
10. Connect the nitrogen service cylinder to one of the SVA ports, and a SVA vent limiting orifice in the opposite port.
11. Ensure that the ball valve on the discharge assembly is in the closed position.
12. Open the nitrogen supply, slowly increase pressure until the SVA actuates. Turn off nitrogen supply.
13. Carefully open the discharge valve.
14. Monitor the discharge to prevent spillage and to ensure that the hose remains secure.
15. Control the rate of discharge via the ball valve.
16. If applicable, stop the flow and change containers.
17. When the discharge is complete, turn off the nitrogen service cylinder supply.
18. Check that the cylinder gauge indicates no pressure, and carefully depress the Schrader on the cylinder valve. Check for any possible flow/leakage of nitrogen.
19. Slowly disconnect the nitrogen supply, relieving pressure from the SVA.
20. Remove the SVA from the valve.
21. Remove the valve/siphon tube assembly by unthreading the valve counterclockwise from the cylinder.
22. Invert the cylinder to remove any residual wet chemical.
23. Clean the cylinder and threads with warm soapy water and rinse with clean water.
24. Blow out any residual moisture from the cylinder and threads with dry air or nitrogen.

**Figure 68 - Cylinder Discharge Assembly**




## Rechecking the System

After the inspections and procedures described previously in this section, the fire-suppression system is ready to be fully checked out before installation of the replacement wet chemical cylinders.

1. Follow the system commissioning and test procedures outlined in **“START-UP/INSPECTION TEST PROCEDURE” on page 64**.
2. Be sure to check the system for all modes of operation.

## Mobile Kitchen/Seasonal Shutdown

**Figure 69** provides details on components that require attention when decommissioning/commissioning mobile kitchens or kitchens used for seasonal occasions.

When the kitchen is not in use for an extended period:

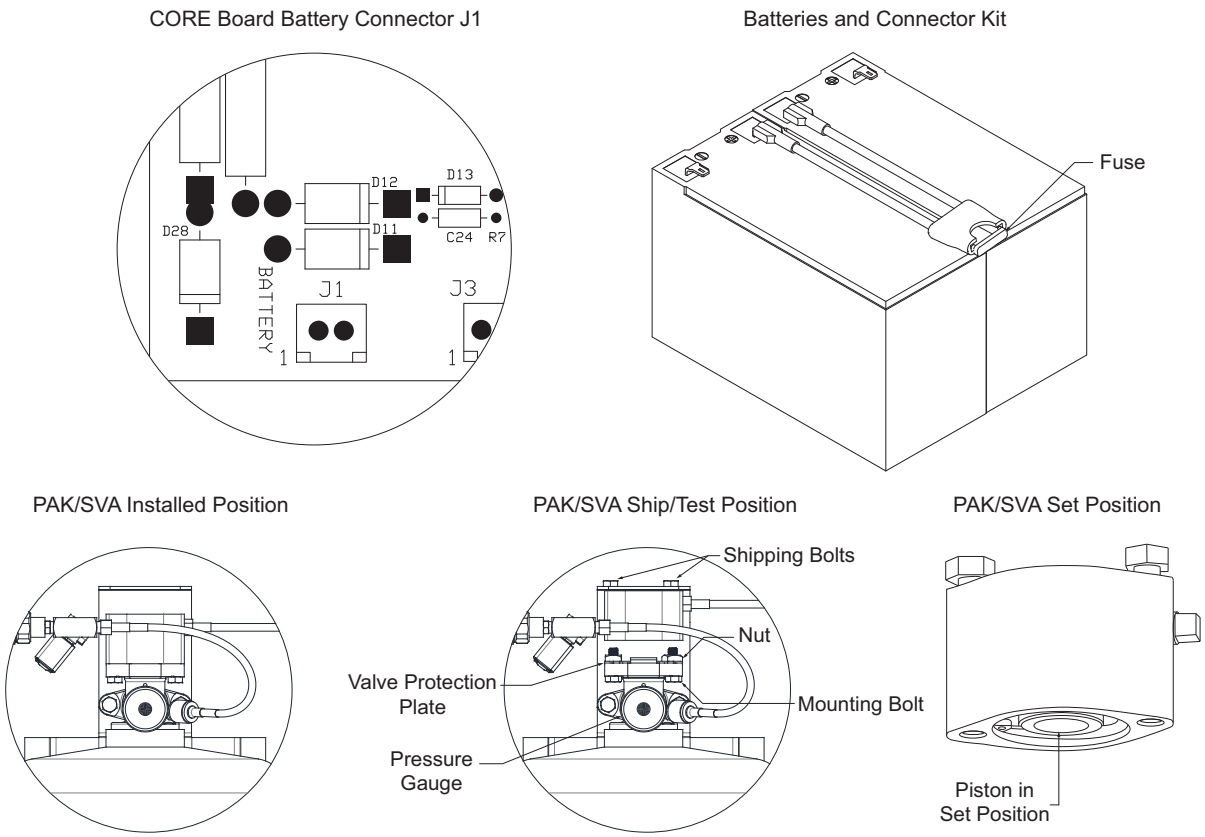
1. Verify incoming power to the hood is OFF or DISCONNECTED.
2. Disconnect the battery connection from the CORE Board at connector J1 located inside the control package. Alternatively, you may remove the fuse (5 amp blade fuse) from the battery connector kit.
3. Disconnect the PAK and SVA(s) from the tank(s).
4. Place the PAK and SVA(s) in the ship/test position. Install valve protection plate.

**NOTE: If the space drops below -20°F, the tanks must be removed and stored in a conditioned space.**

When starting the kitchen backup from an extended shutdown:

1. Verify incoming power to the hood is OFF or DISCONNECTED.
2. Verify the PAK and SVA(s) are in the set position.
3. Install the battery connection to the CORE Board at connector J1. If the fuse (5 amp blade fuse) is removed, install fuse to the connector kit at the batteries. If a replacement connector kit is required, order part number - CORECONKIT12. If replacement batteries are required (12V, 7AH,.250 terminals, AGM), order part number - PS-1270-F2 (must order two).
4. Check the pressure gauge is in the “green” range. If the pressure is low, refer to **“Adding Nitrogen to Tank(s)” on page 73**. If the tank(s) were removed for storage, install the tank(s).
5. Restore incoming power to the hood.
6. Remove the valve protection plate. Place the PAK and SVA(s) in the installed position. Refer to **“START-UP/ INSPECTION TEST PROCEDURE” on page 64** to finish start-up.

**Figure 69 - Actuator and Battery/Fuse Details**



# TANK FIRE SUPPRESSION SYSTEM PARTS

### Table 21 - System Components

| Description | Part Number |
|---|---|
| TFS Cylinder Assembly, Filled & Pressurized | 87-300001-001 |
| Bracket, TFS Cylinder | TFS-UCTANKBRACKET |
| Discharge Adapter | WK-283952-000 |
| Discharge Adapter Tank Locking Plate | DATANKLOCK |
| O-Ring for Discharge Adapter | WK-108019-000 |
| Primary Actuator Kit (PAK) | 87-300030-001 |
| O-ring 1/4” PAK Hose - Hex Fitting | PAKHOSEORING |
| Secondary Valve Actuator (SVA) | 87-120042-001 |
| Secondary Valve Actuator Hose 7” | 87-120045-001 |
| Secondary Valve Actuator Hose 24” | 87-120045-002 |
| Secondary Valve Actuator Hose 60” | 87-120045-003 |
| Cylinder Supervisory Pressure Switch | 87-300040-001 |
| Vent Limiting Orifice | 12A06 |
| Gas Shut-off Valve, 3/4” (ASCO) | 8214235 |
| Gas Shut-off Valve, 1” (ASCO) | 8214250 |
| Gas Shut-off Valve, 1-1/4” (ASCO) | 8214265 |
| Gas Shut-off Valve, 1-1/2” (ASCO) | 8214275 |
| Gas Shut-off Valve, 2” (ASCO) | 8214280 |
| Gas Shut-off Valve, 2-1/2” (ASCO) | 8214290 |
| Gas Shut-off Valve, 3” (ASCO) | 8214240 |

### Table 22 - Maintenance Components

| Description | Part Number |
|---|---|
| Valve Protection Plate | WK-255096-000 |
| Anti-Recoil Plate | WK-255681-000 |
| Discharge Adapter Kit (includes mounting flange) | 83-844908-000 |
| Schrader Cap (used with valve for test and service ports) | 87-300140-001 |
| Schrader Valve (used for test and service ports) | 87-300141-001 |
| SVA bolts | 87-300152-001 |
| Balloons | ADRITE11IN |
| Bucket Support Bracket | BUCKSUP |

### Table 23 - Service Parts (not supplied with system)

| Description | Part Number |
|---|---|
| TANK Fire Suppression Service Kit (Individual Parts Below) | TANK Fire Suppression-S-Kit |
| Fitting 1/4” Male to Male Thread Union | U24 |
| Low-Loss Fitting 1/4” Straight Adapter Male to Female Thread | NABS |
| 1/4” Refrigerant Test Hose, 36" Long | NHD1436 |
| 1/4” Refrigerant Test Hose, 60" Long | NHD1460 |
| O-ring Replacement for 1/4” Refrigerant Test Hose | 19020 |
| Nitrogen Service Cylinder (Ships empty) | HP20 |
| Pressure Regulator | GEN450F |
| Inline Refrigerant Filter | C-032 |
| Digital Pressure Gauge | Varies |

**Notes**

## CLEANING AND MAINTENANCE RECORD

| Date | Service Performed |
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**As a result of our dedication to constant improvements and quality, the MANUFACTURER reserves the right to update specifications without notice. Please refer to MANUFACTURER'S website for up to date documentation.**

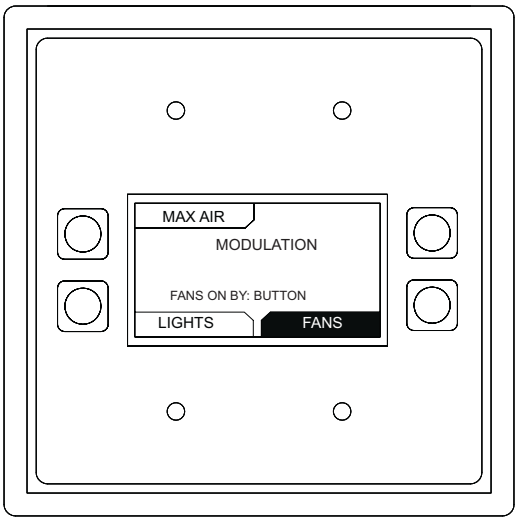
### Technical Support Information

CASLink

Technical Support

Parts Store

# Demand Control Ventilation System
# Installation, Operation, and Maintenance Manual




**RECEIVING AND INSPECTION**

**Upon receiving unit, check for any interior and exterior damage, and if found, report it immediately to the carrier. Check that all accessory items are accounted for and are damage free.**

**WARNING!**

**Installation of this equipment should only be performed by a qualified professional who has read and understands these instructions and is familiar with proper safety precautions. Improper installation poses serious risk of injury due to electric shock and other potential hazards. Read this manual thoroughly before installing or servicing this equipment. ALWAYS disconnect power prior to working on equipment.**

**Save these instructions**. This document is the property of the owner of this equipment and is required for future maintenance. Leave this document with the owner when installation or service is complete.

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## WARRANTY

This equipment is warranted to be free from defects in materials and workmanship, under normal use and service, for a period of 2-years from date of shipment. This warranty shall not apply if:

1. The equipment is not installed by a qualified installer per the MANUFACTURER'S installation instructions shipped with the product.
2. The equipment is not installed in accordance with Federal, State, and Local codes and regulations.
3. The equipment is misused or neglected, or not maintained per the MANUFACTURER'S maintenance instructions.
4. The equipment is not installed and operated within the limitations set forth in this manual.
5. The invoice is not paid within the terms of the sales agreement.

The MANUFACTURER shall not be liable for incidental and consequential losses and damages potentially attributable to malfunctioning equipment. Should any part of the equipment prove defective in material or workmanship within the 2-years warranty period, upon examination by the MANUFACTURER, such part will be repaired or replaced by MANUFACTURER at no charge. The BUYER shall pay all labor costs incurred in connection with such repair or replacement. Equipment shall not be returned without MANUFACTURER'S prior authorization, and all returned equipment shall be shipped by the BUYER, freight prepaid to a destination determined by the MANUFACTURER.

## Control Specifications

The control package may be ordered as a Demand Control Ventilation (DCV), Smart Control (SC), Mixed Demand Control Ventilation (M-DCV), or Residential Hood (Residential-Hood). These systems are designed to control, activate, and operate the exhaust fan(s), supply fan(s), CORE system(s), and wash system dependent on the HMI settings and temperature sensors. The system can have up to two zones that the fans are assigned to. Each fan zone has several parameters that communicate with the system on how to operate.

# INSTALLATION

It is imperative that this unit is installed and operated with the designed airflow and electrical supply in accordance with this manual and applicable codes. For warranty and technical support, refer to **“Technical Support Information” on page 84** for contact information.

## Mechanical

**WARNING: DO NOT LIFT CONTROL PANEL BY COMPONENT WIRING.**

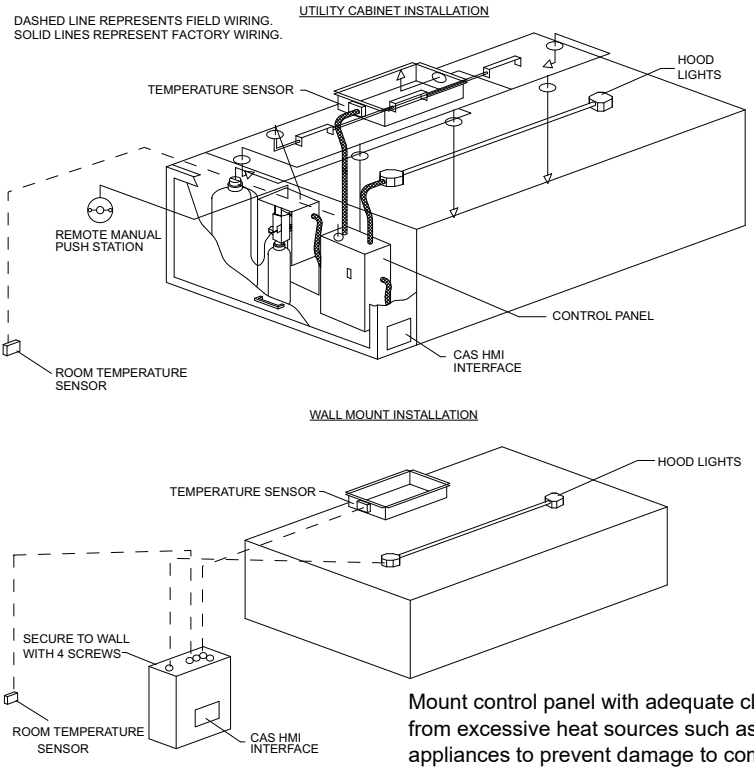
### Site Preparation

1. Provide clearance around installation site to safely install equipment into its final position. Supports must adequately support equipment.
2. Consider general service and installation space when locating unit.

### Assembly

When the control panel is ordered in a utility cabinet installed on the hood, there is some field assembly required by the installer. If the control panel is ordered as a wall-mounted panel, the enclosure must be secured to a fixed wall near the equipment. **Verify there is adequate clearance from excessive heat sources such as appliances to prevent damage to the components**. Check local and national electrical code(s) for clearance requirements in front of the panel, typically 36”. Refer to **Figure 1** for common installation scenarios.

**Figure 1 - Control Panel Mount Installations**




Mount control panel with adequate clearance from excessive heat sources such as appliances to prevent damage to components

# ELECTRICAL

**WARNING!!**

**Disconnect power before installing or servicing unit. High voltage electrical input is needed for this equipment. A qualified electrician should perform this work.**

Before connecting power to the package, read and understand the entire section of this document. As-built wiring diagrams are furnished with each unit by the factory. They are attached to the control module's door or provided with paperwork packet.

Electrical wiring (**Table 1**) and connections must be made in accordance with local ordinances and the National Electric Code, ANSI/NFPA 70. Verify the voltage and phase of the power supply, and the wire amperage capacity is in accordance with the unit nameplate. For additional safety information, refer to AMCA publication 410-96, *Recommended Safety Practices for Users and Installers of Industrial and Commercial Fans.*

**CAUTION!: When disconnecting power is required, do not touch the VFD or any associated components/wiring, as it has a capacitor and may store up to 600V. Wait 3 minutes before touching the VFD or any associated components/wiring.**

1. **Always disconnect power before working on or near this equipment. Lock and tag the disconnect switch and/or breaker to prevent accidental power-up**.
2. Verify that the power source is compatible with the requirements of your equipment. The nameplate identifies the **proper phase and voltage** of the equipment.
3. Before connecting the unit to the building's power source, verify that the power source wiring is de-energized.
4. Do not kink power cable. Secure the power cable to prevent contact with sharp objects.
5. Never allow the cable to encounter oil, grease, hot surfaces, or chemicals.
6. Before powering up the unit, verify that the fan rotates freely. Make sure that the interior of the unit is free of loose debris or shipping materials.
7. If any of the original wire supplied with the unit must be replaced, it must be replaced with type THHN wire or equivalent.
8. Electrically Commutated Motors (ECMs) and Variable Frequency Drives (VFDs) should not be powered through a Ground Fault Circuit Interrupter (GFCI) breaker/outlet. Unnecessary and intermittent tripping may occur.
9. **Exposed/bare wiring or electrical connections may cause damage to the equipment and personal injury.** Check for exposed/bare electrical connections. Secure loose wiring or exposed electrical connections. Replace any damaged electrical connections/wiring.

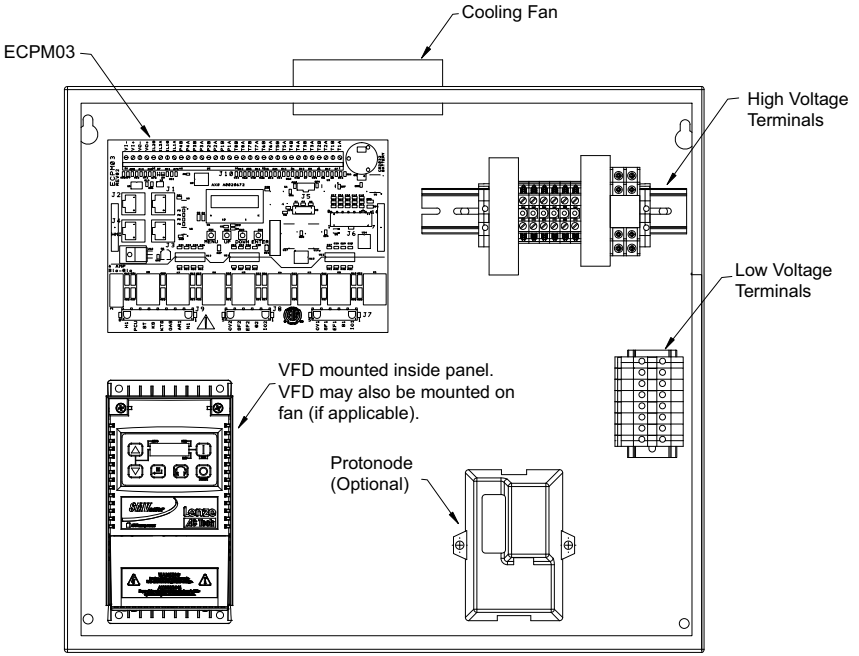
**Table 1 - Copper Wire Ampacity**

| Wire Size AWG | Maximum Amps | Wire Size AWG | Maximum Amps |
|---|---|---|---|
| 14 | 15 | 4 | 85 |
| 12 | 20 | 3 | 100 |
| 10 | 30 | 2 | 115 |
| 8 | 50 | 1 | 130 |
| 6 | 65 | | |

## High Voltage Wiring

- All high voltage wiring shall be connected on the open side of the vertical terminal blocks located on the right-hand side of the panel. The right side knockouts should be utilized for high voltage connections.
- Variable frequency drives will have quick connectors for their line and load power. The load wiring must not share conduit with other motor load wiring. Each motor must have its own conduit, or the warranty is void.
- There are multiple electrical power sources required for this control panel. Refer to installation diagrams inside the panel for details.
- The hood light wiring will also need to be wired to terminals, as indicated on the installation diagram.
- If an ANSUL fire system is present, the fire system micro-switch will need to be wired to terminals as indicated on the installation diagram, typically "**C1**" and "**AR1**". C1 is common and connects to terminal 1 on the micro-switch. AR1 is the armed state and connects to terminal 2 on the micro-switch.

**Figure 2 - Typical Cabinet Layout**



## Low Voltage Wiring

Low voltage wiring should be run through the left side knockouts on the panel. Do not route low voltage wiring in the same conduit as high voltage wiring. Low voltage wiring typically terminates directly on the control board or components.

- **Room Temperature Sensor(s)**: For all installations, at least 1 room temperature sensor must be installed in a safe location. Locate the sensor so that it is free from external heat sources that may affect the sensor readings. It should be indicative of the average room/space temperature and kept away from appliances or heat emitting equipment. 2-wire 18 AWG thermistor cable must be used. The room temperature sensor shall be wired according to the installation wiring schematic, terminals **T1A,** and **T1B**.
- **Temperature Sensors**: For all installations that include the thermostatically controlled option, temperature, or duct mounted sensors will need to be wired in the field. 2-wire 18 AWG plenum-rated thermistor cable must be used and is typically provided. The temperature sensor(s) should be wired to terminal block inputs designated as TxA and TxB. The “x” indicates the temperature input sensor number.
- **Wireless Mini Sensor Board (WMSB)**: For all installations, remote WMSB must be installed in a safe location. Locate the sensor(s) so that they are free from external heat sources that may affect the sensor readings. The solar cell requires 200 lumens per sq. foot or 20 foot candles. The location should be indicative of the average room temperature and relative humidity, and kept away from appliances. Refer to **“Ambient Lighting Requirements” on page 28**.
- **HMI**: The HMI is connected to the ECPM03 board through a **Cat 5** cable. The HMI has two RJ-45 connectors. The HMI connects to either port J4 or J5 (RJ-45) of the ECPM03 board. The other RJ-45 port of the HMI will typically be occupied by an RJ-45 end-of-line terminator. If more than one HMI is included, each HMI must be daisy-chained together to form a loop, with the end-of-line terminator installed at the last HMI. Up to 4 HMIs are possible.
- **VDC Output**: Provides a **0-10V DC** or **2-10V DC** signal to provide a linear representation of exhaust or supply motor speed and light dimming capabilities. This connection can be wired to a Variable Frequency Drive (VFD) that accepts 0-10V DC or 2-10V DC as an input. The 0-10V DC output is generated directly on the control board at terminals VO+ and VO-.
- **Motor Control Pulse Width Modulation (PWM) Outputs**: Provides a **24V DC** signal that can be used to drive an Electrically Commutated Motor (ECM) at a programmed duty cycle. The duty cycle determines the on and off time of a signal to the armature of the motor. PWM outputs should be wired with 18 AWG shielded twisted pair cable. PWM outputs are located at terminals PxA and PxB. These should be wired directly to the connector on the ECM fan motor harness.
- **MUA Interlock**: The Make-Up Air (MUA) interlock is to prove that the safety controls (freezestat, smoke detector, etc.) are satisfied, and the supply damper is open. The MUA safety connections should be wired in series to their zone-based interlock assignment. If the system is set to supply share static or supply share dynamic, the supply interlock will only be associated with **IL1A** and **IL1B**.
- **24V DC Relay Outputs**: Relay outputs are programmed for various different functions. RO1 and RO2 can be used to activate a lighting circuit corresponding to fan zone 1 and fan zone 2. RO3 can be used to give an indication that there is a fault on the board. RO4 and RO5 can be used to activate a relay when the fans are in a particular state (see Fan Status Relay 4/5 on **page 40**). RO6 is an indication of when either of the zones are on by modulation. In certain cases, RO6 is used to drive the cooling panel fan.

- **End-Of-Line Resistors**: Several end-of-line resistors are included in each panel. The purpose of the end-of-line resistor is to filter out reflections that can cause distortion to the source waveform. Be sure that the end-of-line is terminated to avoid network issues. They are typically plugged in at the factory on port J3 or port J4, or in the back of the first HMI. If another HMI or other equipment needs to connect to a port occupied by an end-of-line terminator, it should be removed and placed on the HMI or equipment that became connected at the end of the Modbus network.
- **Other**: If other pieces of equipment, such as a PCU Advanced Filter Monitoring (AFM) system, are connected to this panel, a **Cat 5** cable will be used to run the Modbus communication between these devices. The cable should be plugged in port J3 of the ECPM03 board. The end-of-line terminators should then be relocated from J3 to the last device on the line.

# VFD QUICK CONNECT WIRING

**CAUTION!: Improper installation poses serious risk of injury due to electric shock and other potential hazards. Read product manual(s) and wiring schematics thoroughly before installing or servicing equipment. ALWAYS disconnect power before working on equipment. Refer to "ELECTRICAL" on page 6 for more information.**

When wiring the VFD into the Electrical Control Package (ECP), the quick connectors will be shipped loose for installation. The LINE connectors will mount on the upper DIN rail, and the LOAD connectors will mount on the bottom DIN rail. Refer to **Figure 3**.

## Line Connections

The LINE connector uses two keys, both are located on the right side of the connector. The loose LINE connections will be made from the breaker panel.

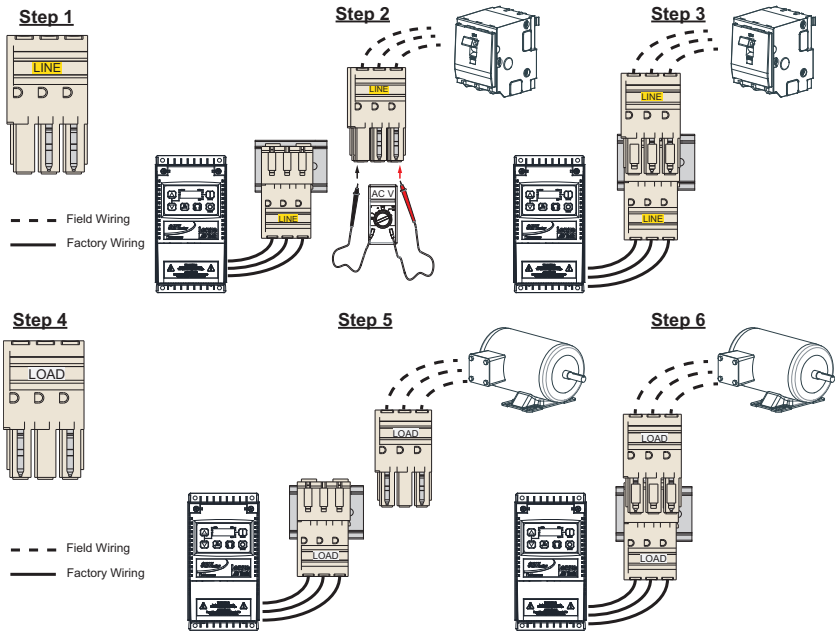
## Load Connections

The LOAD connector uses two keys, one on the left and the other on right side of the connector. The loose LOAD connections will be made from the motor.

### Installation

1. Locate the loose LINE connector(s).
2. Install wiring from the breaker to the loose LINE connector. Before making connections, verify the voltage at the LINE connector. **DO NOT CONNECT THE LINE CONNECTIONS UNTIL THE INCOMING VOLTAGE IS VERIFIED.**
3. Connect the LINE connections.
4. Locate the loose LOAD connector(s).
5. Install wiring from the motor to the loose LOAD connector. **DO NOT CONNECT THE LOAD CONNECTIONS UNTIL THE WIRING IS VERIFIED.**
6. Connect the LOAD connections.

**Figure 3 - Electrical Package VFD Connections**



## Variable Frequency Drive (VFD) Installation

**CAUTION!: Improper installation poses serious risk of injury due to electric shock and other potential hazards. Read product manual(s) and wiring schematics thoroughly before installing or servicing equipment. ALWAYS disconnect power before working on equipment. Refer to "ELECTRICAL" on page 6 for more information.**

Variable Frequency Drives (VFDs) change the speed of 3-phase motors by varying the frequency signal sent to the motor. Refer to the factory wiring schematics to determine which fans are controlled by VFDs. VFDs are referenced on the wiring schematics as SM-x. Two RJ-45 plugs are used to connect the drives to each other and to the ECPM03 control board through Cat 5 cables.

**The load wiring from variable frequency drives must be run in its own conduit. Each motor should not share load wiring conduit with any other motor covered by a variable frequency drive.**

### Input AC Power

- Circuit breakers feeding the VFDs are recommended to be thermal-magnetic and fast-acting. They should be sized based on the VFD amperage and according to **Table 3 on page 15**. Refer to the installation schematic for exact breaker sizing.
- Every VFD should receive power from its own breaker. If multiple VFDs are to be combined on the same breaker, each drive should have its own protection measure (fuses or miniature circuit breaker) downstream from the breaker.
- Input AC line wires should be routed in conduit from the breaker panel to the drives. AC input power to multiple VFDs can be run in a single conduit if needed. **Do not combine input and output power cables in the same conduit.**
- The VFD should be grounded on the terminal marked PE.
- A separate insulated ground wire must be provided to each VFD from the electrical panel. This will reduce the noise being radiated in other equipment.
- VFDs should not be powered through a Ground Fault Circuit Interrupter (GFCI) breaker/outlet. Unnecessary and intermittent tripping may occur.

**ATTENTION: Do not connect incoming AC power to output terminals U, V, W. Severe damage to the drive will result. Input power must always be wired to the input L terminal connections (L1, L2, L3).**

## VFD Output Power

- Motor wires from each VFD to its respective motor MUST be routed in a **separate steel** conduit away from control wiring and incoming AC power wiring. This is to avoid noise and crosstalk between drives. An insulated ground must be run from each VFD to its respective motor. Do not run different fan output power cables in the same conduit.
- VFD mounted in ECP: A load reactor should be used and sized accordingly when the distance between the VFD and motor is greater than specified below. The load reactor should be installed within 10 feet of the VFD output:
  - **208/230V** - Load reactor should be used when distance exceeds 250 feet.
  - **460/480V** - Load reactor should be used when distance exceeds 50 feet.
  - **575/600V** - Load reactor should be used when distance exceeds 25 feet.
- VFD mounted in fan: The load reactor should be sized accordingly when the VFD is mounted in the fan.
  - **208/230V** - Load reactor is optional but recommended for 15 HP and above motors.
  - **460/480V** - Load reactor is optional but recommended for 7.5 HP and above motors.
  - **575/600V** - Load reactors are required for all HP motors.
- If the distance between the VFD and the motor is extremely long, up to 1000 FT, a dV/dT filter should be used, and the VFD should be increased by 1 HP or to the next size VFD. The dV/dT filter should be sized accordingly and installed within 10 feet of the output of the VFD.
  - **208/230V** – dV/dT filter should be used when distance exceeds 400 feet.
  - **460/480V** – dV/dT filter should be used when distance exceeds 250 feet.
  - **575/600V** – dV/dT filter should be used when distance exceeds 150 feet.
- Do not install a contactor between the drive and the motor. Operating such a device while the drive is running can potentially cause damage to the power components of the drive.
- When a disconnect switch is installed between the drive and motor, the disconnect should only be operated when the drive is in a STOP state.

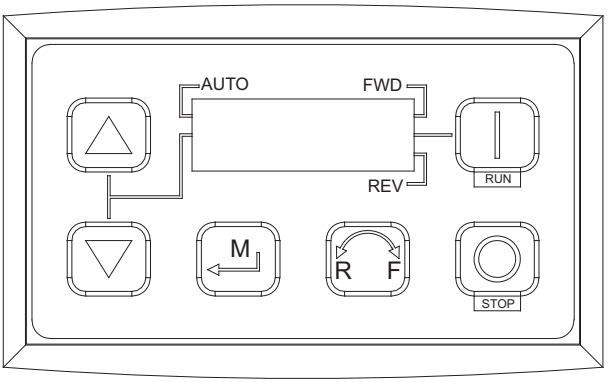
### Variable Frequency Drive Parameters

Variable frequency drive parameters can be changed with the buttons on the face of the drive. Only parameters P107 (line voltage selection) and P108 (motor overload) should be adjusted in the field, if needed. All other settings can be adjusted through the HMI.

To enter the PROGRAM mode to access the parameters:

1. Press the **Mode (M)** button.
2. The display will read “P100”. If prompted for a password (PASS), use the **Up** and **Down** buttons to scroll to the password value (the factory default password is “0225”) and press the **Mode (M)** button. Once the correct password is entered, the display will read “P100”, which indicates that the PROGRAM mode has been accessed at the beginning of the parameter menu.
3. Use the **Up** and **Down** buttons to scroll to the desired parameter number.
4. Once the desired parameter is found, press the **Mode (M)** button to display the present parameter setting. The parameter value will begin blinking, indicating that the present parameter setting is being displayed. The value of the parameter can be changed by using the **Up** and **Down** buttons.
5. Pressing the **Mode (M)** button will store the new setting and exit the PROGRAM mode. To change another parameter, press the **Mode (M)** button again to re-enter the PROGRAM mode. If the **Mode (M)** button is pressed within 1 minute of exiting the PROGRAM mode, the password is not required to access the parameters. After one minute, the password must be re-entered in order to access the parameters again.

**Figure 4 - VFD Screen**




- **P100** is how the user sets the VFD start control. The user may set this to 0 (default) and may use the **RUN** button to start the drive. Setting 4 allows the start control to be switched between a terminal strip and local keypad.
- **P102** is the minimum frequency setting based on motor and fan limitations.
- **P103** is the maximum frequency setting based on motor and fan limitations. The hertz cannot go below the minimum frequency (P102).
- **P107** is set to 0 (Low) if motor voltage is **120V AC**, **208V AC** or **400V AC**. P107 is set to 1 (High) if motor voltage is **230V AC**, **480V AC** or **575V AC**.
- **P108** is calculated as Motor FLA x 100 / Drive Output Rating available in **Table 3 on page 15**.
- **P167** is the rated motor frequency for standard applications. The base frequency default setting is 60 Hz.
- **P194** = Password 0225

- **P410** = Modbus Address of the VFD.
- **P500** parameter provides a history of the last 8 faults on the drive. It can be accessed without getting into PROGRAM mode.
- **P512** is for checking heat sink temperature.

**NOTE: P108 should not be adjusted unless the motor FLA does not match the nameplate FLA as specified in the field wiring schematics.**

Refer to **"VFD Fault List" on page 78** for common faults and troubleshooting guidance.

## VFD Drive Installation & Programming

**WARNING!!**

**Before installing the VFD drive, ensure the input power supply to the drive is OFF.**

**The power supply and motor wiring of the VFD must be completed by a qualified electrician.**

**The VFD is factory programmed, only change if replaced or ordered separately.**

**Not suitable for corner grounded 3 phase input power.** Consult the VFD manual and all documentation shipped with the unit for proper installation and wiring of the VFD. The VFD has been programmed by the factory with ordered specific parameters.

**Table 2 - VFD Installation Check List**

| Check Off | Description |
|---|---|
| | The installation environment conforms to the VFD manual. |
| | The drive is mounted securely. |
| | Space around the drive meets the drive's specification for cooling. |
| | The motor and driven equipment are ready to start. |
| | The drive is properly grounded. |
| | The input power voltage matches the drive's nominal input voltage. |
| | The input power connections at L1, L2, and L3 are connected and tight. |
| | The input power protection is installed. |
| | The motor power connection at U, V, and W are connected and tight. |
| | The input, motor, and control wiring are run in separate conduit runs. |
| | The control wiring is connected and tight. |
| | NO tools or foreign objects (such as drill shavings) are in the drive. |
| | NO alternative power source for the motor (such as a bypass connection) is connected - NO voltage is applied to the output of the drive. |

## ACTECH SMV VFD

**Table 3 - VFD Cross-Reference Table**

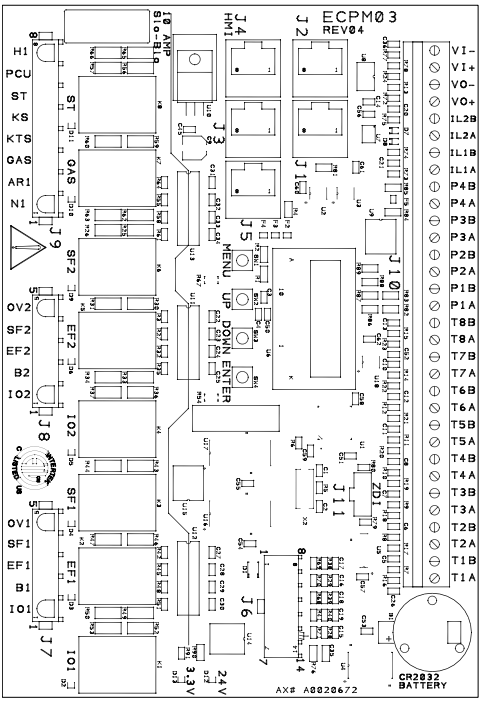
| HP | Part Number | Volts | 1Ø Input | 3Ø Input | Input Amps 1Ø | Input Amps 3Ø | Output Amps | Breaker 1Ø | Breaker 3Ø |
|---|---|---|---|---|---|---|---|---|---|
| 0.5 | ESV371N02YXB571 | 240V | X | X | 5.1 | 2.9 | 2.4 | 15 | 15 |
| 1 | ESV751N02YXB571 | 240V | X | X | 8.8 | 5 | 4.2 | 15 | 15 |
| 1.5 | ESV112N02YXB571 | 240V | X | X | 12 | 6.9 | 6 | 20 | 15 |
| 2 | ESV152N02YXB571 | 240V | X | X | 13.3 | 8.1 | 7 | 25 | 15 |
| 3 | ESV222N02YXB | 240V | X | X | 17.1 | 10.8 | 9.6 | 30 | 20 |
| 5 | ESV402N02TXB | 240V | - | X | - | 18.6 | 16.5 | - | 30 |
| 7.5 | ESV552N02TXB | 240V | - | X | - | 26 | 23 | - | 40 |
| 10 | ESV752N02TXB | 240V | - | X | - | 33 | 29 | - | 50 |
| 15 | ESV113N02TXB571 | 240V | - | X | - | 48 | 42 | - | 80 |
| 20 | ESV153N02TXB571 | 240V | - | X | - | 59 | 54 | - | 90 |
| | | | | | | | | | |
| 1 | ESV751N04TXB571 | 480V | - | X | - | 2.5 | 2.1 | - | 15 |
| 1.5 | ESV112N04TXB571 | 480V | - | X | - | 3.6 | 3 | - | 15 |
| 2 | ESV152N04TXB571 | 480V | - | X | - | 4.1 | 3.5 | - | 15 |
| 3 | ESV222N04TXB571 | 480V | - | X | - | 5.4 | 4.8 | - | 15 |
| 5 | ESV402N04TXB571 | 480V | - | X | - | 9.3 | 8.2 | - | 15 |
| 7.5 | ESV552N04TXB571 | 480V | - | X | - | 12.4 | 11 | - | 20 |
| 10 | ESV752N04TXB571 | 480V | - | X | - | 15.8 | 14 | - | 25 |
| 15 | ESV113N04TXB571 | 480V | - | X | - | 24 | 21 | - | 40 |
| 20 | ESV153N04TXB | 480V | - | X | - | 31 | 27 | - | 50 |
| 25 | ESV183N04TXB571 | 480V | - | X | - | 38 | 34 | - | 70 |
| 30 | ESV223N04TXB571 | 480V | - | X | - | 45 | 40 | - | 80 |
| | | | | | | | | | |
| 1 | ESV751N06TXB571 | 600V | - | X | - | 2 | 1.7 | - | 15 |
| 2 | ESV152N06TXB571 | 600V | - | X | - | 3.2 | 2.7 | - | 15 |
| 3 | ESV222N06TXB571 | 600V | - | X | - | 4.4 | 3.9 | - | 15 |
| 5 | ESV402N06TXB | 600V | - | X | - | 6.8 | 6.1 | - | 15 |
| 7.5 | ESV552N06TXB571 | 600V | - | X | - | 10.2 | 9 | - | 20 |
| 10 | ESV752N06TXB | 600V | - | X | - | 12.4 | 11 | - | 20 |
| 15 | ESV113N06TXB571 | 600V | - | X | - | 19.7 | 17 | - | 30 |
| 20 | ESV153N06TXB571 | 600V | - | X | - | 25 | 22 | - | 40 |
| 25 | ESV183N06TXB571 | 600V | - | X | - | 31 | 27 | - | 50 |
| 30 | ESV223N06TXB | 600V | - | X | - | 36 | 32 | - | 60 |

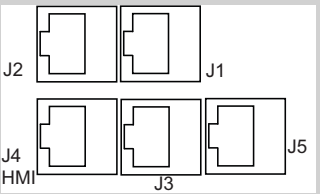
## ECPM03 Board

ECPM03 is the primary control of the system. It receives all digital and analog inputs, and delivers all digital outputs for external devices.

**NOTE: Not all pins or electrical features may be used with your electrical control package. Verify with wiring schematics and/or HMI settings.**

### Connector Descriptions



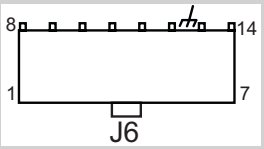

| RJ45 Connectors |  |
|---|---|



J1, J2 - Modbus master network connectors, feed through RJ45s, which conform to the Modbus pin-out for RS485 2 wire differential Modbus RTU standard. J1 and J2 are utilized for Comm Module and external BMS interface. No field wires should be connected to J1 or J2.

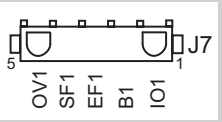
J3, J4, J5: Modbus slave network connectors feed through RJ45s, which conform to the Modbus pin-out for RS485 2 wire differential Modbus RTU standard. Modbus communication is not configured for third party integration without additional components. All network, PCU AFM, HMI, and VFDs report through J3, J4 and J5. The order of connection is irrelevant. See http://www.modbus.org

Connector J6 contains factory only wiring for low voltage connections



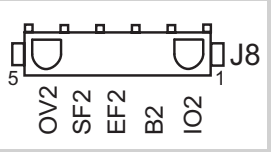

Pin 1 - **24V DC** power input (positive side) to the board.
Pin 2 through pin 7 - Each open collector relay output (RO) sources **100 mA** max and is suitable for driving **24V DC** relays or indicator lamps.
Pin 8 through pin 12 - **4-20 mA** current inputs. 150 Ohm impedance to **24V DC** ground pin 14.
Pin 13 - Chassis ground connection, this pin connects to the **24V DC** ground through a paralleled 1000pf **2000V** capacitor and a 100k Ohm 1/4W resistor.
Pin 14 - **24V DC** power input (negative side) to the board. Ground or common side of the low voltage circuitry.

Connector J7 contains **120V AC** control connector for factory only wiring



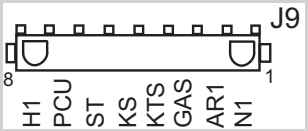

Pin 1 - (IO1) output and input can source **120V AC** and detect the presence of **120V AC**.
Pin 2 - (B1) input can detect the presence of **120V AC**.
Pin 3 - (EF1) output and input can source **120V AC** and detect the presence of **120V AC**.
Pin 4 - (SF1) output can source **120V AC**.
Pin 5 - (OV1) input can detect the presence of **120V AC**.

Connector J8 contains **120V AC** control connector for factory wiring




Pin 1 - (IO2) output and input can source **120V AC** and detect the presence of **120V AC.**
Pin 2 - (B2) input can detect the presence of **120V AC.**
Pin 3 - (EF2) output and input can source **120V AC** and detect the presence of **120V AC.**
Pin 4 - (SF2) output can source **120V AC.**
Pin 5 - (OV2) input can detect the presence of **120V AC.**

Connector J9 contains **120V AC** control connector for factory only wiring



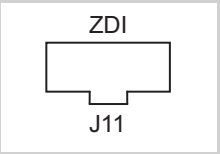

Pin 1 - (N1) is the neutral or return path for the detection of **120V AC** by the input pins. It would be connected to the neutral side of the **120V AC** supply.
Pin 2 - (AR1) input can detect the presence of **120V AC.**
Pin 3 - (GAS) output can source **120V AC.**
Pin 4 - (KTS) input can detect the presence of **120V AC.**
Pin 5 - (KS) output can source **120V AC.**
Pin 6 - (ST) output can source **120V AC.**
Pin 7 - (PCU) input can detect the presence of **120V AC.**
Pin 8 - (H1) is the **120V AC** 50/60Hz input to the board, it feeds through an on-board 10 Amp Slow-Blow fuse and is used to source **120V AC** to all the pins described as **120V AC** outputs. The total current draw of all the **120V AC** outputs must not exceed 10 Amps.

Connector J10 contains low voltage field wiring connections




Pin 1 through pin 16 - thermistor probe inputs. 10k type B thermistors are connected to these inputs.
Pin 17, 19, 21, 23, 25, and 27 - sources **24V DC** which is current limited through an onboard **200 mA** PTC Poly-Fuse. This is the high side of the pulse width modulated outputs, and low voltage inputs listed below.
Pin 18, 20, 22, and 24 - Open collector PWM outputs, **100 mA** max each. Suitable for driving the optoisolated PWM speed control inputs of EC motors.
Pin 26, 28 - low voltage inputs, suitable for detecting dry contact closures with pins 25, 27 above.
Pin 29 - **0-10V DC** output, **5 mA** max, suitable for driving instrumentation inputs.
Pin 30 - negative, common or ground side of the above **0-10V DC** output.
Pin 31 - **0-10V DC** input, 10k Ohm impedance to ground or common.
Pin 32 - negative, common or ground side of the above **0-10V DC** output.

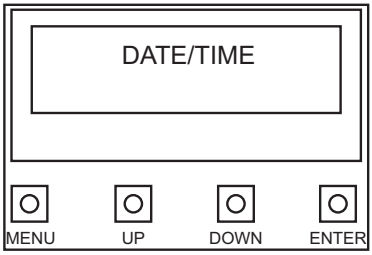
Connector J11 factory programming only, Zilog ZDI micro-controller debug/ programming interface




Pin 1 - **3.3V DC**
Pin 2 - reset
Pin 3 - Gnd
Pin 4 - DBG input
Pin 5 - Gnd
Pin 6 - NC

## ECPM03 LCD Screen

**Figure 5 - ECPM03 LCD Screen**




The ECPM03 board allows the user to monitor the system and configure a broad range of options associated with the functionality of the system.

The ECPM03 LCD (**Figure 5**) has 4 buttons for navigation: **MENU**, **UP**, **DOWN**, **ENTER**. When in configuration mode, the four buttons on the HMI will be labeled the same.

The **MENU** button typically takes moves up one level in the menu tree. The **ENTER** button moves down one level. The **UP** and **DOWN** buttons navigate through the same level of the menu tree and allows the user to change the value of a parameter.

**NOTE: A reboot of the board will cause the electric gas valve (if equipped) to shut off. Confirm that gas/pilot lights are re-lit if necessary. It will also cause the VFDs to stop if not in auto mode.**

The following parameters can be accessed through the ECPM03 board:

- Temperature - Allows the user to view all temperatures measured by the room, duct, and temperature sensors.
- Faults - Allows the user to “View Faults,” “Last Fire Info (**page 20**),” or “Clear Faults.”
- System Bypass - This option is designed to bypass the system and have the fans running at their max designed CFM. This function can be utilized for Test and Balance purposes. Starting from the main menu, press the **DOWN** button until the screen displays “System Bypass.” Press the **ENTER** button. Press the **UP** or **DOWN** buttons to activate or deactivate system bypass. Press enter to save the selection.
- Fan Monitoring and Motor Amps - Starting from the main menu, press the **DOWN** button until the screen displays “Fan Monitoring.” Press the **ENTER** button. Press the **UP** and **DOWN** buttons to alternate between “Fan Frequencies” and “Motor Amps.” Press **ENTER** for either one to view “Frequency” of each VFD or amps drawn by the motor on each fan.

**NOTE: Fans controlled by contactors or via PWM output will not have an amp or frequency value.**

- Proving Calibration - When proving is enabled, Calibration is required at start-up. To perform the calibration procedure, make sure a Test and Balance has been performed on the entire system first. Filters should be in place.
  - Starting from the main menu, press **DOWN** until the screen displays “Calibration.” Press **ENTER**. The screen should display “Proving Calib. Calibrate?” Press **ENTER** again to start the calibration process, the calibration takes approximately 2 minutes and 30 seconds.
  - Press **MENU** one time when calibration is complete. If calibration is unsuccessful, the message “Calibration Fail” will appear. Verify the VFDs are running, current sensor assignments are properly set to the Electronically Commutated Motor(s) (ECM), zones, and contactors. Check that the Make-Up Air (MUA) interlock signals are wired correctly to terminal pins ILxA and ILxB.

## Changing Time Zone ID

Use the ECPM03 board menu to change the time zone (**Figure 6**).

- Use the **UP** or **DOWN** buttons to scroll to the “Date/Time” menu. Press **ENTER**.
- The current time zone parameter is shown. Press **UP** or **DOWN**.
- “Change Time Zone?” is now displayed. Press **ENTER**.
- Scroll until the correct time zone is found.

The “Offset” parameter is based on Universal Coordinated Time (UTC). Time zones that observe Daylight Savings Time (DST) are programmed to follow this schedule. Time zones that do not observe DST, are programmed to follow their standard time setting.

The most common time zones used are:

ID: 3 (UTC -10:00) Hawaii Time – (DST - No)

ID: 4 (UTC -09:00) Alaskan Time – (DST - Yes)

ID: 6 (UTC -08:00) Pacific Time – US & Canada (DST - Yes)

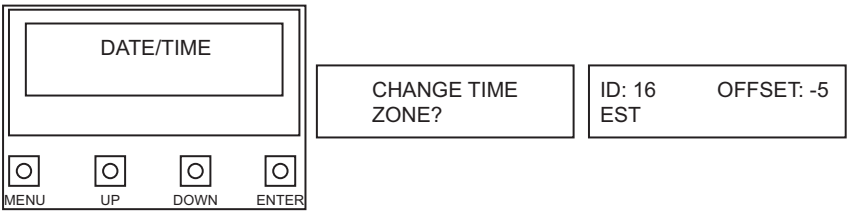
ID: 7 (UTC -07:00) Mountain Time – Arizona (DST - No)

ID: 9 (UTC -07:00) Mountain Time – US & Canada (DST - Yes)

ID: 11 (UTC -06:00) Central Time – US & Canada (DST - Yes)

ID: 16 (UTC -05:00) Eastern Time – US & Canada (DST - Yes)

**Figure 6 - Time Zone**




## Last Fire Info

When viewing information from the “Last Fire Info” screen, the user may see the following:

- Date of when the fire activation occurred.
- Time of when the fire activation occurred.
- If the activation occurred through manual activation or a firestat.
- If the system was in Test or Armed mode when the activation occurred.
- Up to 32 temperature sensor readings are displayed on the ECPM03 board. If a temperature sensor is not connected, N/A will be displayed.

To cycle through the menus, press up once to view activation and mode status. Press up again to view temperature readings.

## Components

### HMI

The HMI (**Figure 7**) is designed to withstand grease and water. The main HMI is normally installed on the face of the hood or utility cabinet. HMIs have a built-in temperature sensor, which is typically used to help monitor or control the automatic functions of the unit. The HMI can be ordered to have a humidity sensor option. If this option is present, the system can display humidity readings. This option should be placed in a location where there are no cooking operations to obtain an accurate humidity reading. **Do not mount an HMI used for humidity readings onto the hood.**

The interface is connected to the ECPM03 through a Cat 5 cable. If the interface is installed on the face of the hood, a high-temperature Cat 5 cable is used.

The HMI can be mounted to a standard 2-gang junction box. Do not use junction boxes with rounded corners.

If the HMI is not attached to the hood, the HMI can be used as a room temperature sensor for a fan zone. If the HMI is used as a temperature sensor, do not mount the HMI on the hood to avoid false temperature readings. It is suggested that the HMI be mounted in a wall-mounted gang box away from external heat sources.

### Room Temperature Sensor

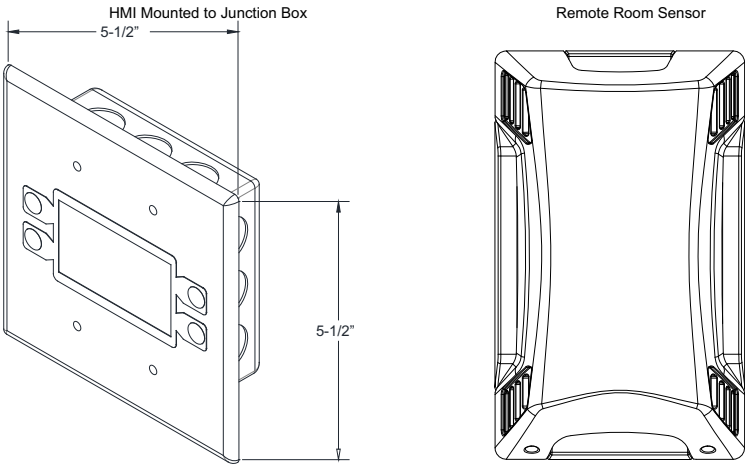
The Room Temperature Sensor (**Figure 7**) is a 10K ohm type-2 thermistor. The sensor provides room temperature reading to the control board. The sensor should be installed on a wall within the space but not directly under the hood or close to an appliance. Sensor readings may be affected by heat.

Typically, a system will have one room temperature sensor. However, systems configured with 2 fan zones have the option to be ordered with 2 room temperature sensors, one for each zone. They should be mounted in the space accordingly.

**Do not install the sensor on the ceiling or at a location that will not be an accurate representation of the ambient room temperature.**

If using a Wireless Mini Sensor Board (WMSB), refer to **“Wireless Mini Sensor Board (WMSB)” on page 24**.

**Figure 7 - HMI and Remote Room Sensor**



**Temperature Sensor**

The temperature sensor (**Figure 8**) is a 10K ohm thermistor. The sensor gives constant feedback to the control board. One sensor is installed in every exhaust riser for packages, which include the thermostatically controlled fan option.

There can be a maximum of 32 sensors in the system (including the room temperature sensors). Only a maximum of 8 sensors can be connected to the ECPM03 board, normally one room-temperature sensor and then other temperature sensors. If more temperature sensors are needed, an ECPM03EX board will need to be installed. Each ECPM03EX board can connect up to 8 additional temperature sensors.

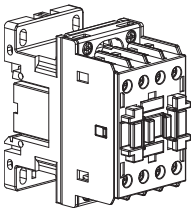
**Figure 8 - Temperature Sensor**



**Contactor(s)**

**Figure 9 - Contactors**

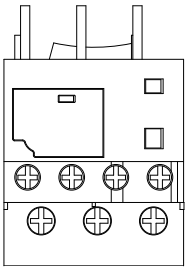
A contactor (**Figure 9**) is an electrically controlled switch used for controlling the flow of electricity to an electrical circuit. These can be used to control electric motors, lights, and other electrical loads.



**Overloads**

**Figure 10 - Overload Relay**

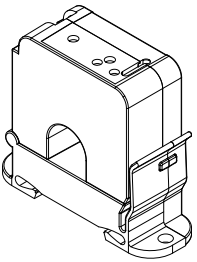
Overload relays (**Figure 10**) are devices that are generally connected to a contactor. These relays will actuate a set of contacts if a high current draw is detected on the power flowing through the contactor. They are required for all 3-phase motor applications, and all single phase motor applications 2 HP and above. Terminals 97 and 98 provide normally open connections, and 95 and 96 provide normally closed connections. These terminals will activate when the overload circuit is tripped.



**Current Sensor**

**Figure 11 - Current Sensor**

The current sensor (**Figure 11**) is used to convert the amperage reading from the load to a 4-20mA signal. This signal is used for proving applications of Electronically Controlled Motors (ECM) and contactor controlled motors. Current sensors are only required for non-VFD equipped fans.

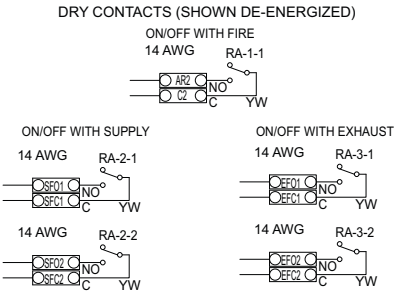


### Dry Contacts

Dry contacts (**Figure 12**) are used to provide normally open or normally closed points of wiring when the relay is activated.

Depending on which options are included with the panel, it may be configured with dry contacts that turn ON/OFF with FIRE, ON/OFF with SUPPLY FAN, ON/OFF with EXHAUST FAN. There will be at least two contacts (a single relay) for single zone, or up to four contacts (two relays) for two zones.

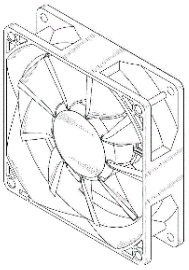
**Figure 12 - Dry Contacts Wiring Reference**




### Cooling Panel Fan

If the package is supplied with a VFD, there will be a cooling panel fan (**Figure 13**) mounted in the electrical control enclosure. When the VFD is running, the cooling fan will be activated. The cooling panel fan will be connected to EF1 if there is one zone. If there are two zones, then the fan will run off of a **24V DC** relay driven by RO6. The cooling panel fan will be connected with **120V AC** using the normally open dry contacts.

**Figure 13 - Cooling Fan**



## Wireless Mini Sensor Board (WMSB)

The Wireless Mini Sensor Board (**Figure 14**) is used in conjunction with Electrical Control Packages (ECPs). The WMSB is designed to replace room temperature sensors that are installed in areas that are unable to obtain proper room temperature/relative humidity/ barometric pressure readings. A significant benefit to using the WMSB is that it is wireless and can be installed in any location in a room to obtain proper connection to ensure the package receives room temperature/relative humidity/barometric pressure readings.

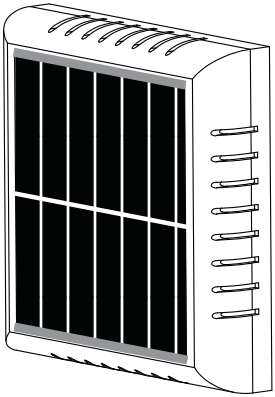
Before installing, find the best location where the sensor can obtain accurate readings for room temperature/relative humidity/barometric pressure. The sensor can communicate overall room temperature/relative humidity/barometric pressure readings to multiple control boards via Bluetooth connectivity.

The photovoltaic solar panel and rechargeable lithium-ion battery located behind the solar panel cover provides continual power and extended battery life to the sensor. The sensor's solar panel must be located in an area where there is bright light, without any impedance to lighting.

Installing the WMSB eliminates the need for a wired thermistor connection back to the ECP. This allows the sensor to be moved and installed anywhere in the space where it can obtain proper room temperature/relative humidity/barometric pressure readings.

**NOTE: The battery for the sensor is not connected at the factory. This connection must be completed in the field prior to installing on the wall. Refer to Figure 15 on page 25 for connection locations.**

**Figure 14 - Wireless Mini Sensor Board**



## Board Description

Connectors J2 and J3 are the Modbus connections to connect the WMSB to other control boards.

Connector J4 is a 5-pin connector. This connector is divided into two sections. One side of the connector contains analog inputs (24V DC, 0-10V, and a common contact). The other side has temperature input connections (TH, and a common contact).

- 24V DC is the output to power the sensor.
- 0-10V is the input to connect third-party sensors.
- COM is the common (negative) for 24V DC and 0-10V connections.
- TH is the connection for additional thermistor(s) to be connected in the field.
- COM is the common (negative) contact connection.

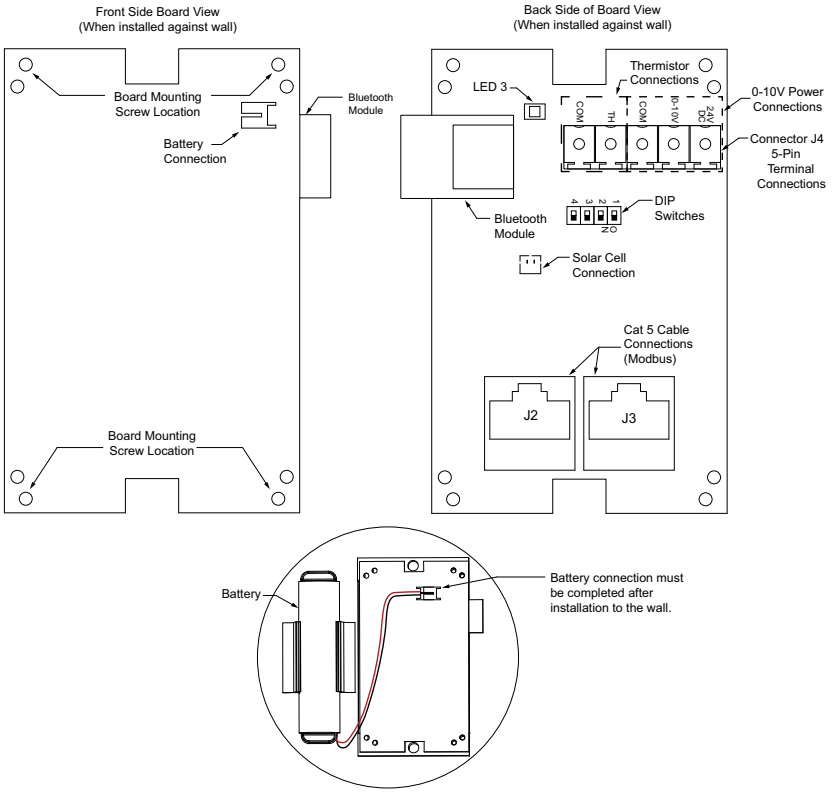
The P1 (solar cell) connection is located on the backside of the board.

The P2 (battery) connection is located on the front side of the board when installed against a wall. The battery must be connected to the board in the field.

The DIP switches are used to configure the board as a Base or Remote. No pairing is required between the base and the remote units. All configurations are based on the DIP switch settings. Refer to **“Modes of Operation” on page 26** for more information.

- 1111 is used for Base units.
- 0000 through 1110 is used to configure Remote units.

**Figure 15 - WMSB Connections**



## Modes of Operation

There are two modes of operation the WMSB board contains. One is the Base Mode, and the other is the Remote. Each zone can have up to five sensors. For example, DCV packages only use two zones. Therefore, a max of 10 sensors will be used with the system. **DIP Switch Group 1 will be assigned to Zone 1 and DIP Switch Group 2 will be assigned to Zone 2**.

The WMSB Remote will send temperature, relative humidity, and barometric pressure readings to the WMSB Base every transmission rate duration. The WMSB Remote will record a temperature reading every "wake up time" duration. If the temperature reading is 2°F higher or lower than then last temperature reading, it will instantly send the new temperature, relative humidity, and barometric pressure readings to the WMSB Base.

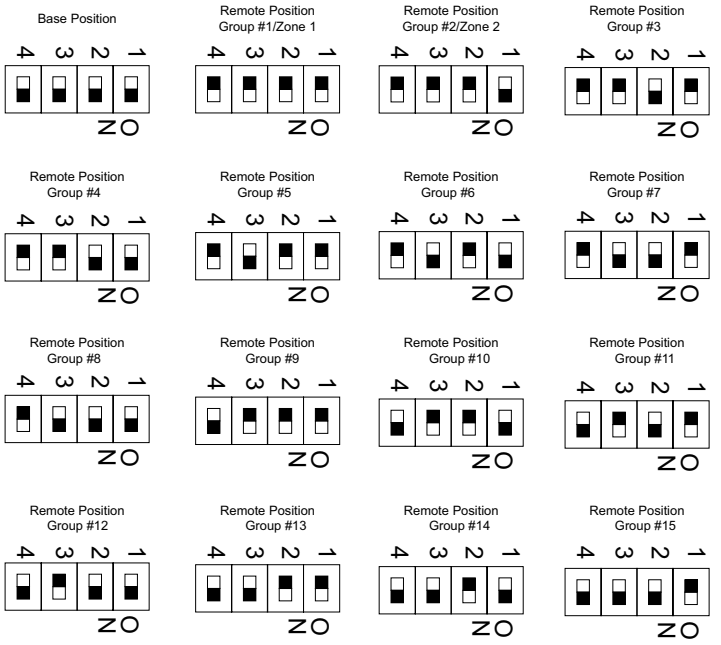
**Base Mode** - In base operation mode, the WMSB acts as a data collector and communicates to all the remote boards to collect the temperature and relative humidity (RH) readings. The base unit must be powered using 24V DC connections. It can utilize power over a Modbus (Cat 5) connection or hardwired 24V DC power line. The base module sensor should be connected to the Modbus master board using Cat 5.

**Remote** - In remote operation mode, the WMSB board acts as a data transmitter. It can transmit temperature and relative humidity (RH) information periodically to all base modules.

**Figure 16** shows the difference in DIP switch settings. When all the switches are ON (black boxes), the sensor is set to Base. Any combination of switches other than all set to ON, the unit will be configured as Remote.

**NOTE: When the rechargeable battery is connected to the sensor, LED 3 will light up for one second. This determines that the WMSB is working and ready to send data via Bluetooth connection.**

**Figure 16 - DIP Switch Settings**



## WMSB Installation

Install the sensor in an area where it can obtain accurate room temperature/relative humidity/barometric pressure, and the solar panel will receive sufficient bright light. Keep objects away from the solar panel so as not to impede any light required to keep the sensor's battery charged. Verify the sensor is within 10-15 feet of the electrical control package.

**Avoid mounting the sensor in the following locations**:

- Where the sensor will be in direct sunlight.
- Near heat emitting from appliances under the hood or warming stations.
- Near diffusers/PSP where the sensor may be influenced by cold or hot air streams.

**Best mounting locations for the sensor**:

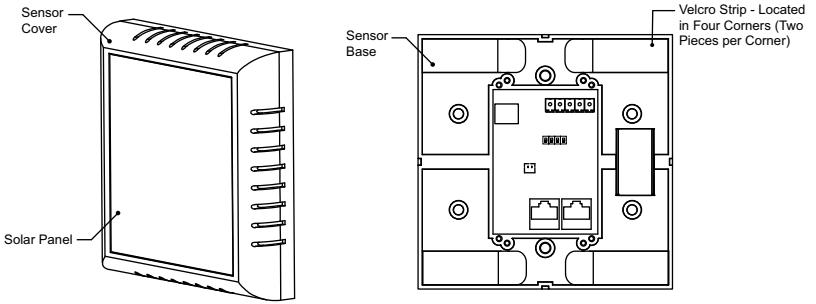
- On a wall near a return duct, if possible.
- A location that will provide an accurate representation of the average room temperature/relative humidity/barometric pressure.

The primary installation options are using provided wall adhesion strips or electrical J-boxes (single or double). Refer to **Figure 19 on page 28** for proper installation examples. Refer to **Figure 20 on page 28** for improper installations.

### Wall Installation

When using the provided adhesion strips (**Figure 17**), located on the backside of the sensor base. Clean the wall from any debris, grease, or dirt. Find a suitable location for the sensor, and perform a mock fitment for installation. Remove the top and bottom adhesion strips to install sensor to the wall.

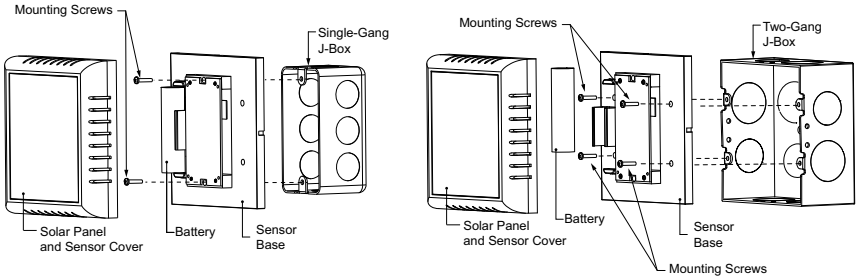
**Figure 17 - Adhesion Strip Installation Details**




### J-Box Installation

When using J-boxes (**Figure 18**) to install into a wall, do not install the WMSB close to high-power (110V AC or higher) wiring or components. Locate the best area for sensor.

**Figure 18 - J-Box Installation Details**



## Ambient Lighting Requirements

Lighting conditions for optimum operation of the solar cell is 200 lumens per sq. foot or 20 foot candles.

**Figure 19 - Proper Installations**

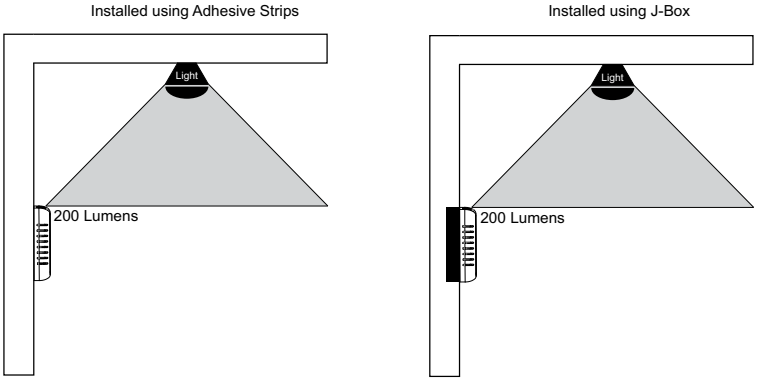
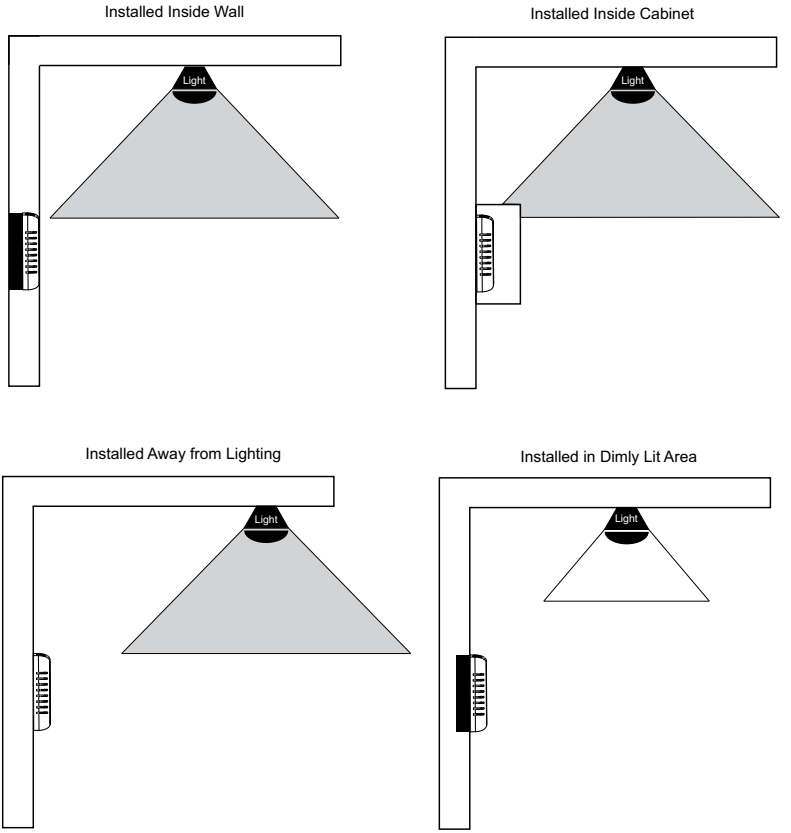



**Figure 20 - Improper Installations**



## DCV Room Temperature Logic

**Table 4 - Room Temperature Logic**

| WMSB | Wired Sensor | HMI Sensor | Average Value |
|---|---|---|---|
| X | X | X | All Sensor Avg. |
| X | X | - | Two Sensors Avg. |
| X | - | X | Two Sensors Avg. |
| - | X | X | Two Sensors Avg. |
| X | - | - | One Sensor Avg. |
|  | X | - | One Sensor Avg. |
| - | - | X | One Sensor Avg. |
| - | - | - | Preset Room Temp |

The DCV will dynamically adjust all the valid readings and ignore the invalid or missing readings. If all reading are invalid, the DCV will revert to Preset Room Temp values.

## Electronically Commutated Motor Speed Control

For packages that use the PWM 0-10V Board, see **page 72**.

ECMs should not be powered through a Ground Fault Circuit Interrupter (GFCI) breaker/ outlet. Unnecessary and intermittent tripping may occur.

External PWM Signal

The ECPM03 board contains four PWM outputs, which can be used to control the speed of an Electrically Commutated Motor (ECM). These PWM outputs are located at connector J10 pins P1A/B, P2A/B, P3A/B, and P4A/B. The PWM signal is a 24V DC output signal that sends a duty cycle pulse. This duty cycle is the percentage of time a digital signal is on during an interval or period of time. This is used to control the speed of the ECM.

Adjusting Job Parameters

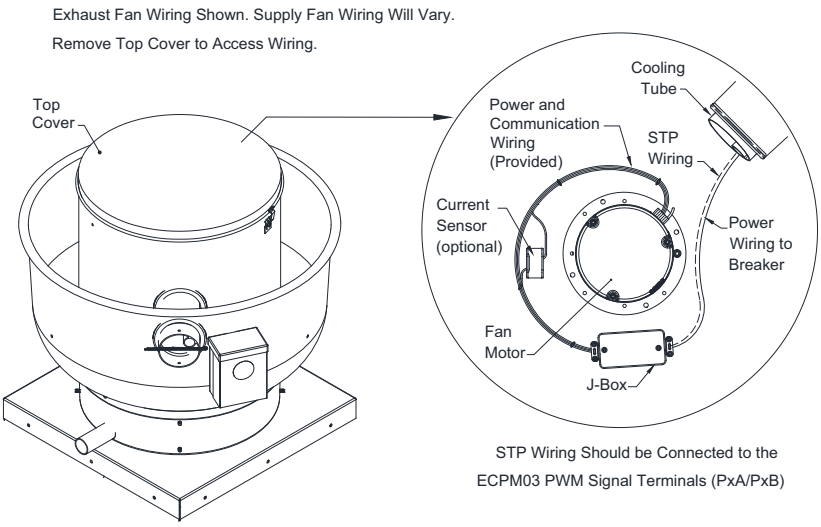
The ECM High Speed, ECM Low Speed, ECM CFM can be changed and accessed from the HMI to adjust the operating speed of the ECM. For more information and how to access the parameters, refer to **“Motor Control” on page 42**.

ECM Installation Instructions

It is recommended to use Shielded Twisted Pair (STP) wire for the communication wiring of the signal from the ECPM03 board’s PWM signal connection (PxA and PxB) to the input speed control of the ECM. PxA references the positive signal, and PxB references the negative signal. If using a different type of wiring, the wire should be rated for outdoor weather conditions, sunlight resistant, and operate within a temperature range to withstand minimum and maximum ambient temperatures of the job site. If the ECM requires proving, a current sensor is used to monitor the amperage of the motor load. Separate wiring (preferably STP) should be used to run the 4-20 mA signal from the current sensor to the ECPM03 board. Power wiring from the breaker is directly fed to the fan and does not need to run through the Electrical Control Package (ECP). The fan unit will be shipped with power wiring and communication wiring fed to an internal junction box (J-Box). The fan is shipped with STP wire, which is used for wiring to a remote PWM signal. Power the unit off. Remove top cover from the fan. Remove J-Box cover to access wiring connections. Refer to **Figure 21 on page 30**.

- The STP wire is connected to the communication wiring of the motor using wire nuts in the junction box. If a preset length of STP is provided, it will be connected to wiring located in the junction box from the factory.
- If wiring is not connected from the factory, connect the red wire to the positive PWM signal and the black wire to the negative PWM signal. Reference schematics for all wiring connections (PxA and PxB).
- Run STP wiring through the cooling tube, and along with the power wiring of the fan. Secure the two together with zip ties. Ensure there is enough slack for the fan to hinge open and close freely.

**Figure 21 - ECM Fan Wiring**



## Motor Speed Controller (MSC) Installation

The Motor Speed Controller (MSC) is a versatile device able to output various signal types to many different Electrically Commutated Motors (ECMs). The MSC signal output types can be selected under the 'Motor Type' section of the MSC menu. The MSC may be installed in a fan, remotely in a kitchen space, or in a mechanical room. While this device can be mounted remotely and powered using 24V, it may also be mounted with the fan where it will be exposed to higher voltages. If installed in the fan, the electrical installation must be carried out according to the appropriate regulations (e.g., cable cross-sections, circuit breaker, protective earth [PE] connection). National and local codes must be followed during the installation process.

The MSC board may be powered through a 120VAC/24VAC CLASS 2 transformer, 120V AC/24V DC CLASS 2 power supply, or through MODBUS connections.

The MSC contains static sensitive components. Therefore, you must handle with care to avoid damage to these components. All operations concerning installation, commissioning, and maintenance must be carried out by qualified, skilled personnel who are familiar with the installation, assembly, commissioning, and operation of the electronic board and the application for which it is being used.

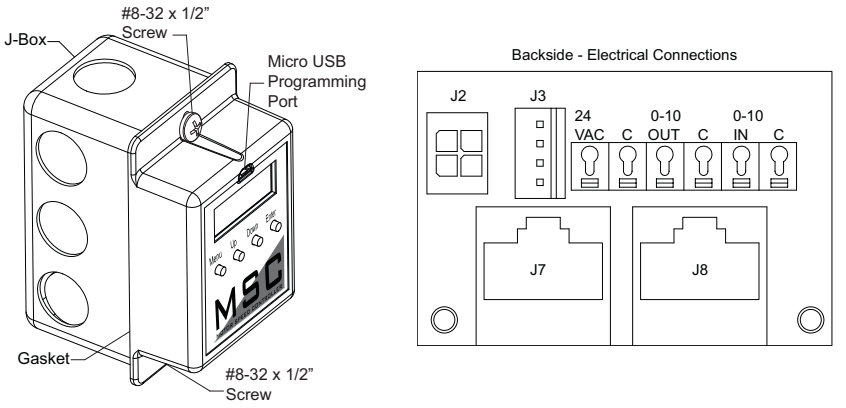
Ensure proper handling and avoid excessive mechanical stress. Do not bend any components when handling or installing component. **Do not touch any electronic components or contacts**.

**Precautions must be adhered to during installation, testing, servicing, and repairing of this board. Component damage may result if proper procedures are not followed.**

Do not install the MSC where it is subjected to adverse environmental conditions such as combustibles, oils, hazardous vapors, corrosive chemicals, excessive dust, moisture, direct sunlight, or extreme temperatures. When removing or installing the MSC to the j-box, verify the gasket is present. All electrical connections for the MSC are located on the backside of the controller. Refer to **Figure 22** for details on installation and electrical connections. When the micro-USB programming port is not in use, place the weather-seal plug into the port location.

**NOTE: The MSC can be daisy-chained to VFDs. Each component must have a unique Modbus address for proper operation.**

**Figure 22 - Installation/Electrical Connections**



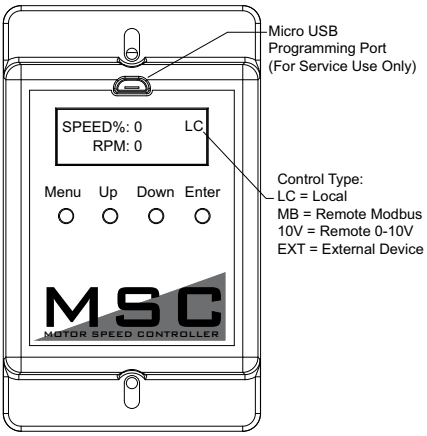
## MSC Controller Overview

There are four buttons to navigate through the menu screens, refer to **Figure 23**.

Press the **MENU** button to access menu settings/parameters, pressing **MENU** will also back out of the current menu screen. To scroll through menus, use **UP** and **DOWN** buttons. Press the **ENTER** button to change setting/parameter selection.

To enter password, press MENU, then press **ENTER** when 'Board Config' is displayed. Use **UP** and **DOWN** to scroll through numbers, press **ENTER** to advance to the next numerical setting. To save changes, press **MENU** until the screen displays 'SAVE CHANGES? [ENTER] TO SAVE.' Press the ENTER button to save changes.

**Figure 23 - MSC Front Detail View**



### MSC Menu

**Board Config** - Password (default is 0225)

- **Motor Type** - User may change motor type between Nidec, Telco 42, Telco 48, Ziehl, 0-10V, Other.
- **Control Type** - This setting adjusts how the fan will be controlled.
  - **Local** - The fan will be controlled by the MSC.
  - **Remote Modbus** - The fan will be controlled by another master board through the MSC. A connection between the 0-10V Out to 0-10V In must be made for start command.
  - **Remote 0-10V** - The fan will be controlled by an external 0-10V signal.
- **Speed Settings** - Provides access to speed and voltage settings.
  - **Low Speed** - Adjustable speed from 20% up to high speed setting, or 0-10V. Setting cannot go above High Speed parameter.
  - **High Speed** - Adjustable speed from 100% down to low speed setting, or 10-0V. Setting cannot go below Low Speed parameter.
  - **Set Speed%** - Adjustable speed range is dependent on Low Speed and High Speed settings. This controls the output of the motor.
  - **Voltage Range** - Only available when Motor Type 'OTHER' is selected. Default setting is 24V. Other available voltages are 5V and 10V.
- **Modbus #** - Adjustable Modbus ID. Exhaust Fan range 11 through 18, Supply Fan range 21 or 22. **A VFD and MSC cannot use the same Modbus #**.
- **Options**
  - **Feedback Fault** - If set to ENABLED, the MSC will monitor RPM feedback. If the MSC does not receive data for 30 seconds or 70% of the expected RPM, this fault will be displayed. **Ziehl motors do not provide feedback.**
  - **2 Speed** - The 0-10V output cannot be used when the 2 Speed or Manual Speed options are On, or if the 'Control Type' is set to Modbus. When the 0-10V OUT and 0-10V IN terminals are **not** jumped together, the fan will operate at low speed. When 0-10V OUT and 0-10V IN terminals are jumped together, the fan will operate at high speed.
  - **Analog Speed** - The user may enable/disable the option, and calibrate a potentiometer for proper operation that is connected between the 0-10V OUT and 0-10V IN terminals. When enabled, you must calibrate the potentiometer. Follow the MSC's on-screen instructions. The speed will be adjustable between 0V (low speed) to 10V (high speed).
  - **Input Threshold** - When control type is set to Remote 0-10V, an input threshold will be created for motor control. Refer to **Figure 24 on page 35** for threshold examples.
    - **Zero Operation** - The user may select how the motor will operate when the 0-10V input is at 0V. The options will be Off or Low Speed (default).
    - **Threshold** - Increasing the threshold value will allow for the device to hold its voltage/RPM output while the input is between the 0 - threshold value.
- **Restore Settings** - Provides access to restore factory settings, and test & balance settings.
  - **Factory Settings** - This will reset all values back to factory settings.
  - **T & B Settings** - This will reset all values back to last saved test & balance settings.
- **Change Password** - Users may update the password setting to their own preference. Password 0225 will also be stored for backup. Both passwords will allow users to enter 'Board Config' settings.

**Software Version** - Displays the current software version installed on the board.
**Faults** - This provides access to ‘Fault History,’ ‘Fault Totals,’ and ‘Clear Faults.’

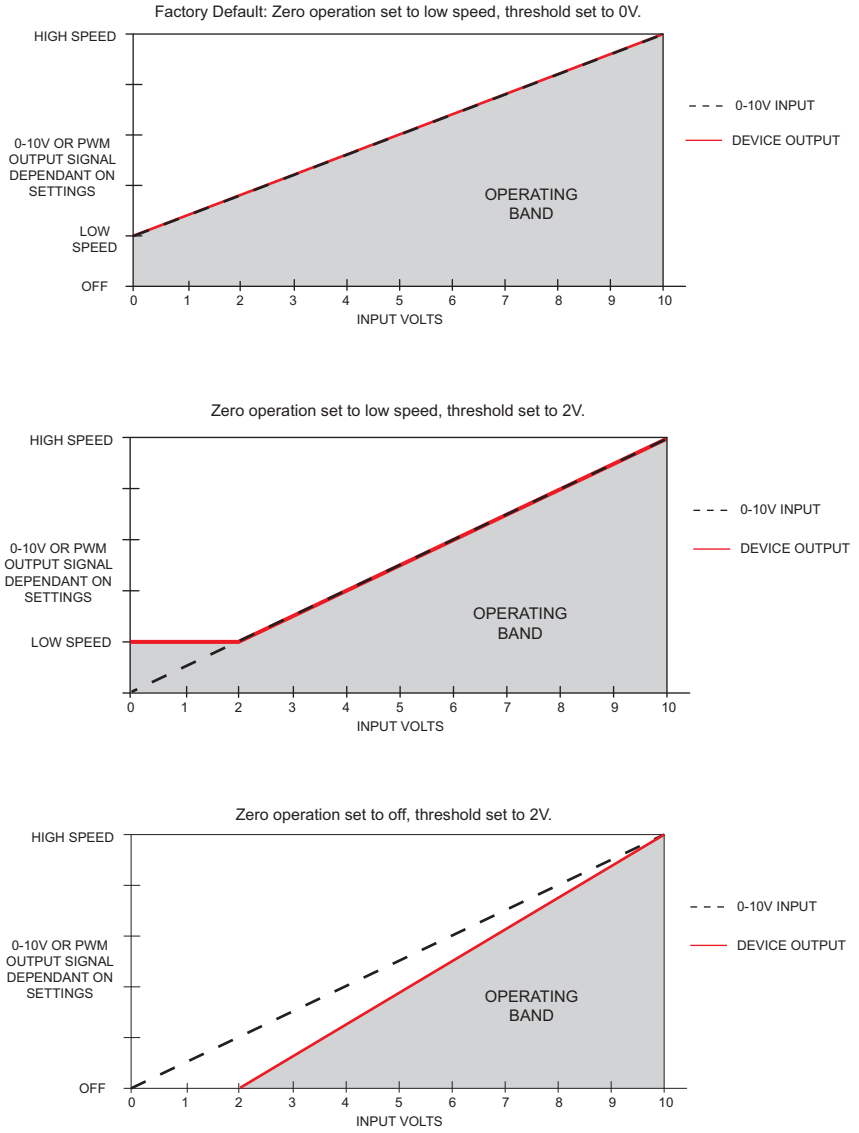
- **Fault History** - Displays fault history and board reboots in chronological order. Possible displayed faults are:
  - **No Faults** - There are no active faults with the system.
  - **Feedback Fault** - Only displayed for motors with feedback capabilities.
  - **Reboot** - Any time the fan goes from OFF to ON, this “fault” will be logged. This fault will only display in ‘Fault History.’
  - **Modbus** - Issue with Modbus communication between the MSC and master board.
  - **Variable Device Fault** - When ‘Analog Speed’ is selected and a potentiometer is connected, if the voltage drops below 1V, this fault will be displayed.
- **Fault Totals** - Displays the number of faults for Modbus, Feedback, Var Device, Reboot, and Total Faults.
- **Clear Faults** - Users may clear all faults from the board.

**Service** - This provides access to service settings. Password: 1234

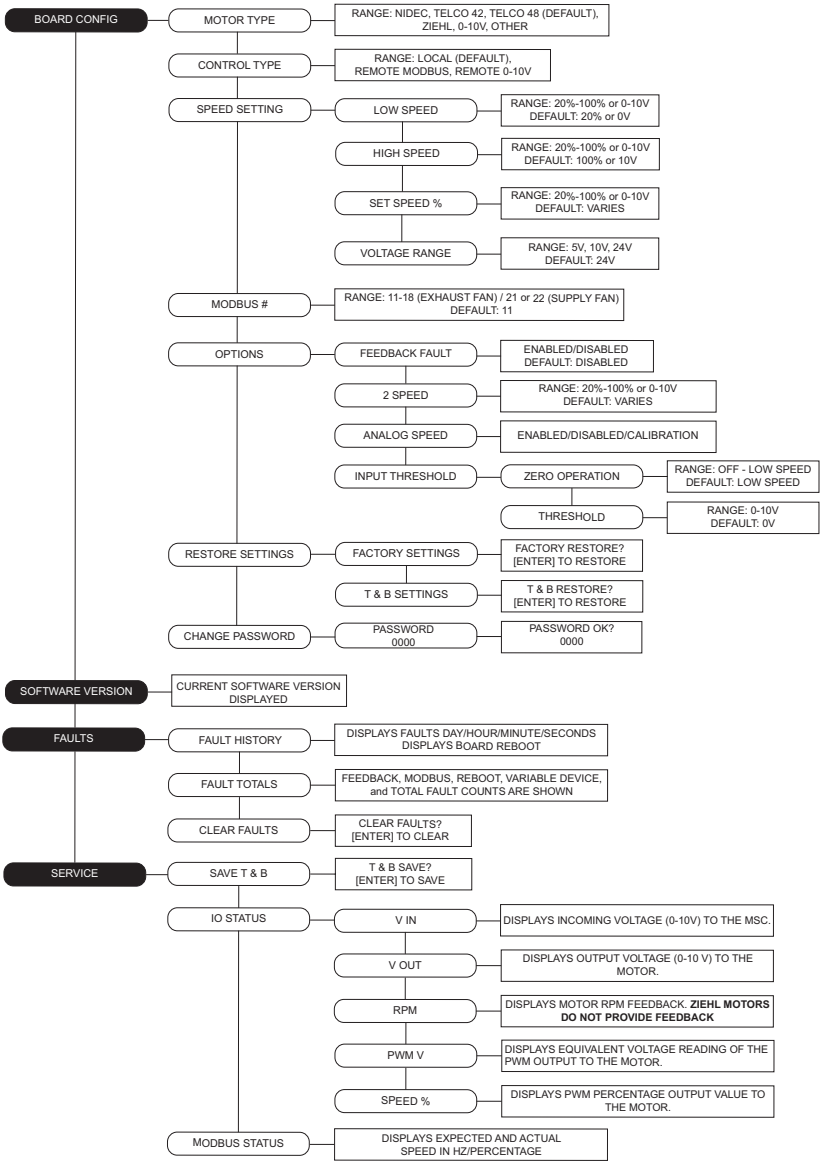
- **Save T & B** - After the test & balance process has been completed, save adjustments under this menu.
- **IO Status** - Provides access to information about the inputs and outputs of the MSC board.
  - **V In** - Displays the incoming voltage (0-10V) to the MSC.
  - **V Out** - Displays the output voltage (0-10V) to the motor.
  - **RPM** - Displays motor RPM feedback. **Ziehl motors do not provide feedback.**
  - **PWM V** - Displays equivalent voltage reading of the PWM output to the motor.
  - **Speed%** - Displays PWM percentage output value to the motor.
- **Modbus Status** - Provides access to expected and actual speeds in hertz and percentage.

## Input Threshold

**Figure 24 - Input Threshold Examples**



## MSC Menu Tree

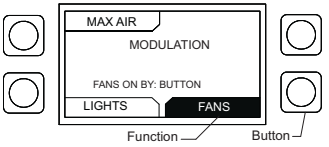


# OPERATION

## HMI Function

**NOTE: The fire system must be in an ARMED state before proceeding (C1/H1 terminal block must have continuity with AR1 terminal block).**

**Figure 25 - HMI Buttons**




Once all required connections have been completed as indicated on the installation schematic, start-up can begin. Apply power to the panel and fans. The ECPM03 board and the HMI(s) will power up. If the unit does not power up correctly, check all power connections. Verify no alarm message(s) are displayed on any of the HMI screens. If there are alarms present, you can press the MUTE button to silence the alarm and then work to resolve them.

The HMI has 4 buttons (**Figure 25**); a function is displayed adjacent to each button on the LCD. These functions will change depending on the status of the panel. If no text is adjacent to the button, it does not have a function.

Typically, the bottom two buttons are for operating the LIGHTS and FANS functions. The status of those elements is shown by the shading used inside the box associated with the function. An unshaded box around the FAN function means that the fans are turned off. A dark box around the FAN function means that the fans are turned on. The same applies to lights.

**NOTE: For the rest of the document, the term button will be used to refer to either the actual button or the function associated with it.**

The HMI will display informational or fault messages in the main body of the screen.

When a fault occurs, an audible alarm is triggered and a message is displayed on the HMI(s). The audible alarm can be silenced by pushing the MUTE button that appears on the top right corner.

Press the LIGHTS button to energize the hood lights. If the lights do not come on, make sure the light bulbs are installed and/or check the lighting circuit. To dim the lights, press and hold the LIGHTS button for 3 seconds. **See “Light Brightness” on page 72.**

Press the FANS button to energize the fans. When dynamic mode and prep mode are enabled, pressing the PREP OFF button will turn prep mode off and put the system into modulation mode, **See “Dynamic Fan Zone” on page 61.**

If cooking appliances are connected to an electric gas valve, then the electric gas valve is controlled by the control package. The GAS/GAS RESET button will only show if the “Gas Valve Option” is set to YES. The gas valve can be turned on by pressing the GAS RESET button on the top right corner of the HMI. If the control package includes the CORE Appliance Fire System, Onboard Wash, or Electric Wet Chemical with Self-Cleaning a WASH button will be displayed on the HMI. Push the button to start the wash cycle. Water will be sprayed in the plenum and duct of the hood, and surfactant will be injected every minute during the wash. The wash cycle will stop when the wash timer expires or when the STOP WASH button is pressed. **Make sure the hood filters remain in place during the wash cycle.**

If the “Proving” option is enabled, a calibration step is required at initial start-up. Refer to **“Proving Enabled (Optional)” on page 58** for further details about this function. The calibration process is also available through the control board, refer to **page 19**.

## HMI Configuration

Configuring settings are done through the HMI by pressing the top two buttons on the HMI.

To set the HMI number or to adjust the screen contrast, press the bottom two buttons simultaneously on the HMI faceplate. Use the Up and Down buttons to select the parameter that will be adjusted. Press Enter to select the highlighted parameter.

Setting the HMI number configures the Modbus address for that HMI. The default is 55 for the first HMI. For every additional HMI, increase the address by one. For example, if a second HMI is used, the Modbus Address should be 56. For a third HMI, the Modbus Address should be 57.

To change the contrast, select “Advanced Options.” The user may adjust the setting from 0 to 10. Setting the contrast to 0 is the lowest setting available and 10 is the highest contrast setting available. The factory default contrast setting is 5.

To set the clock, refer to **“Set Clock” on page 39**.

To view, set, or adjust board options, refer to **“Board Settings” on page 40**.

To monitor diagnostic values, refer to **“Diagnostics” on page 73**.

## Passwords

To access the Configuration for Factory Options, the password 1111 must be used.

To access the Configuration for Motor Control, the password 1111 must be used.

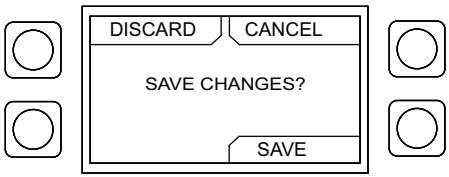
To access the Configuration for Fire Options, the password 1234 must be used.

*After changing parameters in the configuration menus, the user needs to press MENU multiple times on the* HMI until the screen displays “SAVE CHANGES?” (**Figure 26**). The screen will display:

- DISCARD – Pressing the **DISCARD** button will erase any parameter changes made in the HMI during this time. This will not erase parameter changes made previously.
- CANCEL – Pressing **CANCEL** will take you back to the options settings. This will not discard any parameter changes made.
- SAVE – Pressing **SAVE**, the screen will display “Saving…Wait for reboot”. As indicated, the processor will reboot. This allows the board to correctly process the parameters changed.

All the items below are accessed by putting the **HMI into Configuration mode**.

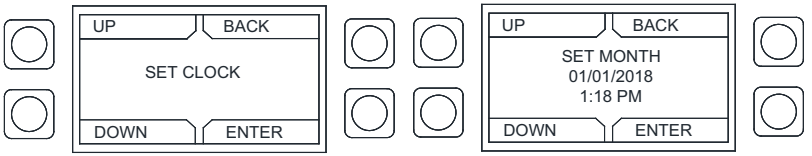
**Figure 26 - Save Changes**



## Set Clock

To set the clock (**Figure 27**) on the HMI, enter the HMI configuration mode. Scroll to “SET CLOCK,” press **ENTER**. When configuring the time setting, use the **ENTER** and **MENU** buttons to cycle through the parameters. Use the **UP** and **DOWN** buttons to set the parameter. Once the parameter is set, press **ENTER**. After all of the settings are set, press the **MENU** button continuously to back out and save settings.

**Figure 27 - Set Clock**




## ESP Dry Mode

Following an ESP self-cleaning cycle, the PCUAFM board will force the fans on for the duration of the ESP dry mode timer (**Figure 28**). The time will be displayed on the DCV home screen. The wash button will be hidden while the dry mode timer is active.

**Figure 28 - Dry Mode Timer**



## Board Settings

### Options

Allows the user to set preferences for the system. **Setting defaults will vary depending on how the package was ordered from the factory.**

- Language (Factory default is English) – The user may set the language between English or Spanish.
- Temperature Units (Factory default is Fahrenheit) – The user may set temperature units to Fahrenheit or Celsius.
- HMI Dimming? – This option allows the backlight on all HMIs to turn off whenever a timer is satisfied. The timer is refreshed every time HMI button is pressed.
- HMI Dim Delay – Available if HMI dimming is set to On. Allows user to set dimming time preference for HMI.
- Is Sequential Wash Enabled? – Available if CORE is enabled. Wash each individual CORE system with sequential delay.
- Sequential Wash Delay – Available if CORE is enabled. Allows user to set a time delay between wash cycles.
- Sequential Wash Both Zones – Available if CORE is enabled. The wash cycle will wash each zone one at a time.
- Fan Status Relay 4 / Fan Status Relay 5 – Zone 2 offers the same status selections as Zone 1. When one of the status options is selected, the relay will output a signal to the fan status light.

  - RO Disabled
  - Zone 1 Proving Fault
  - Zone 1 Proving Calib
  - Zone 1 System Bypass
  - Zone 1 Max Air
  - Zone 1 Wash
  - Zone 1 Temperature
  - Zone 1 Occupied
  - Zone 1 BMS Fans
  - Zone 1 IO
  - Zone 1 Fans Button
  - Zone 1 BMS Prep
  - Zone 1 Prep Button
  - Zone 1 Prep Temp
  - Zone 1 HRC Defrost
  - Zone 2 (Same selections as Zone 1)
  - Zone 1 Any
  - Zone 2 Any
  - Zone 1 and 2 Any
  - Zone 1 Any Prep
  - Zone 2 Any Prep
  - Zone 1 and 2 Any Non Prep

- Scheduling? – Allows the user to set scheduling to be active.
- Occupied Fans On – Allows the user to set the fan zone to activate during the occupied time setting.
- Unoccupied Offset 1/2 – This allows the user to add an unoccupied offset temperature range (0-30°F) on top of the other system offset settings. Use this setting to prevent false fan activation during an unoccupied time range.

### Options – Board Restart

Changing the following settings will cause the board to restart:

- Enable/Disable CORE
- Enable/Disable PCU CORE
- Enable/Disable Core Ansul Wash
- Enable/Disable Hood Recovery Coil
- On-board Wash
- Sequential CORE Wash
- Is Proving Enable
- Canadian Proving Enable
- Fans Continue in Proving
- CS Assignment
- CS Proving %
- Celsius/Fahrenheit
- Lights During Fire
- Supply During Fire
- Gas Valve Enable
- Kill Switch Enable
- Gas Follow Fans
- Shunt Follow Fans
- Dim Enable
- Auxiliary Interlock
- Low Surfactant Shut-down
- Supply Share – Static
- Supply Share – Static Speeds
- Supply Share – Dynamic
- Number Of Light Zones
- Wash Speed % Of Fan High Speed
- Fan Direction
- Dim Delay
- Fan Zone Assignments
- Number Of Temp Sensors
- Number Of HMIs
- Number Of Fan Zones
- VDC Output Type
- Number Of PCUAFM
- Number Of EXH VFDs
- Number Of SUP VFDs
- Number Of EXH ECMs
- Number Of SUP ECMs
- VDC Output Range
- Language
- Exhaust During Fire
- Current Sensor Proving %
- Fan CFMs
- Min Prep Frequency/Speed
- Fan Controller Type
- VFD Proving %
- IO Delay
- Fan Zone – Static/Dynamic
- Constant Transfer CFM
- Prep Enabled
- IO High Speed?
- Independent Light Control?
- Cool Timer
- HMI Fan Zone Assignment
- HMI Enable Light Switch
- HMI Enable Fan Switch

Changing the following options will not cause the board to restart:

- Prep Offsets
- Temp Sensor Offsets
- Temp Sensor Assignments
- Fan Modulation
- Min Room Temp
- Preset Room Temp
- Hysteresis Temperature
- Hysteresis Time
- Manual To Auto Fans Time
- Max Air Time
- Wash Time
- Autowash Min Fan Runtime
- Autowash Min Interval Time
- Fan Status Relays
- CORE Zone Assignments
- Unoccupied Offset 1/2
- Sequential Wash Delay
- Number Of Light Zones
- Time Zone ID
- Hood Recovery Coil Temp
- All Zones On During Wash
- Fan Low Frequency/Speed
- Fan High Frequency/Speed
- Occupied Fans On 1/2

## Motor Control

Motor Control is visible when a fan is controlled by a VFD or ECM. The motor control menu allows the user to access the control settings for the motor. The selectable motors are dependent on the number of Exhaust VFDs, Supply VFDs, Exhaust ECMs, and Supply ECMs. Verify if the fan zone is set to static or dynamic, check “Fan Zone Config” setting located in **“Factory Options” on page 53**.

If the fan motor unit is assigned to a dynamic zone, see **“Motor Control - Fan Zone set to Dynamic” on page 51**. If the fan motor unit is assigned to a static zone, see **“Motor Control - Fan Zone set to Static” on page 52**. Certain parameters may need to be adjusted in the field if there is an existing motor on the job site, see below parameters marked with an (*).

**EXH VFD #**

- Min Prep Frequency (prep enabled)
- High Frequency*
- Low Frequency*
- CFM*
- Modulation
- Direction (Rotation of motor)

**SUP VFD #**

- High Frequency*
- CFM*
- Direction (Rotation of motor)

**EXH ECM #**

- Min Prep Speed (prep enabled)
- High Speed*
- Low Speed*
- CFM*
- Modulation

**SUP ECM #**

- High Speed*
- CFM*

**VDC Output Type**

- Light Control
- Zone 1 Supply
  - High Speed*
  - CFM*
- Zone 1 Exhaust
  - Min Prep Speed (prep enabled)
  - High Speed*
  - Low Speed*
  - CFM*
  - Modulation
- Tot XFR (Total Transfer) Ratio Zone 1
- Sup (Supply) CFM Ratio Zone 1
- Exh (Exhaust) CFM Ratio Zone 1
- None

Min Prep Frequency (Factory Default: 15Hz) – This option is only visible when Prep Time Mode is enabled. Its maximum value is the minimum of the low frequencies of all the fans controlled by the package, and the minimum value is 10Hz.

## Factory Options

This sub-menu is Password protected (1111).

**# Fan Zones (1 or 2)** – This function allows the user to set the number of fan zones in the system. This can be configured to 1 or 2 fan zones. Certain features will restrict the number of fan zone selections. The **On-board Wash** feature will restrict the system to 1 fan zone. The **Supply Share Static** and **Dynamic** will restrict the system to 2 fan zones.

**Fan Zone Config** – This allows the user to set various configurations in the fan zone.

- **Is Dynamic?** – Yes/No option. When the zone is set to dynamic and the motor is on a VFD/PWM, it will modulate based on temperature. When the zone is set to static (Is Dynamic? set to no), the VFD/PWM will only operate at one speed on activation.
- **Is Prep Enabled?** - Option is visible when the zone is dynamic. Yes/No option.
  - Preparation mode is available for morning operation when appliances are off or when very light food preparation is performed. Dedicated make-up air will be locked out, only allowing the use of transfer air during this mode.
  - The speed of the exhaust fan(s) in Preparation Time is calculated automatically and is equal to the speed that will produce the same amount of CFM than the Transfer CFM when the fans are running at full speed in normal operation. If there is no dedicated supply fan in the system, the exhaust fans will run at the set high frequency divided by 4 (typically 15 Hz).

**NOTE: If the calculated value falls below the set minimum frequency, then the value will be adjusted to the lowest allowable frequency.**

- **Constant Transfer CFM?** – Yes/No option. This feature alters the calculation for supply frequency for a dynamic zone. The difference between exhaust and supply ratio will be held constant.
- **Independent Light Control?** – Yes/No option. The independent light control feature allows the user to control the lights from the HMI. If independent light control is disabled, the lights will automatically activate whenever the fans activate.
- **IO Delay** – This option is intended for applications that require the fans to keep running for a specific amount of time after an external signal (BMS, machine, etc.) is turned off. The delay time value may be set up to 18 hours. The fans will remain on for the set time after the external signal is de-energized.
- **Preset Room Temp** – 75.0°F (default). Allows the user to adjust Preset Room Temperature.
- **Minimum Room Temperature** – 50.0°F (default). This prevents a system from activating the fans unnecessarily due to a large gap between room temperature and the thermostatic temperature sensors. This option can also help alleviate fan activation troubles with lower temperature appliances, which are not satisfying the minimum temperature requirements for fan activation.
- **Maximum Room Temperature** – 120.0°F (default). When the room temperature sensor reading is above the maximum room temperature setpoint, the system will use the maximum room temperature setpoint overriding the room temperature reading. This will prevent poor operation when a room temperature sensor receives a false high temperature reading that is not a true representation of the space room temperature.
- **Temp Hysteresis** – 2.0°F (default). The hysteresis is used to prevent the fans from cycling on and off when the temperature in the tempering space is near the activation value. The fans will turn on when the duct temperature exceeds the activation value, but they will only turn off when the duct temperature goes below the activation temperature minus the temperature hysteresis. For example, if the Activation

Temperature is at 85°F and Temperature Hysteresis is set to 2°F, the fans will turn on at 85°F and will turn off at 83°F.

- **Hysteresis Timer** – 00:30:00 (30 minutes default). The hysteresis is used to prevent the fans from cycling on and off too often due to small appliances generating just enough heat to turn on the fans but not enough to keep them on for a long time. The hysteresis timer will maintain the fans on after they have been activated by temperature for a minimum time set by this timer, even if the temperature in the duct cools back down.
- **Is Max Air Enabled?** – Option is visible when the zone is dynamic. Yes/No option. If Max Air is enabled, a **MAX AIR** Button will appear when the system is in modulation mode. If pressed, this will send the system into Maximum Air Mode.
- **Max Air Time** – Option is visible when the zone is dynamic. Max Air Timer maintains all exhaust and supply fans running at their maximum frequency for the configured time.
- **Manual to Auto?** – Yes/No option. When the system is turned on manually (by button) a timer will start that sends the system into automatic mode once the timer is completed (this is advised to be about the length of time the restaurant will be open).
- **Exhaust Contactor CFM/Supply Contactor CFM** – Option is visible when zone is dynamic. The user can adjust the CFM from 0-65,000 CFM.
- **Cool Time** – Option is visible when zone is dynamic. The fans will go into cool down mode when the duct temperature goes below the activation point minus the temperature hysteresis of 2 degrees. For example, if the activation temperature is at 85°F and the hysteresis is set to 2°F, cool down mode will start at 83°F.
- **IO High Speed Mode?** – Option is visible when zone is dynamic. Yes/No option. Enters high speed once **120V AC** is detected on IO input. The fans stay on for as long as the IO High Speed Timer is set. The 120V AC must be sourced from the same breaker as the control power, terminal H1.
- **Wash time** – 03:00 minutes (default).
- **Autowash Min Fan Runtime (H)** – This is the minimum amount of time the fans must be running for autowash to occur.
- **Autowash Min Interval Time (H)** – Adjustable between 0-24 hours. This is the minimum amount of time between washes for autowash to occur.
- **Wash Speed % Of Fan High Speed** – This percentage is used to calculate the fan speed of VFD or PWM controlled exhaust. The actual wash speed of each fan is determined by multiplying the wash speed percentage by the high frequency of the exhaust fan.
- **WMSB Temp Averaging Enabled?** – Yes/No option. When set to Yes, DCV includes all WMSB temp readings to be averaged into the room temp readings.

**# Light Zones (0-2)** – This allows the user to set the number of light zones. This feature allows for the light zones to be independent of the number of fan zones. RO1 is used to activate a 24V DC relay to control light zone 1. RO2 is used to activate a 24V DC relay to control light zone 2.

**# HMIS (1-4)** – This allows the user to set the number of HMI(s) in the system. Each package should have at least one HMI in the system to easily access features. The system can operate without an HMI connected.

**HMI Config** – This allows the user to select:

- Zone Assignment – Assign the HMI to a fan zone.
- Enable Light Switch – Yes/No option.
- Enable Fan Switch – Yes/No option.
- Enable Temperature Sensor (internal to HMI). Yes/No option.

**# Temp Sensors** – This menu is where the number of temperature sensors in the system can be set. Only a maximum of 8 sensors can be connected to the ECPM03 board. If more sensors are needed for the system, you will need to add the ECPM03EX board. Up to 32 sensors can be added to the system.

**Temp Sensor Config** – This allows the user to set various configurations for the temperature sensors. See **"Temperature Selection and Configuration" on page 48** for more information.

**# Exhaust VFD (0-8)** – This menu is where the number of exhaust VFDs controlled by the ECPM03 board can be set. VFDs are connected from the J3 port on the ECPM03 using Cat 5 cable. Successive VFDs are daisy-chained. The Modbus address for exhaust VFDs starts at 11 and ends at 18. The first VFD in the chain is defined as Modbus address 11. The second VFD is assigned to Modbus address 12, and so on.

**# Supply VFD (0-2)** –This menu is where the number of supply VFDs controlled by the ECPM03 board can be set. VFDs are connected from the J3 port on the ECPM03 using Cat 5 cable. Successive VFDs are daisy-chained. The Modbus address for exhaust VFDs starts at 21 and ends at 22. The first VFD in the chain is defined as Modbus address 21. The second VFD is assigned to Modbus address 22.

**# Exhaust ECM (0-4)** – This menu is where the number of exhaust ECMs in the system can be set. The PWM wiring is connected to PWM signals on the board at connector J10 pins P1A/B, P2A/B, P3A/B, and P4A/B. Only 4 ECMs may be assigned between the exhaust and supply. PxA is the positive PWM signal and PxB is the negative PWM signal.

**# Supply ECM (0-4)** – This menu is where the number of supply ECMs in the system controlled by the ECPM03 board can be set. The PWM wiring is connected to PWM signals on the board at connector J10 pins P1A/B, P2A/B, P3A/B, and P4A/B. Only 4 ECMs may be assigned between the exhaust and supply. PxA is the positive PWM signal and PxB is the negative PWM signal.

**Is Proving Enabled?** – The supply fan and exhaust fan activate simultaneously.

**Is Canadian Proving Enabled?** – The supply fan must prove first, then the exhaust fan.

**Fans Continue In Proving Fault?** – The fans will continue to operate if a proving fault is active.

**NOTE:** When proving options are enabled, the user may configure the minimum setpoint that the motors are considered to be proven. These values can be changed at CS1 Proving percentage through CS5 Proving percentage for any current sensor. The VFDs setpoint can be set under motor control. See **"Menu Tree" on page 50**. Verify with local/regional codes for proper settings. Refer to **"Proving Enabled (Optional)" on page 58** for more information.

**Select Current Sensor** – Allows user to assign a current sensor to a fan. While the fan is operating, amperage draw is monitored to validate proving.

- **CS Assignment** – Assignable current sensor options.
- **CS Proving %** – Minimum percentage setpoint for proving.

**# PCU AFM** – Defines the number of PCU AFM boards that communicate back to ECPM03. This allows for the DCV system to display any PCU AFM errors on the HMI.

**Is On-board Wash Enabled?** – Yes/No option. If this feature is enabled, the system will only be allowed to operate with one fan zone configuration. This enables connector J8 on the electrical board to be used for wash control. Connector J8 is a five-pin connection. Pin EF2 is used to control the hot water solenoid. Pin SF2 is used to control the surfactant pump. Pin OV2 is used to monitor the liquid level sensor. Pin IO2 is used to prime the pump system.

**Surfactant Duration** – Allows the user to increase time setting for surfactant injection duration. For heavy-duty grease applications, increase the injection duration during wash cycles. Adjustable range from 1-15 seconds.

**Disable Autowash** – Allows the user to disable the autowash function. This function should be disabled if wash is controlled through a schedule. If no schedule is defined, autowash timers will need to be enabled.

**VDC Output Type** – The demand control system provides a 0-10V DC analog output from VO- and VO+ directly proportional to the calculated ratio for fan speed and light dimming control. This output can be configured depending on the type of signal needed by the building management system or the equipment receiving it.

The types of signals that are available:

- Light Brightness = Voltage signal
- Total Exhaust CFM Ratio = Total Operating Exh CFM / Total Design Exh CFM
- Total Supply CFM Ratio = Total Operating Sup CFM / Total Design Sup CFM
- Total Transfer CFM Ratio = Total Operating Transfer CFM / Total Design Transfer CFM
- Zone 1 or Zone 2 Exhaust
- Zone 1 or Zone 2 Supply

- Total Exhaust CFM Ratio could be sent to a Roof Top Unit providing make-up air to the hood.
- Total Transfer CFM Ratio could be sent to an HVAC unit indicating how much transfer air is needed for the kitchen. This selection takes into consideration the Preparation Time Mode, where the same amount of transfer air is used when the fans are all running at maximum speed.
- Total Supply CFM Ratio is only available if a supply fan is present in the DCV system. In Preparation Time, Total Supply CFM Ratio would be 0.

**VDC Output Range** – VDC output signal options are **0-10V DC** or **2-10V DC**. Provides a linear representation of exhaust or supply motor speed.

**Supply Share Static** – Yes/No option. IL1A and IL1B must be jumped with a proving damper signal for the supply fan to run. Setting up a 2 zone configuration: Consists of 1 supply fan and at least two exhaust fans. When supply share static is on, there will be three Zone Supply % options available. The exhaust fans will run at the single speed defined by job requirements.

- If the zone 1 fan is turned on, then the exhaust fan will turn on, and the supply fan goes to speed one (**Supply % EF1**).
- If zone two is on, then exhaust fan Zone 2 will turn on, and the supply fan speed goes to speed 2 (**Supply % EF2**).
- If both zone 1 and zone 2 are on, then the supply fan will go to speed 3, (**Supply % EF1 and EF2**).

**Supply % EF1** – This is the supply speed when Zone 1 is on. EF1 Only > 50% (typical).

**Supply % EF2** – Supply speed when Zone 2 is on. EF2 Only > 50% (typical).

**Supply % EF1 and EF2** – Supply speed when both zones are on. This option is ideal for using one supply fan to provide makeup air to a building. The supply fan will run at the set speed based on which zone is currently on. EF1 and EF2 > 100% (typical).

**Supply Share Dynamic** – Yes/No option. This option is an adaptation of supply share static where the fans will automatically calculate the starting speed based on the fan CFM. The supply will appropriately compensate for the speed of either or both exhausts.

**Modbus** – This menu will allow you to view the Modbus address of the ECPM03 board. This address should always be set to 59. Do not change this address.

**Low Surfactant Shut-Down** – Yes/No option. This allows the user to have the system shutdown when the surfactant level is low with a CORE system. When the level is low and activates the shut-down process, the gas output signal will be de-energized and the kill switch will be de-energized. The shunt trip will be energized.

**Hood Recovery Coil Enable?** – Yes/No option. Allows the user to enable the Hood Recovery Coil (HRC) option, if applicable. When the appliances are not in use and this option is enabled, the hood recovery coil temperature setting is used to operate the exhaust fans. The exhaust fans will remove cold air preventing damage to the hood recovery coil system.

**Hood Recovery Coil Temp** – 40.0°F (default). This is an adjustable setting that allows the user to set the HRC temperature setpoint. The hood input coil and hood output coil temperature sensor monitors the temperature in the duct and plenum. When the temperature drops below the setpoint, the exhaust fans will turn on and remove cold air from the duct and plenum. The hood input and output coils may not be located by the HRC. Since these temperatures are used as reference points, you may want to set the temperature threshold higher as the temperature may be colder near the HRC.

**Residential Hood Option** – Yes/No option. Allows the user to enable the residential hood option, if applicable. Refer to Light Commercial Hood Manual for more information.

**Residential Hood Fire Set Point** – When the hood thermistor exceeds setpoint (default 150°F), the hood will enter a FIRE state. Once the temperature drops below setpoint, press “Reset” on the HMI. User may adjust setpoint between 150 to 200°F.

**NFPA 101 Compliant** – NFPA requires that a fire system covers a residential hood. If the hood is set to No, the residential hood will not be compliant.

**Residential Fire System** – Set the type of fire system installed on the hood.

**Residential Max Air Mode** – On/Off option. When the hood is in static mode and max air is On, the “Max Air” button is displayed. When pressed, the fan speed will go to high speed for the duration of max air timer. High speed is set under “Motor Control/Exh ECM.” “Max Air Time” is set under “Fan one Config.”

**Residential Fan Polarity** – Enables the ability to inverse the PWM output from the board to the residential hood fan. Set at the factory based on fan model.

**WMSB Enabled?** – Yes/No option. Enable this option when the Wireless Mini Sensor Board (WMSB) will be utilized to monitor temperature/relative humidity readings.

**Factory Reset** – This will allow the system to be restored to original factory settings.

## Temperature Selection and Configuration

| Monitoring Sensors | Control Sensors | Control Sensors |
|---|---|---|
| • Room Temp<br>• Preset Temp<br>• Auxiliary Temp<br>• PSP Discharge<br>• ACPSP Discharge<br>• Contact Monitoring<br>• Water Temp | • Contactor Zone 1 Riser<br>• Contactor Zone 1 Capture Volume<br>• Contactor Zone 2 Riser<br>• Contactor Zone 2 Capture Volume<br>• VFD Riser Exhaust<br>• VFD Capture Volume Exhaust | • ECM Riser Exhaust<br>• ECM Capture Vol Exhaust<br>• VDC Output Riser Exhaust<br>• VDC Output Capture Volume Exhaust<br>• Hood Coil Input<br>• Hood Coil Output |

Each fan zone must have a room temperature setting which is used for temperature offset calculations. The ECPM03 board can average HMI temperature sensors, along with other room tempering sensors that are assigned to a zone.

- Room Temperature – A temperature sensor corresponding to the zone. The system calculates the temperature offset based on the temperature detected by the sensor.
- Preset Room Temperature – No temperature sensor is needed, the room temperature is set to the preset temperature.

Monitoring sensors are only used to give a status of the temperature reading.

- Auxiliary Temperature Sensor – A thermistor sensor that may be externally or internally located in various locations.
- PSP Discharge – A thermistor sensor that monitors the discharge temperature in the Perforated Supply Plenum (PSP) section of the hood for Make-Up Air (MUA).
- ACPSP Discharge – A thermistor sensor that monitors the AC discharge temperature in the ACPSP section of the hood for cooling the space.
- Contact Monitoring – The ECPM03 board will monitor when the contactor pulls to activate the load (i.e. appliance, fan, lighting, etc.).
- Water Temperature Monitoring – A sensor used to monitor water temperature for self-cleaning systems used with CORE and on-board wash systems. The water temperature for wash should be between 140-170 degrees F for optimal performance. This setting can be monitored from the ECPM03 HMI, CASLink, or BMS.

Control sensors are used as feedback to the system on how to operate based on the fan zone configuration. The riser and capture sensor name will correspond to its location in the hood or plenum. These sensors may be assigned to a contactor zone or a VFD/PWM exhaust fan controller. Multiple sensors can be assigned to a specific motor or zone. The highest temperature reading will activate all the fans in a particular zone. If the zone is dynamic, the fan assigned to the variable controlled fan will modulate based on temperature associated with the assigned temperature sensor.

Additional Control Sensors for Defrost Control Activation (Hood Recovery Coil).

- **Hood Coil Input** – A thermistor sensor that monitors incoming water temperature on a hood recovery coil. If this temperature reaches the setpoint the system will go into HRC Defrost Mode.
- **Hood Coil Output** – A thermistor sensor that monitors outgoing water temperature on a hood recovery coil. If this temperature reaches the setpoint, the system will go into HRC Defrost Mode.

## Fire Options

This sub-menu is Password protected (1234). **Changes should not be made after passing an inspection**.

**Is Gas Valve Enabled?** – This option will be enabled by default if the system is equipped with a CORE Fire Protection System. This option provides a **120V AC** signal, which is wired from the board, to control an electric gas valve. Shuts off in “critical conditions” when having gas flowing through the system could be dangerous.

**Is Kill Switch Enabled?** – This feature enables the KTS to activate as a kill switch or tamper switch input. The KTS input detects a loss of **120V AC**, which will de-energize the Kill Switch output (KS), de-energize the gas valve output and energizes the **120V AC** shunt trip.

**Is CORE Enabled?** – If a CORE Fire Protection System is connected to the DCV system, alarms from the CORE system will automatically be displayed on the HMI. Multiple CORE systems can be connected to the same DCV system. Refer to the CORE Manual for setup of CORE Interlock Network addressing to prevent communication conflicts. When the CORE system is left in test mode for more than 15-minutes the shunt trip will energize, the kill switch will de-energize, and the gas valve will de-energize to shut off the gas supply.

**CORE Zone Assignment** – Available if CORE is enabled. Up to 15 CORE boards can be assigned. The zones are configurable through on the CORE Board. Refer to the CORE manual for setup.

**CORE Ansul Wash** – If CORE is enabled, then this option will be available. This option is based on whether an Electric Wet Chemical system includes self-cleaning. If the Electric Wet Chemical package with the self-cleaning option is available, this option is set to Yes. If the Electric Wet Chemical package does not include self-cleaning, this option is set to No.

**All Zones On During Wash** – When a system uses one CORE wash zone and two fan zones, this option must be enabled. With this option, both zone exhaust VFDs and ECMs will run at wash speed defined in fan configuration.

**Shunt Follows Fans?** – If this option is enabled, the shunt trip will be energized whenever the fans are off. This is meant to prevent electric cooking appliances from running when the fans are off and is only required in some jurisdictions.

**Does Gas Valve Follow Fans?** – This option is visible when “Is Gas Valve Enabled” is set to Yes or CORE is enabled. If this option is enabled, the gas valve is shut off whenever the fans are off and requires a reset when the fans are turned on. This is meant to prevent gas cooking appliances from running when the fans are off and only required in some jurisdictions.

**NOTE: Gas Valve Reset button on HMI must be pressed and appliance pilots must be relit after each fan cycle when this option is enabled.**

**Exhaust During Fire** – When Max Speed is set, the exhaust fans will be turned on in a fire condition at their maximum speed. When Continue is set, the exhaust fans will stay in whatever state they were before the fire condition. When off is set, the fans will not be active during a fire condition.

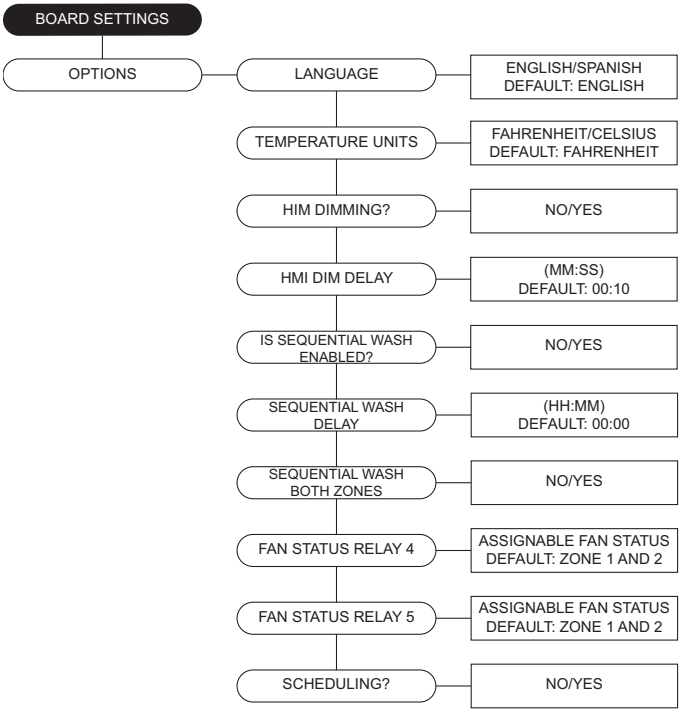
**Supply During Fire** – When this option is turned off, the supply fans will be turned off in a fire condition. When Max Speed is selected, the supply fans will turn on in a fire condition.

**Lights During Fire** – When this option is set to “CONTINUE,” the lights will continue their state during a fire. If the option is set to “OFF,” the lights will turn off during a fire.

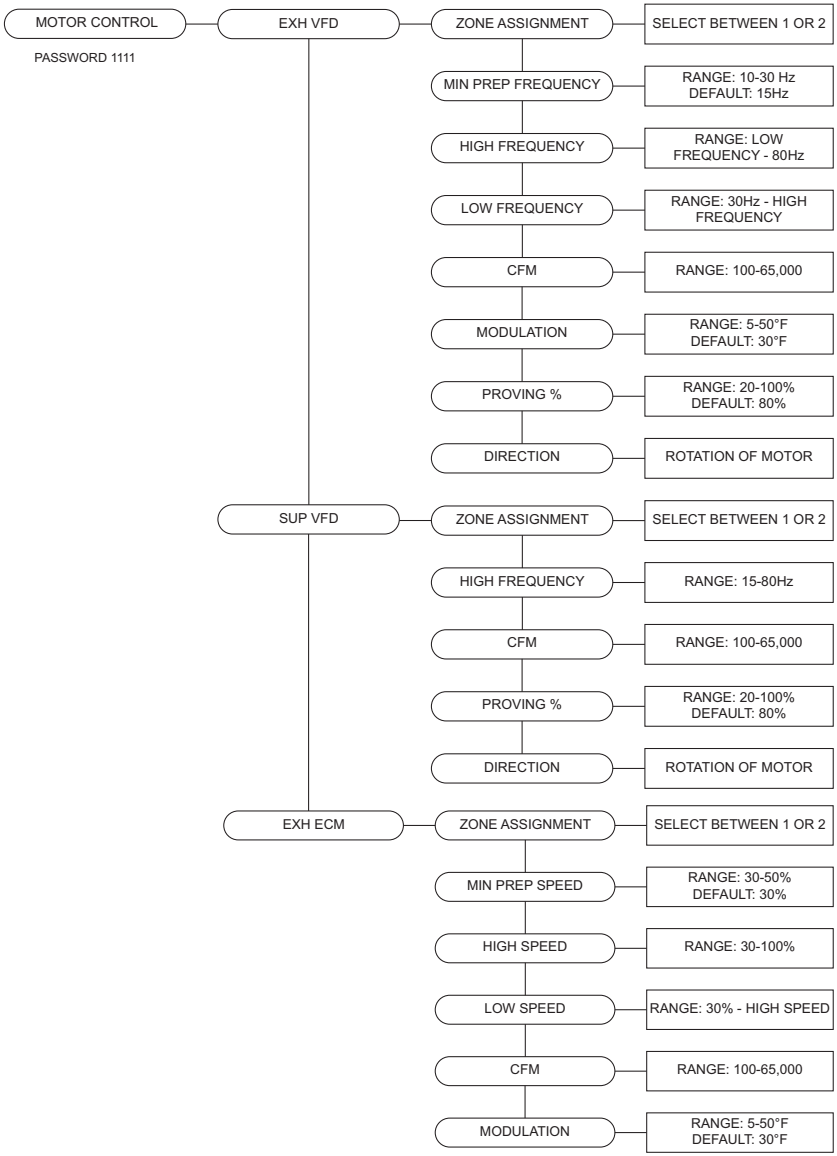
## Menu Tree

**NOTE: If the default option is not specified, the default is factory set.**

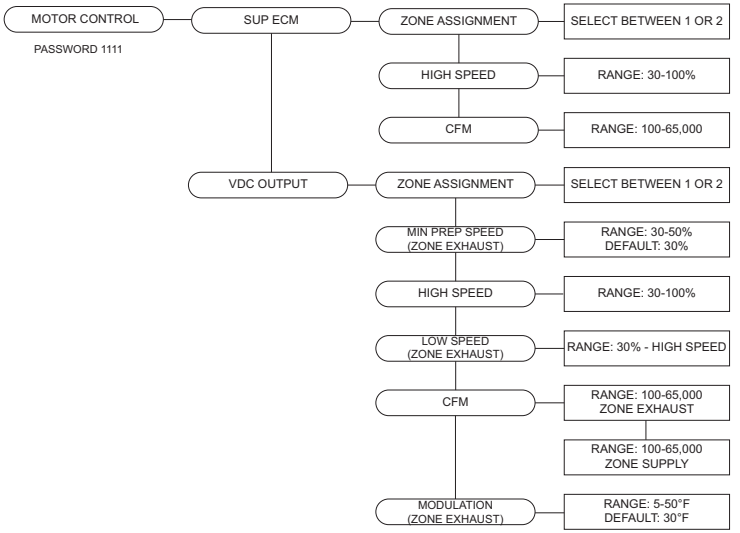
### Board Settings - Options



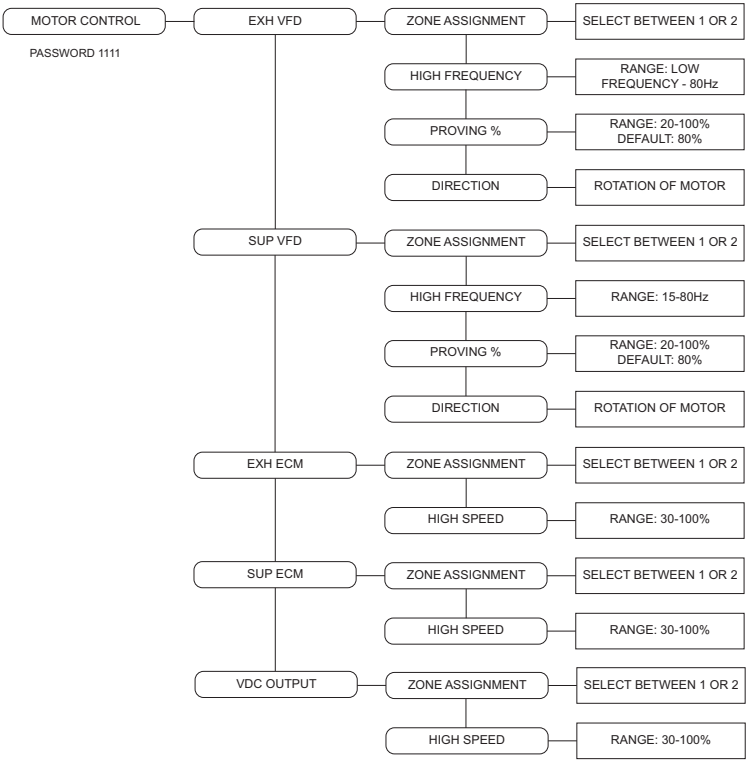
## Motor Control - Fan Zone set to Dynamic



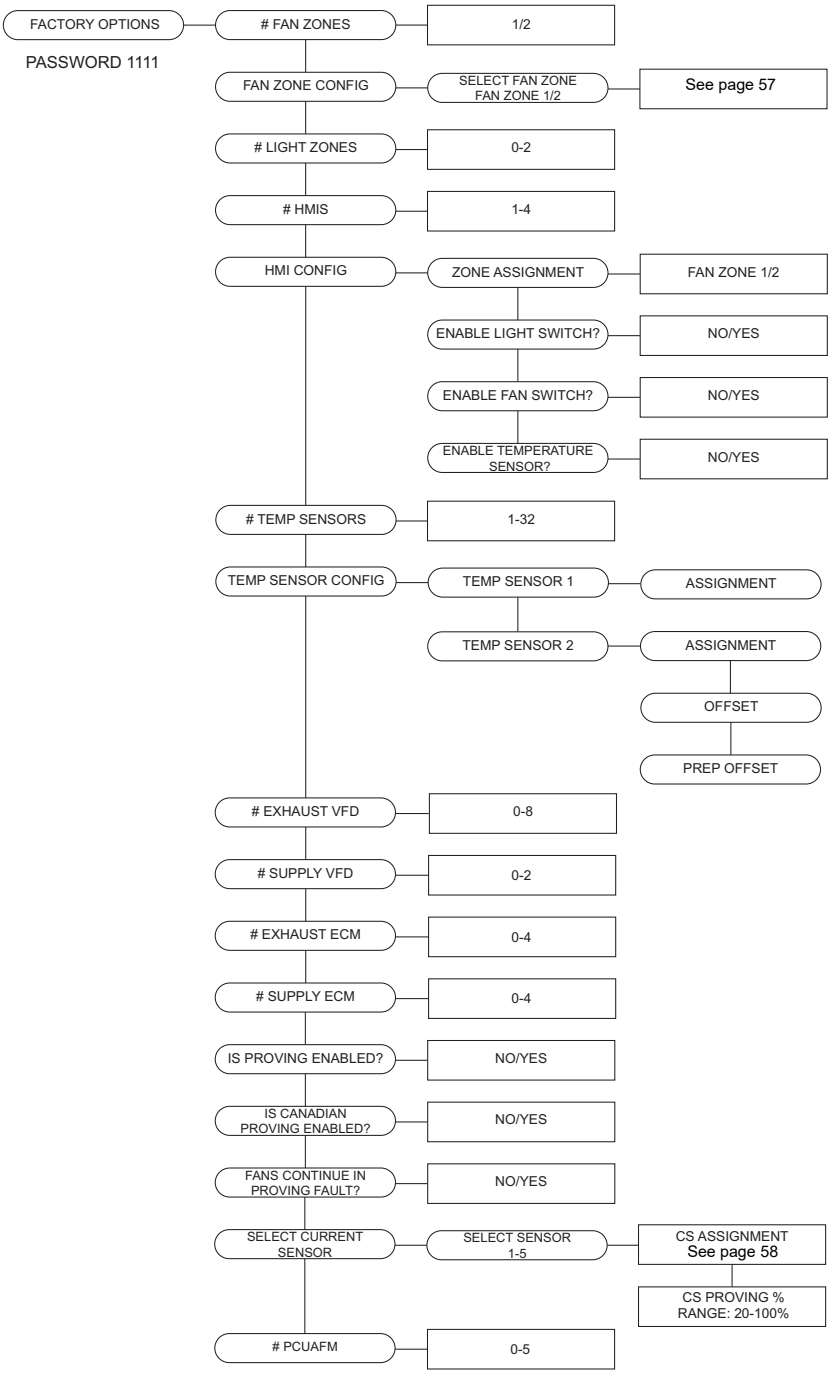
## Motor Control - Fan Zone set to Dynamic



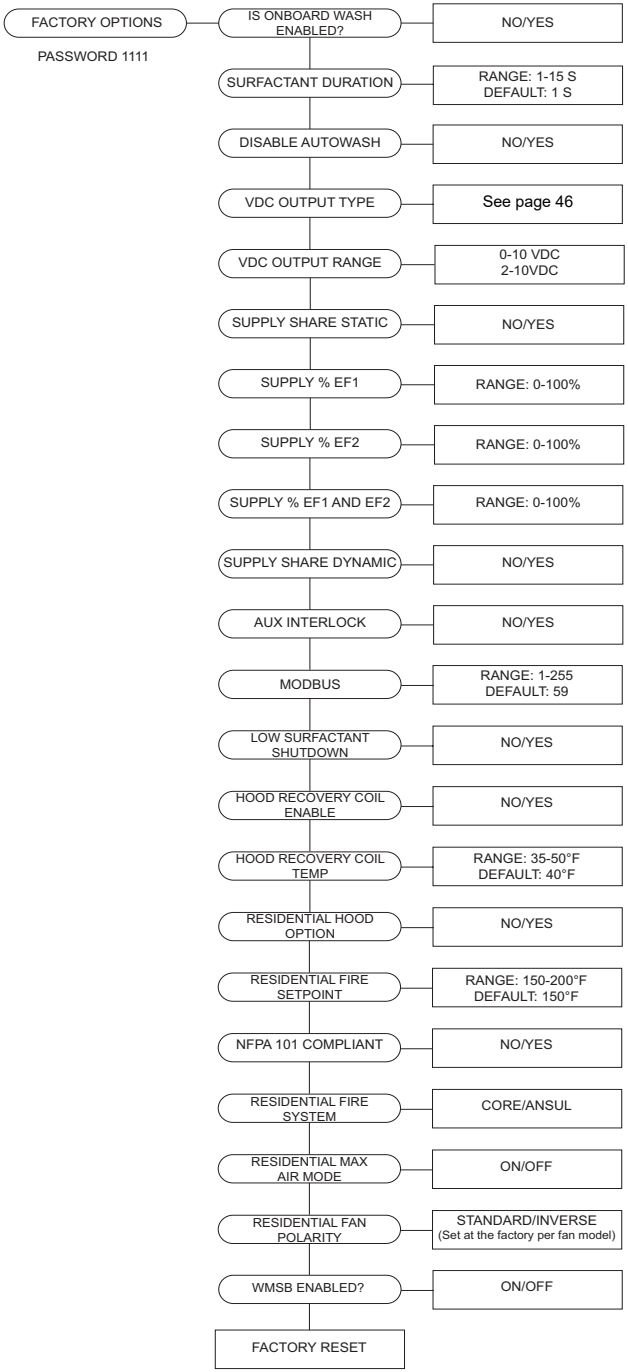

## Motor Control - Fan Zone set to Static



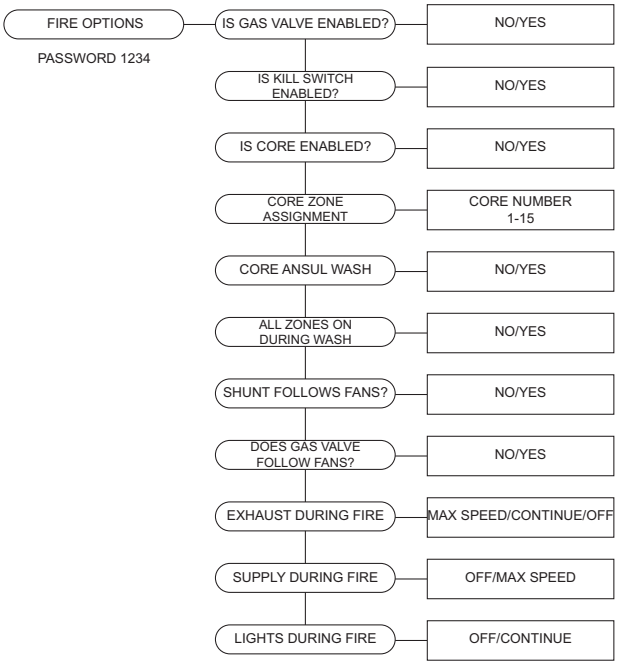
## Factory Options



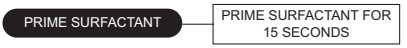
## Factory Options



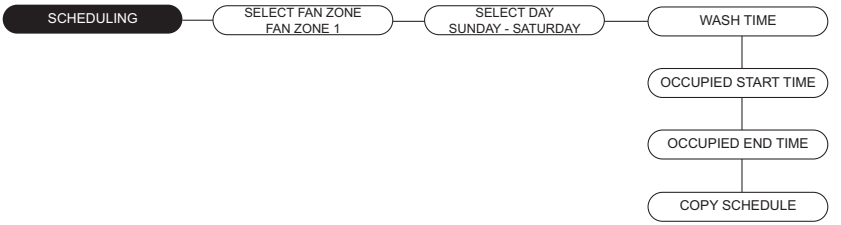
## Fire Options



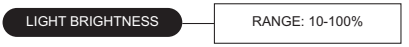

## Prime Surfactant



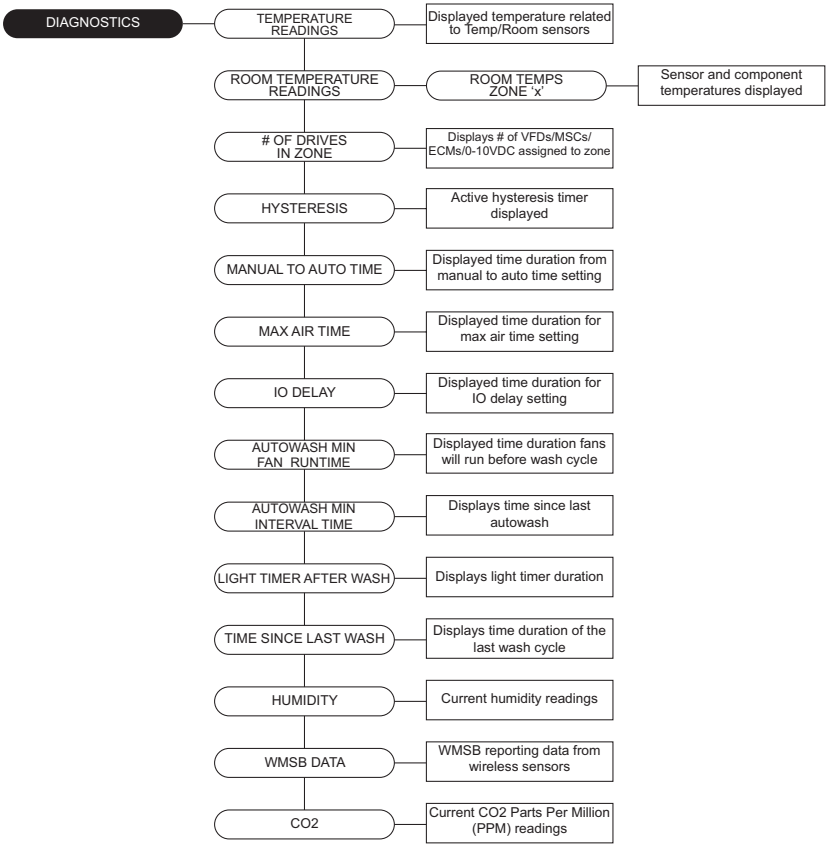

## Scheduling



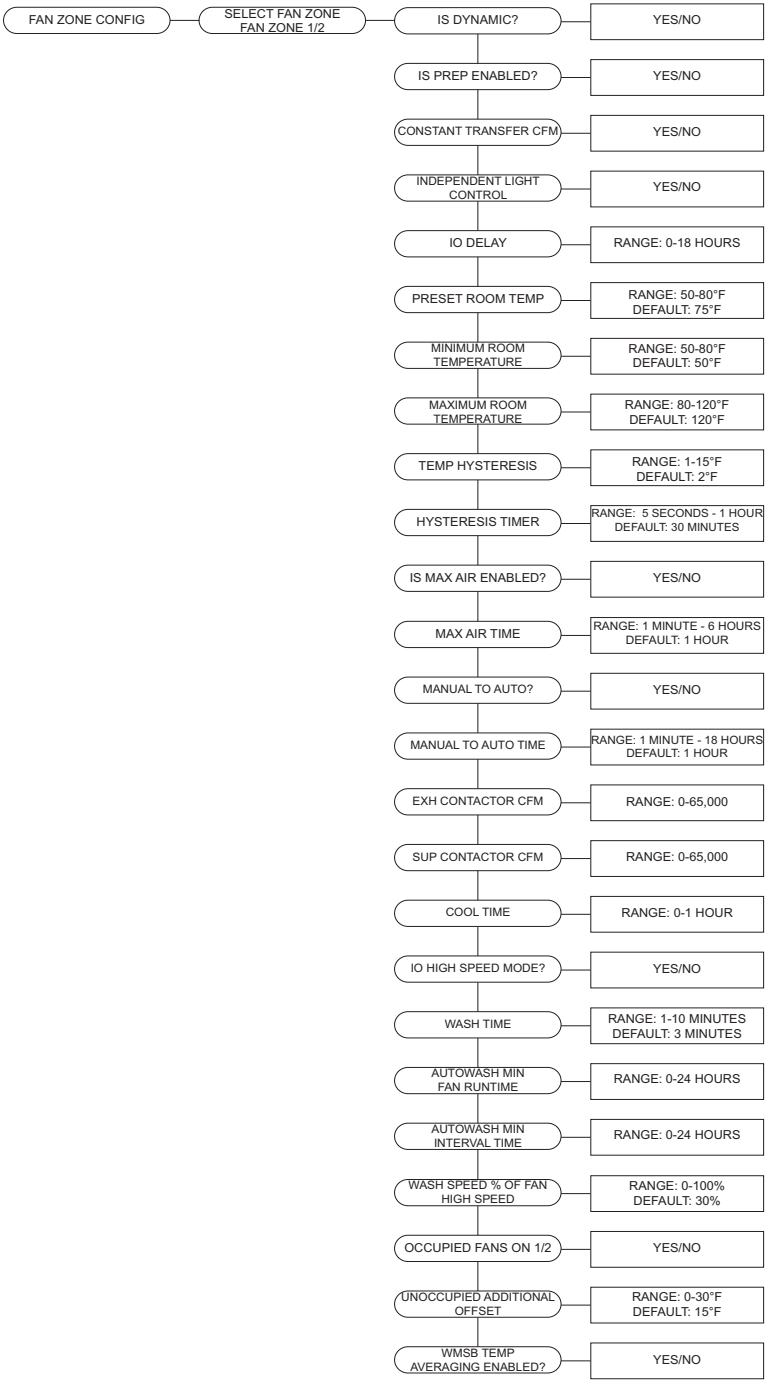

## Light Brightness



## Diagnostics



## Selectable Fan Zone Options



## Scheduling (Fans)

Verify scheduling is set to Yes, see **“Scheduling” on page 65**. For setting a schedule, see **“Occupancy Schedule” on page 66**

Occupied Time

- The user may select between three different schedules (A, B, C).
- When the fans are set to operate in the occupied time setting, they will run in modulation mode if “Occupied Fans On” is enabled. When the “Occupied End Time” is reached, the fans will run based on temperature.

Unoccupied Time

- The user may select between three different schedules (A, B, C).
- During unoccupied time, the fans turn on at a higher offset to prohibit fans from turning on during an unwanted time.

To adjust the offset, see **“Unoccupied Additional Offset” on page 71**.

## Proving Enabled (Optional)

(i.e. Loss of Load Interlock/Airflow Fault Interlock)

This function is designed so that if the supply or exhaust fans are not operating properly, all fans will shut off. Also, any gas valves or shunt trips in the system will shut off cooking equipment connected to the ECPM03 board.

If the “Proving Enabled” option is set to Yes, Calibration is required at start-up. Before calibration, verify the current sensor(s) are set properly in the HMI, refer **“Menu Tree” on page 50**.

- When using the CS Assignment option, assign current sensor(s) to one of the following selections: Zone 1/2 Exhaust, Zone 1/2 Supply, ECM 1-4, MSC Exhaust 1-8, MSC Supply 1-2, or Unassigned.
- If the CS Assignment will not be used, set to Unassigned.
- When using CS %, set percentage to desired value based on proving sensitivity.

To perform the calibration process:

- Make sure a “Test and Balance” has been performed on the entire system first.
- Verify that the filters are in place.
- Verify that the current sensors are assigned to the correct drive type.
  - Contactor current sensors are assigned as Zone X Exhaust or Zone X Supply where the “X” variable represents the zone number.
  - PWM controlled motors are assigned as the PWM reference number on the circuit board. For example, if current sensor 2 is monitoring motor circuit controlled by P2A and P2B, then current sensor 2 is assigned as ECM 2.
  - MSC Exhaust X and MSC Supply X where the “X” variable represents the fan number.
- ECPM03 Board: Starting from the main menu, press DOWN until the screen displays “Proving.” Press ENTER. The screen should display “Calibrate System?” Press ENTER to start the calibration process which can take 2 minutes and 30 seconds. Press MENU once when calibration is complete.
- HMI: Enter the configuration menu. Scroll to “Proving,” press ENTER. “Calibrate System?” will be displayed, press ENTER. The calibration process will start. Monitor the screen.
- Make sure the VFDs are running, ECM or contactor controlled motors are running, and the Make-Up Air (MUA) interlock signal is wired correctly to ILxA ILxB.

When enabled, the load on all the exhaust and supply fans is constantly monitored. If the load for an exhaust fan or the load for a supply fan drops below the threshold calculated after initial prove for approximately 15 seconds, all exhaust and supply fans will shut down.

If proving is enabled:

- **Is Proving Enabled?** – The supply fan and exhaust fan will activate simultaneously. After start-up, the system will take 90 seconds to detect a proving fault. Once the fans have proven, the timer switches to 15 seconds to detect loss of load.
- **Is Canadian Proving Enabled?** – First, the supply fan will activate, the fan will operate for 2 minutes to prove. If the supply fan proves, the exhaust fan will activate. The exhaust fan will take an additional 90 seconds to detect a proving fault. Once the fans have proven, the timer switches to 15 seconds to detect loss of load.
- **Fans Continue In Proving Fault?** – Yes/No option. When enabled On, loss of signal between MUA interlock will not stop the fans from operating.

The system sequence for Proving will be:

- The supply fan signal is activated to open dampers. If there are supply contactors, they will also be activated.
- When the interlock contacts close, all supply and exhaust fans will start on assigned zone.
- The system will have a maximum of 90 seconds to prove exhaust fans and supply fans.
- Once the fans have ran past their threshold, the system will monitor for a loss of proving. If there is a loss of proving, this will trigger a timer. If there is a loss of proving for 15 consecutive seconds, a proving fault will occur.

The system sequence for Canadian Proving will be:

- The supply fan signal is activated to open dampers. If there are supply contactors, they will also be activated.
- When the interlock contacts close, all supply fans on a zone will activate.
- The system will have a maximum of 120 seconds to prove a supply fans on the zone.
- Once all supply fans on the zone have passed their calibrated threshold, all exhaust fans on the zone will activate.
- Each zone will have a maximum of 90 seconds for each exhaust fan to prove.
- Once the fans have ran past their threshold, the system will monitor for a loss of proving. If there is a loss of proving, this will trigger a timer. If there is a loss of proving for 15 consecutive seconds, a proving fault will occur.

A few examples of why a fan would not be operating are: overload tripped, broken fan belt, defective motor, disconnect switch off, etc.

To reset the system after a proving fault, press the **Fault Reset** button on the HMI.

## Fan Control

The control panel controls fans through outputs EF1, EF2, SF1, SF2, PWM outputs, 0-10V DC outputs, and VFDs. Each panel may be configured to utilize one or more of the above fan control methods.

**Sample Temperature calculations**:

An example of a typical application that the system will use to operate.

Average Room Temperature: 75

Temperature Sensor Prep Offset: 5

Temperature Sensor Offset: 10

Fan Zone Hysteresis: 2 (hysteresis for each fan zone)

Fan Zone Operating Range: 25

Preparation Activation Temperature: 75+5 = 80

Activation Temperature: 75+10 = 85

Hysteresis Temperature: 85-2 = 83

Maximum Temperature: 85+25 = 110

Temperature Range: 85 to 110

### Static Fan Zone

**Figure 29** displays the HMI screen state when fans are active.

Fans will activate when:

- The unshaded **FANS** button is pressed, the button will then turn shaded.
- If a temperature sensor assigned to the zone reads activation temperature.
- IO input, BMS, or Scheduling is activated.

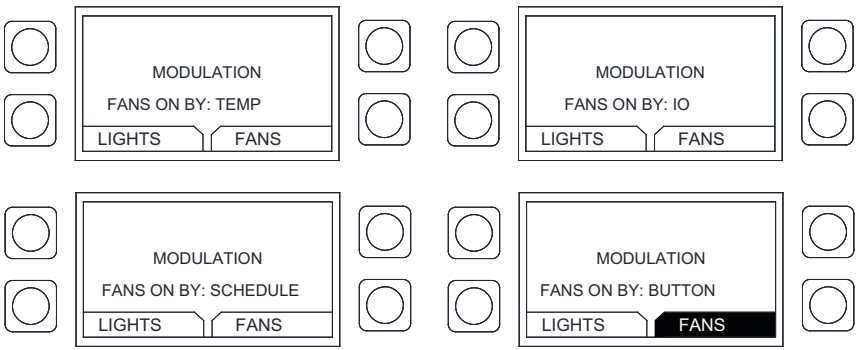
When fans are in Activation Mode:

- Exhaust fans run at the constant motor speed defined. Fans will run at this constant speed as long as temperature is above the hysteresis setting.
- The system will stay in activation mode at a minimum for the defined hysteresis timer.

Fans will turn off when:

- Pressing the shaded **FANS** button will turn off the fans, unless the previous mode settings are still active (Fans by Temp, IO, BMS, Scheduling).
- The hysteresis timer is satisfied and the temperature is below the hysteresis setting.
- Fan control can be turned to Auto Mode if fans were turned on manually (by button) and automatically (temperature is above the activation temperature).

**Figure 29 - Static Mode Activation**



## Dynamic Fan Zone

**Figure 30** displays the HMI screen state when the fans are in prep mode.

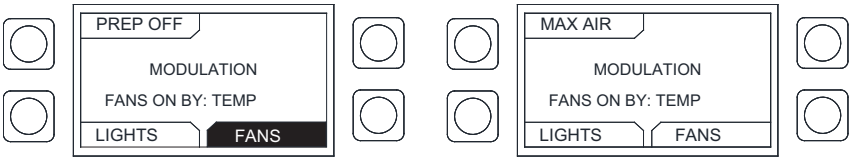
Fans will go into PREP MODE when:

- **FANS** button is pressed
- Temperature sensor assigned to the zone reads Preparation Activation Temperature.

Fans Operation in PREP MODE:

- The system will stay on for the minimum hysteresis timer. After the hysteresis timer is satisfied, the system can drop down to Fans Off Mode, if the temperature is below Preparation Hysteresis Temperature.
- When fans are in Preparation Mode (exhaust fans run at calculated Preparation Mode Frequency, supply fans are turned off). Any fans in the same zone controlled by a contactor will not activate.

**Figure 30 - Prep Mode**




Fans will activate in modulation when:

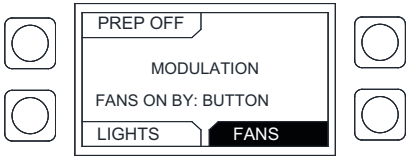
**Figure 31** displays the HMI screen state when the fans are in modulation.

- Pressing **PREP OFF** sends the system into modulation mode.
- If Preparation Mode is disabled, and if a temperature sensor assigned to the zone reads activation temperature, the fans will go into modulation mode.
- IO input

Fans Operation in modulation mode:

Exhaust fans run at dynamic modulation temperature calculation as long as the temperature is between the temperature range settings.

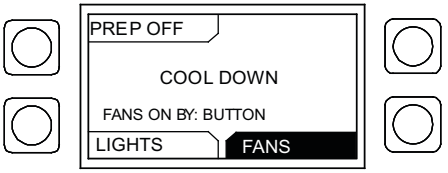
**Figure 31 - Modulation Mode**



Fans will go out of modulation mode when:

- After the hysteresis timer is satisfied, the system will drop to Cool Down Mode (**Figure 32**), if Prep is enabled, or to **FANS** mode if the temperature is below hysteresis temperature setting.
- Fans can only be turned off in modulation mode if there is insufficient heat under the hood to maintain the fan activation temperatures.

**Figure 32 - Cool Down Mode**



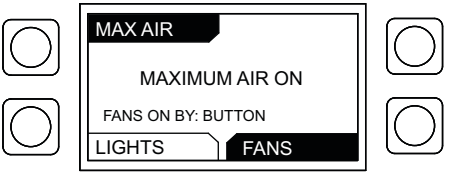

Fans in AUTO MODE when:

- Fans can be turned to **AUTO MODE** if fans were turned on manually (by button) and if the temperature is above the activation temperature.
- If a **FANS** button is not present, the fans are in Auto Mode. The fans will only be controlled by temperature sensors.

When fans are in Maximum Air Mode:

- If Max Air is enabled, a **MAX AIR** button (**Figure 33**) will appear. If pressed, this will send the system into Maximum Air Mode.
- Exhaust and supply fans will run at high speed.

**Figure 33 - Max Air**



## Other Options

### Make-Up Air Interlock

When the dedicated supply fan is a tempered make-up air unit, the blower inside the supply unit can be interlocked. The interlock must be closed for the supply fans to run. The unit will not run unless the safety controls (freezestat, smoke detector etc.) inside the supply fan are armed, and the internal motorized damper has reached its end limit switch. When the interlock is open, the supply VFDs or PWM/0-10V DC signal will shut off corresponding to their interlocked zone. An alarm will appear on the HMI if the signal from the make-up air is not received by the ECPM03 in ninety seconds (factory default) after the start signal is sent to the supply fan. If this fault occurs, the SF signal will de-energize. If proving is enabled, then the exhaust fans will not operate when the interlock is open.

The panel ships with a jumper wire between terminals IL1A and IL1B for all supply fans on Zone 1, and IL2A and IL2B for all supply fans on Zone 2. The jumper has to be removed first before wiring the interlock from a make-up air unit. Supply share static and dynamic only require a make-up air interlock on IL1A and IL1B.

### Appliances Pilot Check Warning

Every time an electronic gas valve is reset, a warning message will be displayed on the HMI for 1 minute. A **CLEAR** button will be displayed on the HMI to clear the warning message and stop the beeps. The message disappears after 1 minute when the clear button is not pressed. This message is normal and provided as a reminder only. There is no need to take any action.

### 120V AC BMS Dry Contact (Optional)

All controls are equipped with the ability to control the fans via a dry contact BMS interlock. Terminal IO1 should be energized by closing a dry contact placed between terminals H1 and IO1. Removing the signal from IO1 will typically cause the fans to turn off. However, if the thermostat sensors are hot or if the fans are energized through the fan button on the HMI, then the fans will continue to run.

**NOTE: If the panel is ordered with a digital building management option, such as CASlink, BACnet, or LonWorks, please refer to the Building Management Owner's Manual for alternative fan interlock scheduling.**

### Electric Gas Valve Reset

If the gas valve option is turned ON, an additional button (**GAS RESET**/**GAS ON**) will be displayed on the HMI to allow the user to reset or re-energize an electric gas valve connected to the panel. The gas valve is de-energized at initial start-up, when the fire system is triggered or in other conditions as well.

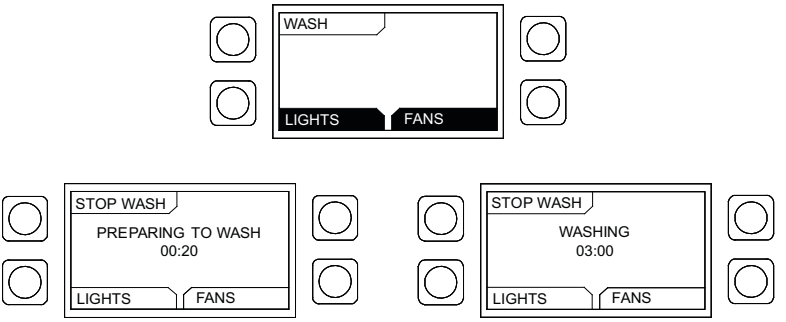
If the gas valve is enabled, then the **GAS RESET** button will be present. Once the **GAS RESET** is pressed, the **GAS ON** button will appear.

## Wash Self-Cleaning (Optional)

The two types of self-cleaning options available are Onboard, and CORE. On-board should only be utilized for W1, and WL option panels.

During the wash cycle, water will be sprayed in the plenum and duct. Surfactant is injected once per minute during the wash cycle. The wash frequency is the value at which all exhaust fans will run in a wash mode. The supply fan will be stopped during wash when set to static zone. Refer to **Figure 34** for wash sequence displays.

**Figure 34 - Wash Screens**




**NOTE: The fan frequency will change when the zone is set to dynamic. See "Factory Options" on page 43.**

The wash cycle will stop when the wash timer expires or when the **STOP WASH** button is pressed again.

The wash timer is factory set to 3 minutes and is adjustable through the menu. The surfactant is injected for 1 second at the start of each minute of wash (the surfactant injection time can be increased to 15 seconds).

**Hood filters MUST remain in place during the wash cycle**.

The wash cycle can be initiated in several ways:

- **Manually** - When the **WASH** button is pressed on the HMI.
- **Automatically** - If all of these conditions are met:
  - Fans will need to go out of modulation mode by the duct temperature cooling down and the hysteresis value and timer are met.
  - The fans will need to have effectively run cumulatively for an amount of time longer than the "Fan Runtime (H)." The (H) value is Hours for this option.
  - The amount of time elapsed since the previous wash cycle is greater than the "Interval Time" value. The (H) value is Hours for this option. That elapsed time is reset to zero when the wash cycle is active.

**NOTE: Preparation/Cool Down mode fan time does not count toward the runtime. The wash timers are reset to zero when the wash cycle is activated.**

- **Building Management System** - Refer to the Building Management Owner's Manual for more information.
- **Scheduled Wash** - Refer to **"Setting Wash Schedule" on page 68.**

If the surfactant level is too low, an alarm will be triggered on the HMI. If the wash cycle is initiated while this alarm is active, water will be sprayed, but no surfactant will be injected. Refill surfactant as soon as possible for best results. (Refer to Self-Cleaning or CORE Manual for additional information).

## Prime Surfactant

The prime surfactant option is only visible when “Onboard Wash” is enabled to Yes. When using the surfactant prime option, the surfactant pump will operate for 15 seconds. This will allow the user to test that the pump is operating properly.

## Scheduling

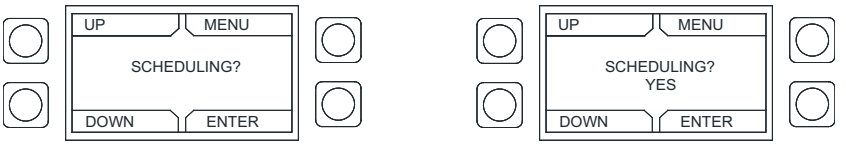
When scheduling is enabled, this will allow the user to set a schedule for the fans and wash system to run on various days and at various time settings. The selectable settings are Wash Time/Occupied Start Time/Occupied End Time/Copy Schedule. First, select a day to start your schedule. Occupied Start Time and Occupied End Time will have three schedules available.

- **Wash Time** – Options for wash time are Disabled or setting a time (12:00 AM-11:55 PM). When creating a scheduled wash, start your wash time for when the appliance(s) are not in use.
- **Occupied Start Time** – Set your start time for when the appliance(s) will be in use. The settings available are Disable or setting time (12:00 AM-11:55 PM).
- **Occupied End Time** – Set your end time for when the appliance(s) will no longer be in use. The settings available are Disabled, a time (this range is based on the start time, you cannot set this time before the “Occupied Start Time”), or Next Day. If setting a schedule past 11:55 PM, use “Next Day” to continue the schedule overnight.
- **Copy Schedule** – This allows the user to copy a set schedule from one day to the next, set a schedule to weekdays or all days.

### Enable Scheduling

1. Press the two top buttons at the same time to enter configuration mode.
2. “Board Settings” is the first screen to appear. Press **ENTER**.
3. “Options” will be the next screen. Press **ENTER.**
4. Use the **UP** or **DOWN** buttons to scroll to “Scheduling?” (**Figure 35**).
5. Verify “Scheduling?” is set to YES. If it is set to NO, select YES.

**Figure 35 - Enabling Schedule**



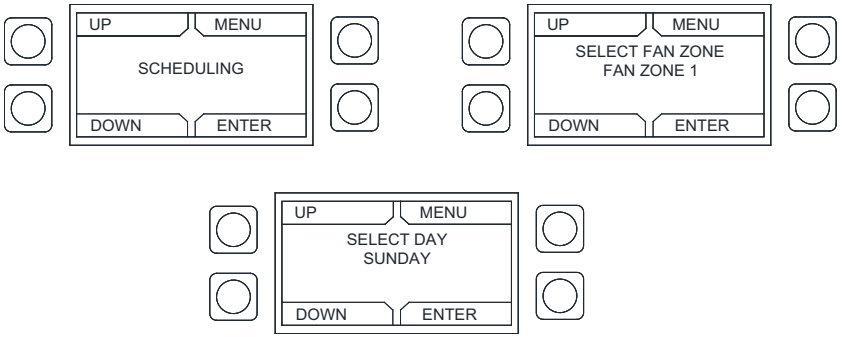
## Occupancy Schedule

1. Setting an occupancy schedule will control when the fan(s) and wash cycles start and stop.

**NOTE: Temperature sensor readings can still drive the automatic operation of the system.**

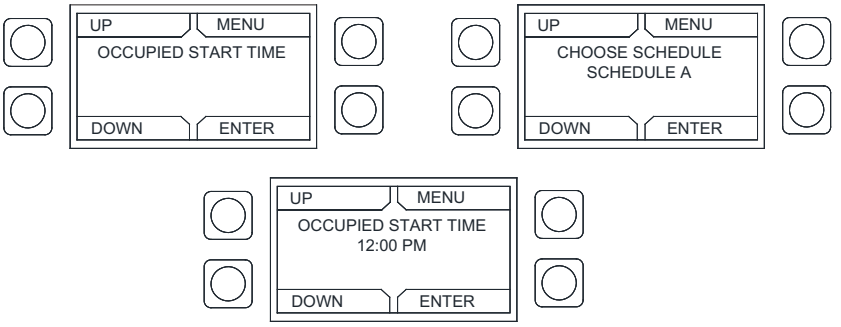
2. Enter configuration mode to set an occupancy schedule.
3. Scroll to “Scheduling” (**Figure 36**). Press **ENTER**.
4. The next screen, you may select “Fan Zone 1” or “Fan Zone 2”. Use the **UP** or **DOWN** buttons to select zone. After selecting which zone you want to set, press **ENTER**.
5. The next screen will allow you to select what day to set the schedule for. Use the **UP** or **DOWN** buttons to select a day (Sunday – Saturday).
6. The “Loading…” screen will appear.

**Figure 36 - Occupancy Schedule**




7. The next screen will display “Wash Time” as the first selectable option. Other options available on this screen:
   - Occupied Start Time
   - Occupied End Time
   - Copy Schedule
8. Set start time. Scroll to “Occupied Start Time.”
9. Choose a schedule. You may select three different schedules.
   - Schedule A
   - Schedule B
   - Schedule C
10. This will allow the user to set various schedules. The user may set schedules for morning, afternoon, or evening use.
11. The default “Occupied Start Time” (**Figure 37**) varies on which schedule you select.
12. Use the **UP** or **DOWN** button to set your time.
13. The range setting: Disabled - 11:55 PM.

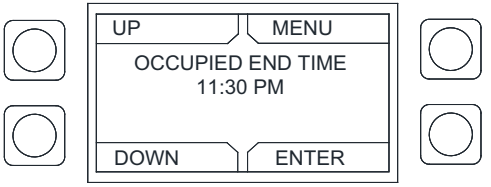
**Figure 37 - Start Time**




14. Set end time (**Figure 38**). Once the occupied start time is set, the user must set an end time.
15. Select schedule (A, B, C).
16. The range setting: Disabled - Next Day.

**NOTE: When using "Next Day," set the next day start time to 12:00 AM.**

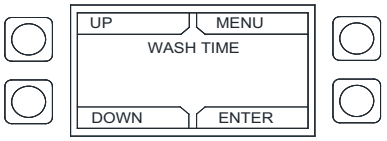
**Figure 38 - End Time**

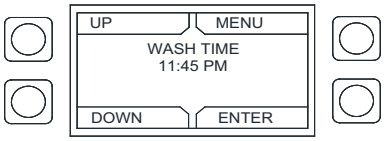


## Setting Wash Schedule

1. To set a wash schedule, enter configuration mode.
2. Scroll to “Scheduling.” Press **ENTER**.
3. The next screen, you may select fan zone 1 or fan zone 2.
4. Use the **UP** or **DOWN** buttons to select zone. After selecting which zone you want to set, press **ENTER**.
5. The next screen, you may select what day you want to set for a schedule.
6. Use the **UP** or **DOWN** buttons to select a day (Sunday – Saturday).
7. The “Loading…” screen will appear.
8. Select “Wash Time” (**Figure 39**).
9. Set the time you want the wash to start. You cannot set a wash time if the system is in an occupied time setting. If a scheduled wash is active, automatic washing is disabled. Scheduled washes should ideally be set at a time just after cooking operations have completed, and the duct and plenum are still warm.
10. You may hold the **UP** or **DOWN** button to fast scroll.
11. The range setting: Disabled - 11:55 PM.

**Figure 39 - Wash Schedule**

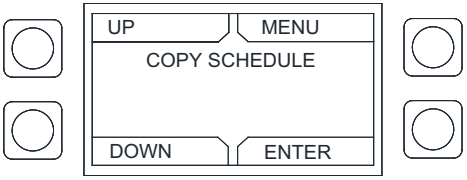


## Copying a Schedule

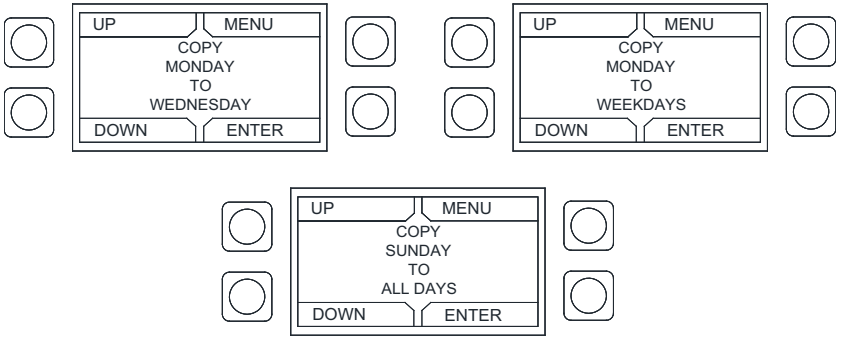
1. Before copying a schedule, verify that the proper day, schedule, start time, end time, and wash time are set.
2. Scroll to “Copy Schedule” (**Figure 40**). Press **ENTER**.

**Figure 40 - Copy Schedule**



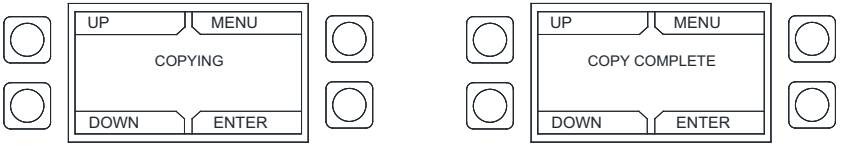

3. Determine what schedule to copy (**Figure 41**). Scroll through the selectable options:
   - Day to Day
   - Day to Week Days
   - Day to All Days
4. Day to day should be used if the schedule is the same for specific days but not for all. For example: If the equipment is operated at the same time on Monday, Wednesday, and Friday, copy Monday’s schedule to Wednesday and then to Friday. Set the proper schedule for the other days.
5. Day to weekdays should be used if the schedule is the same throughout the weekdays (Monday – Friday). Using this option will not set a schedule for Saturday or Sunday.
6. Day to all days should be used if the schedule is the same for all days (Sunday – Saturday).

**Figure 41 - Picking Schedule**




7. When copying a schedule (**Figure 42**), the HMI will display “Copying” then “Copy Complete.”

**Figure 42 - Copying Schedule**



## Setting a Continuous Schedule

When setting a continuous schedule (**Figure 43**), verify that the proper day, schedule, start time, end time, and wash time are set for your initial start day.

When using the “Next Day” setting, verify that the “Occupied Start Time” for the next day is set to 12:00 AM, then set the “Occupied End Time” for that day.

For example, to set a schedule from 8:00 AM to 2:00 AM (next day), set the following:

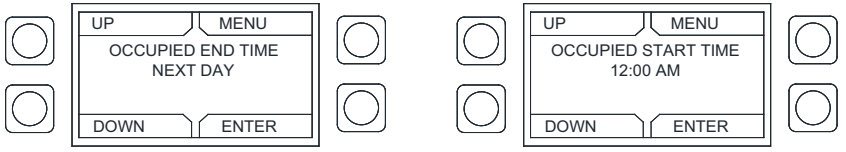
Monday

- Occupied start time A = 8:00 AM
- Occupied end time A = Next Day

Tuesday

- Occupied start time A = 12:00 AM
- Occupied end time A = 2:00 AM

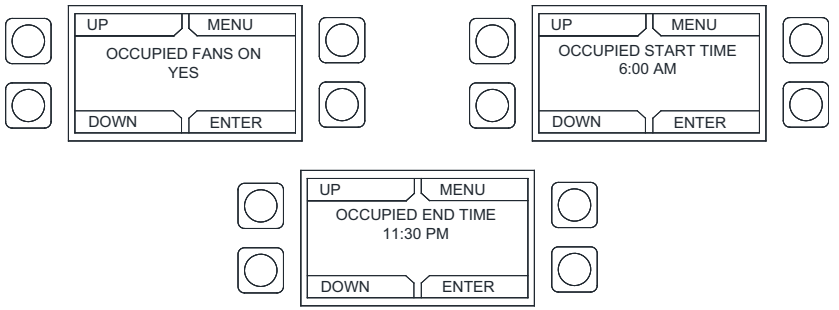
**Figure 43 - Continuous Schedule**




## Setting a Fan Schedule

1. Press the two top buttons at the same time to enter configuration mode.
2. “Board Settings” is the first screen to appear. Press **ENTER**.
3. Use the **UP** or **DOWN** buttons to scroll to “Factory Options.” Enter Password 1111. Press **ENTER.**
4. Scroll to “Fan Zone Config.” Press **ENTER.**
5. Scroll to “Select Fan Zone 1/2.” Select which zone you want to set up. Press **ENTER.**
6. Scroll to “Occupied Fans On” (**Figure 44**). Press **ENTER.**
7. Verify “Occupied Fans On” is set to YES. If it is set to NO, select YES.
8. The fan(s) will operate during the start time and end time settings.
9. When the fan(s) are operating in an occupied setting, they will run in modulation mode when “Occupied Fans On” is enabled.

**Figure 44 - Fan Schedule**

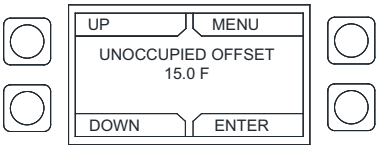


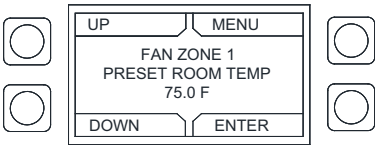
## Unoccupied Additional Offset

1. Fan schedule must be enabled. Press the two top buttons at the same time to enter configuration mode.
2. “Board Settings” is the first screen to appear. Press **ENTER**.
3. Use the **UP** or **DOWN** buttons to scroll to “Factory Options.” Enter Password 1111. Press **ENTER.**
4. Scroll to “Fan Zone Config.” Press **ENTER.**
5. Scroll to “Select Fan Zone 1/2.” Select which zone you want to set up. Press **ENTER**.
6. Scroll to “Unoccupied Additional Offset” (**Figure 45**). Press **ENTER**.
7. Adjusting the unoccupied offset allows the user to add an unoccupied offset temperature range on top of the other system offset settings. The default temperature setting is 15.0°F. This setting is adjustable from 0-30°F.
8. The fans turn on when the temperature exceeds the additional unoccupied offset during an unoccupied time. The "Unoccupied Offset" prevents false fan activation during an unoccupied time range.

**Example:** If the Room Temperature is set to 75°F, the Temperature Sensor Offset is set to 10°F, then the user sets an Unoccupied Offset of 15°F, the fans will turn on at 100°F in an unoccupied time range. If your hysteresis value is set to 2°F, the fans will shut off when the temperature drops to 98°F and the hysteresis timer has expired.

**Figure 45 - Unoccupied Offsets**



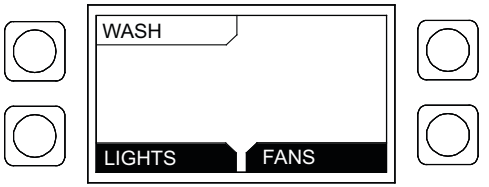



## Light Brightness

This option is used on hoods that accept a 10V DC input signal, and maybe wired between two zones. When enabled through VDC Output Type, the light's brightness setting may be adjusted by entering the configuration menu and scrolling to "Light Brightness" or by pressing and holding the **LIGHTS ON** button for 3 seconds (**Figure 46**). The setting range is 10-100% and adjusts in increments of 5. Default is 100%.

The dimming control threshold varies between 0-10V and 2-10V. If the lights are not operating when set at a low percentage, try adjusting to a higher percentage before troubleshooting the system.

**Figure 46 - Light Brightness**



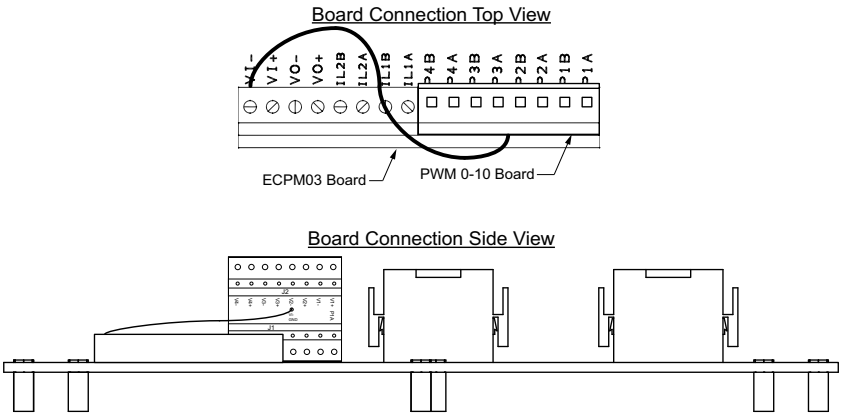

## PWM 0-10V Board

The PWM 0-10V board (**Figure 47**) is an accessory board used with the ECPM03 board, and eliminates the need for providing a small horsepower VFD for jobs that require a 0-10V signal.

The 0-10V board is capable of providing up to four separate 0-10V signals, allowing the ECPM03 board up to five 0-10V output signals. The 0-10V board connector J1 will connect to the PWM outputs of the ECPM03 board at connector J10 terminals P1A through P4B. The 0-10V board will convert the PWM signal and output 0-10V signals at connector J2. There is a ground wire connection on the 0-10V board labeled VI(-) GND. This connection should be connected to the ECPM03 at connector pin VI(-). When the 0-10V board is in use, the ECPM03 board will no longer be capable of outputting PWM signals.

The Electronically Commutated Motor (ECM) percentage limits will convert to an equally limited 0-10V signal. For example, 50% = 5.0V. You must set the # of ECM fans to how many 0-10V signals will be utilized from this board.

**Figure 47 - PWM 0-10V Board**



## Diagnostics

If there is an issue with the system or certain parameters, use the HMI diagnostic menu to check settings. Using the diagnostic menu will help determine why or why not certain functions are working when they should not be or why certain functions will not work. Timers and system settings will override certain functions depending on the settings.

- Temperature Readings
- Room Temperature Readings
- # of Drive in Zone
- Hysteresis Timer
- Manual to Auto Time
- Max Air Time
- IO Delay
- Autowash Fan Runtime
- Autowash Min Interval Time
- Light Timer After Wash
- Time Since Last Wash
- Humidity (All sensor readings displayed)
- WMSB Data

**Temperature Readings** - This menu provides temperature readings for wired and HMI sensors connected to the package. If multiple sensors are attached, scroll through using the Up and Down buttons on the HMI.

**WMSB Data** - This menu provides temperature (°F), relative humidity (%), and barometric pressure (mBAR) readings for all WMSB connected to the package. Use the Up and Down buttons on the HMI to scroll through the readings. Displays number of remote units reporting in each zone.

## Humidity Monitoring

If the electrical package is ordered with an HMI that is capable of monitoring humidity, the HMI will display the humidity percentage under the diagnostics menu. If the electrical package is ordered with an HMI that is not capable of monitoring humidity, the HMI will display N/A under humidity.

When installing an HMI to monitor the space's humidity, you must install in an area that is away from heat sources. Do not mount on hood, near cooking appliances or other heat-emitting sources. The humidity readings will not be accurate for that area.

## TROUBLESHOOTING CONTROL PACKAGE

The following table lists causes and corrective actions for possible problems with this control package. Review this list before consulting manufacturer.

| Problem | Potential Cause | Corrective Action |
|---|---|---|
| Smoke Rollout from Hood – Fans don't start-up when appliances are ON | Dirty temperature sensor | Clean grease and dirt from sensor. |
| | Poor heat detection | Decrease duct temperature offset values. |
| | Improper hood installation | Check for proper hood overhang, cross drafts, or improper hood design. |
| Fan(s) Spin in the Wrong Direction | 3-phase motor output wired backwards | Swap 2 of the 3-phase wires on the output of the starter feeding the motor. |
| VFDs start On, then shut Off | Modbus fault | Check Modbus connections and VFDs. |
| Gas Valve Reset Does Not Show | Settings not configured properly in HMI | Refer to **"Electric Gas Valve Reset" on page 63**. |
| Dimming Lights Erratic | Dimming circuit setup | The minimum dimming control threshold may vary if using dimming control options by other manufacturers. Adjust the lighting control through the HMI and monitor the lighting brightness. |
| Fans Operating Overnight | Modulation offset too high | Lower the modulation offset for fans to trigger modulation at a lower temperature. |
| | Fans button by manual | Ensure cooking staff is deactivating fans at night. |
| Current Sensor - No readings | Faulty wiring/sensor | Confirm there is +12 to 30V DC in series with the current sensor output terminals and the analog input of the control panel. |
| | | Check the polarity of the circuit. |
| | | Verify that the terminals are secured, and wires are firmly in place. |
| | | Disconnect the input to the control panel. Insert a current meter (mA range) in series with the current sensor output to verify that the circuit is working properly. |

| Problem | Potential Cause | Corrective Action |
|---|---|---|
| Current Sensor - Erratic readings | Faulty wiring/sensor | Verify that the wires are terminated properly. |
| | | Check that the +12 to 30V DC input is clean. In areas of high RF interference, shielded cable may be necessary to stabilize signal. |
| Calibration Failure | Check fan power | Check there is power to fans. |
| | | Check fan settings are configured to proper number in system. |
| | | Check current sensor is assigned to proper motor type. Ensure all unused current sensors are marked as unassigned. |
| | | Check that interlock closed from MUA. |

**WMSB Troubleshooting**

If you experience issues with the sensor or charging, perform the following checks:

- Verify the sensor is within 10-15 feet of the electrical control package.
- Check that the sensor is receiving proper lighting on the solar panel. There should be approximately 200 lumens for the solar panel to function properly.
- Verify electrical connections from the solar cell to the board are properly connected.
- Verify the battery connection is connected to the board. This must be connected in the field.
- Check that there are no objects or any type of impedance to the sensor or lighting.
- Do not mount the sensor inside a cabinet.
- Verify the sensor is not installed inside the wall. The back of the sensor should be flush to the outside of the wall.
- When the battery is low, a fault will be displayed on the ECP HMI. Change battery.

### HMI Fault Messages

The following table lists fault messages displayed on the HMI and corrective actions. Review this list before consulting manufacturer.

| HMI Message | Potential Cause | Corrective Action |
|---|---|---|
| “Fire” | There is a fire condition or the fire circuit not wired properly. | If a fire is not present, verify connection between terminal blocks C1/H1 and AR1. |
| “Light Fault Zone 1 Bx De-energized” | Light output is energized but no power is detected on terminal B1. | Verify the light relay is not damaged and that the light circuit breaker is not tripped. |
| “Light Fault Zone x B1 energized” | Light output is de-energized but power is detected on terminal B1. | Verify that the light relay contact is not welded in the closed position. |
| “Overload Zone x” | One of the overload relays for fans associated with zone 1 is tripped. | Reset overload relay. Monitor fan to see why overload tripped. |
| “Surfactant Low” | Surfactant level is low. | Refill surfactant tank. |
| “PCU Fault” | PCU filters are clogged or missing. | Check PCU filters. If the filters are clogged or dirty, clean or replace if needed. |
| “Proving Fault” | Proving enabled. Exhaust fan not meeting its minimum calibrated load. | Verify fans are running properly. |
| | | Verify proving calibration. Refer to **“Proving Enabled (Optional)” on page 58**. |
| “Fuse F1 Blown” | Fuse F1 is blown or missing. | Check ECPM03 wiring connections at J9-1 and J9-8. |
| | | Verify the fuse is blown. Check for a short circuit at 120V AC outputs. Verify the load is below 10 amps. |
| “Temp Sensor x Not Connected” | Temperature sensor x is not wired to the ECPM03 board. | Verify wiring connections to terminals TxA and TxB. |
| | | Check for faulty wiring or sensor. |

| HMI Message | Potential Cause | Corrective Action |
|---|---|---|
| “Modbus Communication Fault” | One or several components on the Modbus network are not responding. | Verify HMIs are plugged in. |
| | | Verify CORE or PCU AFM are plugged in. |
| | | Verify the configurations are set correctly. |
| | | Verify Cat 5 connections. Check for damaged wiring or ends. |
| “CORE x Fault” Fault description | Specific fault is present on the CORE fire system. | Verify the CORE DIP switch settings are correct. |
| | | Refer to CORE manual for specific fault description. |
| “PCU x Fault” Fault description | Specific fault is present on the PCUAFM x connected to the system. | Refer to the PCUAFM manual for specific fault description. |
| “ESP x Fault” Fault description | Specific fault is present on the PCUAFM x connected to the system. | Refer to the PCUAFM manual for specific fault description. |
| "Sup 1 Interlock" "Check MUA-1 Controls" | Interlock signal was not received back from the MUA. | Verify MUA is not faulted and damper is fully open. |
| | | Verify Interlock is properly wired. |
| "Exh" or “Sup” "VFD Fault" | VFD fault on exhaust or supply. | Refer to the VFD manual for details. |
| “Temp Sensor x Bad Sensor” | Faulty temperature sensor due to overheating or internal failure. | Check for faulty wiring or sensor. |
| “Communications fault Check Configuration” | ECPM03 board and HMI not communicating due to:<br>- Software incompatible<br>- HMI # doesn’t match number of zones | Re-flash the HMI |
| | | Change HMI # |
| | | Replace Cat 5 cable |
| | | Replace EOL resistor |
| Invalid Activation | Voltage on CORE Board at Connector J3-7/J3-10 | Check for external voltage being applied at J3-7 and J3-10. |

## VFD Fault List

Adjusting VFD parameters may cause other operating system issues. Improper handling of these devices may be dangerous. Only a trained service technician should work and make adjustments to the VFD and settings. Refer to VFD Manual for more information.

To reset faults, remove power until VFD display is blank. Refer to **Table 5** for common VFD faults. Refer to **Table 6 on page 79** for VFD fault list.

**Table 5 - Common VFD Faults**

| Fault # | Fault Description | Potential Cause | Corrective Action |
|---|---|---|---|
| 1 | IGBT temperature fault | Drive is too hot inside | Reduce load to drive. |
| | | | Improve cooling. |
| | | | Verify control cabinet cooling fan operation and check air filter (If VFD is mounted in ECP). |
| | | | Verify VFD Internal cooling fan operation (3HP and above). |
| 2 | Output fault | Short circuit | Check motor/cable. (Megohmmeter may be necessary for proper diagnosis). |
| | | Mechanical issue | Check system for mechanical issues. |
| | | Excessive capacitive charging | Verify correct cables and wiring are used to the VFD. |
| | | | Install reactor between motor and drive. |
| | | Acceleration time too short | Increase P104 (Accel Time). Adjustable from 0 Hz– base frequency (P167), refer to **"Variable Frequency Drive Parameters" on page 13**. |
| | | Failed output transistor | Contact factory technical support. |
| 3 | Ground Fault | Grounded motor phase | Check motor/cable. (Megohmmeter may be necessary for proper diagnosis). |
| | | Grounded wiring between VFD and motor | |
| 4 | Temperature fault | Drive is too hot inside | Reduce load to drive. |
| | | | Improve cooling. |
| 5 | Flying Start Fault | Over-current | Verify fan is not rotating at run command to VFD. |
| 6 | High DC bus | Main voltage too high | Check main voltage and P107, refer to **"Variable Frequency Drive Parameters" on page 13.** |
| 7 | Low DC bus | Main voltage too low | Check main voltage and P107, refer to **"Variable Frequency Drive Parameters" on page 13.** |

**Table 5 - Common VFD Faults**

| Fault # | Fault Description | Potential Cause | Corrective Action |
|---|---|---|---|
| 8 | Overload fault | Excessive motor load for too long | Verify proper motor rotation. |
| | | | Decrease the high-frequency setting. |
| | | | Adjust motor pulley to reduce load (if applicable). |
| | | | Check fan for mechanical issues (debris in fan wheel, motor failure, bearing failure, etc.). |
| | | | Verify P108 setting, refer to **"Variable Frequency Drive Parameters" on page 13.** |
| | | | Verify motor and drive are proper size for application. |

**Table 6 -VFD Drive Fault List**

| Fault Number | Description | Fault Number | Description |
|---|---|---|---|
| 0 | No Fault | 12 | Phase Lost |
| 1 | IGBT Temperature Fault | 13 | External Fault |
| 2 | Output Fault | 14 | Control Fault |
| 3 | Ground Fault | 15 | Start Fault |
| 4 | Temperature Fault | 16 | Incompatible Parameter Set |
| 5 | Flying Start Fault | 17 | EPM Hardware Fault |
| 6 | High DC BUS | 18 - 27 | Internal Fault |
| 7 | Low DC BUS | 28 | Remote Keypad Lost |
| 8 | Overload Fault | 29 | Assertion Level Fault |
| 9 | OEM Fault | 30 - 33 | Internal Fault |
| 10 | Illegal Setup Fault | 34 | Comm. Module Failure |
| 11 | Dynamic Brake Fault | 35 - 44 | Network Fault |

Refer to VFD Manual for more information.

## MSC Troubleshooting

| Fault | Problem | Potential Cause | Corrective Action |
|---|---|---|---|
| Feedback Fault | Feedback Fault on MSC Display | Disconnected/faulty wiring. | Secure connections to fan. If faulty wiring is found, repair, or replace as required. |
| | | No feedback for 30 seconds. | Check parameters. |
| | | Less than 70% of RPM. | Check duct/fan for obstructions. |
| Modbus | Modbus fault on MSC Display | Faulty Cat 5 connection/cable. | Find and replace faulty cable. |
| | | ECPM03 does not recognize device. | Verify Modbus # on device is set correctly. |
| Variable Device Fault | Motor not responding to changes made on variable device (potentiometer) | Defective potentiometer. | Replace potentiometer. |
| | | Faulty wiring to motor. | Find and replace faulty wiring. |
| Motor not responding | Motor not functioning as expected | 2-Speed switch not working. | Check switch and wiring. |
| | | Wiring to motor defective. | Find and replace faulty wiring. |
| | | Check for other faults on MSC display. | If no other faults are present, motor may be defective. |

**TURN OFF POWER TO THE MOTOR WHILE PROGRAMMING THIS DEVICE.**

- If the device has a potentiometer or a 2-Speed switch, a jumper wire can be placed in between the 10V In and 10V Out terminals to rule out a defective device. This will cause the motor to go to HIGH SPEED.
- The IO STATUS menu can be used to verify the inputs and outputs of the device are functioning as expected.
- The FAULT HISTORY menu can be used to keep track of faults while working on the device.

# MAINTENANCE

To guarantee trouble-free operation of this control, the manufacturer suggests following these guidelines. Most problems associated with unit failures are directly related to improper service and maintenance.

Please record any maintenance or service performed on this equipment in the documentation section located at the end of this manual.

**WARNING: Do not attempt maintenance on this control until the electrical supply has been completely disconnected.**

## General Maintenance

1. Control enclosure should be kept clean and free from any grease or dirt build-up.
2. All fasteners should be checked for tightness each time maintenance checks are performed before restarting unit.
3. Control enclosure door panel should be securely closed after maintenance to prevent tampering or electrical shock.
4. Real Time Clock (RTC) battery should be replaced every 10 Years. Use CR2032 or equivalent.

## Every Month

1. Temperature sensor(s) in exhaust hood riser(s) must be cleaned by removing any grease or dust build-up from the probe with a clean cloth. A clean sensor ensures that the temperature switch will quickly respond to changes in exhaust air temperature.
2. Check all fasteners, sensors, and electrical connections for proper tightness and continuity.

## Wall Mounted Enclosure Fan Filter Inspection

1. Remove outer black plastic housing of the enclosure fan to gain access to the fan filter. The cover is held in place by frictional clips, simply pry on it to remove.
2. Inspect the fan filter for grease/debris. If the filter is dirty, clean, or replace. **Replacement fan filter part number: MC32658 (pack of 5)**.

**WARNING: If fan filter cleaning is not performed, grease/debris buildup may occur, resulting in VFD failure due to overheating. VFD warranty may be denied if filter inspection is not performed monthly and logged on the maintenance record.**

## Self-Cleaning

Please refer to the Self-Cleaning, Electric Wet Chemical, or CORE Manual for Installation, Operation, and Maintenance of the self-cleaning system.

## Notes

## Notes

## Start-Up and Maintenance Documentation

**START-UP AND MEASUREMENTS SHOULD BE PERFORMED AFTER THE SYSTEM HAS BEEN AIR BALANCED (Warranty will be void without completion of this form)**

**Job Information**

| | | | |
|---|---|---|---|
| Job Name | | Service Company | |
| Address | | Address | |
| City | | City | |
| State | | State | |
| Zip | | Zip | |
| Phone Number | | Phone Number | |
| Fax Number | | Fax Number | |
| Contact | | Contact | |
| Purchase Date | | Start-up Date | |

## Maintenance Record

| Date | Service Performed |
|---|---|
| | |
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As a result of our dedication to constant improvements and quality, the MANUFACTURER reserves the right to update specifications without notice. Please refer to MANUFACTURER's website for up to date documentation.

## Technical Support Information

CASLink

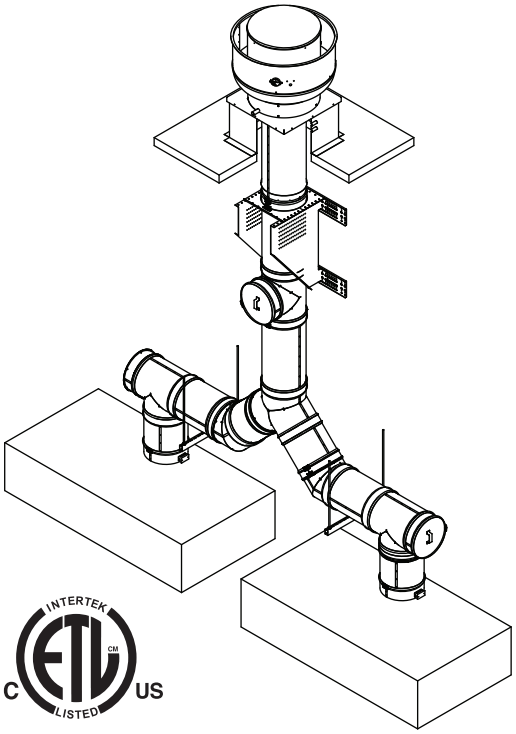
Technical Support

Parts Store

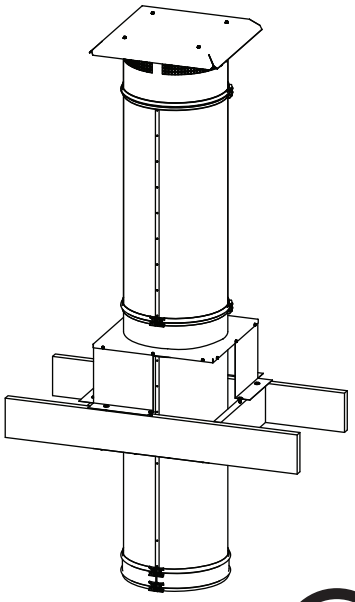
**Non-Welded Double Wall Grease Duct/Type HT Chimney Systems**

# Installation, Operation, and Maintenance Manual

Grease Duct



Chimney



**FOR YOUR SAFETY**

**TWO MAJOR CAUSES OF GREASE DUCT RELATED FIRES: (1) FAILURE TO MAINTAIN REQUIRED CLEARANCE (AIR SPACE) TO COMBUSTIBLE MATERIALS AND (2) FAILURE TO CLEAN GREASE LADEN DUCTS. IT IS OF UTMOST IMPORTANCE THAT THIS GREASE DUCT BE INSTALLED ONLY IN ACCORDANCE WITH THESE INSTRUCTIONS. DO NOT INSTALL GREASE DUCT WITHOUT FIRST READING THESE INSTRUCTIONS VERY CAREFULLY.**

**RECEIVING AND INSPECTION**

**EXAMINE ALL COMPONENTS FOR POSSIBLE SHIPPING DAMAGE PRIOR TO INSTALLATION.**

**DIFFERENT MANUFACTURERS HAVE DIFFERENT JOINT SYSTEMS AND ADHESIVES. DO NOT MIX PIPE, FITTINGS, OR JOINING METHODS FROM DIFFERENT MANUFACTURERS.**

**Save these instructions. This document is the property of the owner of this equipment and is required for future maintenance. Leave this document with the owner when installation or service is complete.**

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# WARRANTY

## Grease Ductwork Systems

This Grease Ductwork System is warranted to be free from defects in material and workmanship, under normal use and service from the date of shipment. A Lifetime Warranty is included on Double Wall Grease Sections - Model DW-2R, DW-3R, and DW-3Z. A 20-Year Warranty period is included for mechanical installation components such as; clamps, access doors, access door grease dams, hardware, etc.

## Chimney Systems

This Chimney System is warranted to be free from defects in material and workmanship, under normal use and service from the date of shipment. A 20-Year Warranty period is included on Chimney Sections - Model 103 (HT), and all mechanical installation components such as; clamps, access doors, hardware, etc.

### Warranty Conditions

Warranties shall not apply if:

1. The equipment is not installed by a qualified installer per this installation guide; this guide should be kept with the equipment once installation is complete.
2. The equipment is not installed in accordance with Federal, State, and Local codes and regulations.
3. The equipment design or sizing is not approved per MANUFACTURER'S specifications.
4. The equipment is misused, neglected, or not maintained per the MANUFACTURER'S maintenance instructions.
5. The equipment is exposed to elevated temperatures due to a fire originating in the building, hood, fan, duct, chimney, or kitchen appliances.
6. The equipment is not operated within its published capacity.
7. The equipment is operated, tested, or stored in the presence of chlorines, solvents, refrigerant vapors, caustic substances, halogenated compounds, or other conditions that could cause condensation of corrosive materials within or on the system.
8. The equipment is substituted or connected with parts not manufactured per Original Equipment Manufacturer.
9. The invoice is not paid within the terms of the sales agreement.

The MANUFACTURER shall not be liable for incidental and consequential losses and damages potentially attributable to malfunctioning equipment. Should any part of the equipment prove to be defective in material or workmanship within the warranty period, upon examination by the MANUFACTURER, such parts will be repaired or replaced by the MANUFACTURER at no charge. The BUYER shall pay all labor costs incurred in connection with such repair or replacement. Equipment shall not be returned without MANUFACTURER'S prior authorization, and all returned equipment shall be shipped by the BUYER, freight prepaid to a destination determined by the MANUFACTURER.

## LISTINGS

This Grease Duct has been tested and is listed to UL1978, UL2221, CAN/ULC-S115, and CAN/ULC-S144. Testing has been extended to recognize ASTM E2336, ASTM E814, and AC101 Standards due to similar testing criteria.

Models 2R, 3R and 3Z are used for grease duct applications when installed in accordance with these instructions and National Fire Protection Association “NFPA 96”; Standard for Ventilation Control and Fire Protection of Commercial Cooking Operations.

This Factory Built Chimney has been tested and is listed to UL103 and UL103HT. Testing has been extended to recognize CAN/ULC-S629-M87, and ULC/ORD-C959-1993, unenclosed installation and is for commercial use only. For use in applications where the flue gas temperature not exceeding 1000°F (540°C), under continuous operating conditions, intermittent operation (less than one hour) at temperatures not exceeding 1400°F (760°C), and brief (maximum 10 minute) operation at temperatures not exceeding 2100°F (1125°C).

Model 2R Type HT chimney system has been tested and is listed for installations in positive pressure applications where the chimney is subject to positive pressure rather than negative or neutral pressures. The chimney system is rated for use at maximum 60 inch water column internal pressure when used in Positive Pressure Applications.

Factory Built Chimney Model 2R has been tested and is listed to UL2561. Testing has been extended to recognize ULC/ORD-C959-1993, unenclosed installation and is for commercial use only. For use in applications where the flue gas temperature not exceeding 1000°F (540°C), under continuous operating conditions, intermittent operation (less than one hour) at temperatures not exceeding 1400°F (760°C), and brief (maximum 10 minute) operation at temperatures not exceeding 2100°F (1125°C).

This chimney system is intended for installation within commercial/industrial applications and is not intended for use in family dwellings. When installed in accordance with these instructions and National Fire Protection Association “NFPA 211”; Standard for Chimneys.

## CLASSIFICATIONS

**UL 2221**: Standard for Fire Resistive Grease Duct Enclosure Assemblies. Chapter 7 of this standard references a test labeled Internal Fire Test. Section 7.1.1 references two installation conditions, Condition A and Condition B. Condition A represents all installation conditions except for installation within non-ventilated combustible enclosures. Condition B represents installation within a non-ventilated combustible enclosure.

**UL 2561**: Standard for 1400 Degree Fahrenheit Factory-Built Chimneys.

**UL 103**: Standard for Factory Built Chimneys for Residential Type and Building Heating Appliances.

**Model 3Z** is classified under UL2221 (Test of Fire Resistive Duct Enclosure Assemblies) as an alternate to 2-Hr. fire resistive shaft enclosures with a minimum zero clearance to combustibles (sizes 5” to 36” diameter). Model 3Z is listed in accordance with the requirements for duct enclosure Condition A and B.

**Model 3R** is classified under UL2221 (Test of Fire Resistive Duct Enclosure Assemblies) as an alternate to 2-Hr. fire resistive shaft enclosures with a reduced clearance to combustibles (sizes 5” to 24” diameter). Model 3R is listed in accordance with the requirements for duct enclosure Condition B.

**Model 2R** is classified under UL2221 (Test of Fire Resistive Duct Enclosure Assemblies) as an alternate to 2-Hr. fire resistive shaft enclosures with a reduced clearance to combustibles (sizes 5” to 18” diameter). Model 2R is listed in accordance with the requirements for duct enclosure Condition B.

**Model 2R Type HT** is listed under UL103 (Building Heating Appliance Chimney). Insulated double wall building heating appliance Chimney / Type HT Factory Built Chimney intended for commercial and industrial applications in sizes 5” through 16” ID.

**Model 2R** is listed under UL2561 (Building Heating Appliance Chimney for coverage as a Medium Heating Appliance 1400°F Chimney System). Insulated double wall Factory Built Chimney intended for commercial and industrial applications in sizes 5” through 16” ID.

# APPLICATION

## Grease Ducts

**CAUTION: OPEN WINDOWS DURING THE FIRST START-UP TO DISSIPATE SMOKE AND ODORS. When operating the appliances for the first time, you will experience smoke and odor from the duct system resulting from the curing of paint and burning off of any oils remaining from manufacturing. Odors may be irritating to sensitive individuals. Smoke detectors may activate.**

**NOTE: For caustic environments, including coastal environments, duct systems will be constructed of 444 stainless steel (SS) parts. The duct and joint connections (V bands) will be constructed of 444 SS and supplied with 316 SS hardware.**

Double wall grease ducts are listed for a continuous internal temperature of 500°F and intermittent temperatures of 2000°F. Double wall grease duct is ideally suited for use in commercial cooking installations for the removal of smoke and grease laden vapors. Grease duct system size and capacity information may be obtained from the *ASHRAE Handbook – Fundamentals* or from the *Air Pollution Engineering Manual* of the US Environmental Protection Agency. Grease duct installations require provisions for cleaning the interior of the duct. NFPA 96 clean-out requirements are as follows:

1. A clean-out must be provided at each change of direction, except where the entire length of duct can be inspected and cleaned from either the hood or the discharge end.
2. On horizontal duct runs, at least one 20” diameter opening must be provided. Where the opening is smaller than 20” diameter, openings large enough to permit cleaning must be provided at intervals of no more than 12’.
3. Openings must be at the side or the top, whichever is more accessible. When the opening is on the side of the duct, the lower edge of the opening must be at least 1-1/2” above the bottom of the duct. For the listed grease duct, this is accomplished by the use of the grease manifold tee and clean-out cap.
4. On vertical duct runs where personnel entry is possible, access must be from the top of the riser. Where entry is not possible, access must be provided at each floor.

**NOTE: Access requirements are subject to change in accordance with local code. Local authorities should be consulted for exact requirements. Grease duct may be connected only to hoods in a single fire zone on one floor. Do not connect grease ducts to any other part of the building ventilation or exhaust system.**

When the grease duct is installed in accordance with these installation instructions and the joints are sealed properly with the recommended sealant, the system will contain a fire within the duct. A fire can burn at extremely high temperatures. The system should be dismantled and inspected after any exposure to a fire. Any section that is distorted or discolored should be replaced. All joints in the system should be examined.

The sealant expands to ensure a positive seal in the case of a fire, and any sealant that has been exposed to high temperature must be replaced. This will ensure that the system maintains its integrity against fire conditions in the future. The manufacturer of this grease duct cannot be responsible for grease duct systems that are not properly maintained or have been subjected to one or more fire conditions.

## Chimneys

**NOTE: For caustic environments, chimney systems will be constructed of 444 stainless steel (SS) parts. The chimney and joint connections (V bands) will be constructed of 444 SS and supplied with 316 SS hardware.**

Factory Built Chimney Model 2R Type HT is listed for continuous internal temperatures of 1000°F US & 600°F Canada, intermittent temperatures of 2100°F. Factory Built Chimney Model 2R is listed for continuous internal temperatures of 1400°F US & Canada, intermittent temperature of 1800°F. This system is ideally suited for commercial and industrial application for the removal of smoke and heat, and is rated for use at a maximum 60 inch water column internal pressure when used in positive pressure applications. Chimney system size and capacity information may be obtained from the *ASHRAE Handbook – Fundamentals* or from the *Air Pollution Engineering Manual* of the US Environmental Protection Agency.

**NOTE: Model 2R Chimney & Model 2R Type HT Chimney Systems used for positive pressure applications must be sealed with the recommended sealant listed in this manual. NO SEALANT SUBSTITUTES MAY BE USED. Model 2R & Model 2R Type HT Chimney Systems used for neutral or negative pressure applications donot require joints to be sealed.**

When wood is burned slowly, it produces tar and other organic vapors which combine with expelled moisture to form creosote. The creosote vapors condense in a relatively cool chimney flue of a slow burning fire. As a result, creosote residue accumulates on the flue lining. When ignited this creosote makes an extremely hot fire.

Chimney installations require provisions for cleaning the interior of the chimney. Creosote and soot formations need to be removed. The chimney should be inspected once every two months during the heating season to determine if creosote or soot buildup has occurred. If creosote or soot has accumulated, it should be removed to reduce the risk of fire. Clean-out requirements are as follows:

1. A clean-out must be provided at each change of direction, except where the entire length of chimney can be inspected and cleaned from either the equipment or the chimney cap.
2. Openings must be at the side or the top, whichever is more accessible.
3. The chimney inspection should be done every two months during the heating season.
4. If creosote or soot has accumulated it should be removed to reduce the risk of fire.
5. Insert the chimney cleaning brush and brush in a downward motion, be sure to scrub all sides of the chimney thoroughly and remove all debris.
6. Contact local building or fire officials about restrictions and inspections in your area.

**NOTE: Model 2R & Model 2R Type HT Factory Built Chimney Systems are intended for commercial and industrial applications. This system is not intended for family dwellings. Chimney Systems should be sized in accordance with the appliance manufacturer's instructions.**

When the chimney system is installed in accordance with these installation instructions and the joints are sealed properly with the recommended sealant, the system will contain a fire within the chimney. A fire can burn at extremely high temperatures. The system should be dismantled and inspected after any exposure to a fire. Any section that is distorted or discolored should be replaced. All joints in the system should be examined.

The sealant expands to ensure a positive seal in the case of a fire, and any sealant that has been exposed to high temperature must be replaced. This will ensure that the system maintains its integrity against fire conditions in the future. The manufacturer of this chimney system cannot be responsible for chimney systems that are not properly maintained or have been subjected to one or more fire conditions.

# MECHANICAL

## Clearances

In all buildings more than one story in height and in buildings where the roof/ceiling assembly is required to have a fire resistance rating, the duct must be enclosed in a continuous enclosure from the lowest fire-rated ceiling or floor above the hood, through any concealed spaces, to or through the roof to maintain the integrity of the fire separations required by the applicable building code provisions. If the building is less than 4 stories in height, the enclosure shall have a fire resistance rating of not less than 1 hour. If the building is 4 stories or more in height, the enclosure shall have a fire resistance rating of not less than 2 hours. Single wall grease duct is primarily intended for use in non-combustible surroundings. When installed in an open room where an enclosure is not required, double wall grease duct or chimney systems may be located near combustible material to reduce clearance in accordance with **Table 1**. When combining double wall and single wall grease duct for the purpose of clearance reduction, a Double Wall End Cap Assembly is required.

**Table 1 - Grease Duct and Building Heating Appliance Chimney Clearances**

| Duct Model | Inner Diameter (ID) | Outside Diameter | Clearance to Combustibles | Clearance to Non-Combustibles |
|---|---|---|---|---|
| **DW** | 5”-36” | = ID | 18” (1) | 0” |
| **DW - 2R** | 5”-16” | ID + 4 | 3/4” (2) | 0” |
| | 18” | ID + 4 | 1” (3) | 0” |
| **DW - 2R TYPE HT** | 5”-16” | ID + 4 | 2” (4) | 0” |
| **DW - 3R** | 5”-24” | ID + 6 | 3/4” (5) | 0” |
| **DW - 3Z** | 5”-36” | ID + 6 | 0” (6) | 0” |

The information in **Table 1** represents air space, in inches, to surroundings.

**Refer to the latest edition of NFPA 96, Chapter 3 Definitions. This chapter explains the definitions on combustible, non-combustible and limited combustible material.**

(1) Single Wall duct clearance to combustibles from the surface of the duct; refer to single wall grease ductwork manual for more information.

(2) DW - 2R Grease Duct: 3/4” clearance to combustibles from the surface of the duct outer shell; zero inch clearance from combustibles from the tip of the outer V-band.

(3) DW - 2R Grease Duct: 1” clearance to combustibles from the surface of the duct outer shell; zero inch clearance from combustibles from the tip of the outer V-band.

(4) DW-2R & DW - 2R TYPE HT Chimney: unenclosed, 2” clearance to combustibles from the surface of the chimney outershell.

(5) DW - 3R: 3/4” clearance to combustibles from the surface of the duct outer shell; zero inch clearance from combustibles from the tip of the outer V-band.

(6) DW - 3Z: 0” clearance to combustibles from the surface of the duct outer shell.

**NOTE: Double wall grease duct systems with reduced clearance “R” have been tested using condition B – installed within non-ventilated unenclosed combustible enclosure. See Figure 1 for representation of reduced clearance note, the V-band may be in contact with a combustible surface.**

**Figure 1 - Grease Duct Reduced Clearance**

1. Combustible Surface
2. Duct
3. Double V-band

A. Reduced Clearance
   - 2R sizes 5”-16” = 3/4”
   - 2R size 18” = 1”
   - 3R = 3/4”
   - 3Z = 0”

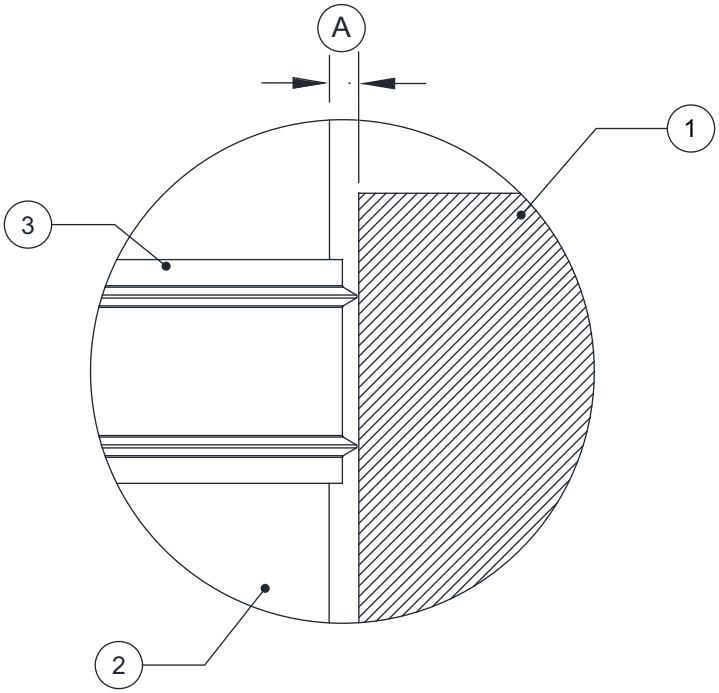
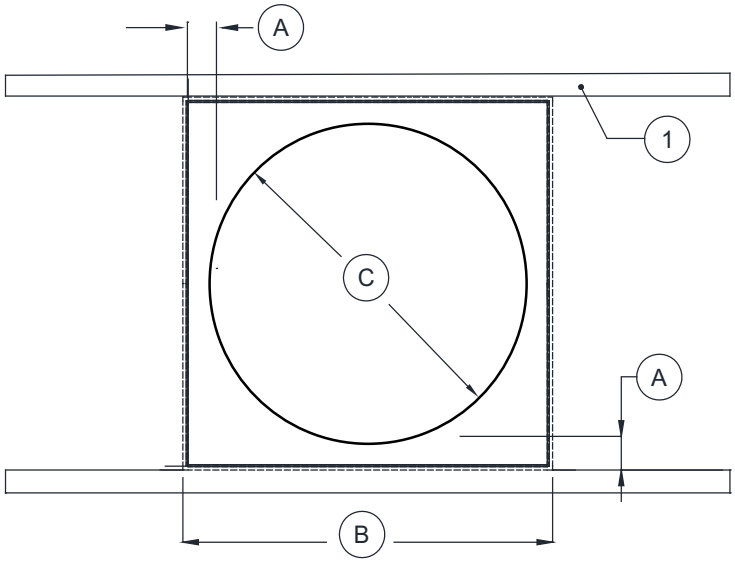



**Figure 2 - 2R Type HT Chimney Reduced Clearance**

1. Combustible Surface

A. 2” Reduced Clearance
B. 2R Type HT Shell + 4-1/2”
C. Duct Diameter



## Joint Sealant

**Proper joint assembly is essential for safe installation. Follow these instructions exactly as written. Check severeness of joints upon completion of assembly.**

The joint sealant used to seal all joint assemblies is 3M Fire Barrier 2000+ Silicone Sealant. This sealant is a ready-to-use, gun-grade, one-component silicone elastomer that cures upon exposure to atmospheric humidity to form a flexible seal. 3M Fire Barrier 2000+ Silicone Sealant, when installed properly, will control the spread of a fire before, during, and after exposure to open flames. It will stop the spread of noxious gas, smoke, and water, and maintain the integrity of fire-rated assemblies and construction. All grease ducts must be liquid-tight per NFPA 96.

Model 2R & Model 2R Type HT chimney used in positive pressure applications must be liquid-tight per UL103 and UL103HT listing. When Model 2R & Model 2R Type HT chimney is used in neutral or negative pressure applications, the system does not require the joints to be sealed with the 3M Fire Barrier 2000+ Silicone Sealant per the listing report. But 3M Fire Barrier 2000+ Silicone Sealant is recommended for commercial cooking appliances where grease is present.

**CAUTION: OPEN WINDOWS DURING THE FIRST START-UP TO DISSIPATE SMOKE AND ODORS. When operating the appliances for the first time, you will experience smoke and odor from the duct system resulting from the curing of paint and burning off of any oils remaining from manufacturing. Odors may be irritating to sensitive individuals. Smoke detectors may activate.**

Refer to **Table 2** for tube usage per duct diameter. **NO SEALANT SUBSTITUTES MAY BE USED.**

**Sealant Features:**

1. Superior adhesion. Applied with a standard caulk gun.
2. Class 25 sealant, per ASTM C920. Capable of withstanding 2000°F + temperatures.
3. Re-enterable/repairable. Provides up to 4-hours fire-rating.
4. Cures upon exposure to atmospheric humidity. Working time 30 minutes. Full cure time: 14 to 21 days.
5. The duct/chimney can be placed in operation 7 days after installation, before full cure.

**Table 2 - 3M Fire Barrier 2000 Plus Usage Chart**

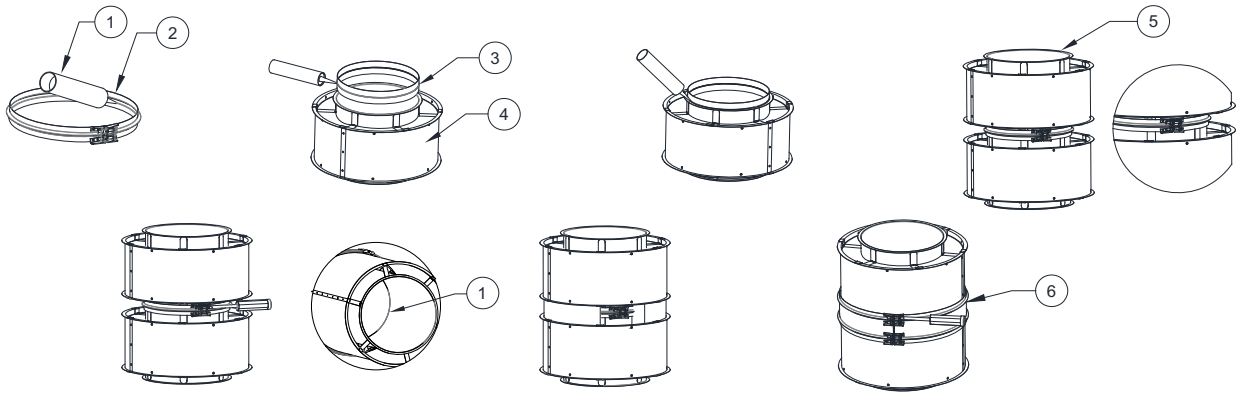
| Diameter | Duct Perimeter Feet | Average Feet Per Tube | Number of Joints Per Tube |
|---|---|---|---|
| 5” | 1.43 | 30 | 10.5 |
| 6” | 1.70 | 30 | 9 |
| 7” | 1.96 | 30 | 7.5 |
| 8” | 2.16 | 30 | 7 |
| 10” | 2.68 | 30 | 6 |
| 12” | 3.21 | 30 | 5 |
| 14” | 3.73 | 30 | 4 |
| 16” | 4.25 | 30 | 3.5 |
| 18” | 4.78 | 30 | 3 |
| 20” | 5.30 | 30 | 3 |
| 22” | 5.83 | 30 | 2.5 |
| 24” | 6.35 | 30 | 2.5 |
| 26” | 6.93 | 30 | 2 |
| 28” | 7.46 | 30 | 1.5 |
| 30” | 7.98 | 30 | 1.5 |
| 32” | 8.39 | 30 | 1.5 |
| 34” | 8.91 | 30 | 1 |
| 36” | 9.55 | 30 | 1 |

## Grease Duct and Chimney Joint Assembly

All grease ducts are to be liquid tight per NFPA 96. Model 2R & Model 2R Type HT chimney used in positive pressure applications must be liquid tight per UL103, UL103HT, and UL2561 listings. When a chimney system is used in a positive pressure application, it must be fitted with an internal joint collar and sealed as shown in **Figure 3** (positive pressure only). When a chimney system is used in a negative or neutral pressure application, it does not need to be sealed per the listing report; although, sealing the system is recommended for commercial cooking appliances where grease is present.

1. Fill the V-band with 3M Fire Barrier 2000+ Silicone. The bead should be continuous. Refer to **"Joint Sealant" on page 10** for sealant details. For neutral and negative chimney or grease duct applications, proceed to step 4.
2. For positive pressure chimney applications: Apply a 1/4" wide continuous bead of 3M Fire Barrier 2000+ Silicone around the formed bead on the internal joint collar. Push down into the chimney section being assembled.
3. For positive pressure chimney applications: The internal joint collar should be pushed down into the chimney section until the bead sits on the chimney flange.
4. Place the loose V-band over the duct flange. Apply a continuous bead of 2000+ Silicone 1/4" wide to the flange that will be joined.
5. Join the two flanged ends of the inner duct sections together and rotate slightly to ensure complete coverage of sealant on flanges.
6. For horizontal duct runs, the V-band hardware should be located on the top side of the duct and orientated between the 3 and 9 o'clock position on the duct.
7. NEVER install the V-band with hardware orientated on the bottom side of the duct on horizontal runs.
8. Install the V-band around the duct flanges making sure the flanges are located within the V-band. Tap the outside of the V-band while tightening V-band hardware to make sure the flanges are aligned and have been pulled together. Secure the 1/4"-20 hardware between **40-60 in-lbs**. Smooth out any excess sealant from inside of the duct surface.
9. Insulation must be minimum of 4-1/2" wide, and the same type and number of layers as the base duct. Tightly pack and completely fill all voids between the inner duct and the outer shell.
10. Install the double V-band ensuring the outer shell flanges are positively engaged in the V-bands before tightening the 1/4"-20 hardware between **40-60 in-lbs**. The double V-band can be sealed using 3M Fire Barrier 2000+ Silicone when being installed outside.

**Figure 3 - Duct and Chimney Joint Assembly**




1. 3M Fire Barrier Silicone
2. V-band
3. Internal Joint Collar (Positive Pressure Chimney)
4. First Duct Section
5. Second Duct Section
6. Double V-band

**IMPORTANT: THE HARDWARE USED TO ASSEMBLE THIS DUCTWORK/CHIMNEY IS SPECIFICALLY DESIGNED FOR THIS APPLICATION. NO SUBSTITUTE HARDWARE IS ALLOWED. ALL REPLACEMENT HARDWARE MUST BE PURCHASED FROM THE FACTORY.**

## Double Wall Adjustable Duct, Chimney and Transition Plate

Adjustable duct sections may be used in conjunction with transition plates when they terminate at the fan. The adjustable duct section is fully welded to the transition plate, and then connected to the standard duct length using non-welded connections. Double wall adjustable duct sections are assembled in the field, as the exact length needed for the application is not known. Components for outer shell and insulation ship loose. Once fully assembled, the transition plate is secured to the curb using the method referenced in **Figure 16**. When a Model 2R & Model 2R Type HT chimney system is used in positive pressure applications, it must be fitted with an internal joint collar and sealed as shown in **Figure 3**. When a chimney system is used in a negative or neutral pressure application, it does not need to be sealed per the listing report; although, sealing the system is recommended for commercial cooking appliances where grease is present. Refer to **Figure 4** for assembly details.

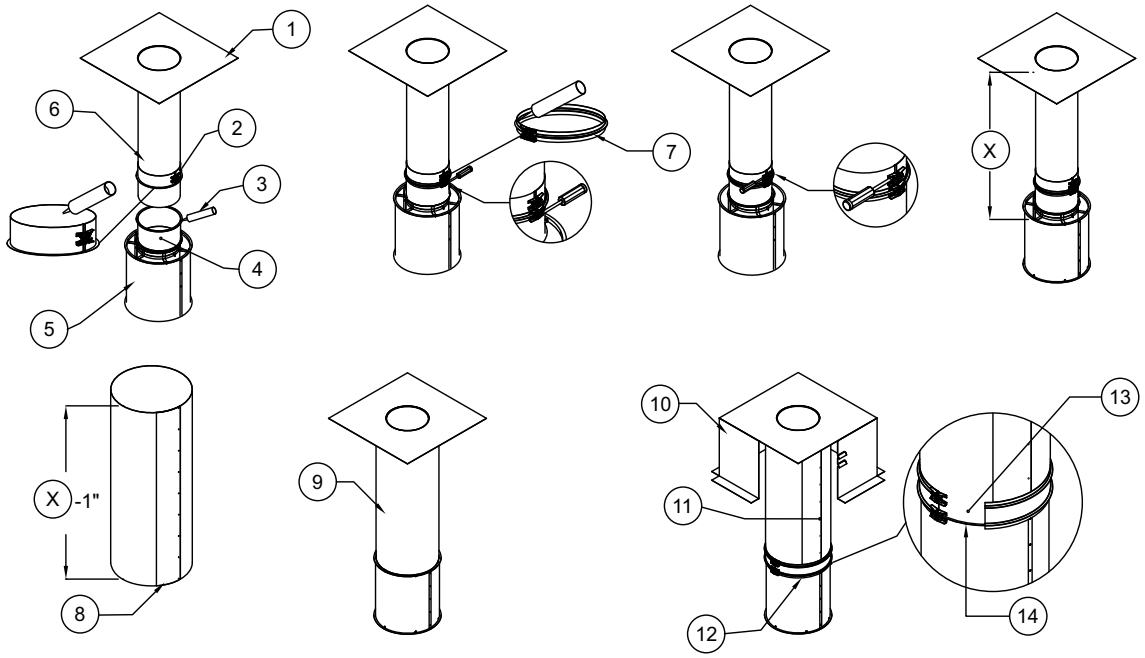
1. The 7” standard duct section in the adjustable assembly is installed the same as the **“Grease Duct and Chimney Joint Assembly” on page 11**.
2. When adjustable duct assemblies are used with transition plates, the 7” standard section is connected to the mating duct section. The adjustable duct with single flange is welded to the transition plate.
3. The adjustable collar is slipped onto the adjustable section. Make sure the adjustable collar flanges are opposite the adjustable duct section flange. Apply 3M Fire Barrier 2000+ Silicone to the collar.
4. The adjustable section is pushed inside the 7” standard section. Verify the minimum overlap is set correctly, refer to **Table 3**.
5. If the protruding section interferes with mating parts in the duct run, you will need to cut the adjustable section that is interfering with mating parts, refer to **Figure 5 on page 13**.

**NOTE: For Positive Pressure Applications - If the adjustable section is used in a positive pressure chimney application, the adjustable section may need to be cut to length. This will prevent interference with the internal joint collar. Refer to Figure 4 for adjustable section installation.**

6. Once the overlap is set correctly, apply 3M Fire Barrier 2000+ Silicone to the flanges of the duct section and the adjustable collar.
7. Apply 3M Fire Barrier 2000+ Silicone to the single V-band groove. Install single V-band around adjustable collar flange and standard duct flange. Tighten the single V-band hardware to **40-60 in-lbs**.
8. Once the single V-band has been installed, tighten the adjustable collar hardware to **40-60 in-lbs**.
9. Measure the distance between mating duct flange and transition plate prior to installing insulation and outer shell cover.
10. Subtract 1” from the measured distance and cut the pre-rolled shell to this dimension.
11. After the single wall adjustable section has been installed, wrap the assembly using blanket insulation provided. Make sure all voids are adequately filled.
12. Wrap the pre-rolled outer shell cover around the insulation. Ratchet strap(s) may be used around outer shell to aid in compressing insulation.
13. Install the double wall V-band on either end of the assembly. Make sure the double wall V-band is secured onto the mating duct flange and overlapping onto the shell before tightening hardware.
14. The double wall V-band will close the pre-rolled shell as they are tightened. Once closed, secure the outer shell cover along the seam using the 1” sheet metal screws that have been provided.
15. Use 3M Fire Barrier 2000+ Silicone to seal the outer shell, if required or installed outside.

**NOTE: Outer Shell Must Extend Behind the Double Wall V-band.**

**Figure 4 - Adjustable Duct, Chimney and Transition Plate**




1. Transition Plate
2. Adjustable Collar
3. 3M Fire Barrier 2000 Plus
4. 7” Standard Duct Section
5. Mating Duct Section
6. Adjustable Duct Section
7. Single V-band
8. Outer Shell Cover
9. Insulation
10. Curb
11. Sheet Metal Screws
12. Double Wall V-band
13. Shell Overlap
14. Mating Duct Flange

X. Measured Distance

**Figure 5 - Adjustable Duct and Chimney Overlap**

1. Duct Section
2. Double Wall V-band
3. Outer Shell Cover - Cut to size
4. Adjustable Collar
5. Single V-band
6. Adjustable Duct Section

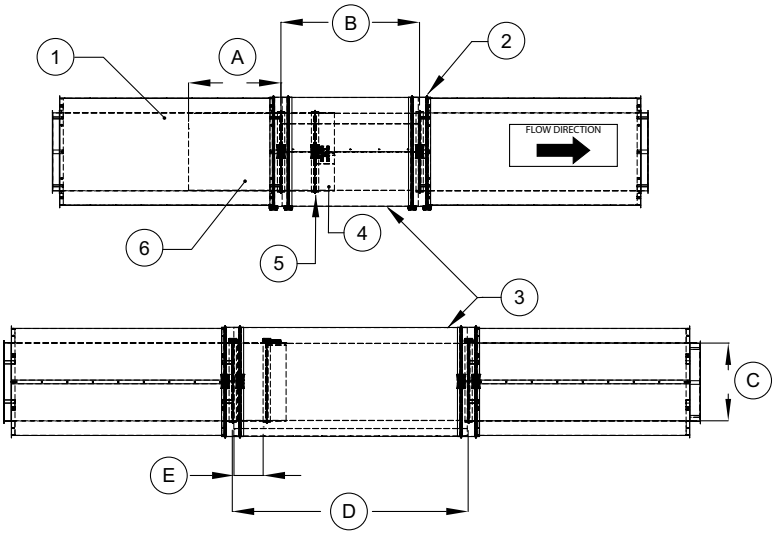
A. Adjustable Section Protrusion - May need to be cut

B. Minimum Length

C. Diameter

D. Maximum Length

E. Minimum Overlap




**NOTE: Protruding section may need to be cut in the field if there is interference with mating parts in the duct run.**

**NOTE: When installing duct, verify directional label is in the correct direction of airflow. (Exception: When grease is draining in a downward slope, the arrow should be opposite of airflow).**

## Double Wall Adjustable Duct, Chimney Standard Installation

Adjustable duct lengths are used to make up variable lengths in the duct system(s). Adjustable sections should always be installed with the overlap to the inside of the standard duct section. Overlap should always be opposite the direction of airflow. This will allow grease/water to run back to the hood/appliance when the system is shut down. If the inner adjustable section is too long to fit into the adjacent section of duct without interfering with the flow path, it should be trimmed to the desired flange to flange length. Flange to flange length of adjustment can range from 5” to 26”. When a Model 2R & Model 2R Type HT chimney system is used in positive pressure applications, it must be fitted with an internal joint collar and sealed as shown in **Figure 3**. When a chimney system is used in a negative or neutral pressure application, it does not need to be sealed per the listing report; although, sealing the system is recommended for commercial cooking appliances where grease is present.

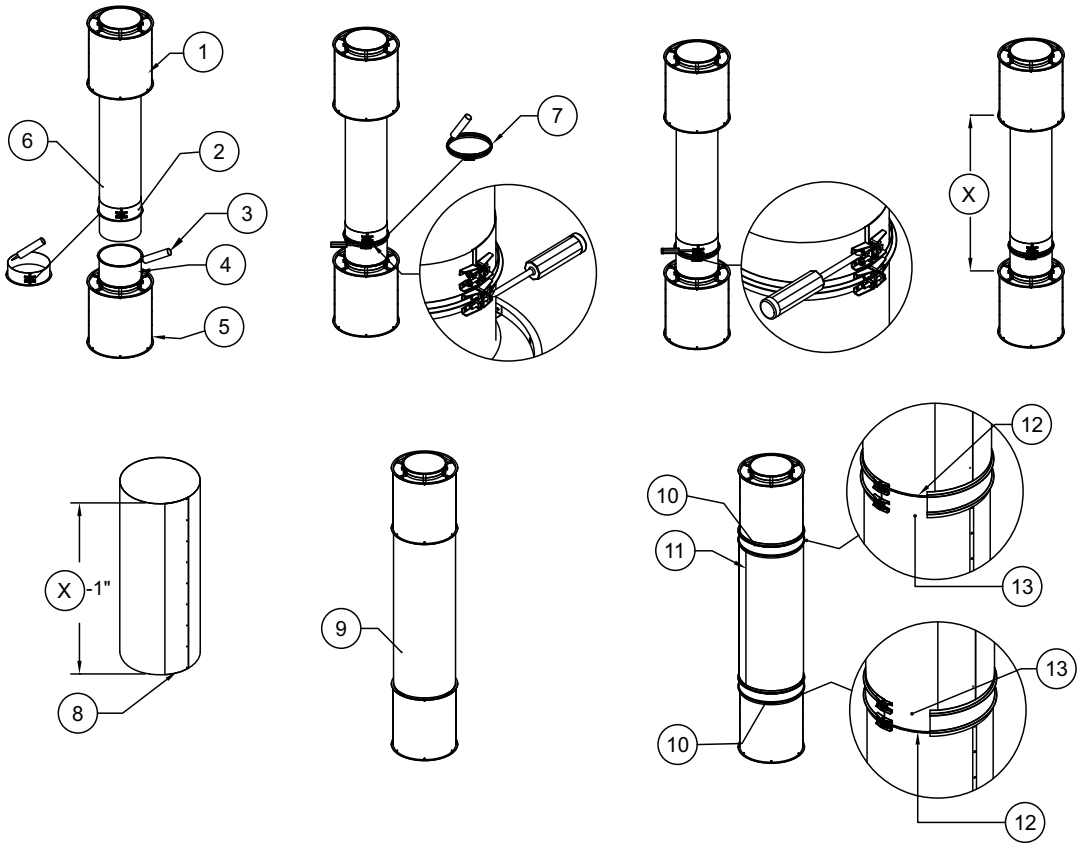
1. The 7” standard duct section in the adjustable assembly is installed the same as the **“Grease Duct and Chimney Joint Assembly” on page 11**.
2. The adjustable collar is slipped onto the adjustable duct section. Make sure the adjustable collar flanges are opposite the adjustable duct section flange.
3. The adjustable section is pushed inside the 7” standard duct section. Verify the minimum overlap is set correctly, refer to **Table 3**.
4. If the protruding section interferes with mating parts in the duct run, you will need to cut the adjustable section that is interfering with mating parts, refer to **Figure 5**.
5. Once the overlap is set correctly, apply 3M Fire Barrier 2000+ Silicone to the flanges of the duct section and the adjustable collar.

**NOTE: For Positive Pressure Applications - If the adjustable section is used in a positive pressure chimney application, the adjustable section may need to be cut to length. This will prevent interference with the internal joint collar. Refer to Figure 6 for adjustable section installation.**

6. Apply 3M Fire Barrier 2000+ Silicone to the single V-band groove. Install single V-band around adjustable collar flange and standard duct flange. Tighten the single V-band hardware to **40-60 in-lbs**.
7. Once the single V-band has been installed, tighten the adjustable collar hardware to **40-60 in-lbs**.
8. Measure the distance between mating duct flanges prior to installing insulation and outer shell cover.
9. Subtract 1” from the measured distance and cut the pre-rolled shell to this dimension.
10. After the single wall adjustable section has been installed, wrap the assembly using blanket insulation provided. Make sure all voids are adequately filled.
11. Wrap the pre-rolled outer shell cover around the insulation. Ratchet strap(s) may be used around outer shell to aid in compressing insulation.
12. Install the double wall V-band on either end of the assembly. Make sure the double wall V-band is secured onto the mating duct flange and overlapping onto the shell before tightening hardware.
13. The double wall V-band will close the pre-rolled shell as they are tightened. Once closed, secure the outer shell cover along the seam using the 1” sheet metal screws that have been provided.
14. Use 3M Fire Barrier 2000+ Silicone to seal the outer shell, if required or installed outside.

**NOTE: Outer Shell Must Extend Behind the Double Wall V-band.**

**Figure 6 - Collar and Adjustable Duct, Chimney Installation**




1. Duct Section 1
2. Adjustable Collar
3. 3M Fire Barrier 2000 Plus
4. 7” Standard Duct Section
5. Duct Section 2
6. Adjustable Duct
7. Single V-band
8. Outer Shell Cover
9. Insulation
10. Double Wall V-band
11. Sheet Metal Screws
12. Mating Duct Flange
13. Shell Overlap

X. Measured Distance

**Table 3 - Minimum Overlap**

| Diameter | Minimum Overlap for Adjustable Sections |
|---|---|
| 5”, 6”, 7”, 8” | 4” |
| 10” | 5” |
| 12”, 14”, 16”, 18”, 20”, 22”, 24”, 26”, 28”, 30”, 32”, 34”, 36” | 6” |

## Double Wall Offset Distance

Refer to **page 16** through **page 18** for double wall offset details.

**Table 4 - Offset Center Line Distance 15 Degree Elbows**

| Diameter | Flange Diameter | Part Number | HT 1 | CL 1 |
|---|---|---|---|---|
| 5” | 6” | DW0515DWASY | 19” | 2-1/2” |
| 6” | 7” | DW0615DWASY | 19-1/4” | 2-1/2” |
| 7” | 8" | DW0715DWASY | 19-1/2” | 2-1/2” |
| 8" | 9" | DW0815DWASY | 19-3/4" | 2-1/2" |
| 10" | 11" | DW1015DWASY | 20-3/8" | 2-5/8" |
| 12" | 13" | DW1215DWASY | 20-7/8" | 2-3/4" |
| 14" | 15" | DW1415DWASY | 21-3/8" | 2-7/8" |
| 16" | 17" | DW1615DWASY | 21-7/8" | 2-7/8" |
| 18" | 19" | DW1815DWASY | 22-3/8" | 3" |
| 20" | 21" | DW2015DWASY | 22-7/8" | 3" |
| 22" | 23" | DW2215DWASY | 23-3/8" | 3-1/8" |
| 24" | 25" | DW2415DWASY | 23-7/8" | 3-1/8" |
| 26” | 27” | DW2615DWASY | 28-1/4” | 3-1/4” |
| 28” | 29” | DW2815DWASY | 28-7/8” | 3-1/4” |
| 30” | 31” | DW3015DWASY | 25-1/2” | 3-3/8” |
| 32” | 33” | DW3215DWASY | 26” | 3-1/2” |
| 34” | 35” | DW3415DWASY | 26-1/2” | 3-1/2” |
| 36” | 37” | DW3615DWASY | 27-1/8” | 3-1/2” |

**Figure 7 - 15 Degree Offset Details**

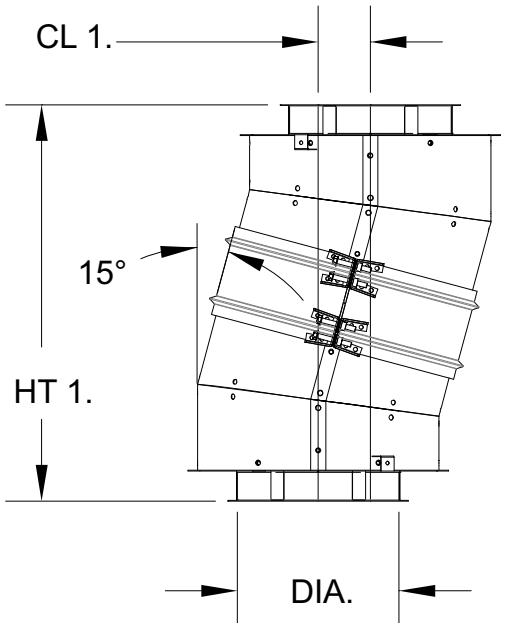


**Table 5 - Offset Center Line Distance 30 Degree Elbows**

| Diameter | Flange Diameter | Part Number | HT 1 | CL 1 |
|---|---|---|---|---|
| 5” | 6” | DW0530DWASY | 19-3/8” | 5-1/8” |
| 6” | 7” | DW0630DWASY | 19-7/8” | 5-3/8” |
| 7” | 8" | DW0730DWASY | 20-3/8” | 5-1/2” |
| 8" | 9" | DW0830DWASY | 20-7/8" | 5-1/2" |
| 10" | 11" | DW1030DWASY | 21-7/8" | 5-7/8" |
| 12" | 13" | DW1230DWASY | 22-7/8" | 6-1/8" |
| 14" | 15" | DW1430DWASY | 23-7/8" | 6-3/8" |
| 16" | 17" | DW1630DWASY | 24-7/8" | 6-5/8" |
| 18" | 19" | DW1830DWASY | 25-7/8" | 7" |
| 20" | 21" | DW2030DWASY | 26-7/8" | 7-1/8" |
| 22" | 23" | DW2230DWASY | 27-3/8" | 7-3/8" |
| 24" | 25" | DW2430DWASY | 28-7/8" | 7-3/4" |
| 26” | 27” | DW2630DWASY | 29-7/8” | 8” |
| 28” | 29” | DW2830DWASY | 30-7/8” | 8-1/4” |
| 30” | 31” | DW3030DWASY | 31-7/8” | 8-1/2” |
| 32” | 33” | DW3230DWASY | 32-7/8” | 8-3/4” |
| 34” | 35” | DW3430DWASY | 33-7/8” | 9” |
| 36” | 37” | DW3630DWASY | 34-7/8” | 9-3/8” |

**Figure 8 - 30 Degree Offset Details**

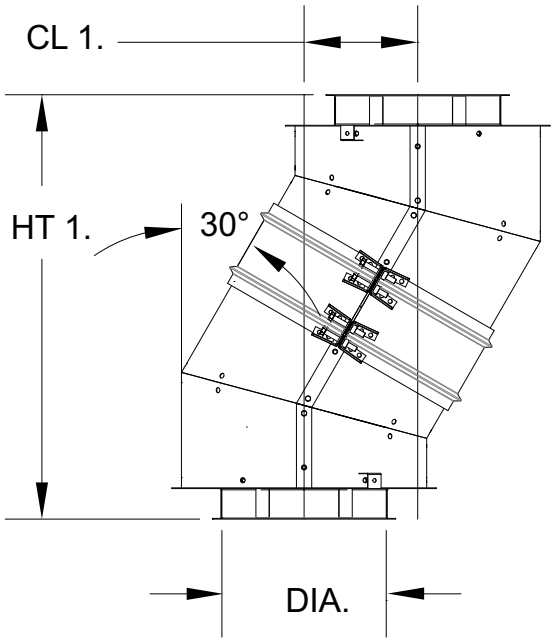
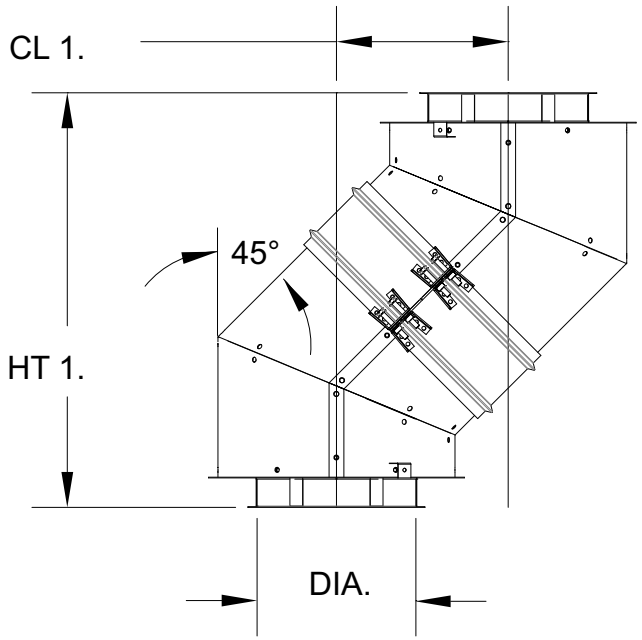


**Table 6 - Offset Center Line Distance 45 Degree Elbows**

| Diameter | Flange Diameter | Part Number | HT 1 | CL 1 |
|---|---|---|---|---|
| 5” | 6” | DW0545DWASY | 18-7/8” | 7-7/8” |
| 6” | 7” | DW0645DWASY | 19-5/8” | 8-1/8” |
| 7” | 8" | DW0745DWASY | 20-3/8” | 8-1/2” |
| 8" | 9" | DW0845DWASY | 21" | 8-3/4" |
| 10" | 11" | DW1045DWASY | 22-1/2" | 9-3/8" |
| 12" | 13" | DW1245DWASY | 23-7/8" | 9-7/8" |
| 14" | 15" | DW1445DWASY | 25-3/8" | 10-1/2" |
| 16" | 17" | DW1645DWASY | 26-3/4" | 11" |
| 18" | 19" | DW1845DWASY | 28-1/8" | 11-5/8" |
| 20" | 21" | DW2045DWASY | 29-1/2" | 12-1/4" |
| 22" | 23" | DW2245DWASY | 30" | 12-7/8" |
| 24" | 25" | DW2445DWASY | 32-3/8" | 13-3/8" |
| 26” | 27” | DW2645DWASY | 33-7/8” | 14” |
| 28” | 39” | DW2845DWASY | 35-1/4” | 14-1/4” |
| 30” | 31” | DW3045DWASY | 36-5/8” | 15-1/4” |
| 32” | 33” | DW3245DWASY | 38” | 15-3/4” |
| 34” | 35” | DW3445DWASY | 39-1/2” | 16-3/8” |
| 36” | 37” | DW3645DWASY | 40-7/8” | 17” |

**Figure 9 - 45 Degree Offset Details**



## Factory and Field (Bolted and Welded) Risers

There are two options for the riser, this is the connection to hood plenum. There may be welded (factory or field) or bolted.

Dimensional data identifying the size and location of the riser must be provided for factory installation. The riser is fully welded to the hood plenum.

When field installed, the riser is shipped loose allowing the installer at the jobsite to decide on the final location of the riser. Field installed risers help when the final location is not known, or adjustments may need to be made due to grease duct/chimney misalignments. Field installed risers may be welded or bolted in place. Refer to **Figure 10** for assembly details.

1. Locate the specific position at which the riser needs to be installed.
2. Use the riser as a guide when marking the hood.

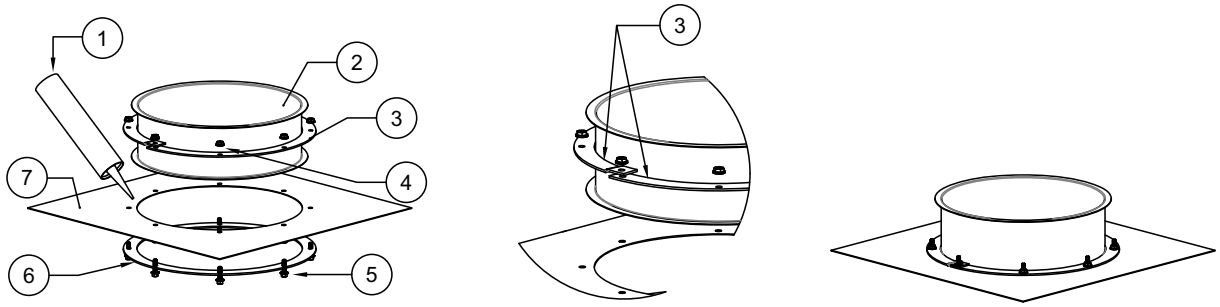
**NOTE: Verify the hole location is inside the plenum area before cutting any holes.**

3. Use the single-piece riser ring as a template to mark the bolt hole locations. Align the inner circles of the hole in the plenum with the single-piece riser ring. Mark the bolt hole circle. Make sure the bolt hole circle is inside the plenum area before cutting.
4. Use 3M Fire Barrier 2000+ Silicone to seal around the riser hole. Apply sealant to the top and bottom of the hole. Make sure the silicone bead is a minimum of 1/4” thick and is continuous inside and outside of the bolt hole circle.
5. Center the riser over the hole in the plenum and push down. Make sure the riser flange is positively sealed. Make sure the two-piece riser ring on the riser is pushed down into the sealant. Sealant should come through the holes on the ring.
6. Align the single-piece riser ring to the hole on the inside of the plenum and push into the silicone.
7. Align the two-piece riser ring above the hood and bolt the rings together using 1/4”-20 bolts and nuts. **Make sure the tabs are on top.**

**NOTE: The bolt head must be installed on the plenum side. This is the bottom side of the hood plenum**.

8. Excess silicone should be removed, and the connection should be inspected for gaps and loose hardware.
9. When joining duct to the riser, refer to **“Double Wall Connection to Riser” on page 20**.

**Figure 10 - Field Installed Riser (Bolted)**

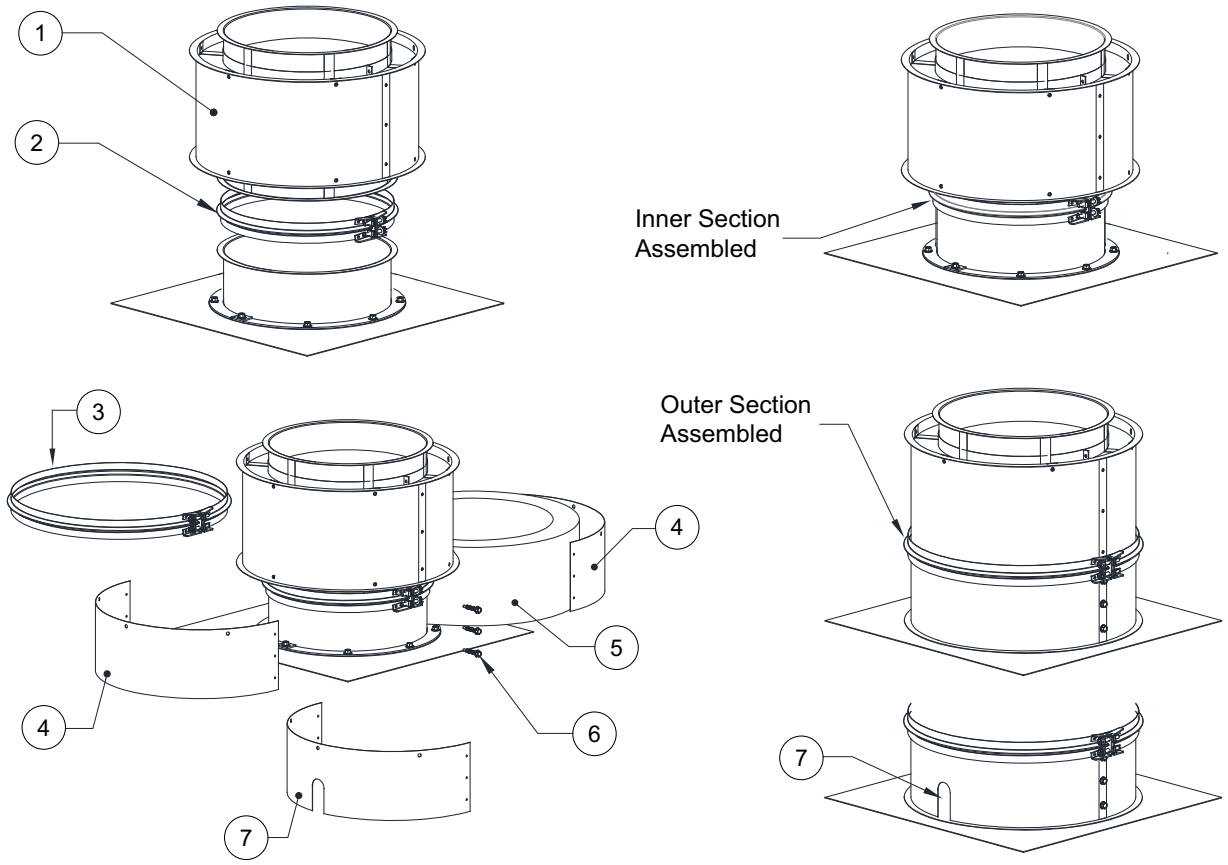



1. 3M Fire Barrier 2000+ Silicone
2. Riser
3. Two-Piece Riser Ring
4. 1/4”-20 Nuts
5. 1/4”-20 Bolts
6. Single-Piece Riser Ring
7. Top of Hood

## Double Wall Connection to Riser

1. After the riser has been installed, see **“Factory and Field (Bolted and Welded) Risers” on page 19**, connect the double wall section to the riser.
2. Connect the duct/chimney section to the riser, refer to steps 1 through step 3 in **“Grease Duct and Chimney Joint Assembly” on page 11**.
3. After the riser and inner section(s) have been connected, install the provided insulation. Make sure all voids are filled.
4. Install the riser covers by pushing the two halves together and secure with provided sheet metal screws. Use only hardware provided, longer screws may penetrate the inner section(s).
5. Place the outer V-band around the double wall duct/chimney shell flange and riser cover. Make sure the V-band engages the outer shell flange and overlaps the riser before tightening.
6. For installations that require a duct stat sensor, use riser cover with duct stat opening. For outside installations, use riser cover without duct stat opening.

**Figure 11 - Duct to Riser Connection**



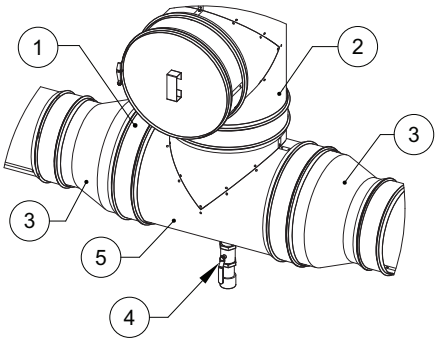

1. Double Wall Duct/Chimney
2. Inner V-band - Connecting riser to inner section
3. Outer V-band - Connecting riser cover to double wall section
4. Riser Cover
5. Insulation
6. Sheet Metal Screws
7. Riser Cover with Opening for Duct Stat Installation

## Duct/Chimney Drains

Drains are used to provide a point at which low points in the duct/chimney system can be drained. Condensation and low lying water leftover from cleaning can be drained easily with the installation of a ball valve drain. Drains are designed to aid in cleaning and can be used to drain accumulation into an approved collection reservoir. When an access door cannot be fitted directly to a tee/drain, the mating part should be a tee with an access door. Adapters and/or other components should be used to create a low point in the system, not less than 1”. Drains can be hard piped to an approved collection reservoir, remove the cap and connect to the 1-1/2” NPT threads.

**Figure 12 - Duct Drain**

1. V-band
2. Tee Section with Access Door
3. Adapter Section
4. Drain
5. Tee

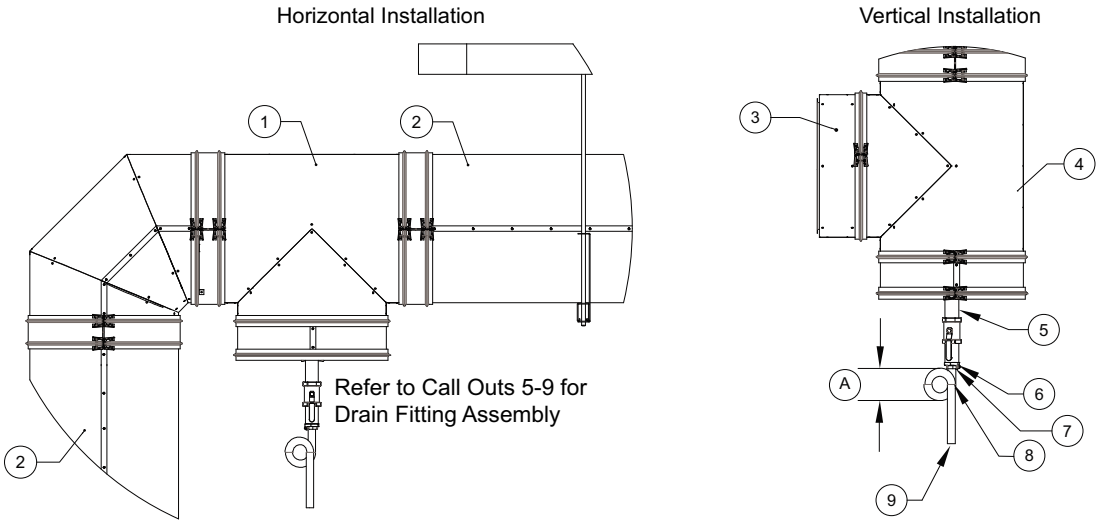



### Chimney Drain Trap Loop

A trap loop must be formed into the drain hose. The trap loop diameter must be at least four times the appliance’s rated stack pressure in inches of water column (w.c.) or 3 inches, whichever is greater. Refer to **Figure 13** callout (A).

Route drain hose to drain system to dispose of condensate according to local code. Do not install a condensate drain on the exterior of the building in cold climate areas. This may result in dangerous icy conditions on surfaces near the drain and may cause damage to the vent system and/or the exterior of the building.

**Figure 13 - Chimney Drain Details**




1. 2R Chimney Pipe Tee and Drain
2. 2R Chimney Pipe Straight Section
3. Appliance Adapter
4. Vertical Tee Drain or Drain Fitting
5. Drain
6. Locknut (by others)
7. Hose Clamp (by others)
8. Cable Tie (by others)
9. Pipe (by others)

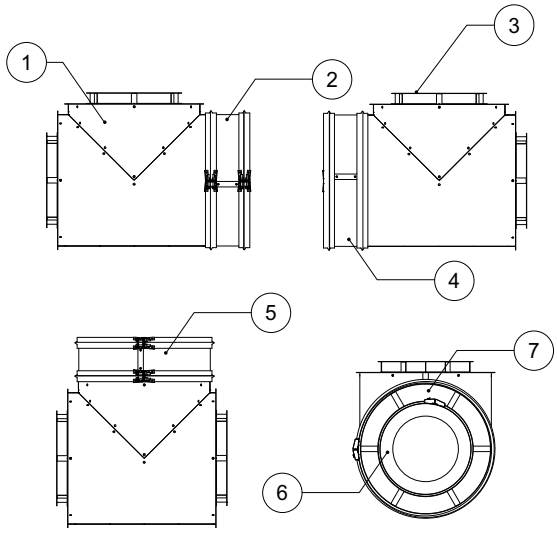
A. Trap Loop

## Manifold Tee

The manifold tee is used to provide access for clean-out to comply with NFPA 96 requirements. It is equipped with an internal blank that acts as a grease dam and gasket. The access port is then closed with a clean-out cap or tee cap. The tee cap is then covered with layers of insulation that is covered in an outer shell called the access door collar. The location of the access port in the tee is dependent on the orientation of the tee in the final installation. The access port location in the manifold tee can be orientated as required. Access ports should never be located where grease can build up and fall out once the clean-out cap is removed or where the access door collar cannot be removed to gain access to the inner duct.

**Figure 14 - Tee Position**

1. Outer Duct Shell
2. Access Door - Right Side
3. Inner Duct Shell
4. Access Door - Left Side
5. Access Door - Top Side
6. Grease Dam and Gasket
7. Insulation



## Access Door (Tee Cap) Assembly

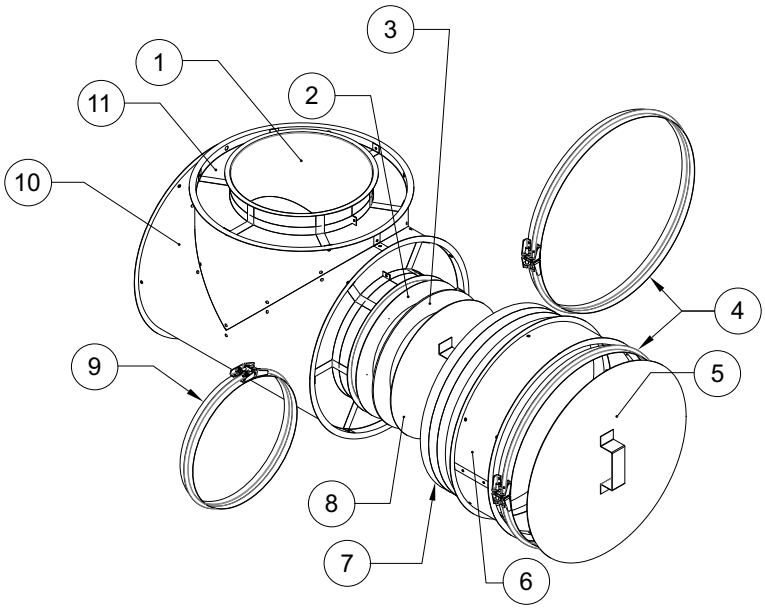
Access doors (tee caps) are available 5” to 36”. They work in conjunction with the manifold tee as shown on **“Manifold Tee” on page 22**. The tee joint connection is the same as the joint assembly method, refer to **“Grease Duct and Chimney Joint Assembly” on page 11**; however, the installation of the access door is slightly different. Read the following instructions very carefully. Consult NFPA 96, Chapter 7, Section 7.3.1 *“Openings shall be provided at the sides or at the top of the duct, whichever is more accessible, and at change of directions”*.

**The Manufacturer will accept the grease duct's installation in a vertical chaseway without cleanouts along the enclosed vertical section as specified in NFPA 96, Chapter 7 - Exhaust Systems, 7.3.3 – “Openings shall not be required in portions of the duct accessible from the duct entry or discharge.” The duct run must be readily accessible from the top and bottom of the run, and it is acceptable to the Authority Having Jurisdiction (AHJ).**

1. Select the location and the position of the access door.
2. All tee joints will be connected as shown in **“Grease Duct and Chimney Joint Assembly” on page 11**, except for the access door.
3. Apply the proper sealant to the flange of the tee that will be used for access door to the duct system.
4. Apply a 1/4” continuous bead around the tee flange.
5. Center the grease dam (inside blank) over the opening of the tee and apply pressure. Pushing the inside blank down onto the tee flange sealant, securing the inside blank to the tee flange.
6. Apply enough pressure to create a positive bond between the tee flange and the inside blank. Remove excess sealant after making parts concentric (centered).
7. Apply a 1/4” continuous bead around the inside blank 1” from the outside edge.
8. Center the listed gasket over the inside blank and push the gasket down into the sealant securing the gasket to the inside blank.
9. Sealant will begin to cure upon exposure to atmospheric humidity. It will form a flexible seal.
10. Once the sealant is dry attach the access door using a V-band. Verify flanges are in the “V” before tightening 1/4”-20 hardware. Tighten between **40 - 60 in-lbs**.
11. Once the inner access door assembly is complete, install the outer access door or access door shell.
12. The outer access door shell is used to seal the inner access door with insulation.

**Figure 15 - Access Door Assembly**

1. Inner Duct Tee
2. Grease Dam (Inside Blank)
3. Gasket
4. Outer V-band
5. Outer Access Door
6. Outer Shell
7. 3-Layer Access Door Insulation
8. Inner Access Door
9. Inner V-band
10. Outer Duct Shell
11. Insulation



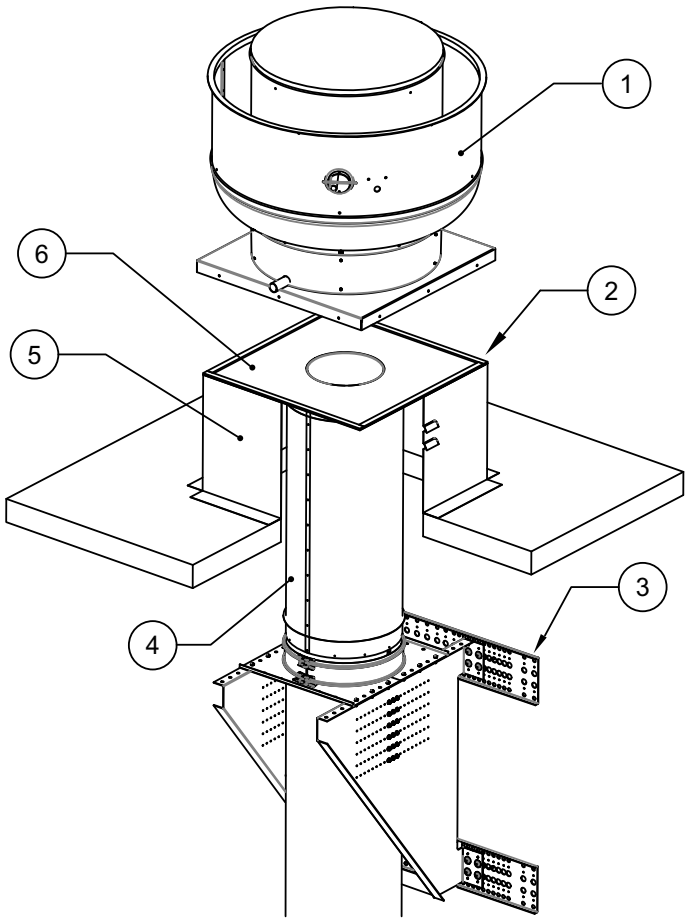
## Transition Plate

The transition plate is designed to connect to a roof curb. The duct section is welded to the underside of the plate. The plate is formed to provide a slope to allow grease deposits to flow back towards the duct. When connected, the plate mounts on top of the fan curb that supports the fan housing. The plate may be positioned off-center within the curb provided that the minimum distance to combustibles is maintained. In the event that the plate is positioned off-center, trim off excess plate material to allow for fan placement. Secure the plate to the curb using a minimum of three fasteners per side. A suitably sized fastener provided by others is used. The plate can be used to maintain distance to combustibles and also for vertical support.

See **"Double Wall Adjustable Duct, Chimney and Transition Plate" on page 12** for adjustable duct section assembly. The top collar is installed upside down to seal the insulation at the fan termination/ transition plate. A maximum of 24' can be supported by the curb and transition plate combination. Refer to **Table 8 on page 28** for vertical support spacing.

**Figure 16 - Transition Plate**

1. Exhaust Fan
2. Ceramic Gasket
3. Vertical Support
4. Adjustable Duct Section
5. Vented Curb
6. Transition Plate



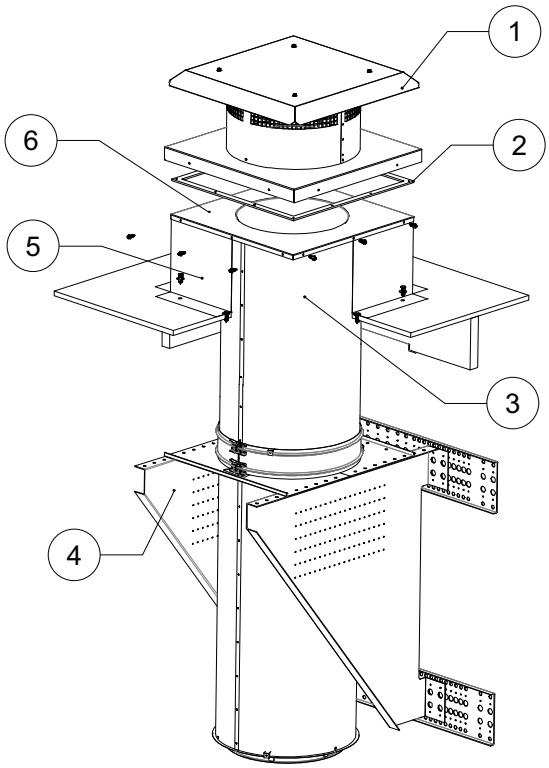
## Chimney Transition Plate

The transition plate is designed to connect to a roof curb. The chimney section is welded to the underside of the plate. When connected, the plate mounts on top of the curb that supports the chimney cap. The plate may be positioned off-center within the curb provided that the minimum distance to combustibles is maintained. In the event that the plate is positioned off-center, trim off excess plate material to allow for chimney cap placement. Secure the plate to the curb using a minimum of three fasteners per side. A suitably sized fastener provided by others is used. The plate can be used to maintain distance to combustibles and also for vertical support. A ceramic gasket is used to seal the adapter plate to the underside of the chimney cap. A maximum of 24' can be supported by the curb and transition plate combination. Refer to **Table 8 on page 28** for vertical support spacing.

**WARNING**: **NO INSULATION SHALL BE PLACED WITHIN THE REQUIRED CLEARANCE SPACE.**

**Figure 17 - Chimney Adapter Plate**

1. Base Cap
2. Ceramic Gasket
3. 2R-103 Straight Chimney Section
4. Vertical Support
5. Vented Curb
6. Transition Plate



## Prevention of Grease Accumulation in Horizontal Grease Duct

In some areas, the local authority will require horizontal duct runs to be sloped. The duct referenced in this manual is listed, 1/16” per foot slope for horizontal runs less than 75 feet. For installations with horizontal runs greater than 75 feet, the duct referenced in this manual is listed, 3/16” per foot slope. In such cases, a short “Slope Transition” section is available from the factory. For correct installation, two slope transitions are generally required - one at the beginning and end of the horizontal duct run. Consult with local code authorities if unsure about local requirements. Offset collars have been designed to meet the above specification. The collar is used in conjunction with other accessories such as tees and elbows to maintain the above listed slope in horizontal duct runs. The “V” band hardware should be located on the top side of the duct and be orientated between the 3 and 9 o’clock position on the duct. Never install the V-band with the hardware orientated on the bottom side of the duct on horizontal runs.

## Alignment & Bracing of Grease Duct/Chimney

The grease duct/chimney has characteristics of a continuous stainless steel pipe and will expand and contract along its entire length with changes in temperature. For this reason, conventional methods of attaching guides and braces to the outer wall of the grease duct/chimney cannot be used. Correctly installed support rings, saddles and wall guide assemblies will serve to keep the duct/chimney aligned, provide for adequate resistance to lateral loads and allow the free axial expansion and contraction movement. A simplified rule for duct/chimney expansion is that the axial growth will be approximately 1 inch per 100 feet of pipe length for each 100 degrees Fahrenheit the exhaust vapor temperature is above the surrounding air temperature.

## Double Wall Horizontal Support and Support Spacing

Horizontal grease duct/chimney runs are supported using 2” x 2” x 1/8” angle, Unistrut and saddle combination, or Unistrut only. B12 Unistrut is recommended. Refer to **Table 7** for horizontal support spacing. When cutting the angle or Unistrut to length, there must be a minimum of 2” on either side of the duct/chimney shell to allow for rod attachment. Once the angle has been cut to length it is suspended using 1/2” threaded rod (minimum). Appropriately sized holes are drilled/punched in either end of the angle. The 1/2” threaded rod is secured to the angle or Unistrut using 1/2” grade 5 hex nuts and 1/2” hardened washers, see **Figure 18**.

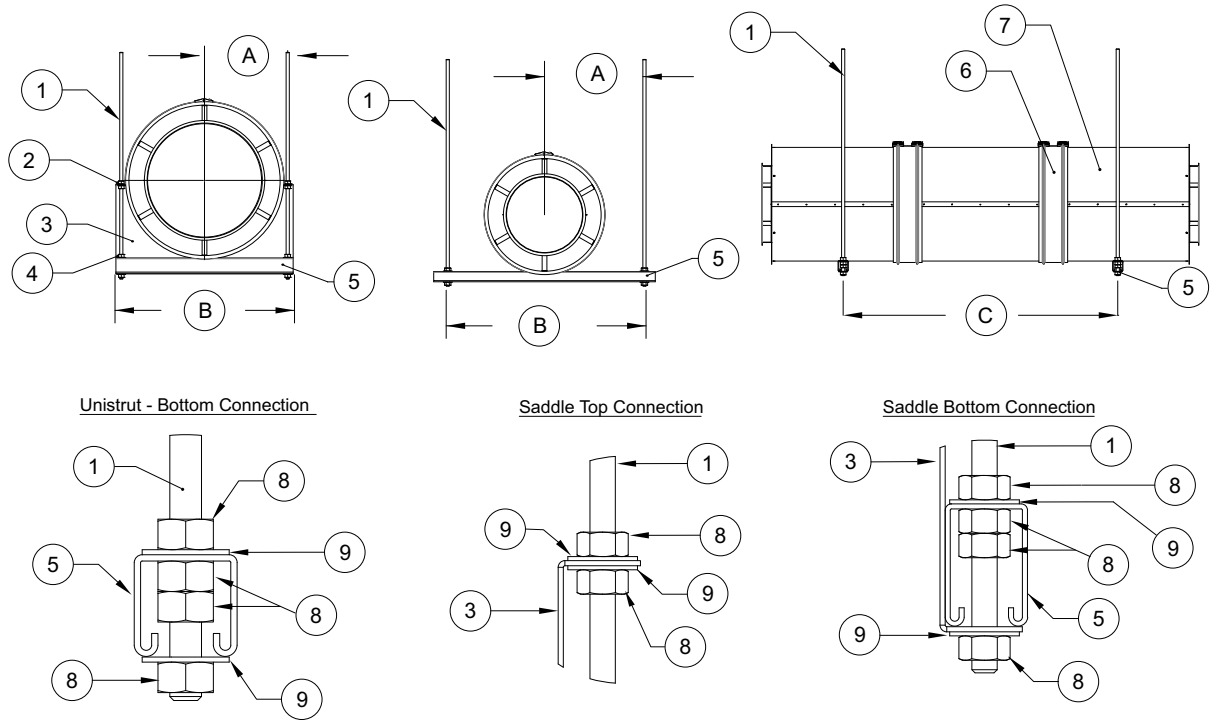
**NOTE: Double hex nuts are used as locking nuts to make sure hardware does not come loose over time.**

**Table 7 - Double Wall Grease Duct/Chimney Horizontal Support Spacing**

| Diameter (Inches) | Horizontal Support Spacing (Feet) |
|---|---|
| 5”, 6”, 7”, 8”, 10”, 12”, 14”, 16” | 7’ |
| 18”, 20”, 22”, 24”, 26”, 28”, 30”, 32”, 34”, 36” | 5’ |

**IMPORTANT: HORIZONTAL SUPPORTS REFERRED TO IN THIS MANUAL ARE REQUIRED. SUPPORTS BY OTHERS MUST BE APPROVED BY THE MANUFACTURER AND AHJ, GREASE DUCT ONLY. CHIMNEY SYSTEMS MUST USE THE SUPPORTS LISTED IN THE MANUAL, SUPPORTS BY OTHER ARE NOT ALLOWED. SUPPORT SPACING MUST BE AS STATED IN THIS MANUAL.**

**Figure 18 - Horizontal Support Details**




1. 1/2” Threaded Rods
2. Saddle Top Connection
3. Saddle
4. Saddle Bottom Connection
5. B12 Unistrut
6. Double Wall V-band
7. Double Wall Duct
8. 1/2” Hex Nuts (Grade 5)
9. 1/2” Hardened Washers

A. Center of Duct
B. Duct Diameter plus 4”
C. Horizontal Support Spacing, refer to **Table 7**

## Vertical Support & Vertical Support Spacing

Duct and chimney system(s) require supports along vertical runs. There are multiple vertical supports used for duct and chimney system(s). Each support assembly is designed for a specific type of installation. Review installation site before selecting supports. There are three different types of hardware supplied depending on the type of wall that the duct and chimney are being supported on. There are three types of wall construction; gypsum with wooden studs, gypsum with 25 gauge steel studs and concrete/masonry. Each wall construction type requires different hardware to be used when installing the support assembly. Refer to **Table 8** for maximum vertical support spacing. Do not exceed this listed vertical spacing.

**The Manufacturer will accept the grease duct's installation in a vertical chaseway without cleanouts along the enclosed vertical section as specified in NFPA 96, Chapter 7 - Exhaust Systems, 7.3.3 – "Openings shall not be required in portions of the duct accessible from the duct entry or discharge." The duct run must be readily accessible from the top and bottom of the run, and it is acceptable to the Authority Having Jurisdiction (AHJ).**

**Table 8 - Vertical Support Spacing**

| Diameter (Inches) | 3R, 3Z Duct Vertical Wall Support Spacing (Feet) | 3R, 3Z Duct Vertical Curb/Floor Support Spacing (Feet) |
|---|---|---|
| 5", 6", 7", 8", 10", 12", 14", 16", 18", 20", 22", 24" | 10' | 24' |
| 26"*, 28"*, 30"*, 32"*, 34"*, 36"* | 10'** | 20' |

***Sizes 26", 28", 30", 32", 34", 36" model 3Z only.**

****Sizes 26", 28", 30", 32", 34", 36" double wall vertical support spacing must be 5 feet when installed on gypsum walls with 25 gauge steel studs.**

| Diameter (Inches) | 2R Wall Support Spacing (Feet) | 2R Duct Vertical Curb/Floor Support Spacing (Feet) |
|---|---|---|
| 5", 6", 7", 8", 10", 12", 14", 16" | 20' | 24' |
| 18" | 18' | 24' |

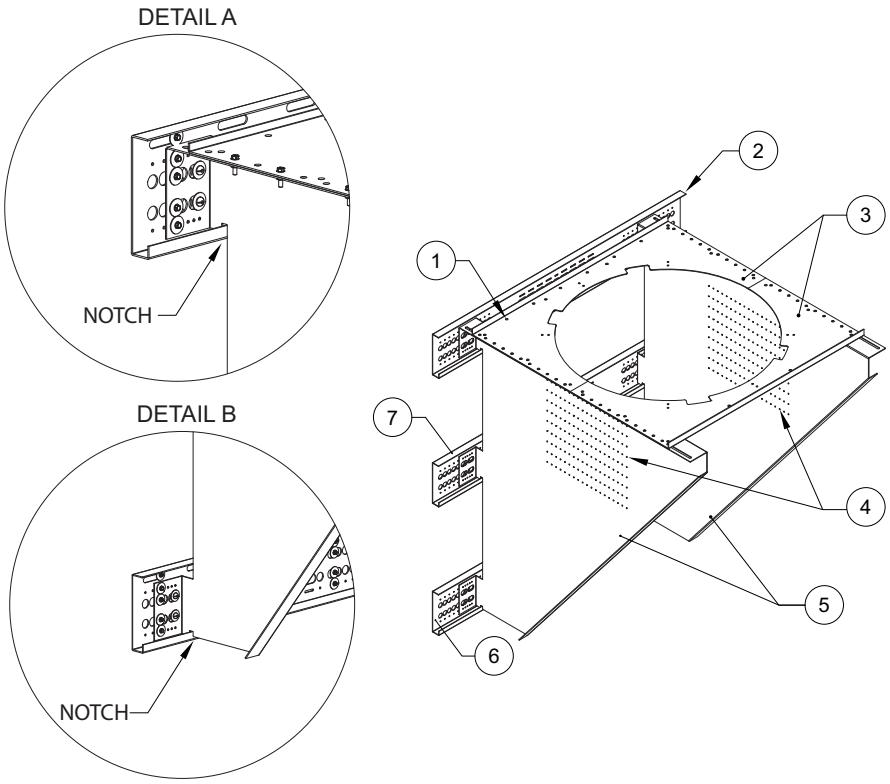
| Diameter (Inches) | 2R & 2R Type HT Chimney Vertical Wall Support Spacing (Feet) | 2R & 2R Type HT Chimney Vertical Support/Floor Support Spacing (Feet) |
|---|---|---|
| 5", 6", 7", 8", 10", 12", 14", 16" | 20' | 24' |

**Vertical support systems must be attached only to the building structure or supported with rigid structural members. Refer to Table 8 for maximum support spacing. It is recommended that vertical support systems are attached to block, concrete, or steel with clearance that is adequate for installation and access.**

**IMPORTANT: VERTICAL SUPPORTS REFERRED TO IN THIS MANUAL ARE REQUIRED. SUPPORTS BY OTHERS MUST BE APPROVED BY THE MANUFACTURER AND AUTHORITY HAVING JURISDICTION (AHJ), GREASE DUCT ONLY. CHIMNEY SYSTEMS MUST USE THE SUPPORTS LISTED IN THE MANUAL, SUPPORTS BY OTHER ARE NOT ALLOWED. SUPPORT SPACING MUST BE AS STATED IN THIS MANUAL.**

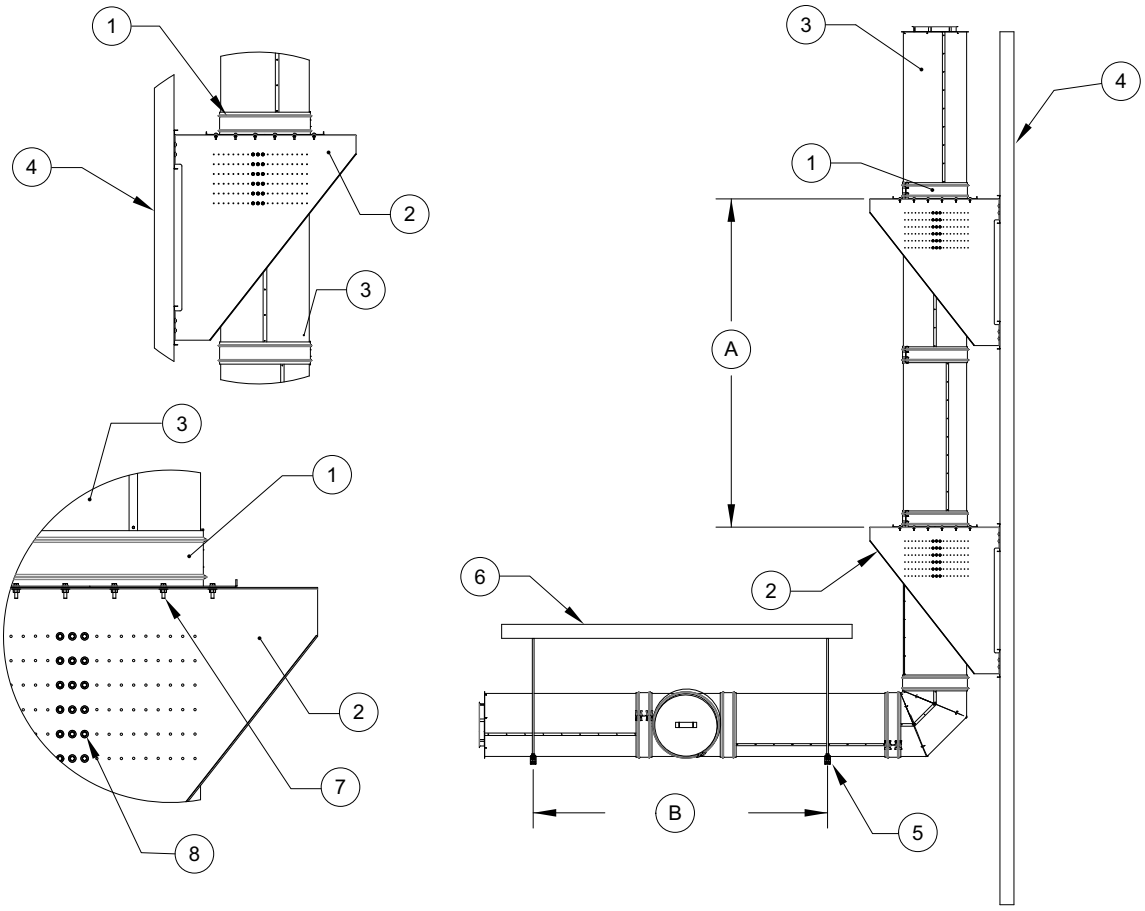
**NOTE: Figure 19 illustrates the vertical wall support kit installation. When installing side support plates, verify the support plate hook is secured into the top and bottom wall support plates.**

**Figure 19 - Vertical Wall Support Kit**




1. 5/16” Whiz Nuts and Bolts
2. Wall Support Plate (Top)
3. Flat Support Plates
4. 5/16”-18 x 1-1/2” Self Drilling Screws. Used to secure double wall duct shell.
5. Side Support Plates
6. Wall Support Plate (Bottom)
7. Wall Plate Support (Middle) - Used for addition support on 26”-36” Duct

**Figure 20 - Vertical Support Details**




1. Double V-band - The V-band is located above vertical support.
2. Vertical Support
3. Duct System
4. Types of Wall Construction: 2” x 4” Wood Studs, 2” x 4” (25) Gauge Studs, Concrete/ Masonry
5. Horizontal Support
6. Ceiling
7. 5/16” Whiz Nuts and Bolts. Used to secure top plate.
8. 5/16”-18 x 1-1/2” Self-Drilling Screws

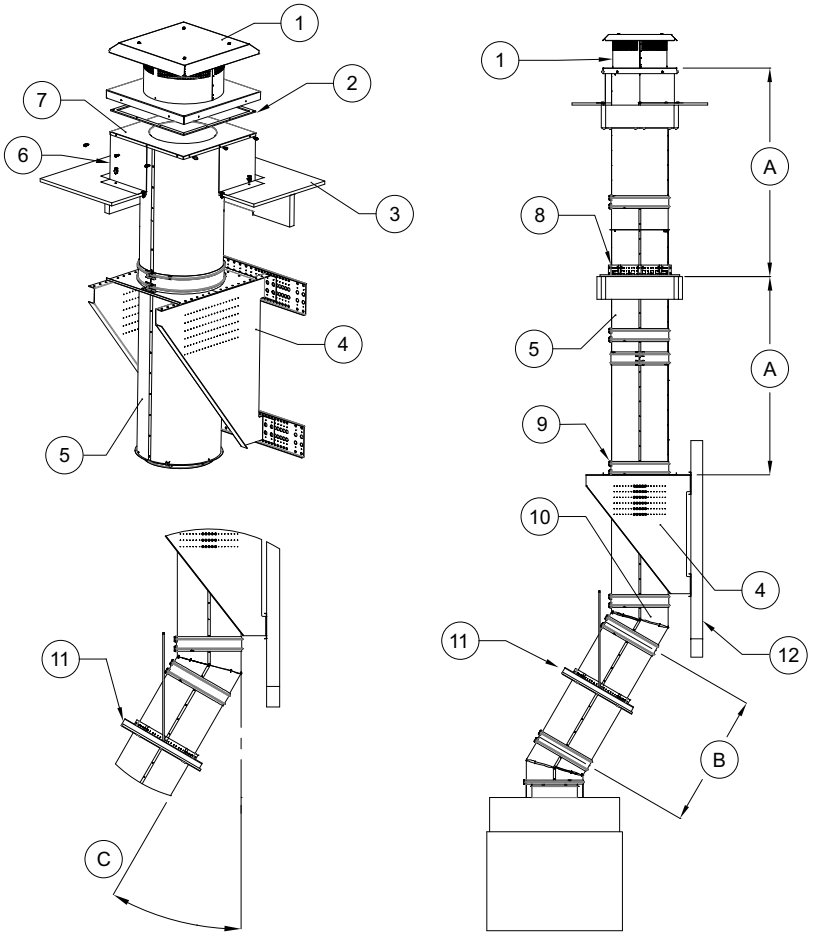
A. Vertical Support Spacing, refer to **Table 8**

B. Horizontal Support Spacing, refer to **Table 7**

There is no limit on the angle or slope of an offset for gas or liquid fuel burning appliances, but with a solid fuel burning appliance the slope must not be greater than 30 degrees (USA) or 45 degrees (Canada) from vertical.

Chimney for combination fuel heating appliances which are capable of burning solid fuel or are convertible to solid fuel are limited to the same 30 degrees (USA) or 45 degrees (Canada) slope even if the current choice of fuel is gas or oil.

**Figure 21 - Vertical Floor Details for Chimney Applications**




1. Base Cap
2. Ceramic Gasket
3. Floor
4. Vertical Wall Support Kit
5. Chimney/Duct Section
6. Vented Curb
7. Transition Plate
8. Vertical Floor Support Kit
9. Double V-band - Located above wall support kit.
10. Elbow
11. Vertical Floor Support with Threaded Rod
12. Wall

A. Vertical Support Spacing, refer to **Table 8**
B. Maximum Straight Length = 8 Feet
C. Maximum angle not to exceed when being used with solid fuel chimney applications - 30° USA / 45°Canada

## Double Wall Vertical Support (Wood, Steel, Concrete)

The V-band will sit on top of the flat support plates after the wall support kit installation is complete.

1. Verify wall construction and hardware kit.
   - For wood wall construction, the wall must be constructed of 2” x 4” wooden studs with a maximum spacing of 24” on center and covered with 5/8” gypsum. Use hardware kit DWVESU-HARDWARE-W. Refer to **Figure 22 on page 33** for wood/steel installation details.
   - For steel stud wall construction, the wall must be constructed of 2” x 4” 25 gauge (minimum) with a maximum spacing of 24” on center and covered with 5/8” gypsum. Use hardware kit DWVESU-HARDWARE-S. Refer to **Figure 22 on page 33** for wood/steel installation details.
   - For concrete/masonry construction, use hardware kit DWVESU-HARDWARE-CM. Refer to **Figure 23 on page 34** for concrete/masonry installation details.
2. The wall support plate has specific holes that locate the side plates so that when installed, they will match the outer shell diameter. Measure the shell diameter, then measure from the wall plate center holes to the radius of the opening to locate the first side plate.

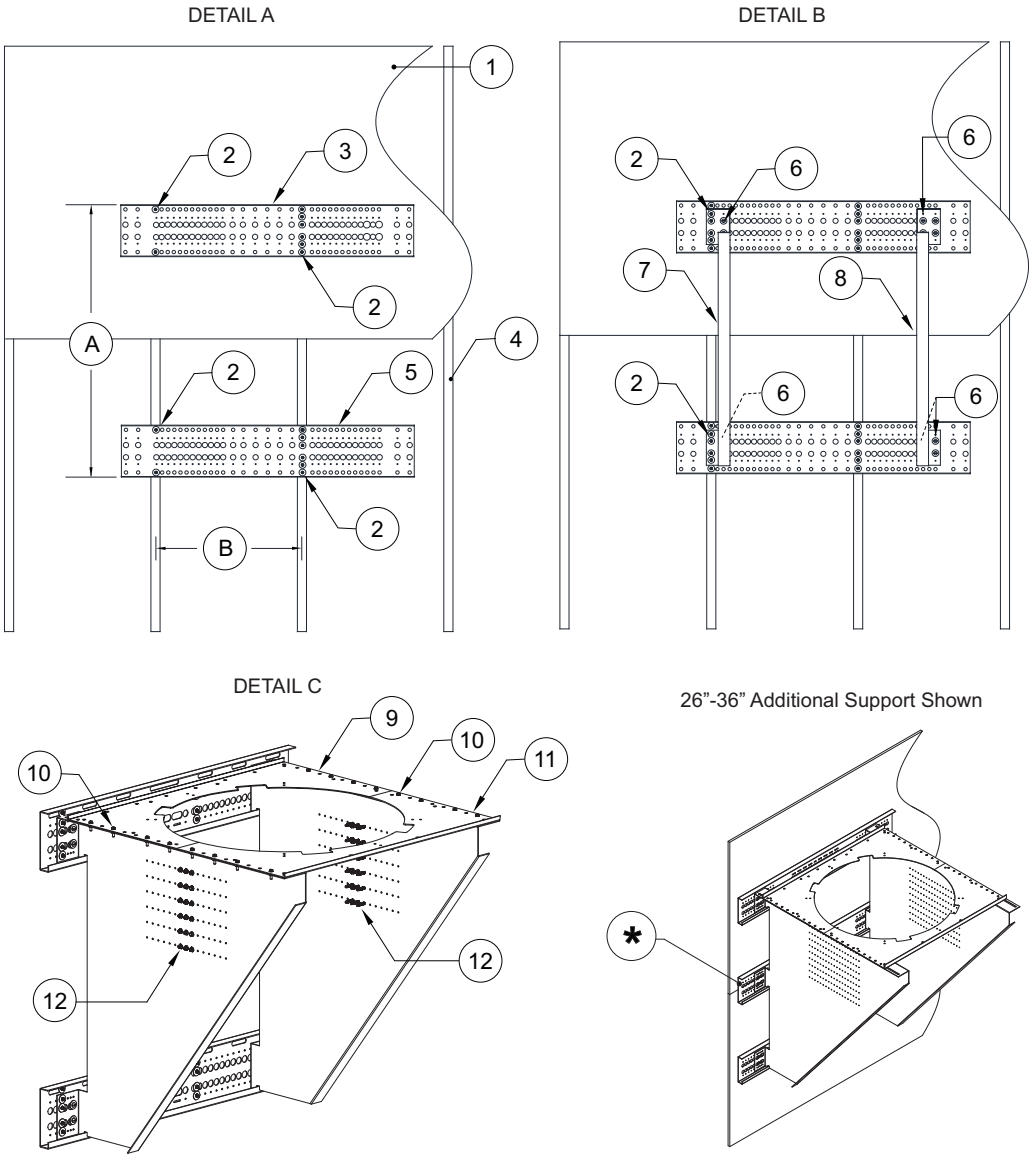
For example: If the shell being installed has a 30” outside diameter, measure from the center of the wall plate 15”. This will locate the inside of the side support plate to the wall plate. Side support plate mounting holes should be on the outside.

3. Once the first wall support plate is located, use the 7/8” holes that are 24” on center from the side plate mounting holes to secure the first support plate. In some cases, the mounting holes may have to be drilled to align with studs.
4. Follow the instructions above and mount the second wall support plate. Measurement will be 44” from the top of the first wall support to the bottom of the second wall support.

**NOTE: For steel studs, alternate self-drilling screws and toggle bolts when installing side plates into stud locations.**

5. Install one of the side support plates. Use the notches on the side plates to mount to the wall plates. This will allow for adjustment before hardware installation. Refer to Detail A and B in **Figure 19 on page 29**.
6. Measure from the center of the wall support plate to locate the first side support plate. Measure 24” from the hardware installed in step 3. Secure wall support plates to the wall.
7. Measure from the center and install the second side plate.
8. Repeat the installation process so that both wall supports and side plates are installed and secure.
9. Install the rear flat support plate using nuts and bolts. Mount the shell so the V-band is above the flat support plates. Secure by installing the front flat support plate. The V-band should be sitting on top of the flat plate. A cutout is provided in the flat plate, align the V-band bracket with the cutout so it does not interfere with the top of the plate.
10. Use self-drilling screws to secure the side support left and right plates to the outer duct shell. Use the guide holes to locate the shell center and fill all holes at the center, center left and center right.

**Figure 22 - Vertical Support (Wood, Steel)**



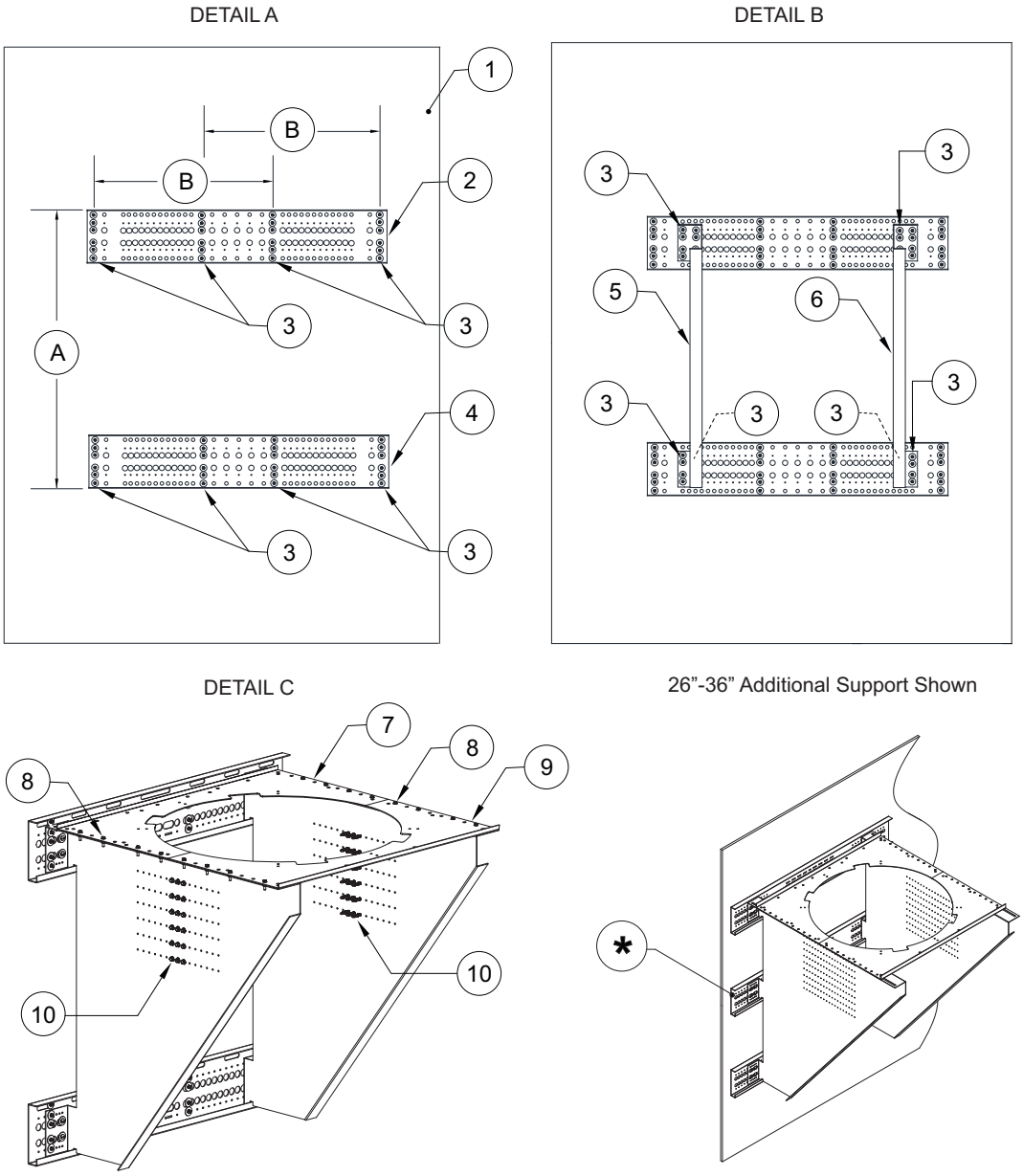

1. Wall Substrate (Wood, Steel)
2. Hardware for Stud Installation - Wood/Steel
   - Wood - 5/16” x 3-1/2” Lag Bolts and Washers
   - Steel - 5/16” x 1-1/2” Self-Drilling Screws and 5/16” x 4” Toggle Bolts
3. Wall Support Plate #1
4. Stud (Wood/Steel)
5. Wall Support Plate #2
6. 5/16” x 4” Toggle Bolts
7. Side Support Plate #1
8. Side Support Plate #2
9. Rear Flat Support Plate
10. 5/16”-18 Hardware, secures flat plates to the side plates.
11. Front Flat Support Plate
12. 5/16”-18 x 1-1/2” Self-Drilling Screws

A. 44” Spacing Distance

B. 24” Centered Spacing Distance

* Third wall support plate used for 26”-36” duct.

**Figure 23 - Vertical Support (Concrete)**




1. Wall Substrate (Concrete)
2. Wall Support Plate #1
3. Hardware from Mounting Kit for Concrete - 5/16” x 2-1/4” Concrete/Masonry Screws and Washers
4. Wall Support Plate #2
5. Side Support Plate #1
6. Side Support Plate #2
7. Rear Flat Support Plate
8. 5/16”-18 Hardware, secures flat plates to the side plates.
9. Front Flat Support Plate
10. 5/16”-18 x 1-1/2” Self-Drilling Screws

A. 44” Spacing Distance

B. 24” Centered Spacing Distance

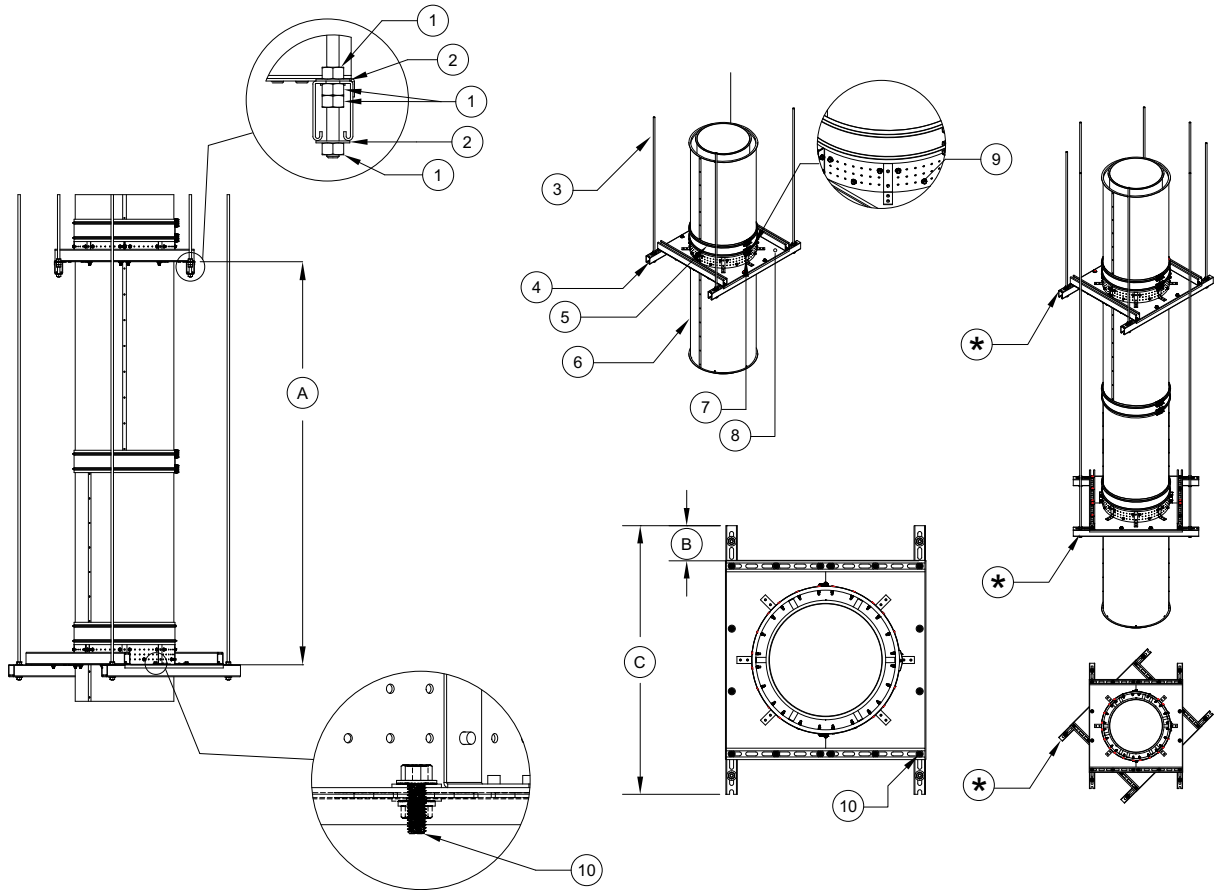
* Third wall support plate used for 26”-36” duct.

## Double Wall Vertical Ceiling Support

1. The vertical ceiling support system is used when a wall support cannot be used or installed.
2. After all-thread has been installed, install Unistrut with provided 1/2” hardware. Install floor support plates to Unistrut with 3/8” hardware. B12 Unistrut is recommended.
3. When installing duct/chimney, make sure that the floor support fastener band and floor support are located under the V-band. Refer to **Table 8 on page 28** for vertical spacing specifications.
4. Secure the floor support fastener band to the outer shell using the 5/16”-18 x 1-1/2” self-drilling screws. Use the guide holes to locate the shell center. Install screw into center, center left and center right. A minimum of 18 screws must be used on each side of the duct/chimney.

**NOTE: Supports must be rotated so that all-thread is attached directly to the ceiling. DO NOT ATTACH ALL-THREAD FROM ONE UNISTRUT TO ANOTHER.**

**Figure 24 - Vertical Ceiling Support**




1. 1/2” Nut
2. 1/2” Washer
3. 1/2” All-Thread - Supplied by others
4. B12 Unistrut
5. Double Wall V-band
6. Double Wall Shell
7. Floor Support Fastener Band
8. Floor Support
9. 5/16”-18 x 1-1/2” Self-Drilling Screws
10. 3/8” Hardware - 18 pieces

A. Vertical Support Spacing, refer to **Table 8 on page 28**
B. 5” Maximum Distance
C. 60” Maximum Distance

* Supports must be rotated so that all-thread is attached directly to the ceiling. DO NOT ATTACH ALL-THREAD FROM ONE UNISTRUT TO ANOTHER.

## Double Wall Vertical Floor Support (Wood, Concrete, Steel)

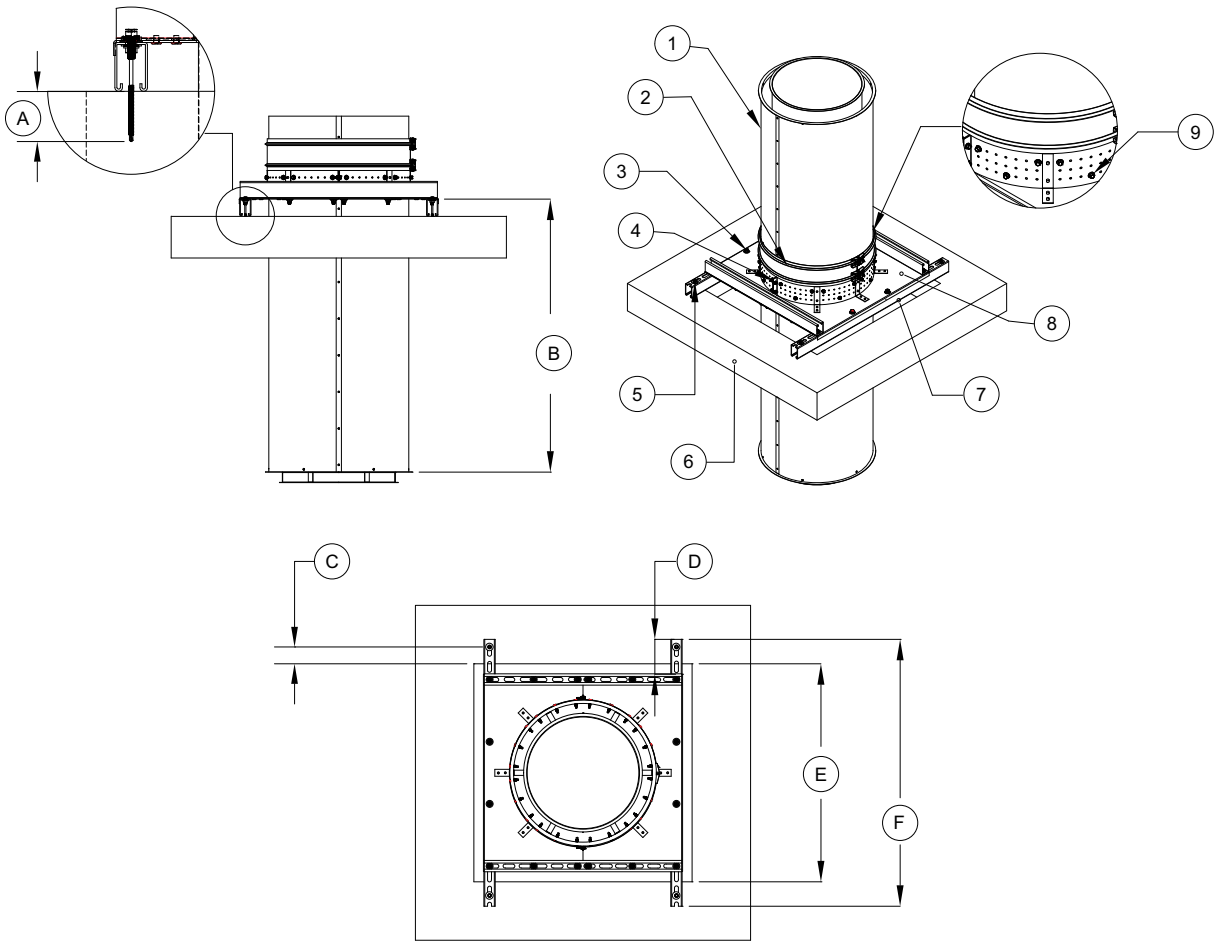
1. Vertical floor supports are used when the duct system is passing through a floor opening. Vertical floor support assemblies consist of two floor support plates and support bands. The support plates are used to span the floor opening, the support bands connect the floor plates to the outer shell of the double wall duct shell.
2. The floor opening is sized per the double wall duct outer shell. Verify the floor opening, refer to **Table 10 on page 41** (grease duct) or **Table 11 on page 43** (chimney).
3. If there is an existing opening in the floor or chase, you must verify the opening. If the opening is larger than the dimension referenced in **Table 10** (grease duct) or **Table 11** (chimney), you must re-frame the opening or change to a chase support. Refer to **Figure 25 on page 37** for chase support details.
4. Chase supports are used when the floor opening is larger than the floor support plates and the floor support plates cannot be secured to the floor.
5. Unistrut is bolted to the floor support plates (chase support). Refer to **Figure 25 on page 37** for details. B12 Unistrut is recommended.
6. Unistrut is designed to span larger opening in floors when the opening cannot be changed.

**NOTE: If there is an existing opening in the floor that exceeds 5” maximum clearance, then re-frame the opening or use “Double Wall Vertical Ceiling Support” on page 35.**

**Table 9 - Substrate Hardware**

| Decking Material | Hardware | Minimum Thread Penetration | Minimum Edge Distance |
|---|---|---|---|
| Wood - Minimum G.42 | Zinc Plated Steel Hex Head Lag Screw<br>3/8” x 2-1/2” with 3/8” washer | 2” | 1-1/2” |
| Concrete - 2500 Minimum PSI | Hilti Kwik Bolt<br>3/8” Diameter TZ Expansion Anchor with 3/8” washer | 2-5/16” | 3” |
| Steel Roof Truss | Dril-Flex Self-Drilling Screws<br>1/4”-14 Min. 1/2” Through with 1/4” washer | 12 Gauge or 1/8” Thick | 3/8” |

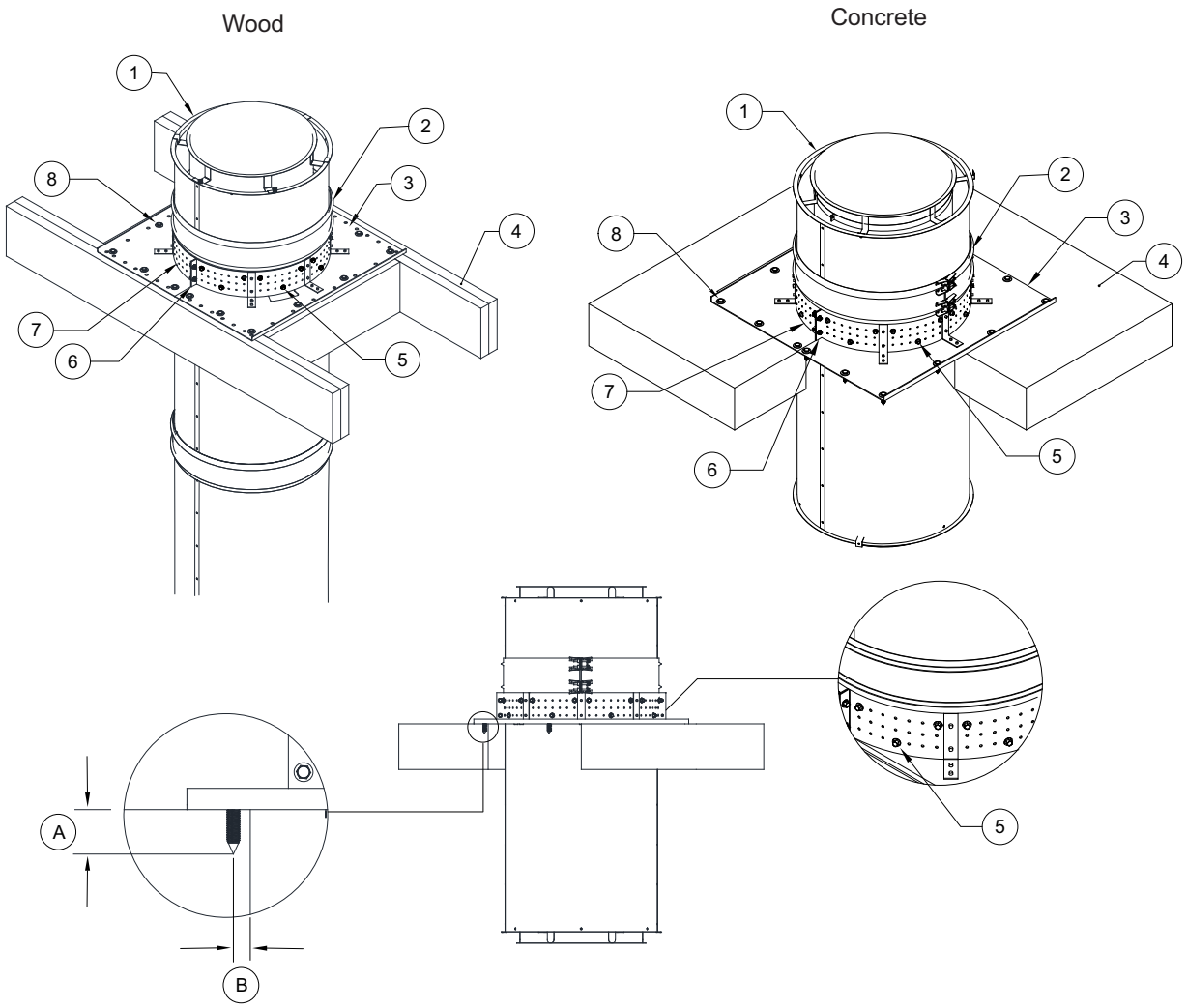
**Figure 25 - Chase Floor**




1. Double Wall Shell
2. Double Wall V-band
3. 3/8” Hardware
4. Floor Support Fastener Band
5. Substrate Fastener - Supplied by others
6. Substrate
7. B12 Unistrut
8. Floor Support
9. 5/16”-18 x 1-1/2” Self-Drilling Screws (Use minimum 3 screws per opening in the band)

A. Minimum Thread Penetration, refer to **Table 9 on page 36**
B. Vertical Support Spacing, refer to **Table 8 on page 28**
C. Minimum Edge Distance, refer to **Table 9 on page 36**
D. 5” Maximum Distance
E. Open Area Chase
F. 60” Maximum Distance

**Figure 26 - Floor Support**




1. Double Wall Shell
2. Double Wall V-band
3. Floor Support
4. Substrate
5. 5/16”-18 x 1-1/2” Self-Drilling Screws (Use a minimum of 3 screws per opening in the band)
6. 1/4”-20 Whiz Nuts and Bolts
7. Floor Support Fastener Band
8. Substrate Hardware, refer to **Table 9 on page 36**

A. Minimum Thread Penetration, refer to **Table 9 on page 36**

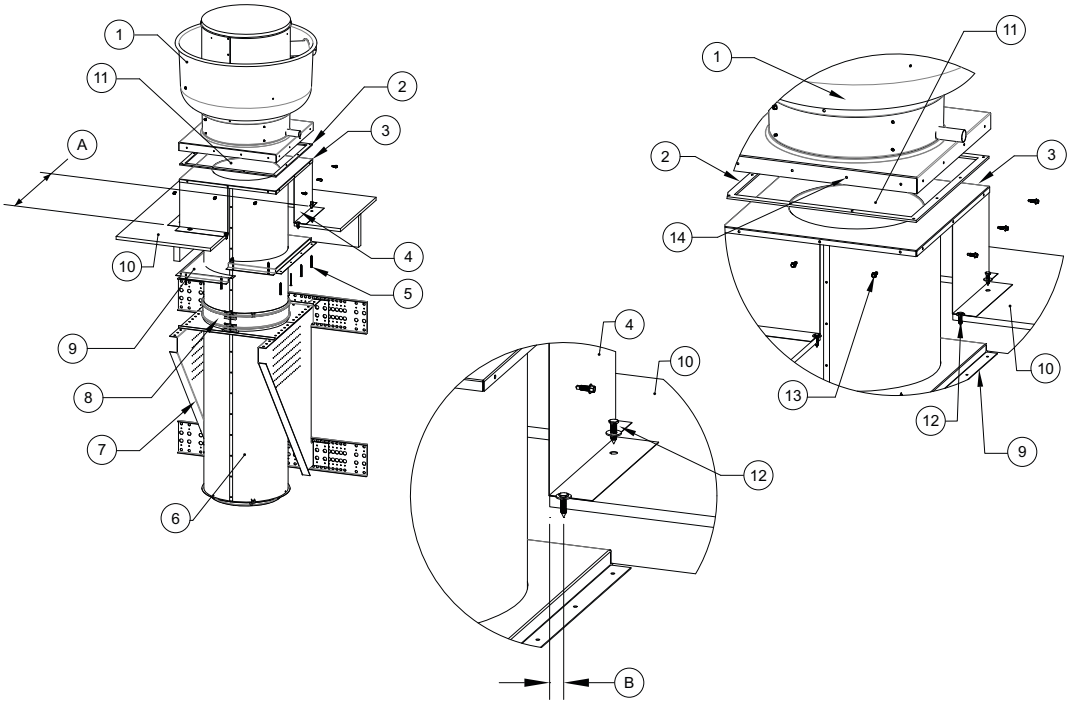
B. Minimum Edge Distance, refer to **Table 9 on page 36**

## Vertical Installation Roof Termination

Model 2R & Model 2R HT Chimney Systems require 2” clearance to combustibles, the clearance is maintained by the correct installation of the transition plates. Clearance plates shown below may be used with grease ducts (2R, 3R, 3Z) to help center grease duct when going through a floor/ceiling.

A high temperature gasket is used to seal the transition plate to the exhaust fan/vent cap. The transition plate is secured to the curb using 1/4”-20 x 1-1/2” zinc plated self-drilling screws. The fan is secured to the vented curb using 1/4”-20 x 2” zinc plated self-drilling screws.

**Figure 27 - Roof Termination Installation Details**




1. Exhaust Fan
2. High Temperature Gasket
3. Transition Plate - Welded to inner duct/chimney
4. Vented Curb
5. Clearance Plate Mounting Screws - Secures clearance plates to combustible surface.
6. Double Wall Duct/Chimney
7. Vertical Wall Support Assembly
8. Double V-band
9. 2” Clearance Plates may be used with grease duct 2R, 3R and 3Z (optional).
10. Substrate - Wood, Concrete or Steel
11. Inner Duct/Chimney
12. Substrate Hardware, refer to **Table 9 on page 36**.
13. 1/4”-20 x 1-1/2” Zinc Plated Self Drilling Screws
14. 1/4”-20 x 2” Zinc Plated Self Drilling Screws

A. Refer to **Table 10 on page 41** for grease duct or **Table 11 on page 43** for chimney.

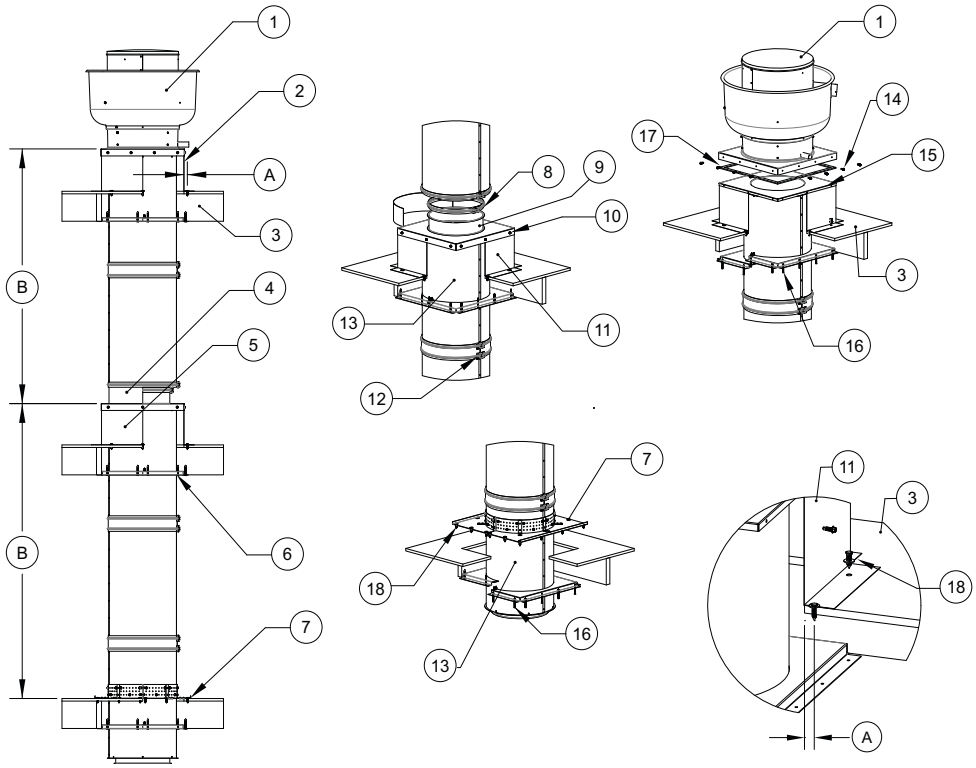
B. Edge Distance, refer to **Table 9 on page 36**.

## Vertical Support Floor and Curb

Model 2R & Model 2R HT Chimney Systems require a 2” clearance to combustibles, the clearance is maintained by the correct installation of the transition plates. Clearance plates shown below ma.y be used with grease ducts (2R, 3R, 3Z) to help center grease duct when going through a floor/ceiling

A high temperature gasket is used to seal the transition plate to the exhaust fan/vent cap. The transition plate is secured to the curb using 1/4”-20 x 1-1/2” zinc plated self-drilling screws. The fan is secured to the vented curb using 1/4”-20 x 2” zinc plated self-drilling screws.

**Figure 28 - Floor and Curb Support Installation Details**




1. Exhaust Fan
2. Vented Curb - Roof Termination
3. Substrate - Wood, Concrete or Steel
4. Riser Cover
5. Through Curb Support with TPDB
6. Clearance Plates may be used with grease duct 2R, 3R, and 3Z.
7. Floor Support Assembly
8. Single V-band - Inner
9. Riser
10. 1/4”-20 x 2” Zinc Plated Self Drilling Screws
11. Through Curb Support with TPDB
12. Double V-band
13. Double Wall Duct/Chimney
14. 1/4”-20 x 1-1/2” Zinc Plated Self Drilling Screws
15. Transition Plate - Welded to inner duct/chimney
16. Clearance Plate Mounting Screws - Secures clearance plates to combustible surface (optional).
17. High Temperature Gasket
18. Substrate Hardware, refer to **Table 9 on page 36**.

A. Edge Distance, refer to **Table 9 on page 36**.

B. Vertical Support Spacing, refer to **Table 8 on page 28**.

## Through Penetration and Fire Stops

Through floor fire stop support assemblies are used to support duct sections that penetrate a fire resistant floor(s). The full support ring is installed under the double V-band; the struts are connected to the support ring with supplied 5/16”-18 hardware. Once the struts have been connected, they are secured to the floor using appropriate type and size fasteners supplied by others. The fire stop support is designed to support the penetrating duct section and maintain annular distance, see **Figure 29 on page 42**.

When duct systems penetrate a fire resistance rated floor, ceiling and/or a wall, a fire stop kit is used to retain the fire resistance rating on the floor and/or wall. The double wall grease duct (2R, 3R and 3Z) and the fire stop assemblies detailed below have achieved 2-hour ratings for integrity, insulation and stability. Testing was conducted in accordance with the applicable requirements UL 2221, Test of Fire Resistive Grease Duct Enclosure Assemblies.

The fire engulfment test conducted per UL 2221 exposes the firestop system to the same furnace condition, uses the same instrumentation for the evaluation of the firestop on the unexposed side of the furnace, and exposes the firestop to a post-fire test hose stream as in ASTM E814 and UL 1479. The UL 2221 fire engulfment test is more severe on the firestop than ASTM E814 or UL 1479. Intertek considers the through penetration firestop system referenced in this manual complies with a 2-hour F and T rating per ASTM E814-13a and UL 1479, 4th edition, September 25, 2014.

**Table 10 - Opening Size through Penetrations Grease Duct**

| Duct Model | Inner Diameter | Outer Diameter | Square/Round Opening Min/Max |
|---|---|---|---|
| DW - 2R | 5” | 9” | 11” - 12” |
| DW - 2R | 6” | 10” | 12” - 13” |
| DW - 2R | 7” | 11” | 13” - 14” |
| DW - 2R | 8” | 12” | 14” - 15” |
| DW - 2R | 10” | 14” | 16” - 17” |
| DW - 2R | 12” | 16” | 18” - 19” |
| DW - 2R | 14” | 18” | 20” - 21” |
| DW - 2R | 16” | 20” | 22” - 23” |
| DW - 2R | 18” | 22” | 24” - 25” |
| DW - 3R / 3Z | 5” | 11” | 13” - 14” |
| DW - 3R / 3Z | 6” | 12” | 14” - 15” |
| DW - 3R / 3Z | 7” | 13” | 15” - 16” |
| DW - 3R / 3Z | 8” | 14” | 16” - 17” |
| DW - 3R / 3Z | 10” | 16” | 18” - 19” |
| DW - 3R / 3Z | 12” | 18” | 20” - 21” |
| DW - 3R / 3Z | 14” | 20” | 22” - 23” |
| DW - 3R / 3Z | 16” | 22” | 24” - 25” |
| DW - 3R / 3Z | 18” | 24” | 26” - 27” |
| DW - 3R / 3Z | 20” | 26” | 28” - 29” |
| DW - 3R / 3Z | 22” | 28” | 30” - 31” |
| DW - 3R / 3Z | 24” | 30” | 32” - 33” |
| DW - 3Z | 26” | 32” | 34” - 35” |
| DW - 3Z | 28” | 34” | 36” - 37” |
| DW - 3Z | 30” | 36” | 38” - 39” |
| DW - 3Z | 32” | 38” | 40” - 41” |
| DW - 3Z | 34” | 40” | 42” - 43” |
| DW - 3Z | 36” | 42” | 44” - 45” |

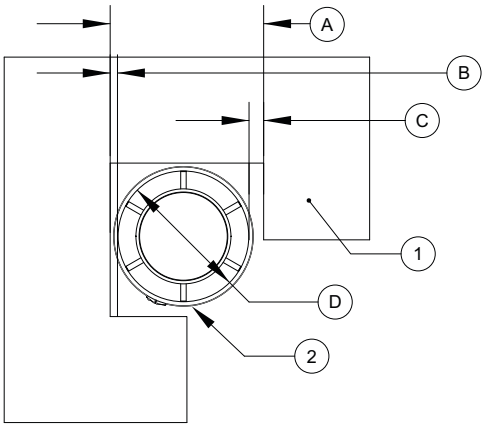
## Annular Distance – Fire Stop

Grease ducts are to be installed eccentrically or concentrically within the fire stop system. The annular space between the grease duct and the periphery of the opening shall be a minimum of 1” to a maximum of 2” for 1 and 2-hour fire rated floor and wall assemblies. Grease duct will be rigidly supported on both sides of the floor and or wall assembly. The F and T rating for the fire stop systems shown below are rated for 2 hours. The fire stop ratings are applicable only when Specified Technologies Series SSS Latex Intumescent (**STI Triple S**) Sealant is used. Annular distance is measured perpendicular from the outside of the grease duct to the periphery of the opening.

**Figure 29 - Annular Distance**

1. Floor/Ceiling
2. Duct

A. Outer Diameter Opening Plus 3” Maximum
B. 1” Minimum Distance
C. 2” Maximum Distance
D. Duct Outer Diameter




## Annular Distance – 2R & 2R Type HT Clearance

Transition plates are used to maintain a 2” clearance to combustibles for Model 2R & 2R Type HT listed chimney systems. Transition plates are not a substitute for through penetration and fire stop plates. Chimney transition plates are designed to center the chimney in the recommend opening and maintain 2” clearance to combustibles, refer to **Figure 30**. Frame or cut the opening in the floor, refer to **Table 11 on page 43**. Chimney transition plates are welded to the section of chimney at the curb. The welded assembly is dropped down through the curb, the chimney transition plate has down-flanges that overlap the side of the curb, locking it in place. The chimney transition plate is secured to the curb using appropriate type and size hardware, refer to **Figure 31 on page 43**. Once the chimney transition plate is secure, the chimney will be centered in the opening with a 2” clearance to combustibles. Model 2R & Model 2R Type HT chimney requires a 2” minimum annular distances in an undisclosed installation.

**WARNING**: **Clearance (air space) to combustibles must be free from any type of insulation.**

**Figure 30 - Clearance Plates**

1. Combustible Surface

A. 2R Shell plus 4-1/2”
B. 2R Shell Outer Diameter

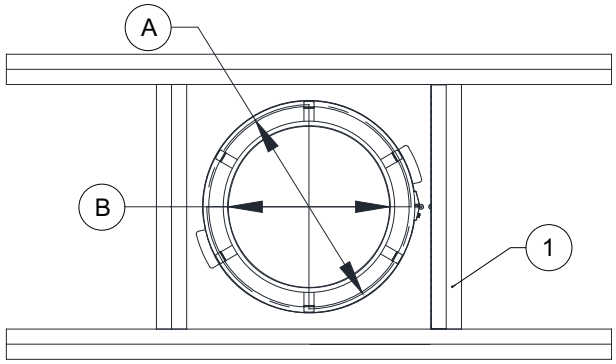
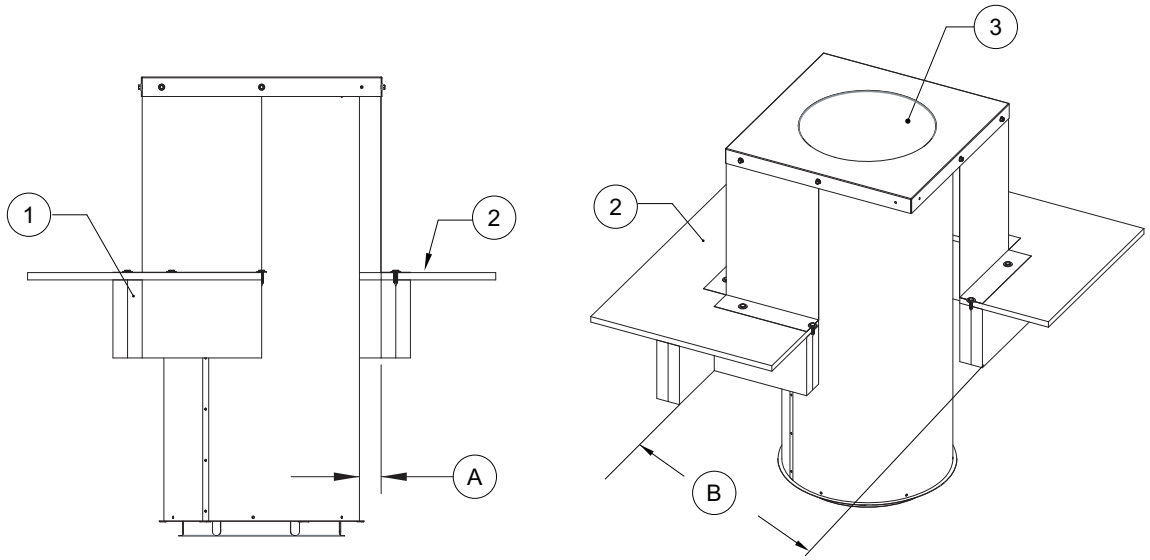


**Table 11 - Chimney Annular Space**

| Chimney Model | Inner Diameter | Outer Diameter | Square/Round Opening Min/Max | Square Opening 2R Type HT |
|---|---|---|---|---|
| DW 2R & 2R Type HT | 5” | 9” | 11” - 12” | 13-1/2” |
| DW 2R & 2R Type HT | 6” | 10” | 12” - 13” | 14-1/2” |
| DW 2R & 2R Type HT | 7” | 11” | 13” - 14” | 15-1/2” |
| DW 2R & 2R Type HT | 8” | 12” | 14” - 15” | 16-1/2” |
| DW 2R & 2R Type HT | 10” | 14” | 16” - 17” | 18-1/2” |
| DW 2R & 2R Type HT | 12” | 16” | 18” - 19” | 20-1/2” |
| DW 2R & 2R Type HT | 14” | 18” | 20” - 21” | 22-1/2” |
| DW 2R & 2R Type HT | 16” | 20” | 22” - 23” | 24-1/2” |

**Figure 31 - Chimney Clearances**




1. Joist
2. Floor
3. Inside Chimney

A. Clearance to Combustibles, refer to **Table 1 on page 8**
B. Opening 2R Shell plus 4”. Refer to **Table 11** for floor opening details.

**WARNING**: **Clearance (air space) to combustibles must be free from any type of insulation.**

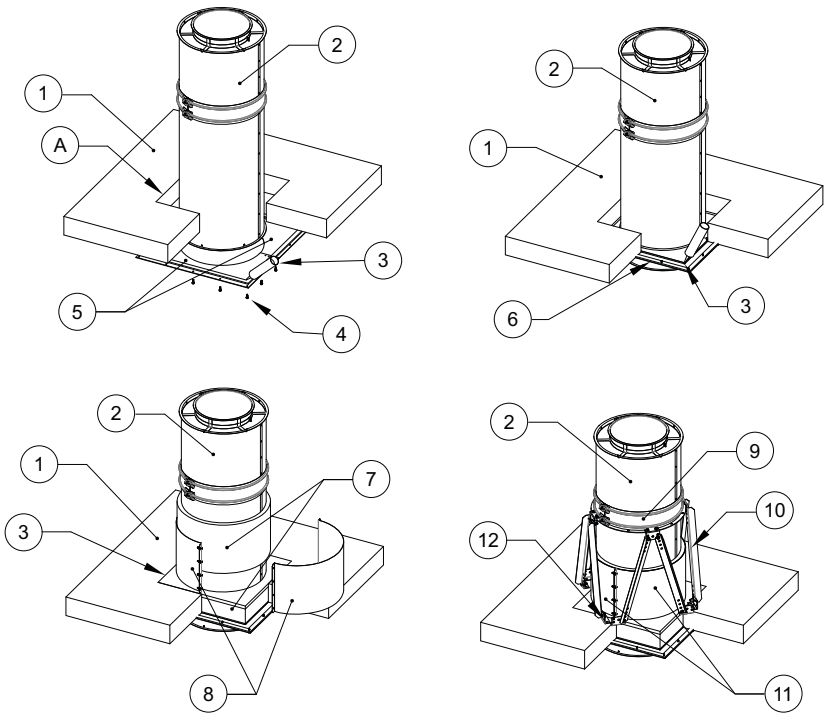
## Floor and Ceiling Fire Stop Installation

1. Cut an opening in the floor/ceiling that is a minimum of 2” and maximum of 3” larger than the outside diameter of the duct being installed, refer to **Table 10 on page 41**.
2. The grease duct can be installed eccentrically or concentrically within the opening. The distance from the outside of the grease duct to the periphery of the opening cannot exceed 2”. The maximum annular distance allowed is 2”, refer to **Figure 29 on page 42**.
3. Apply a continuous 1/2” bead of STI Triple S intumescent around the fire plates. The fire plates are designed to fit around the duct and overlap by 1”.
4. The fire plates are installed on the bottom side of the floor/ceiling. Push the plates up to the floor/ceiling so the intumescent seals the plates against the floor/ceiling. Then secure using 1/4”-20 x 1-1/2” long concrete fasteners where the plates overlap, secure using 1/4”-20 x 1” sheet metal screws.
5. Seal the topside using the intumescent seal around the duct and fire plates. Seal the edge of the opening to the fire plates.
6. Fill the cavity using four layers of insulation, make sure that all voids are filled. The insulation is fully compressed into the opening until it is 3/4” from the top of the opening.
7. Cover the compressed insulation with intumescent. Continue until the intumescent is level with the top of the opening. The intumescent should overlap on to the floor/ceiling, ensuring there are no gaps between the edges of the opening or the duct outer shell.
8. Wrap one layer of 1” x 12” provided insulation around the base of the duct and enclose with the half enclosure bands. The insulation and bands should be touching the intumescent, do not disturb or compromise the intumescent when installing. The enclosure bands are assembled using 1/4”-20 x 3/4” hardware.
9. Install the vertical fire stop support; ensuring the full support ring is installed under the double V-band. Once in place, the legs are secured to the floor/ceiling using appropriate type and size fasteners.

**Figure 32 - Floor and Ceiling Fire Stop Installation**

1. Top Side
2. Duct Section
3. Intumescent Sealant
4. Concrete Screws
5. Fire Plates
6. Fire Plate - Shown secured to substrate
7. Insulation
8. Half Closure Bands
9. Double V-band
10. Vertical Support
11. Half Closure Bands - Shown secured
12. Concrete Anchors

A. Floor Opening, refer to **Table 10**.

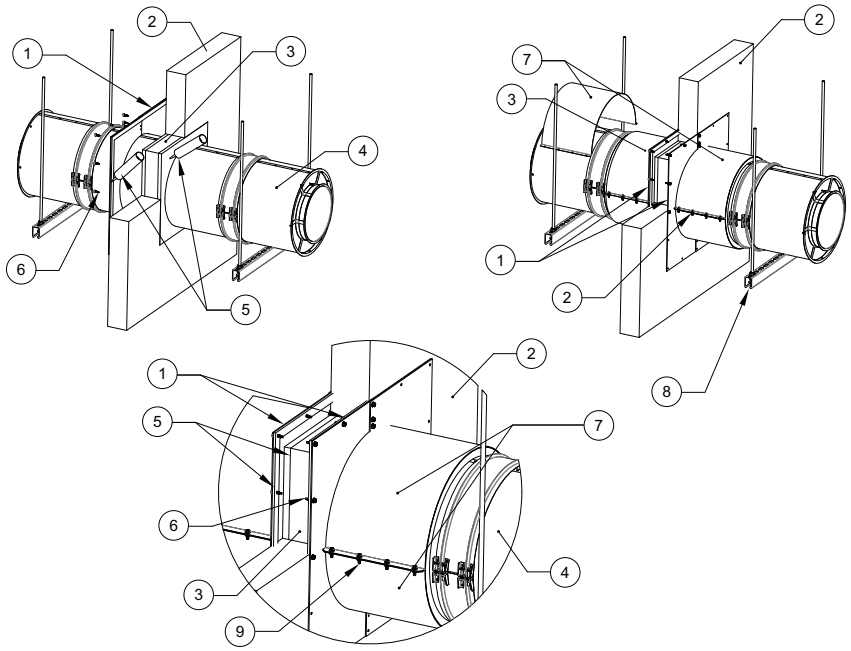


## Wall Fire Stop Installation

1. Cut an opening in the wall that is a minimum of 2” and maximum of 3” larger than the outside diameter of the duct being installed, refer to **Table 10 on page 41**.
2. The grease duct can be installed eccentrically or concentrically within the opening. The distance from the outside of the grease duct to the periphery of the opening cannot exceed 2”. The maximum annular distance allowed is 2”, refer to **Figure 29 on page 42**.
3. Apply a continuous 1/2” bead of STI Triple S intumescent around the fire plates. The fire plates are designed to fit around the duct and overlap by 1”.
4. The fire plates are installed on the backside of the wall. Push the plates up to the wall so the intumescent seals the plates against the wall. Then secure using 1/4”-20 x 1-1/2” long concrete fasteners where the plates overlap, secure using 1/4”-20 x 1” sheet metal screws.
5. Apply a 3/4” covering of intumescent sealant to the inside of the fire plates installed on backside of the wall. The sealant should be smooth and without any gaps on the edges of the opening or outside of duct.
6. Fill the cavity using the insulation provided, ensuring that all voids are filled. The insulation is fully compressed into the opening until it is 3/4” from the edge of the opening in the wall.
7. Cover the compressed insulation with intumescent. Continue until the intumescent is flush with the edge of the wall opening. The intumescent should overlap on to the wall, ensuring there are no gaps between the edges of the opening or the duct outer shell.
8. Install the fire plates on the front side of the wall. Push the plates up to the wall so the intumescent seals the plates against the wall. Then secure using 1/4”-20 x 1-1/2” long concrete fasteners where the plates overlap secure using 1/4”-20 x 1” sheet metal screws.
9. Wrap one layer of 1” x 12” provided insulation around the base of the duct and enclose with the half enclosure bands. The insulation and bands should be touching the intumescent. The enclosure bands are assembled using 1/4”-20 x 1" hardware. This is done on the front and back of the wall.
10. Horizontal supports are used to support the duct on either side of the wall. Refer to **Figure 18 on page 27** for details.

**Figure 33 - Wall Fire Stop Installation**

1. Fire Plates
2. Wall
3. Insulation
4. Duct Section
5. Intumescent
6. Concrete Screws
7. Half Closure Bands
8. Horizontal Support
9. 1/4”-20 Hardware

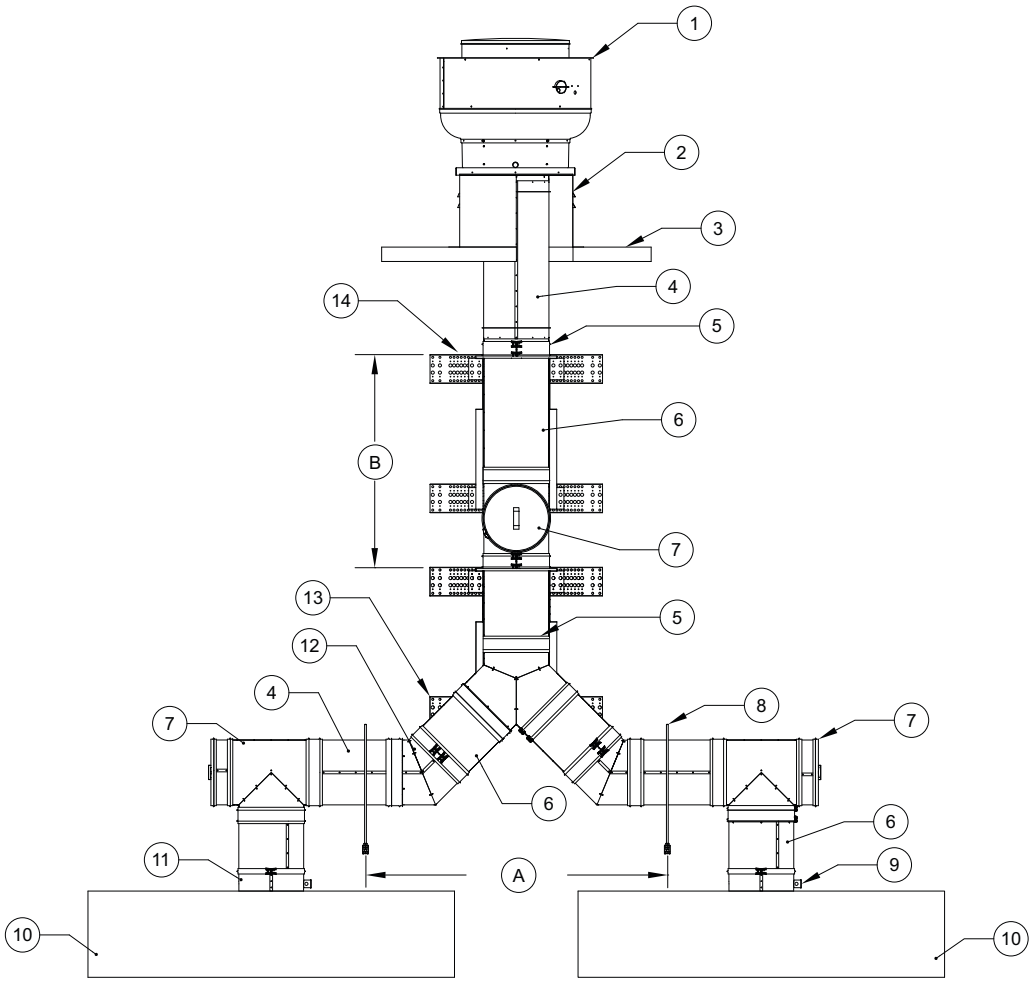


## Grease Duct Assembly

The illustrations shown provide useful information on the installation of grease duct systems. Each installation is specific to the application and the job site. If you encounter a situation not covered by this illustration, refer to the guide or consult the factory. The grease duct systems illustrated in this manual have been tested to and comply with UL 2221, Tests of Fire Resistive Grease Duct Enclosure Assemblies.

Adjustable duct and standard ducts are used to terminate at the transition plate. The duct section is fully welded to the transition plate at the factory.

**Figure 34 - Grease Duct Installation Guide Details View 1**




1. Exhaust Fan
2. Vented Curb
3. Roof
4. Adjustable Duct
5. Double V-band
6. Standard Duct Length
7. Insulated Access Door Cover/Tee - Provided when there is a change in direction.
8. 1/2” Threaded Rod - Minimum size
9. Duct Sensor
10. Exhaust Hood
11. Riser Cover
12. 45 Degree Elbow
13. First Vertical Support - Located at joint #1, after a change in direction. Installed under the double V-band.
14. Second Vertical Support - Installed under the double V-band.

A. Horizontal Support Spacing, refer to **Table 7 on page 26**

B. Vertical Support Spacing, refer to **Table 8 on page 28**

The illustrations shown provide useful information on the installation of grease duct systems. Each installation is specific to the application and the job site. If you encounter a situation not covered by this illustration, refer to the guide or consult the factory. The grease duct systems illustrated in this manual have been tested to and comply with UL 2221, Tests of Fire Resistive Grease Duct Enclosure Assemblies.

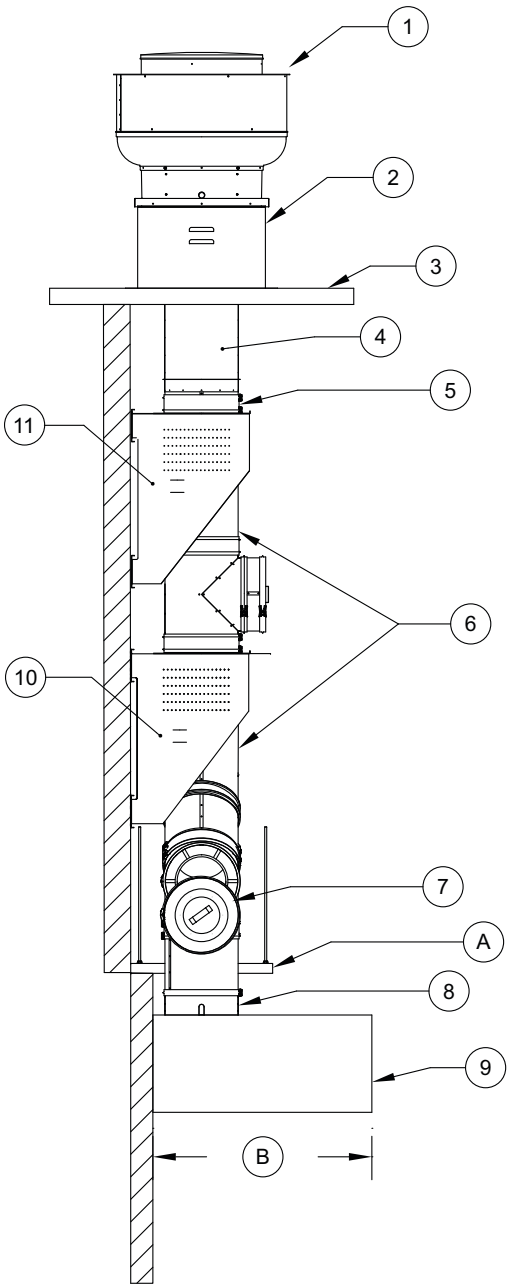
Adjustable duct and standard ducts are used to terminate at the transition plate. The duct section is fully welded to the transition plate at the factory.

**Figure 35 - Grease Duct Installation Guide Details View 2**

1. Exhaust Fan
2. Vented Curb
3. Roof
4. Adjustable Duct
5. Double V-band
6. Standard Duct Length
7. Insulated Access Door Cover/Tee - Provided when there is a change in direction.
8. Riser Cover
9. Exhaust Hood
10. First Vertical Support - Located at joint #1, after a change in direction. Installed under the double V-band.
11. Second Vertical Support - Installed under the double V-band.

A. Horizontal Support Spacing, refer to **Table 7 on page 26**

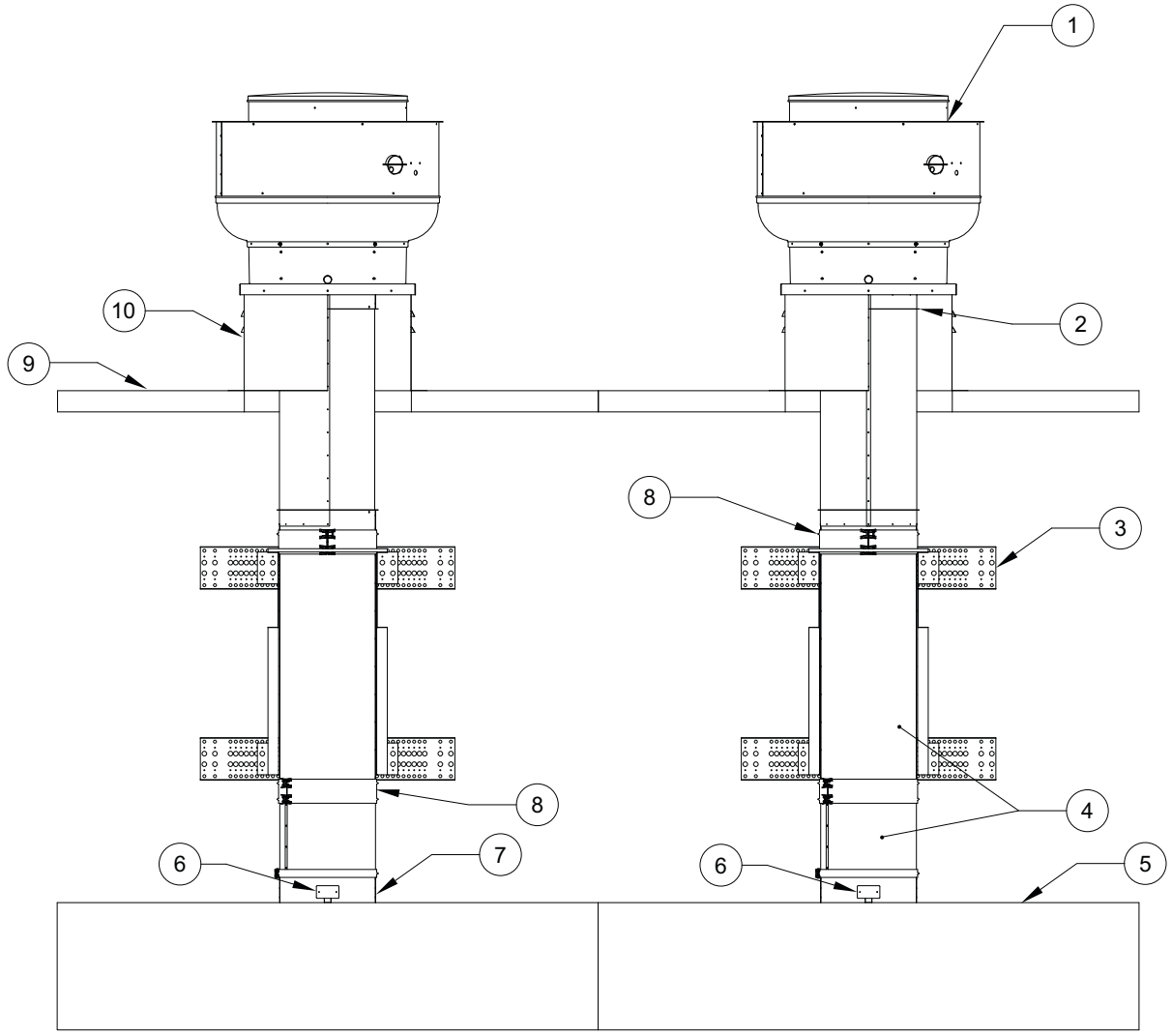
B. Hood Width



The illustrations shown provide useful information on the installation of grease duct systems. Each installation is specific to the application and the job site. If you encounter a situation not covered by this illustration, refer to the guide or consult the factory. The grease duct systems illustrated in this manual have been tested to and comply with UL 2221, Tests of Fire Resistive Grease Duct Enclosure Assemblies.

Adjustable duct and standard ducts are used to terminate at the transition plate. The duct section is fully welded to the transition plate at the factory.

**Figure 36 - Grease Duct Installation Guide Details View 3**

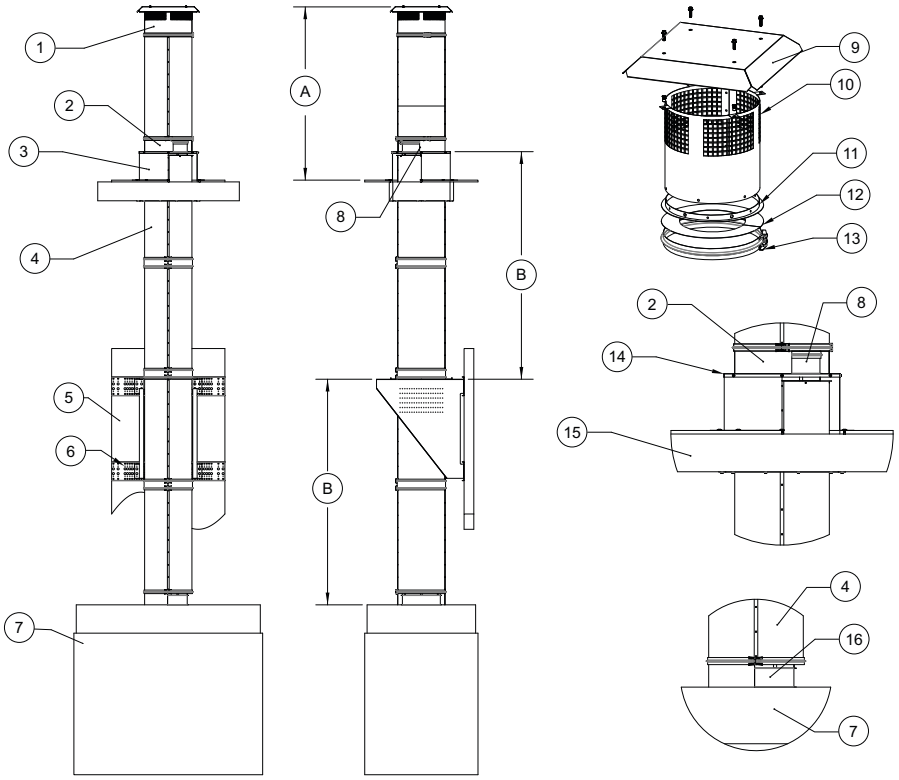



1. Exhaust Fan
2. Adjustable Section - Terminates at transition plate.
3. Vertical Support - Installed under V-band.
4. Standard Duct Length
5. Exhaust Hood
6. Duct Sensor
7. Riser Cover
8. Double V-band
9. Roof
10. Vented Curb

## Chimney Assembly

The illustrations shown provide useful information on the installation of a chimney system. Each installation is specific to the application and the job site. If you encounter a situation not covered by this illustration, refer to the guide or consult the factory. The chimney systems illustrated in this manual have been tested to and comply with UL 103 Type HT, Factory-Built Chimneys for Building Heating Appliances and UL2561 Factory-Built Chimney for Building and Heating Appliance coverage as a Medium Heating Appliance. Chimney needs to be installed additionally in accordance with NFPA 211.

**Figure 37 - Chimney Installation Guide Details View 1**




1. Vent Cap
2. Top Riser Cover and V-band
3. Vented Curb
4. Chimney Shell
5. Wall
6. Vertical Wall Support
7. Appliance
8. Top Riser Connection
9. Cap
10. Airshaft
11. Flange Ring
12. End Cap
13. Single V-band
14. Transition Plate
15. Substrate Surface
16. Connection to Appliance - May be welded/ bolted or field installed

A. Roof support assembly without support - Maximum Distance is 8’

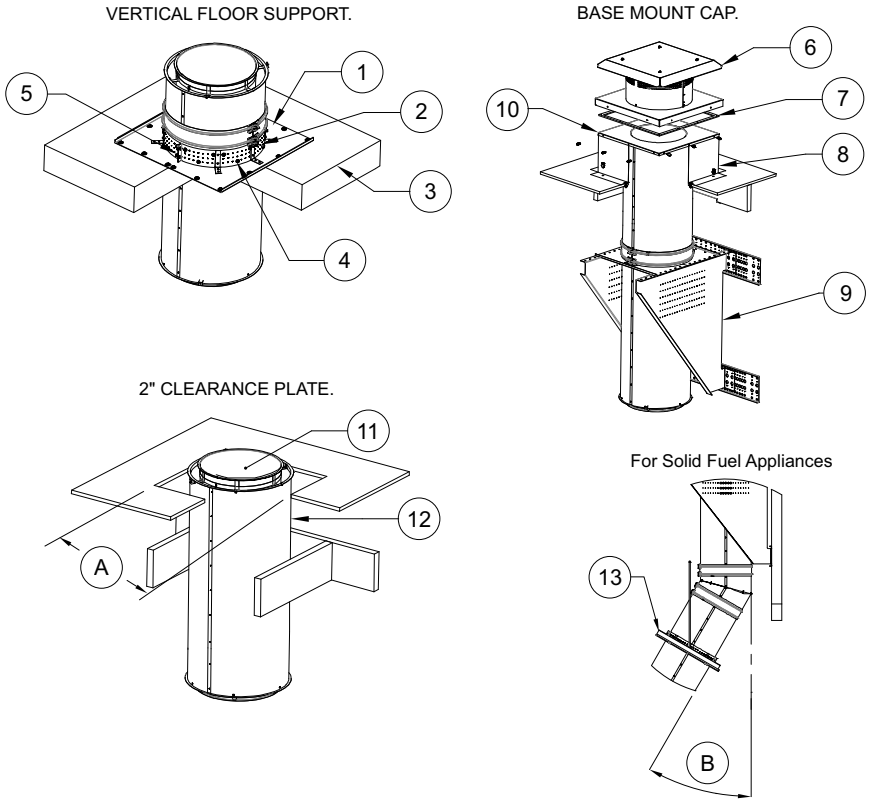
B. Vertical Support Spacing, refer to **Table 8 on page 28**

The illustrations shown provide useful information on the installation of a chimney system. Each installation is specific to the application and the job site. If you encounter a situation not covered by this illustration, refer to the guide or consult the factory. The chimney systems illustrated in this manual have been tested to and comply with UL 103 Type HT, Factory-Built Chimneys for Building Heating Appliances and UL2561 Factory-Built Chimney for Building and Heating Appliance coverage as a Medium Heating Appliance. Chimney needs to be installed additionally in accordance with NFPA 211.

There is no limit on the angle or slope of an offset for gas or liquid fuel burning appliances, but with a solid fuel burning appliance the slope must not be greater than 30 degrees (USA) or 45 degrees (Canada) from vertical, even if a fan is providing ventilation to the system.

Chimney for combination fuel heating appliances which are capable of burning solid fuel or are convertible to solid fuel are limited to the same 30 degrees (US) or 45 degrees (Canada) slope even if the current choice of fuel is gas or oil.

**Figure 38 - Chimney Installation Guide Details View 2**

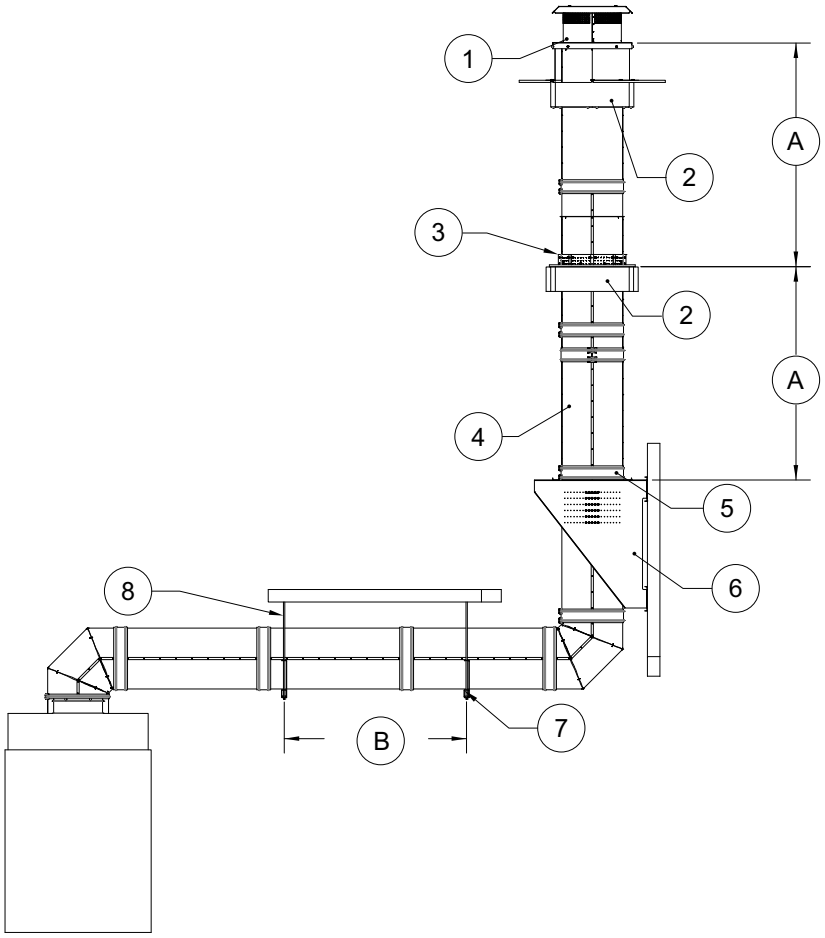



1. Vertical Support Plate
2. Vertical Support Ring
3. Substrate
4. 5/16”-18 x 1-1/2” Self Drilling Screws
5. 1/4”-20 Whiz Nuts and Bolts
6. Base Cap
7. Ceramic Gasket
8. Vented Curb
9. Vertical Support
10. Transition Plate
11. Inside Shell
12. Chimney Shell
13. Vertical Floor Support with Threaded Rod

A. Floor Opening, refer to **Table 11 on page 43**

B. Maximum angle not to exceed when being used with solid fuel chimney applications - 30° USA (45°Canada)

**Figure 39 - Chimney Installation Guide Details View 3**




1. Base Cap
2. Combustible Surface
3. Support Fastener Band
4. Shell
5. Double V-band
6. Vertical Support
7. Horizontal Support
8. 1/2” Threaded Rod (Minimum)

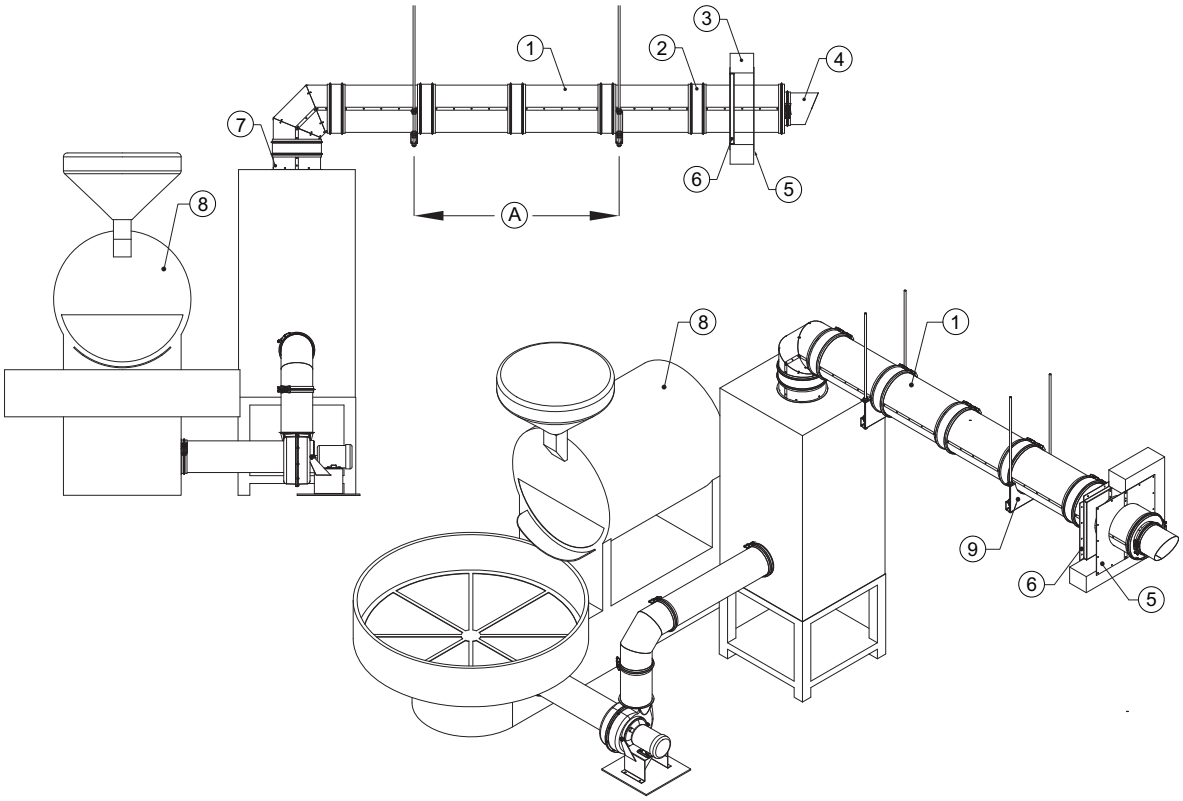
A. Vertical Support Spacing, refer to **Table 8 on page 28**
B. Horizontal Support Spacing, refer to **Table 7 on page 26**

## Chimney Assembly for Direct Vent Applications

**Figure 40** provides information on the installation of a chimney assembly system using a direct vent cap assembly. The chimney assembly for direct vent applications should only be used for gas or liquid fuel burning appliances. **DO NOT USE FOR SOLID FUEL APPLICATIONS**. Each installation is specific to the application and the job site. If you encounter a situation not covered by this illustration, refer to the guide or consult the factory. Direct Vent Chimney systems are listed to UL 103 HT and UL 2561, refer to **"LISTINGS**" on page 4 for listing details.

There is no limit on the angle or slope of an offset for gas or liquid fuel burning appliances. Clearance to combustibles must be always maintained, refer to **"Direct Vent Chimney Cap" on page 53** for information. The direct vent cap assembly shown in **Figure 40** has a 3" clearance to combustibles that must be maintained at all times.

**Figure 40 - Direct Vent Side Wall Installation**




1. 2R Double Wall Section (5"-16")
2. Double Wall V-band*
3. Wall
4. Discharge Vent Section*
5. Outer Cover*
6. Clearance Plates*
7. Equipment Adapter
8. Direct Vent Equipment
9. Vent Support System

* Components included with Direct Vent Cap Assembly

A. Horizontal Support Spacing, refer to **Table 7**

## Direct Vent Chimney Cap

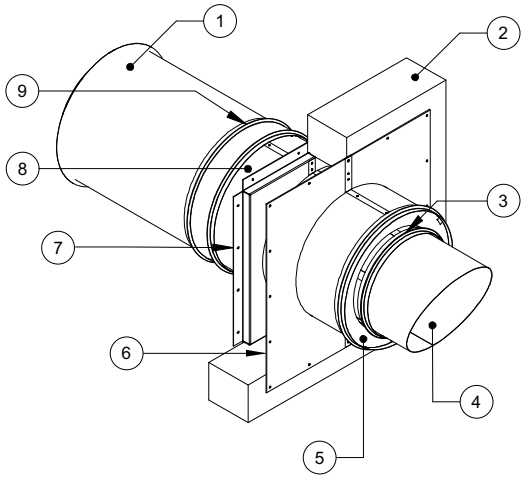
**ATTENTION: Chimney assembly for direct vent systems cannot be used on solid-fuel applications.**

Refer to **Figure 41** for clearance to combustible and wall opening dimensions. Once the opening has been cut, install the 2R direct vent section provided with the kit. Center the clearance plate on the inside of the wall and the outer cover on the outside of the wall. Secure using the provided hardware kit.

Install the 2R direct vent section to the 2R double wall vent section mounted to the wall. Secure sections and double wall end cap with V-bands. Install the direct vent section to the double wall vent section. Secure sections and double wall end cap with V-bands.

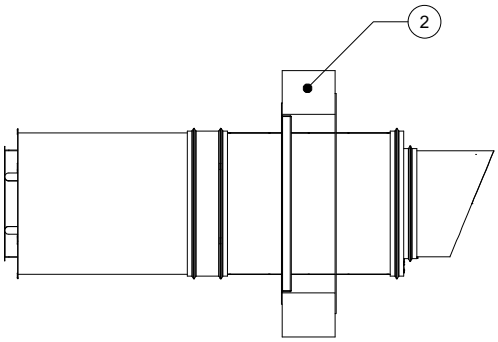
Verify clearance to combustibles for the insulated vent section coming through the wall, refer to “Shell Diameter” clearance in **Figure 41**. Inspect the thimble assembly to make sure all hardware is secure and clearance to combustibles is correct.

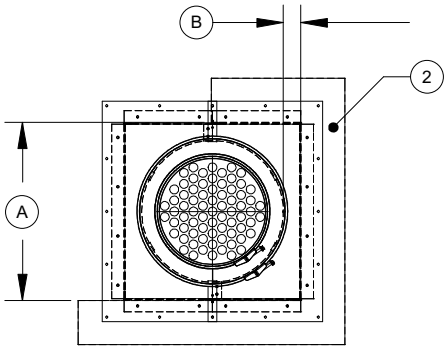
**Figure 41 - Direct Vent Cap Assembly Details**




Clearances for Direct Vent Chimney Cap

| DIAMETER | SHELL DIAMETER | CLEARANCE TO COMBUSTIBLES | CLEARANCE TO NON-COMBUSTIBLES | WALL OPENING |
|---|---|---|---|---|
| 5” | 9” | 3” | 0” | 15-1/2” |
| 6” | 10” | 3” | 0” | 16-1/2” |
| 7” | 11” | 3” | 0” | 17-1/2” |
| 8” | 12” | 3” | 0” | 18-1/2” |
| 10” | 14” | 3” | 0” | 20-1/2” |
| 12” | 16” | 3” | 0” | 22-1/2” |
| 14” | 18” | 3” | 0” | 24-1/2” |
| 16” | 20” | 3” | 0” | 26-1/2” |




1. 2R Double Wall Vent Section (5”-16”)
2. Wall
3. Single Wall V-band*
4. Discharge Vent Section*
5. Single Wall V-band/Double Wall End Cap*
6. Outer Cover*
7. Clearance Plates*
8. 2R Vent Section (5”-16”)*
9. Double Wall V-band*

* Components included with Vent Cap Assembly

A. Wall Opening, refer to **Figure 41**

B. Clearance to Combustibles, refer to **Figure 41**

## Methods Used to Test Duct After Assembly

**NOTE: The mentioned leakage tests are not specific to the listing(s) requirements of the system being tested. Local codes and regulations should be consulted before final inspection. In the absence of local codes and regulations, refer to the latest edition of the International Mechanical Code (IMC) Chapter 5, Exhaust Systems for inspection and testing requirements.**

### Method 1 - Light Test per IMC 506.3.2.5

Prior to the concealment of any portion of a duct system, a leakage test shall be performed. Ducts shall be considered to be concealed where installed in shafts or covered by coatings or wraps that prevent the system from being visually inspected on all sides. The permit holder shall be responsible to provide the necessary equipment and perform a system leakage test. A light test shall be performed to determine that all welded and brazed joints are liquid-tight.

A light test shall be performed by passing a lamp having a power rating of not less than 100 watts through the entire duct section to be tested. The lamp shall be open so as to emit light equally in all directions perpendicular to the duct walls. A test shall be performed for entire duct system, including the hood-to-duct connection. The system shall be permitted to be tested in sections, provided that every joint is tested. For listed factory-built grease ducts, this test shall be limited to duct joints assembled in the field and shall exclude factory welds.

### Method 2 - Smoke Test

**NOTE: Materials or chemicals used for smoke testing should not be corrosive to stainless steel. Smoke generating equipment containing chlorine or chlorinated chemicals must not be used. Consult the factory for any questions regarding the smoke equipment and duct compatibility.**

**EXCEPTION: When performing a Capture and Containment (C&C) test on a ventilation hood, smoke candles (cartridges) are allowed. Only use non-toxic smoke with low chloride concentration <20%. Testing should be conducted with all exhaust fans running to dilute the air.**

After installing the duct, allow the listed sealant to cure for a minimum of 24 hours. Place the smoke equipment at the bottom of the duct system. The natural upward draft will pull the smoke to the top of the duct system. Various length duct runs may require multiple smoke tests. Once the smoke has reached the top of the duct run, cap the duct securely. Inspect all joints for leakage.

**Notes**

## GENERAL DUCT WEIGHTS

The average weight of the duct, per foot of length, can be calculated using the following formulas below. Duct design should provide adequate support to ensure duct components are not overloaded.

## Weight - DW-2R

The following formula can be used to approximate the weight of total length of DW-2R double wall duct. Inner Shell + Outer Shell + Insulation or (.0327*L*D) + [.0218*L*(D+4)] + [.0364*L*(D+2)].

## Weight - DW-3R

The following formula can be used to approximate the weight of total lengths of DW-3R double wall duct. Inner Shell + Outer Shell + Insulation or (.0327*L*D) + [.0218*L*(D+6)] + [.0436*L*(D+3)].

## Weight - DW-3Z

The following formula can be used to approximate the weight of total lengths of DW-3Z double wall duct. Inner Shell + Outer Shell + Insulation or (.0327*L*D) + [.0218*L*(D+6)] + [.0491*L*(D+3)].

## Weight - Example

The “D” value in the formulas above represents the inner duct diameter in inches. The “L” value in the formulas above represents the total length in inches. Duct system: DW-3Z, 12” inner duct, 100 FT long. Using the DW-3Z formula above, (.0327*1200*12) + (.0218*1200*18) + (.0491*1200*15) = 1825 lbs.

## CLEANING & MAINTENANCE RECORD

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As a result of our dedication to constant improvements and quality, the MANUFACTURER reserves the right to update specifications without notice. Please refer to MANUFACTURER’S website for up to date documentation.

### Technical Support Information

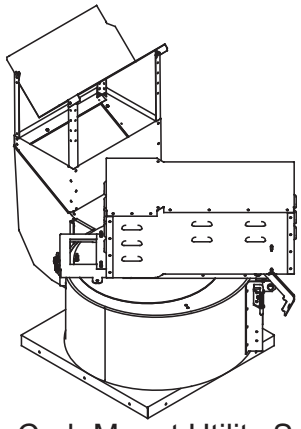
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Technical Support

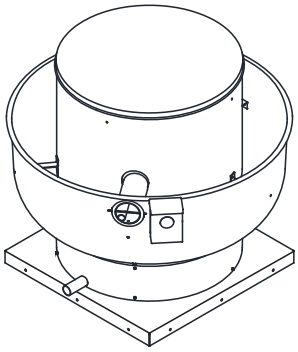
Parts Store

**Power Roof Ventilator/Fans**

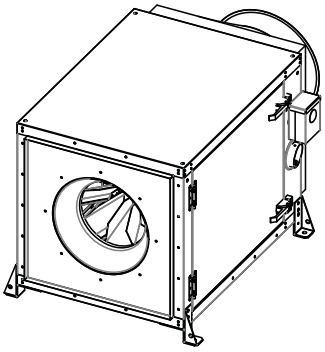
# Installation, Operation, and Maintenance Manual



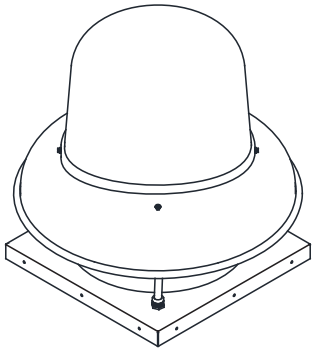
Curb Mount Utility Set



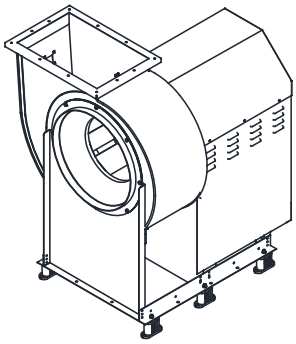
Up-blast Centrifugal Fan



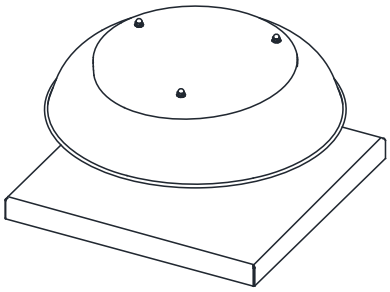
Square Inline



Down-blast Centrifugal Fan



Utility Set



Axial Fan

**RECEIVING AND INSPECTION**

**Upon receiving unit, check for any interior and exterior damage, and if found, report it immediately to the carrier. Check that all accessory items are accounted for and free of damage. Turn the blower wheel by hand to verify free rotation and check the damper (if supplied) operates freely.**

**WARNING!!**

**Installation of this ventilator should only be performed by a qualified professional who has read and understands these instructions and is familiar with proper safety precautions. Improper installation poses serious risk of injury due to electric shock, contact with rotating equipment, and other potential hazards. Read this manual thoroughly before installing or servicing this equipment. ALWAYS disconnect power prior to working on fan.**

**Read and Save these instructions**: This document is the property of the owner of this equipment and is required for future maintenance. Leave this document with the owner when installation or service is complete.

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# WARRANTY

This equipment is warranted to be free from defects in materials and workmanship, under normal use and service, for a period of 2-years from date of shipment. This warranty shall not apply if:

1. The equipment is not installed by a qualified installer per the MANUFACTURER'S installation instructions shipped with the product.
2. The equipment is not installed in accordance with Federal, State, and Local codes and regulations.
3. The equipment is misused, neglected, or not maintained per the MANUFACTURER'S maintenance instructions.
4. The equipment is not installed and operated within the limitations set forth in this manual.
5. The invoice is not paid within the terms of the sales agreement.

The MANUFACTURER shall not be liable for incidental and consequential losses and damages potentially attributable to malfunctioning equipment. Should any part of the equipment prove to be defective in material or workmanship within the 2-year warranty period, upon examination by the MANUFACTURER, such part will be repaired or replaced by MANUFACTURER at no charge. The BUYER shall pay all labor costs incurred in connection with such repair or replacement. Equipment shall not be returned without MANUFACTURER'S prior authorization, and all returned equipment shall be shipped by the BUYER, freight prepaid to a destination determined by the MANUFACTURER.

# GENERAL INFO

## Certifications

**Axial Downblast Fans**

- ETL Listed under 102628244PRT-001
- Complies with UL705 (Electrical Standards)
- Complies with CSA Std. C22.2 No 113
- AMCA 210 Tested
- Meets California Energy Commissions (CEC) Title 20 Regulations

**Centrifugal Downblast Fans**

- ETL Listed under 102628244PRT-001
- Complies with UL705 (Electrical Standards)
- Complies with CSA Std. C22.2 No 113
- AMCA 210 and 300 Tested
- Meets California Energy Commissions (CEC) Title 20 Regulations

**Centrifugal Upblast Fans**

- ETL Listed under 102628244PRT-001
- Complies with UL705 (Electrical Standards)
- Complies with CSA Std. C22.2 No 113
- ETL Listed under 103336443COL-001 (DU12HFA through DU360HFA)
- Complies with ULC-S645 (DU12HFA through DU360HFA)
- AMCA 210 and 300 Tested
- Meets California Energy Commissions (CEC) Title 20 Regulations

**Direct Drive Inline**

- ETL Listed under 103336443COL-001 (SIF Stainless Steel)
- Complies with UL705 (Electrical Standards)
- Complies with CSA Std C22.2, No 113
- AMCA 210 and 300 Tested
- Meets California Energy Commissions (CEC) Title 20 Regulations

**General and Restaurant Duty Utility Set**

- ETL Listed under 103336443COL-001 & 102628244PRT-001
- Complies with UL705 (Electrical Standards)
- Complies with ULC-S645 Standards
- Complies with CSA Std C22.2, No 113
- AMCA 210 and 300 Tested
- Meets California Energy Commissions (CEC) Title 20 Regulations

**Up-Blast Centrifugal Utility Set**

- ETL Listed under 103336443COL-001 & 102628244PRT-001
- Complies with UL705 (Electrical Standards)
- Complies with ULC-S645 Standards
- Complies with CSA Std C22.2, No 113
- AMCA 210 and 300 Tested
- Meets California Energy Commissions (CEC) Title 20 Regulations

# INSTALLATION

It is imperative that this unit is installed and operated with the designed airflow and electrical supply in accordance with this manual. For technical support, refer to **"Technical Support Information" on page 56** for more information.

## Mechanical

**WARNING: DO NOT RAISE VENTILATOR BY THE HOOD, BLOWER OR MOTOR SHAFT, OR BEARINGS – USE LIFTING POINTS PROVIDED OR A SLING.**

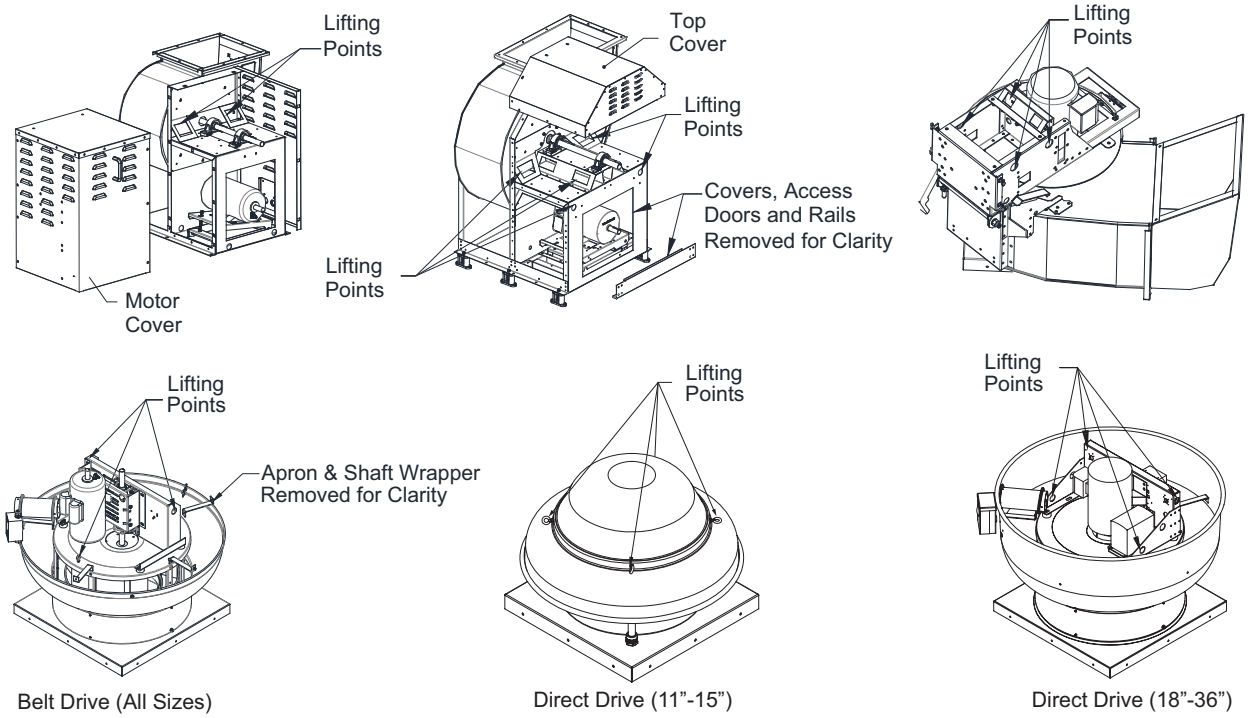
### Site Preparation

1. Provide clearance around installation site to safely rig and lift equipment into its final position. Refer to **Figure 1** for lifting point locations. Supports must adequately sustain equipment. Refer to manufacturer's estimated weights.
2. Consider general service and installation space when locating unit.
3. Locate unit close to the space it will serve to reduce long, twisted duct runs.
4. The fan discharge must be located at least 10 feet away from any supply intakes. The fan discharge shall be in accordance with the applicable building code provisions.
5. Inline fans can be interior mounted, motors shall be located outside of the exhaust air-stream.
6. Interior mounted fans must have a grease drain that is piped to an approved grease reservoir.
7. Interior mounted fans are considered part of the duct system. Clearance to combustibles must always be maintained. If necessary, the fan may be wrapped to maintain the duct system fire rating.

**NOTE: When required, a drip pan will be installed by others.**

**CAUTION: Never Lift Fans From Shafts and Bearings.**

**Figure 1 - Recommended Lifting Points**




Refer to **"Curb Mounted Sled Options (DD Only)" on page 25 and page 26** for lifting points.

## Roof Mounting

Ventilators are designed for installation on top of a prefabricated or factory-built roof curb. If an up-blast fan is used for kitchen hood exhaust, ensure discharge is at least 40” above the roof surface in accordance with NFPA 96. Refer to Authority Having Jurisdiction (AHJ) requirements prior to installation. Follow manufacturer’s instructions for proper curb installation.

1. If a backdraft damper is required, it should be secured within the curb using sheet metal screws to the bottom of a damper box or damper support flanges located below the roof deck.

**CAUTION: NFPA 96 RECOMMENDS THAT DAMPERS SHOULD NOT BE INSTALLED WHEN EXHAUSTER IS USED FOR REMOVAL OF SMOKE AND GREASE LADEN VAPORS FROM COMMERCIAL KITCHEN EQUIPMENT. CONSULT STATE AND LOCAL CODES FOR DETAILED REQUIREMENTS.**

2. On an up-blast fan, normally the power cord is brought through the conduit tube located on the top skirt on the outside of the unit.
3. Curb to substrate installation: Secure curb flange to substrate using suitable hardware (not furnished). Refer to **Table 1** and **Table 2** for hardware details.
4. Fan to curb installation: Use 1/4”-14 x 2” galvanized self-drilling screws. 19” through 40” fan bases use a minimum of 12 screws (3 per side). 44” fan bases use a minimum of 16 screws (4 per side).
5. Before connecting power source to the fan motor, verify power line wiring is de-energized. Check that the power source is compatible with the requirements of your equipment.
6. Connect power supply wiring to the motor as indicated on the motor nameplate or terminal box cover.
7. Before powering up fan, check ventilator wheel for free rotation.
8. Re-install motor cover. Check all fasteners for tightness.
9. A drain pipe is provided for single-point drainage of water and residue on up-blast fans. The drain pipe should be positioned towards the roof slope. Some means for collection of this residue must be provided, either a container directly under the trough or use of an adapter and pipe to carry the residue to a remote collection point. An optional downspout and grease collection box is available as an accessory item for up-blast fans.

## Wall Mounting

Refer to Authority Having Jurisdiction (AHJ) requirements prior to installation. Follow manufacturer’s instructions for proper curb installation.

1. The same instructions, warnings, and notes found under Roof Mounting section will apply. Follow steps 1-9 from above, with additional mounting information below.
2. **Masonry Wall/Steel Studs:** Around the wall opening, install an angle iron frame at least 2” x 2” x 1/4”. Frame should be approximately 1/2” smaller than the inside base dimension of the ventilator. For masonry, secure the lead cinch type anchors with non-ferrous bolts (3 per side). For steel, use self-drilling screws (3) per side. The ventilator should be mounted to the mounting angle iron frame with self-tapping sheet metal screws (3 per side).
3. **Wood Sidings:** Around the wall opening, install a wooden frame 2” high x 2” wide. Frame should be approximately 1/2” smaller than the inside base dimension of the ventilator. Secure with counter-sunk expansion type lag bolts (3 per side). The ventilator should then be mounted to the mounting frame with square head wood screws (3 per side) 3/8” minimum.
4. Steel wall mount brackets are also available as a factory option for the fan.
5. The mounting flange connections should be coated with a suitable caulking compound or an approved waterproof mastic sealer.
6. Wall mount application is not recommended for fans greater than 24” wheel with 2 HP motor (1 or 3 phase); 24” wheel with 3 HP motor (3 phase only).

**IMPORTANT: OSHA REGULATIONS REQUIRE THE VENTILATOR TO BE MOUNTED AT LEAST EIGHT (8) FEET ABOVE GROUND OR FLOOR LEVEL.**

## Curb and Ductwork

This fan was specified for a specific CFM and static pressure. The ductwork attached to this unit will significantly affect airflow performance. Flexible ductwork and square elbows should not be used. Also, transitions and turns in ductwork near the fan inlet will cause system effect and will drastically increase the static pressure and reduce airflow. **There must be at least 3 duct diameters of straight duct leading to the inlet and outlet of the exhaust fan. Follow SMACNA guides and recommendations for the remaining duct run.** Fans designed for rooftop installation should be installed on a prefabricated or factory-built roof curb. Follow curb manufacturer's instructions for proper curb installation.

An example of a curb installation: Curbs should be secured to structural members, such as wooden studs, steel studs, or concrete. The curb should be installed to the roof and/or wall using appropriate type and size fasteners. Refer to **Table 1** for minimum hardware requirements, refer to **Table 2** for quantity per curb flange. Always use suitable fasteners (not furnished) and quantity recommendations.

Refer to **Figure 2** and **Figure 3** for installation details. The fan should be installed on a curb and/or rail. Caulking, flashing, and sealing of wall/roof penetration done by contractor or installer.

Verify that the duct connection and fan inlet are properly aligned and sealed. The fan base is secured to the curb with 1/4"-14 x 2" galvanized self-drilling screws. Use a minimum of 12 screws (3 per side) for units with base sizes 19" through 40". Use a minimum of 16 screws (4 per side) for units with a base size of 44". Shims may be required depending upon curb installation and wall/roofing material. Check all fasteners for tightness.

**Figure 2 - Curb Mount Details**

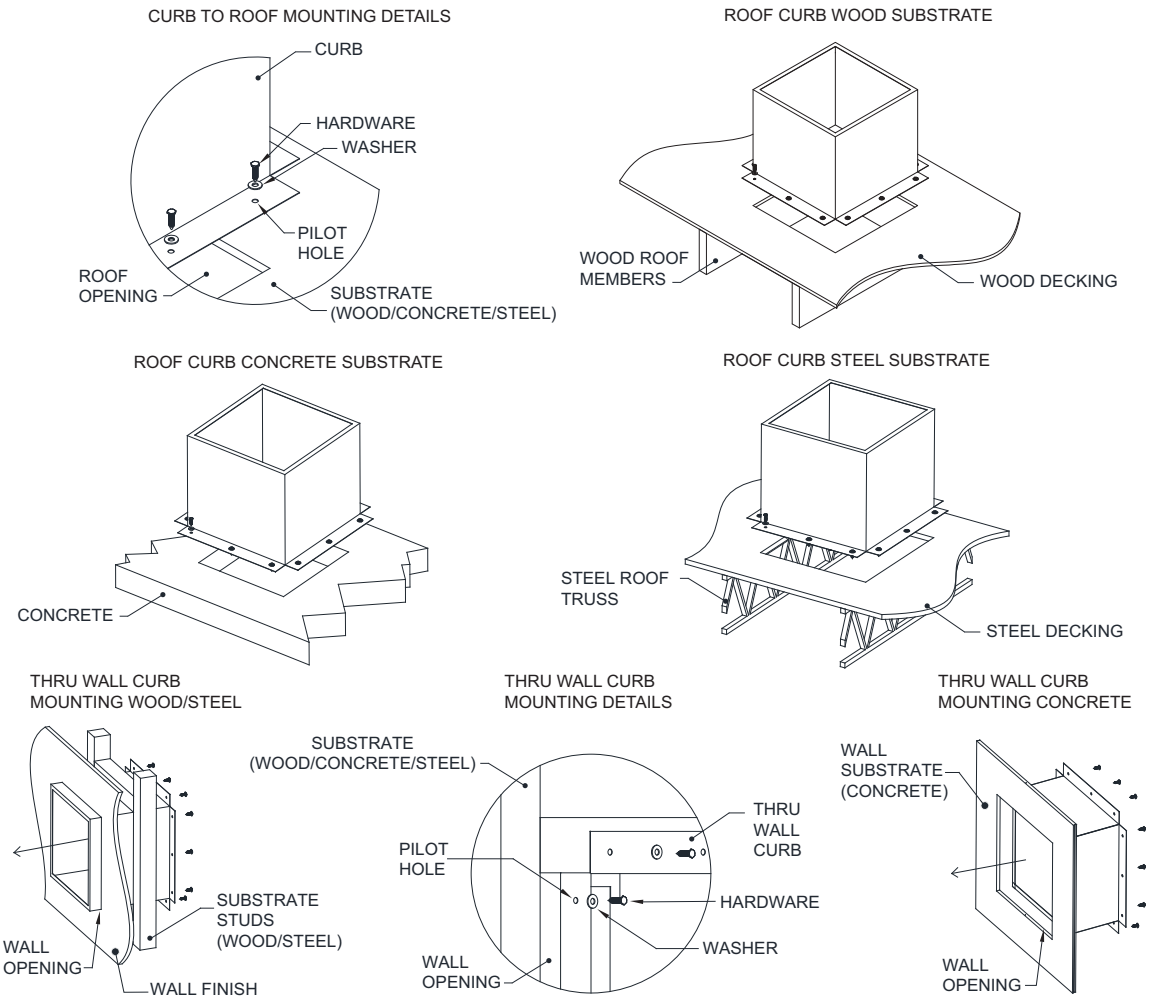


**Figure 3 - Minimum Edge Distance and Penetration Details**

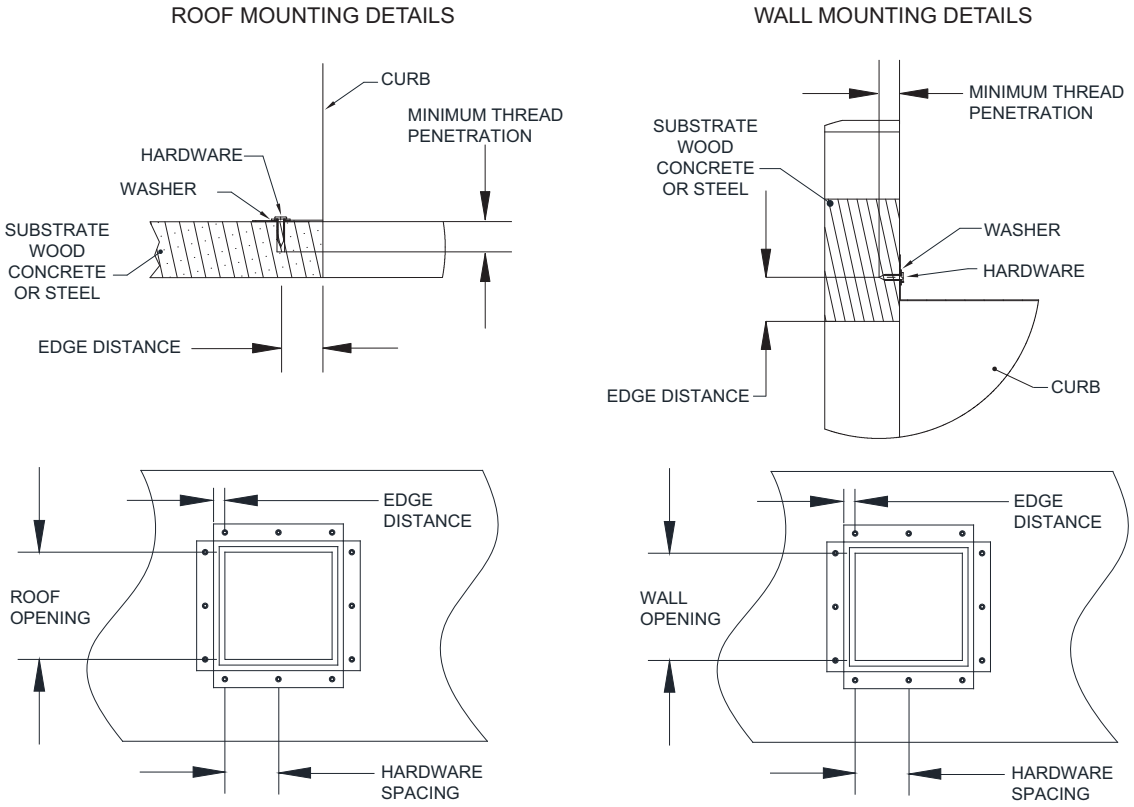



**Table 1 - Minimum Hardware Requirements**

| Material | Minimum Hardware Specifications | Minimum Thread Penetration | Minimum Edge Distance |
|---|---|---|---|
| Wood - Minimum G.42 | Zinc Plated Steel Hex Head Lag Screw<br>3/8” x 2-1/2” with 3/8” washer | 2” | 1-1/2” |
| Concrete - 2500 Minimum PSI | Hilti Kwik Bolt<br>3/8” Diameter TZ2 Expansion Anchor with 3/8” washer | 2-5/16” | 3” |
| Steel<br>(Studs/Roof Truss) | Dril-Flex Self-Drilling Screws<br>1/4”-14 Min. 1/2” Through with 1/4” washer | 12 Gauge or<br>1/8” Thick | 3/8” |

**Table 2 - Curb to Deck Minimum Fastener Quantity**

| Fan Base Size | Hardware Quantity Wood | Hardware Quantity Concrete | Hardware Quantity Steel |
|---|---|---|---|
| 19” | 12 (3 per side) | 12 (3 per side) | 12 (3 per side) |
| 21” | 12 (3 per side) | 12 (3 per side) | 16 (4 per side) |
| 24-3/4” | 16 (4 per side) | 16 (4 per side) | 20 (5 per side) |
| 26” | 20 (5 per side) | 20 (5 per side) | 24 (6 per side) |
| 28” | 20 (5 per side) | 20 (5 per side) | 24 (6 per side) |
| 33” | 24 (6 per side) | 24 (6 per side) | 28 (7 per side) |
| 40” | 28 (7 per side) | 28 (7 per side) | 36 (8 per side) |
| 44” | 40 (10 per side) | 36 (9 per side) | 44 (11 per side) |

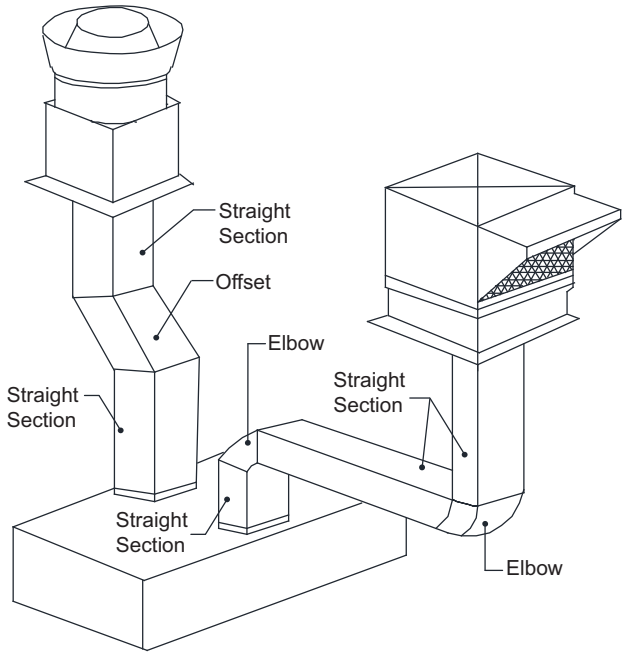
| Fan Base Size | Hardware Quantity Wood | Hardware Quantity Concrete | Hardware Quantity Steel |
|---|---|---|---|
| 41” x 27” | Long Side 14 (7 per side)<br>Short Side 10 (5 per side) | Long Side 14 (7 per side)<br>Short Side 10 (5 per side) | Long Side 16 (8 per side)<br>Short Side 12 (6 per side) |
| 59” x 27” | Long Side 22 (11 per side)<br>Short Side 10 (5 per side) | Long Side 20 (10 per side)<br>Short Side 10 (5 per side) | Long Side 20 (10 per side)<br>Short Side 12 (6 per side) |
| 61” x 27” | Long Side 22 (11 per side)<br>Short Side 10 (5 per side) | Long Side 20 (10 per side)<br>Short Side 10 (5 per side) | Long Side 20 (10 per side)<br>Short Side 12 (6 per side) |
| 64” x 27” | Long Side 24 (12 per side)<br>Short Side 10 (5 per side) | Long Side 20 (10 per side)<br>Short Side 10 (5 per side) | Long Side 20 (10 per side)<br>Short Side 12 (6 per side) |
| 45” x 31” | Long Side 20 (10 per side)<br>Short Side 12 (6 per side) | Long Side 18 (9 per side)<br>Short Side 12 (6 per side) | Long Side 22 (11 per side)<br>Short Side 14 (7 per side) |
| 74” x 31” | Long Side 28 (14 per side)<br>Short Side 12 (6 per side) | Long Side 24 (12 per side)<br>Short Side 12 (6 per side) | Long Side 24 (12 per side)<br>Short Side 14 (7 per side) |
| 52” x 42.5” | Long Side 22 (11 per side)<br>Short Side 20 (10 per side) | Long Side 20 (10 per side)<br>Short Side 18 (9 per side) | Long Side 22 (11 per side)<br>Short Side 22 (11 per side) |
| 94” x 42.5” | Long Side 28 (14 per side)<br>Short Side 20 (10 per side) | Long Side 24 (12 per side)<br>Short Side 18 (9 per side) | Long Side 24 (12 per side)<br>Short Side 22 (11 per side) |
| 62” x 51” | Long Side 22 (11 per side)<br>Short Side 20 (10 per side) | Long Side 20 (10 per side)<br>Short Side 20 (10 per side) | Long Side 20 (10 per side)<br>Short Side 20 (10 per side) |
| 108” x 51” | Long Side 34 (17 per side)<br>Short Side 20 (10 per side) | Long Side 28 (14 per side)<br>Short Side 20 (10 per side) | Long Side 28 (14 per side)<br>Short Side 20 (10 per side) |

**NOTE: Fan to Curb Installation: Use 1/4”-14 x 2” self-drilling screws. Use a minimum of 12 screws (3 per side) for 19” through 40” fan bases. Use a minimum of 16 screws (4 per side) for 44” fan bases.**

## Duct Routing

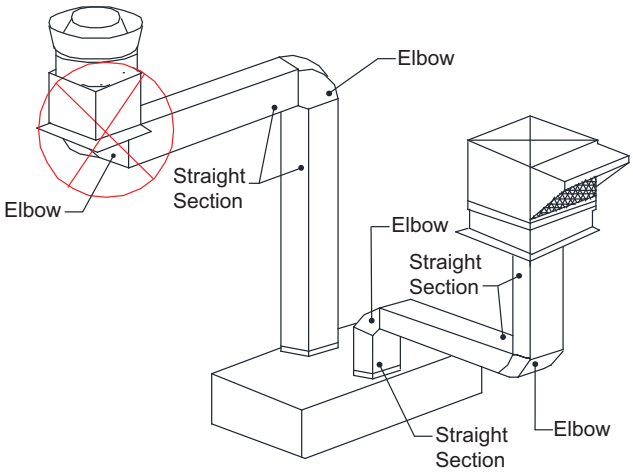
**Figure 4 - Examples of Duct Routing**

Proper Duct Routing



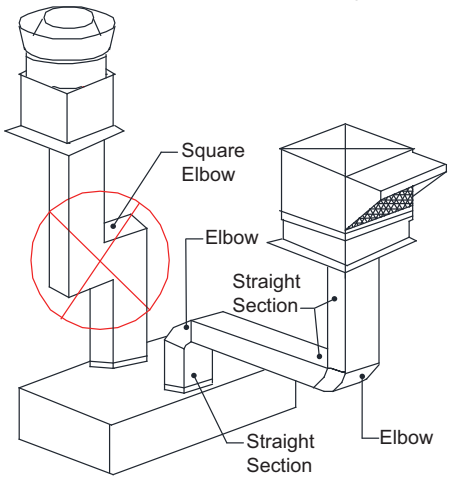

Use offsets if the duct cannot be routed straight up.

Improper Duct Routing




DO NOT connect elbow directly to fan inlet.

Improper Duct Routing




DO NOT use square elbows.

### Up-blast Wall Mount Details

Drill pilot holes into the bracket.

Secure wall mount bracket to the wall. Refer to **Table 1** for hardware details.

Use at least (3) suitable fasteners (not furnished) per side.

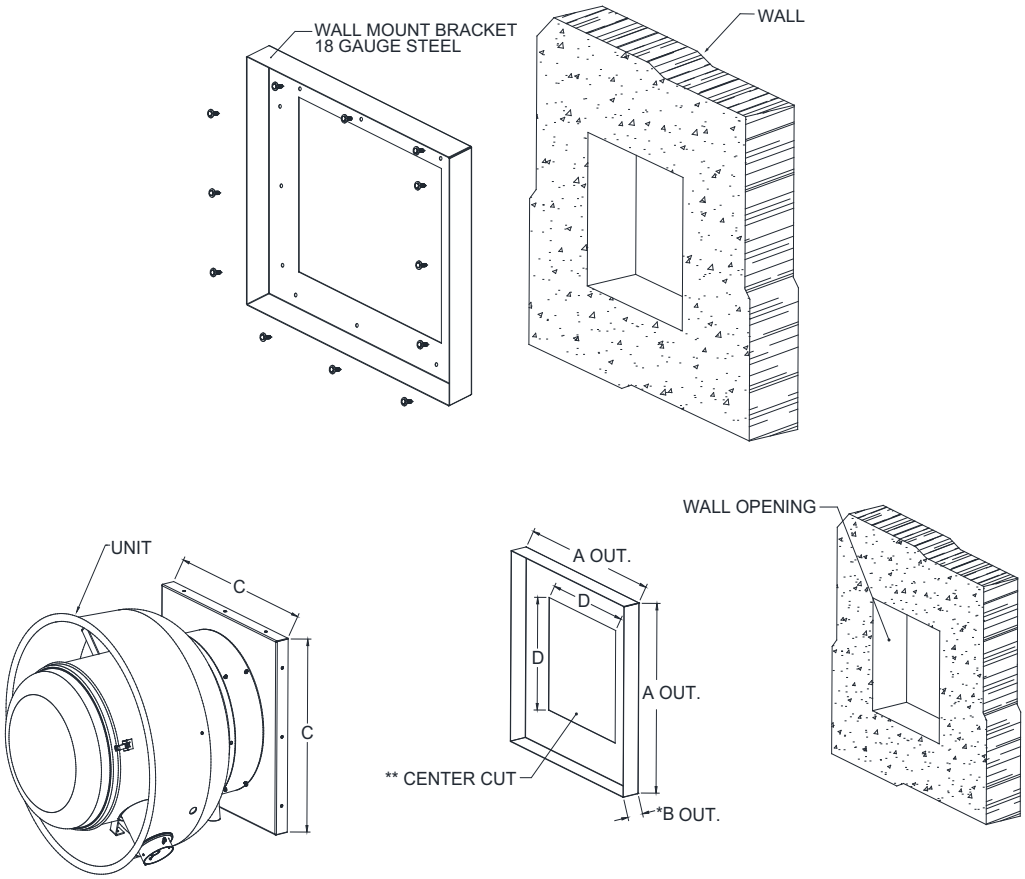
Wall bracket fits into base of fan.

Use self-drilling screws to attach unit to the wall mount bracket.

* “B” dimension = 5” when used with damper.

** Centered in wall mount.

**Figure 5 - Wall Mount Bracket**




| A Outer | B Outer | C | D |
|---|---|---|---|
| 18-1/2” | 2” | 19” | 13” |
| 20-1/2” | 2” | 21” | 16” |
| 21-1/2” | 2” | 22” | 16” |
| 24-1/4” | 2” | 24-3/4” | 20” |
| 25-1/2” | 2” | 26” | 20” |
| 27-1/2” | 2” | 28” | 24” |
| 32-1/2” | 2” | 33” | 28” |

## Up-blast Through Wall Mount Details

Standard curb fits into base of fan.

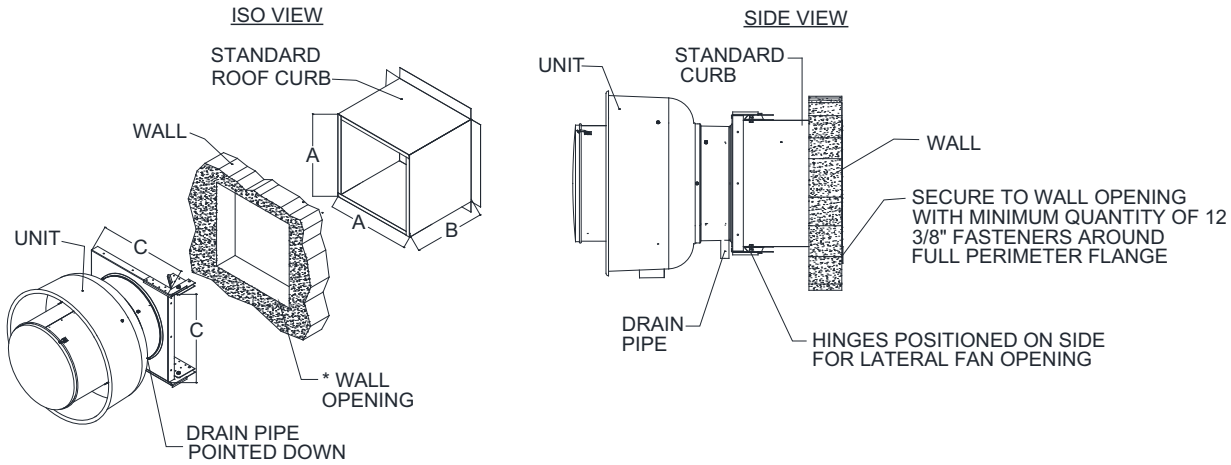
Refer to **"Curb and Ductwork" on page 7** for curb installation details.

Use self-drilling screws when attaching unit to curb.

Flashing and sealing of wall penetration done by contractor or installer.

For use with fans up to: 24" Wheel 2 HP - 1 Phase Maximum; 24" Wheel 3 HP - 3 Phase Maximum

**Figure 6 - Through Wall Mount Details**




*Contractor or installer must flash wall to curb.

| A Dimension | B Dimension | C Dimension |
|---|---|---|
| 19-1/2" | 22" | 21" |
| 19-1/2" | 20" | 21" |
| 23" | 20" | 24-3/4" |
| 26-1/6 | 20" | 28" |
| 26-1/2" | 20" | 28" |
| 31-1/2" | 20" | 33" |

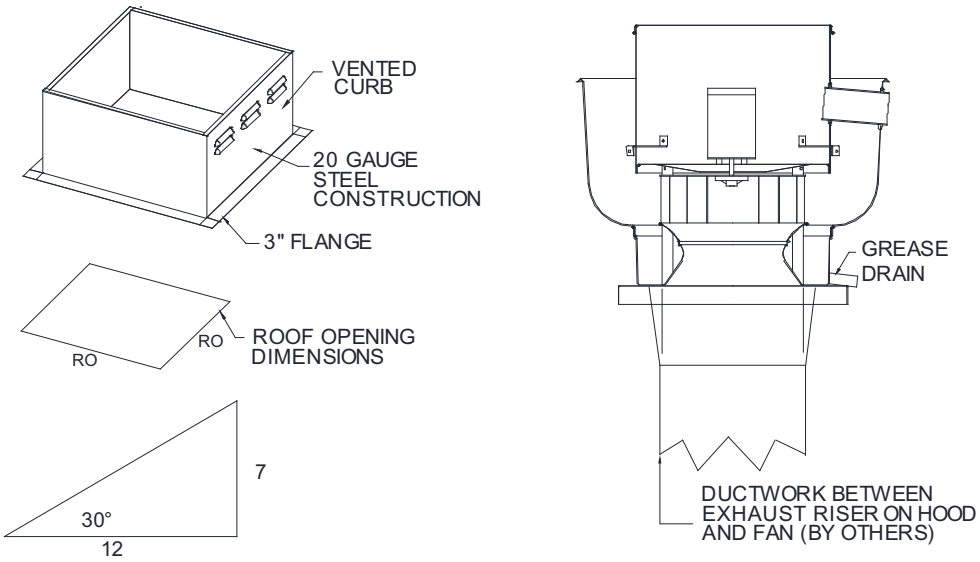
## Up-blast Roof Mount Installation

Normal temperature test – The 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 – The 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.

Pitched curbs are available. Specify pitch when ordering, for example: 7/12 Pitch = 30° Slope

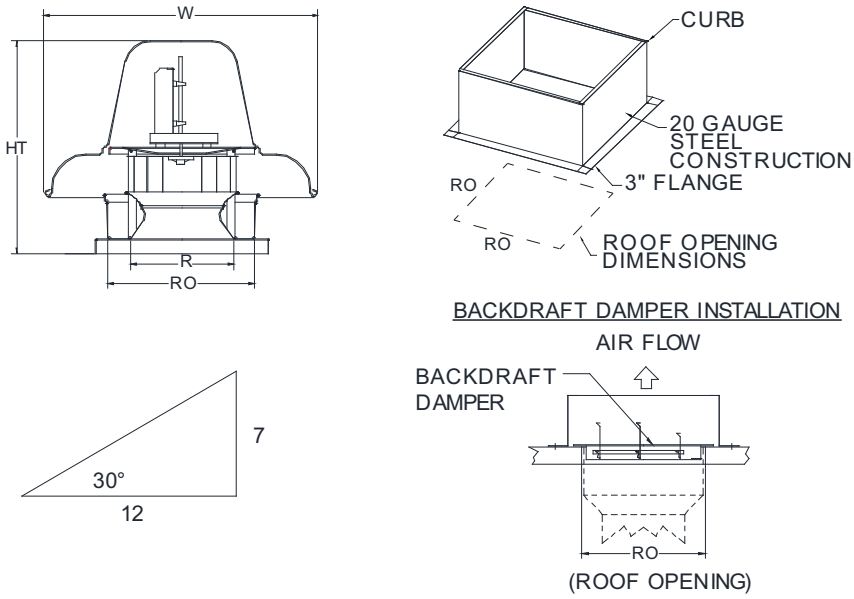
**Figure 7 - Up-blast Roof Mount Details**




## Down-blast Installation

Pitched curbs are available. Specify pitch when ordering, for example: 7/12 Pitch = 30° Slope.

**Figure 8 - Down-Blast Details**



## Typical Hinge Kit - Centrifugal Up-blast

Hinge Kit Field Installation

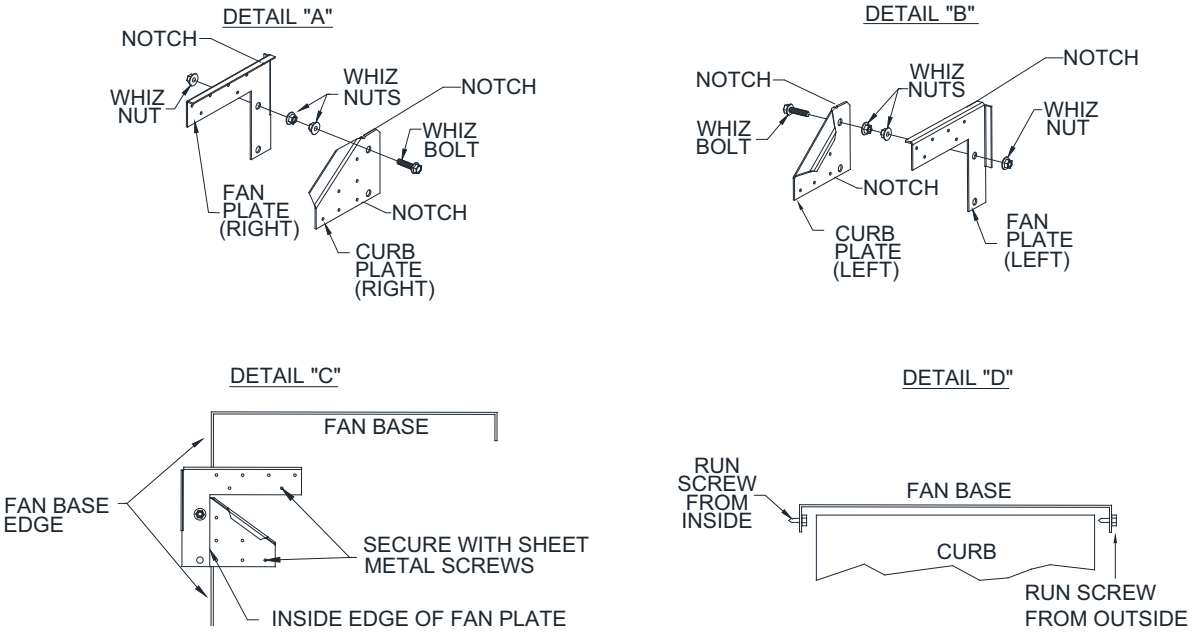
**Attention: Installer Must Supply Enough Electrical Cord to Allow the Fan to Swing Open.**

1. If parts are not already assembled, refer to **Figure 9** for assembly instructions. Assemble the fan plate and curb plate with hardware, as shown in **Figure 9** Detail “A” and Detail “B”.
2. Line up fan base edge to inside edge of fan plate, as shown in **Figure 9** Detail “C”. Refer to **Figure 10** for positioning fan plate on fan base. Use provided notches.
3. Secure the fan plate to the fan base using sheet metal screws (#14 x 3/4” – qty 12). **If the screws interfere with the curb, run the screws from the inside of the fan base**. **Refer to Figure 9 Detail “D”. Verify hardware does not interfere with curb when fan swings open or closed.**
4. Secure the curb plate to the curb using sheet metal screws (#14 x 3/4” – qty 12), **Figure 9** Detail “C”. Verify all parts and hardware are secure and tight. Verify that the fan and base swings open properly, see **Figure 10**.

**Parts List**

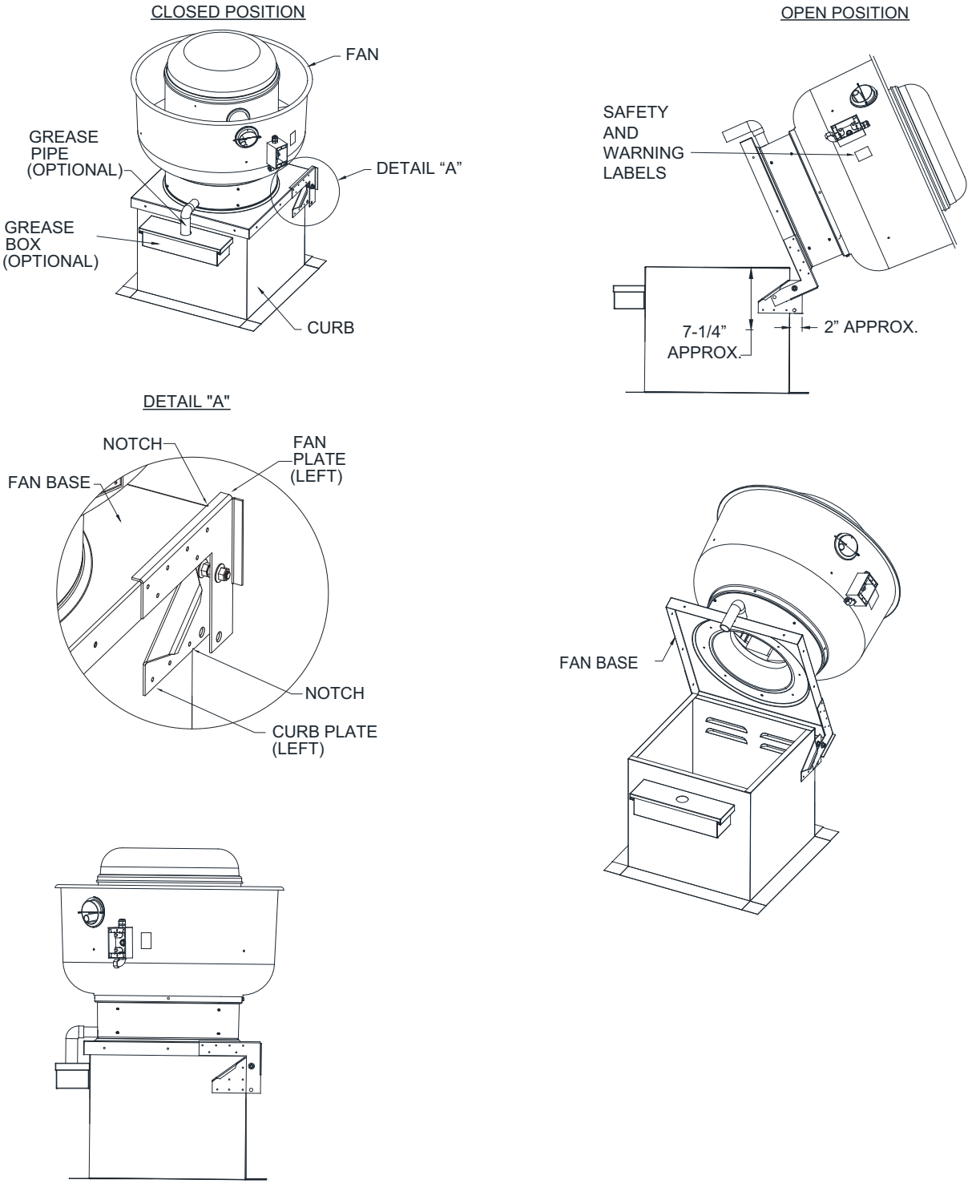
- Left/Right Fan Plates - Qty 2
- Left/Right Curb Plates - Qty 2
- Whiz Nuts - Qty 6
- Whiz Bolts - Qty 2
- Sheet Metal Screws (#14 x 3/4”) - Qty 24

**Figure 9 - Typical Hinge Kit Fan Plate and Curb Plate Details**



**Attention! Installer Must Supply Enough Electrical Cord to Allow the Fan to Swing Open.**

**Figure 10 - Centrifugal Up-blast Hinge Kit Installation Details**



## Heavy Duty (HD) Hinge Kit Installation

Hinge Kit Field Installation

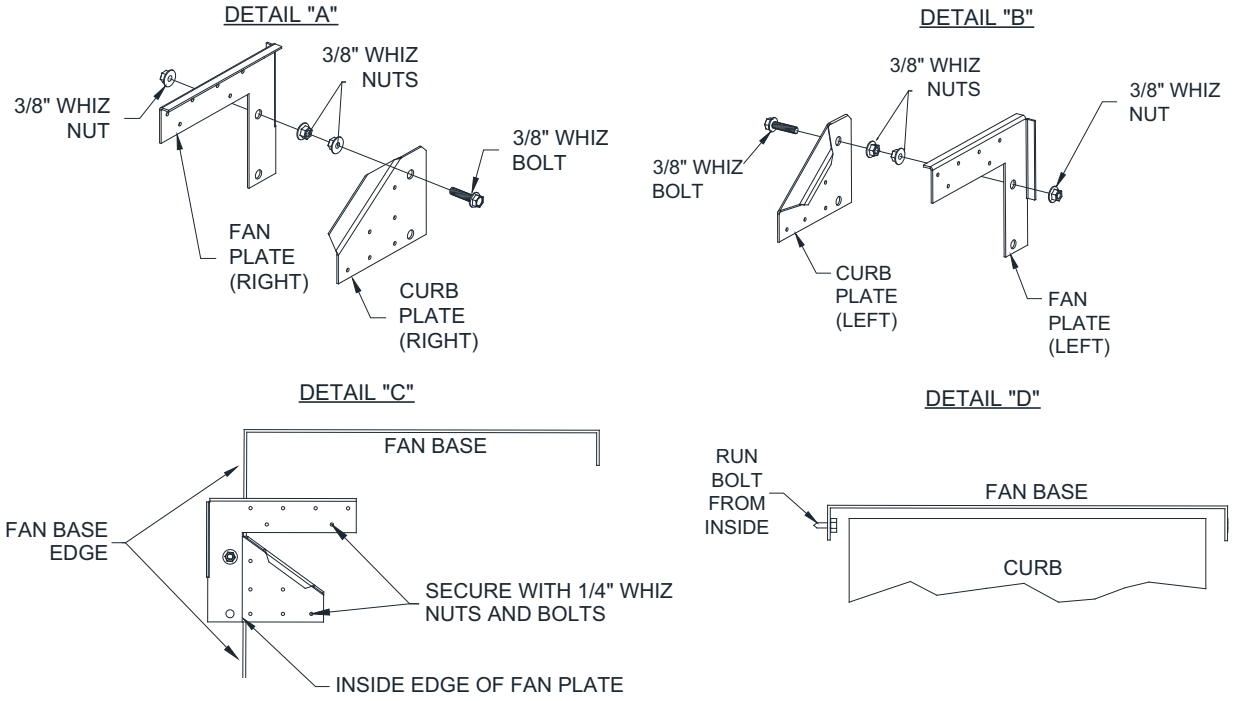
**Attention: Installer Must Supply Enough Electrical Cord to Allow the Fan to Swing Open.**

1. If parts are not already assembled, refer to **Figure 11** for assembly instructions. Assemble the fan plate and curb plate with hardware, as shown in **Figure 11** Detail “A” and Detail “B”.
2. Secure the hinged backplate to the curb with provided hardware, refer to **Figure 12** Detail “B”.
3. Line up fan base edge to inside edge of fan plate, as shown in **Figure 11** Detail “C”. Refer to **Figure 12** detail “A” for positioning fan plate on fan base.
4. Secure the fan plate to the fan base using provided hardware (1/4”-20 – qty 11). **If the screws interfere with the curb, run the screws from the inside of the fan base**. **Refer to Figure 11 Detail “D”. Verify hardware does not interfere with curb when fan swings open or closed.**
5. Secure the curb plate to the curb using provided hardware (1/4”-20 – qty 9), **Figure 11** Detail “C”. Verify all parts and hardware are secure and tight. Verify that the fan and base swings open properly, see **Figure 12**.

**Parts List**

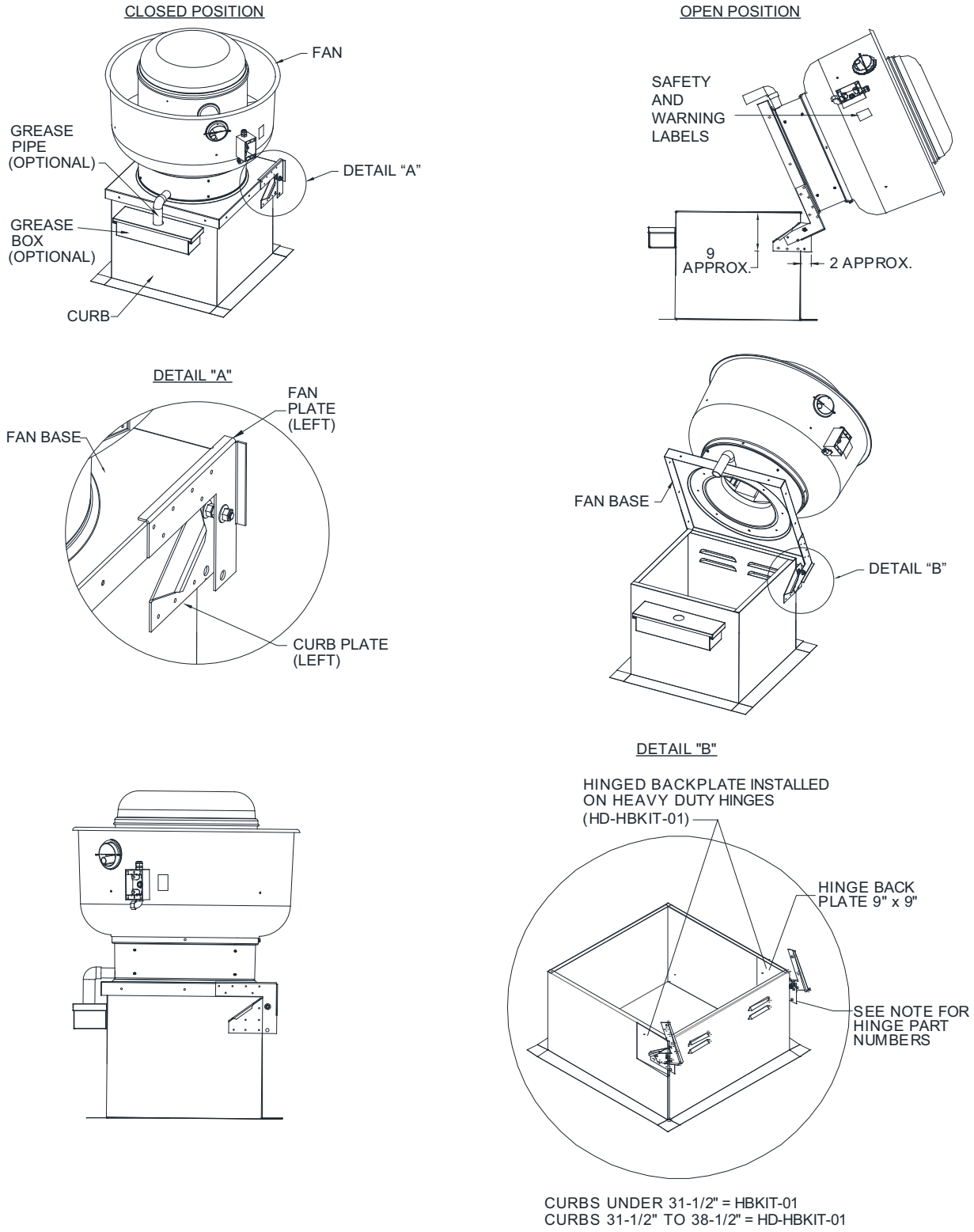
- Left/Right Fan Plates - Qty 2
- Left/Right Curb Plates - Qty 2
- 3/8”-16 Whiz Nuts - Qty 6
- 3/8”-16 Whiz Bolts - Qty 2
- 1/4”-20 Whiz Bolts - Qty 20
- 1/4”-20 Whiz Bolts - Qty 20

**Figure 11 - HD Hinge Kit Fan Plate and Curb Plate Details**



**Attention! Installer Must Supply Enough Electrical Cord to Allow the Fan to Swing Open.**

**Figure 12 - Heavy Duty (HD) Hinge Kit Installation Details**



## Heavy Duty (HD)/Extended Locking Hinge Kit Installation

Hinge Kit Field Installation

**Attention: Installer Must Supply Enough Electrical Cord to Allow the Fan to Swing Open.**

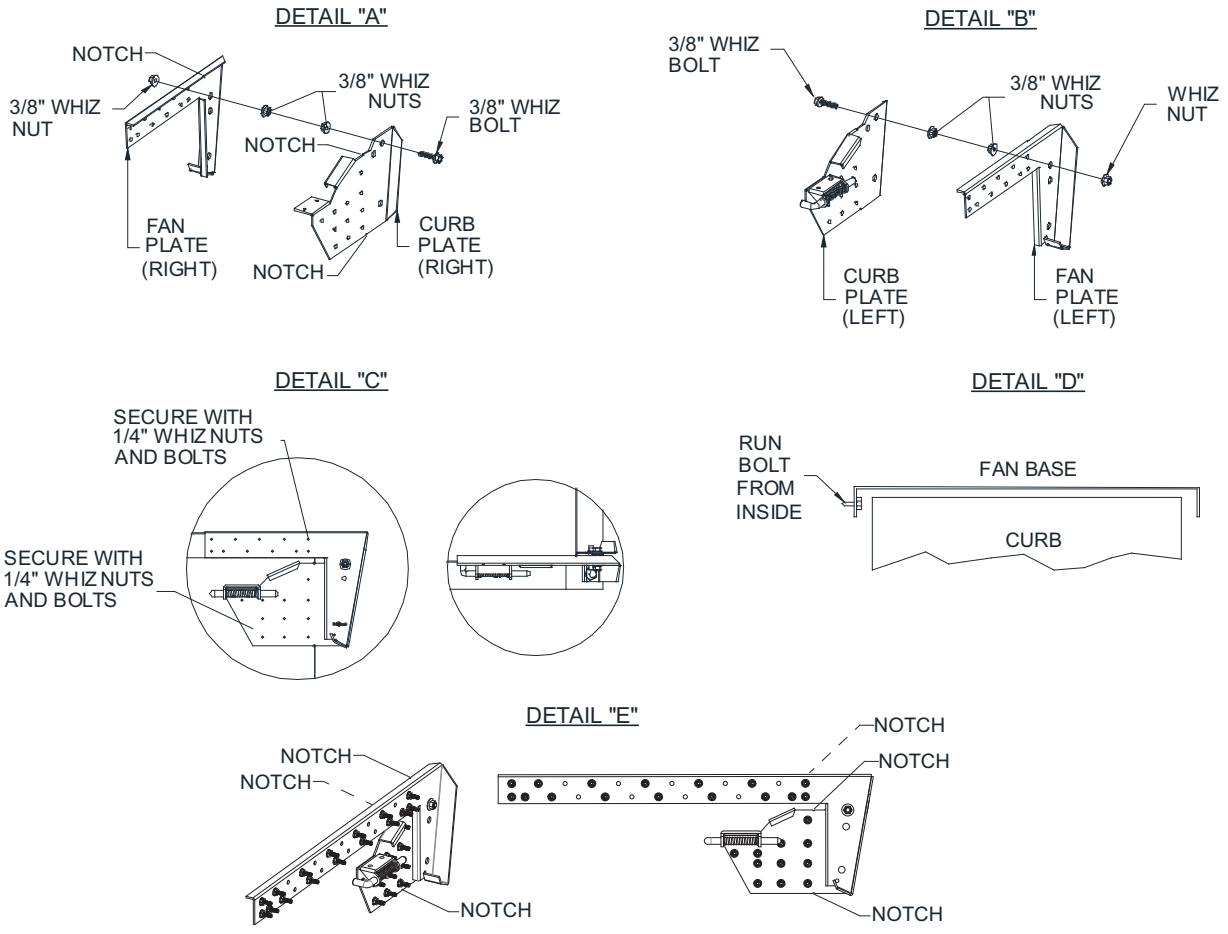
1. If parts are not already assembled, refer to **Figure 13** for assembly instructions. Assemble the fan plate and curb plate with hardware, as shown in **Figure 13** Detail “A” and Detail “B”.
2. Secure the hinged backplate to the curb with provided hardware, refer to **Figure 14** Detail “B”.
3. Line up fan base edge to inside edge of fan plate, as shown in **Figure 13** Detail “C”. Refer to **Figure 14** detail “A” for positioning fan plate on fan base. Use provided notches.
4. Secure the fan plate to the fan base using provided hardware (see parts list). **If the screws interfere with the curb, run the screws from the inside of the fan base**. **Refer to Figure 13 Detail “D”. Verify hardware does not interfere with curb when fan swings open or closed.**
5. Secure the curb plate to the curb using provided hardware (see parts list), **Figure 13** Detail “C”. Verify all parts and hardware are secure and tight. Verify that the fan and base swings open properly, see **Figure 14**.
6. For the extended locking hinge kit, follow the recommended mounting pattern in **Figure 13** Detail “E”.

* The HD kit requires 22 whiz nuts and bolts. The Extended kit requires 27 whiz nuts and bolts.

### Parts List

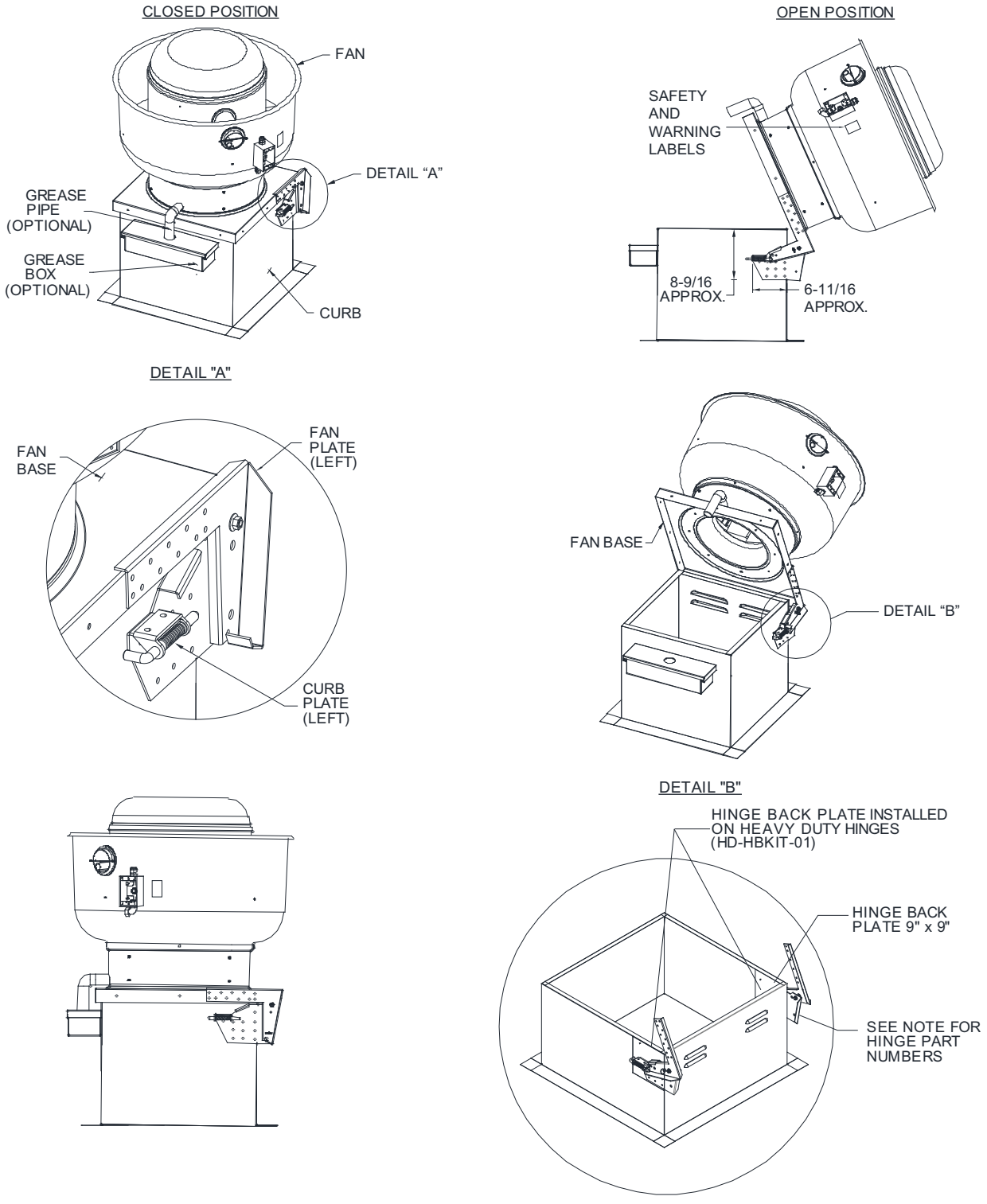
- Left/Right Fan Plates - Qty2
- Left/Right Curb Plates - Qty 2
- 3/8”-16 Whiz Nuts - Qty 6
- 3/8”-16 Whiz Bolts - Qty 2
- 1/4”-20 Whiz Bolts* - Qty 22/27
- 1/4”-20 Whiz Nuts* - Qty 22/27

**Figure 13 - HD/Extended Locking Hinge Kit Fan Plate and Curb Plate Details**



**Attention! Installer Must Supply Enough Electrical Cord to Allow the Fan to Swing Open.**

**Figure 14 - Heavy Duty (HD) Locking Hinge Kit Installation Details**



## Typical Grease Box Installation

Grease Box Field Installation

1. Mark a mounting location 3” from the top of the curb for the grease box cover. Refer to **Figure 15** Detail “A”.
2. Secure grease box cover to the curb using provided sheet metal screws (qty 3). Refer to **Figure 15** Detail “B”.
3. Slide the grease box into the grease box cover lip. Refer to **Figure 15** Detail “C”.
4. Install grease pipe into grease box cover. Refer to **Figure 15** Detail “D”.

**Figure 15 - Typical Grease Box Installation**

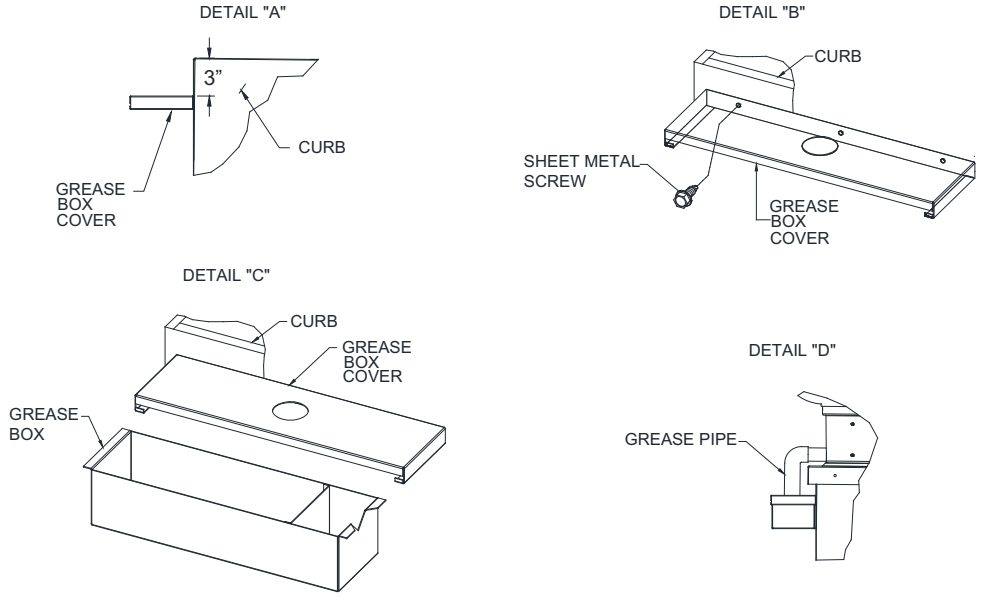
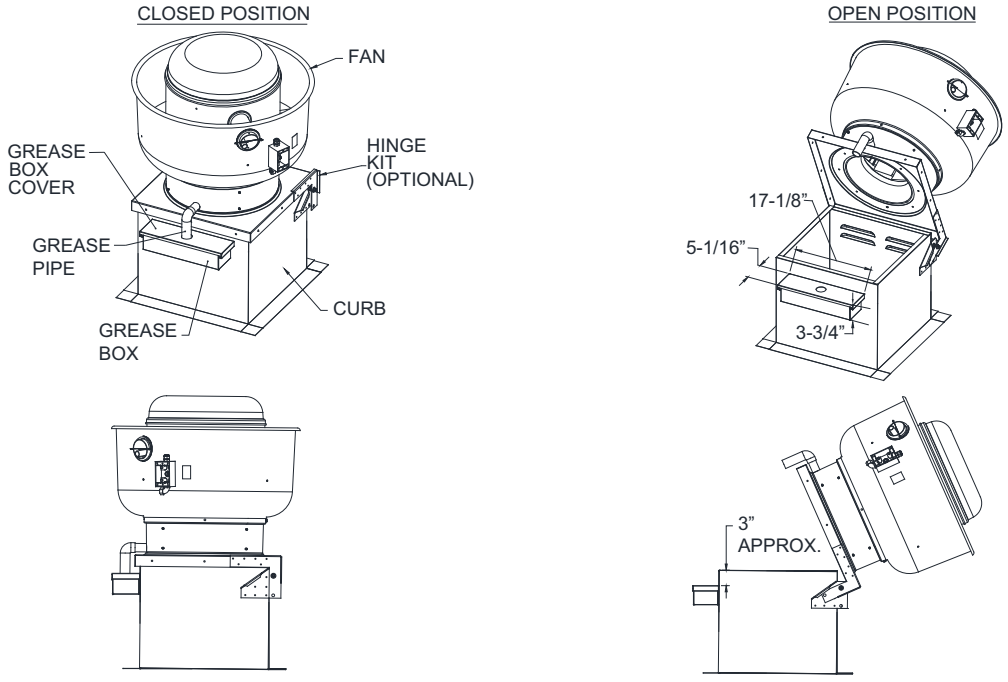



**Figure 16 - Grease Box Installed**



## Up-blast Utility Set Installation

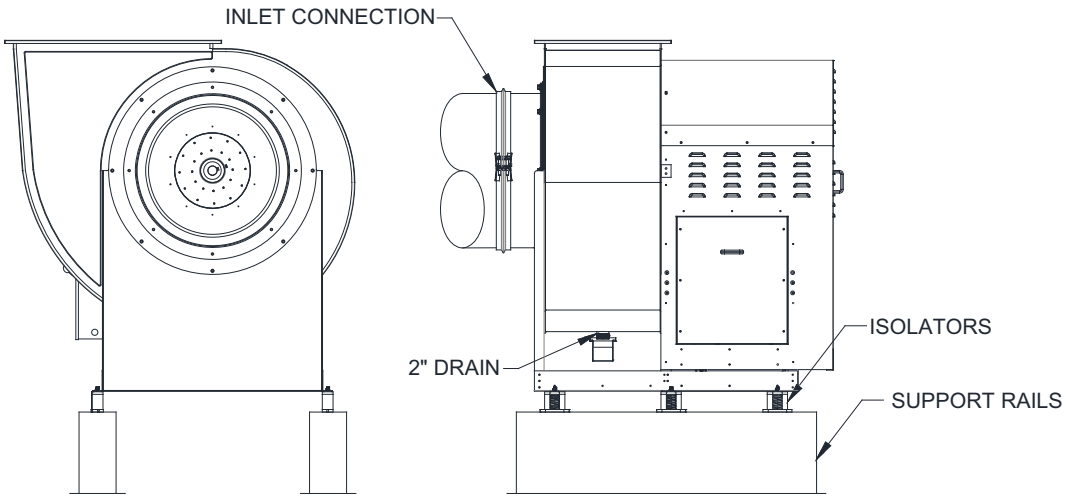
Normal temperature test belt drive – The exhaust fan must operate continuously while exhausting air at 350°F (176°C) until all fan parts have reached thermal equilibrium, and without any deteriorating effects to the fan which would cause unsafe operation.

Normal temperature test direct drive – The exhaust fan must operate continuously while exhausting air at 350°F (176°C) until all fan parts have reached thermal equilibrium, and without any deteriorating effects to the fan which would cause unsafe operation.

Direct driveshaft diameter may change due to motor selected Horsepower (HP)/frame size.

| Features | Options |
|---|---|
| Roof Mounted Fans | Grease Box |
| Restaurant Model | Shaft Seal |
| UL705 | Vibration Isolators |
| High Heat Operation Direct Drive 350°F (176°C) | Extension |
| High Heat Operation Belt Drive 350°F (176°C) | Inlet Adapters |
| Heat Slinger | Inlet Riser |
| Grease Classification Testing | Support Rails |
| 2” Drain | Rain Cap |
| Motor Weather Cover | Curb Mounted Sled with Vibration Isolators (DD only) |
| Fully Sealed Scroll Housing | Curb Mounted Sled with Vibration Isolator and Down Oriented Starter Duct (DD Only) |
| Scroll Access Door | |
| Flange 1 = 1/4”-11 through 20” | |
| Flange 2 = 2”-24 through 36” | |

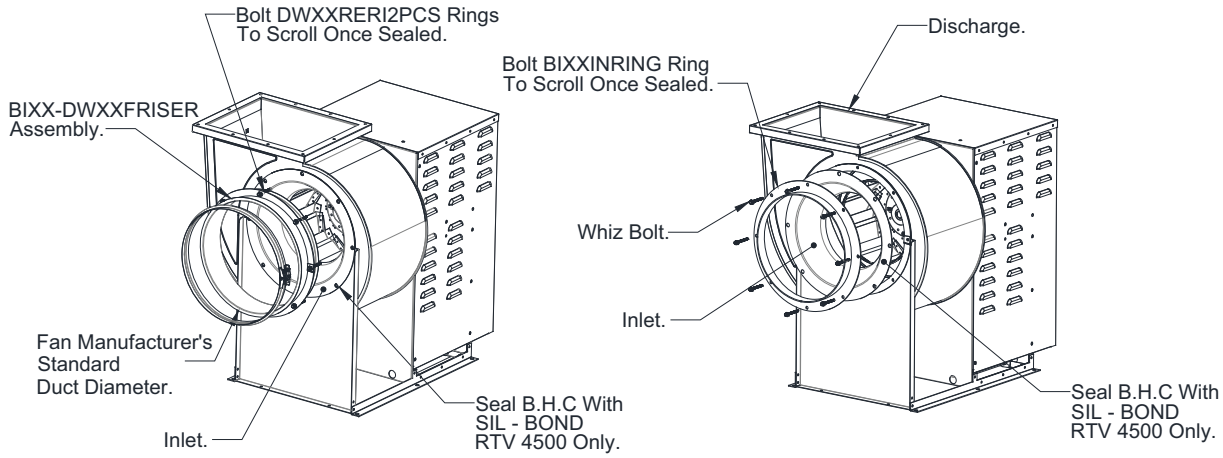
**Figure 17 - Up-blast Utility Set Installation**




Refer to **“Curb and Ductwork” on page 7** for duct installation details.

## Up-blast Utility Set Inlet Options

**Figure 18 - Up-blast Utility Set Inlet Options**



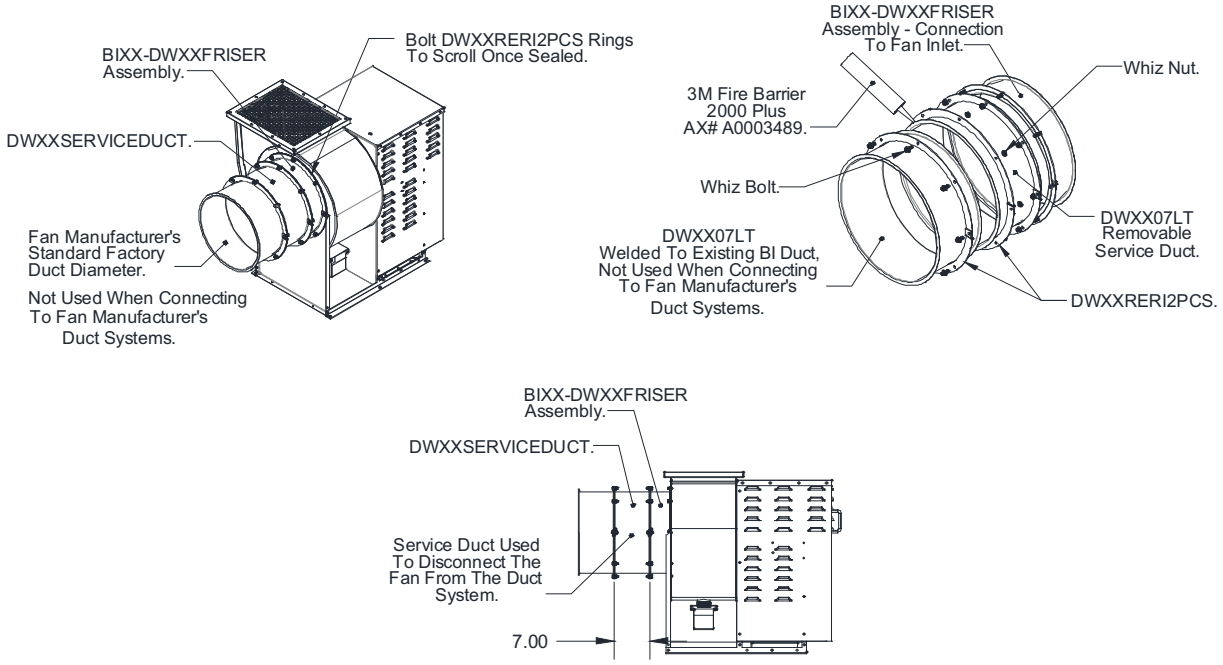

| Fan Size | Duct Diameter | Inlet Connection | Inlet Rings | Quantity | Duct Riser | Quantity | Whiz Bolt | Quantity |
|---|---|---|---|---|---|---|---|---|
| 11 | 12” | BI11-DW12FRISER | A0028896/ DW12RERI2PCS | 2 | DW12RISER | 1 | A0005696/ 1/4”-20 x 1-1/2” | 8 |
| 13 | 14” | BI13-DW14FRISER | A0028897/ DW14RERI2PCS | 2 | DW14RISER | 1 | A0005696/ 1/4”-20 x 1-1/2” | 8 |
| 15 | 16” | BI15-DW16FRISER | A0028898/ DW16RERI2PCS | 2 | DW16RISER | 1 | A0005696/ 1/4”-20 x 1-1/2” | 8 |
| 18 | 20” | BI18-DW20FRISER | A0028900/ DW20RERI2PCS | 2 | DW20RISER | 1 | A0005696/ 1/4”-20 x 1-1/2” | 8 |
| 20 | 20” | BI20-DW20FRISER | A0028901/ DW20RERIUSBI202PCS | 2 | DW20RISER | 1 | A0005696/ 1/4”-20 x 1-1/2” | 8 |
| 24 | 24” | BI24-DW24FRISER | A0028904/ DW24RERIUSBI242PCS | 2 | DW24RISER | 1 | A0005678/ 3/8”-16 x 1-1/2” | 8 |
| 30 | 24” | BI30-DW24FRISER | A0028905/ DW24RERIUSBI302PCS | 2 | DW24RISER | 1 | A0005678/ 3/8”-16 x 1-1/2” | 8 |
| 36 | 30” | BI36-DW30FRISER | A0030879/ DW30RERIUSBI362PCS | 2 | DW30RISER | 1 | A0005678/ 3/8”-16 x 1-1/2” | 8 |
| 11 | 12” | A0023766/BI11INRING | N/A | | N/A | | A0005696/ 1/4”-20 x 1-1/2” | 8 |
| 13 | 14” | A0023767/BI13INRING | N/A | | N/A | | A0005696/ 1/4”-20 x 1-1/2” | 8 |
| 15 | 16” | A0023768/BI15INRING | N/A | | N/A | | A0005696/ 1/4”-20 x 1-1/2” | 8 |
| 18 | 20” | A0023769/BI18INRING | N/A | | N/A | | A0005696/ 1/4”-20 x 1-1/2” | 8 |
| 20 | 20” | A0023770/BI20INRING | N/A | | N/A | | A0005696/ 1/4”-20 x 1-1/2” | 8 |
| 24 | 24” | A0023771/BI24INRING | N/A | | N/A | | A0005678/ 3/8”-16 x 1-1/2” | 8 |
| 30 | 24” | A0023772/BI30INRING | N/A | | N/A | | A0005678/ 3/8”-16 x 1-1/2” | 8 |
| 36 | 30” | A0023773/BI36INRING | N/A | | N/A | | A0005678/ 3/8”-16 x 1-1/2” | 8 |

## Inlet Service Duct Option

Service duct kits allow a quick disconnect between the fan inlet and duct system. Refer to **"Curb and Ductwork" on page 7** for duct installation details.

1. Service duct kits come with (2) 7" long duct sections, (8) riser rings, and installation hardware.
2. Service duct flanges must be sealed with 3M Barrier 2000+.
3. Once sealed, the service duct is secured using bolt together riser rings.
4. The first 7" long duct section can be welded directly to existing duct systems.
5. If connecting to fan Manufacturer's factory duct, the first 7" long duct section may or may not be used. You may connect fan Manufacturer's standard duct directly to service duct using V-bands.

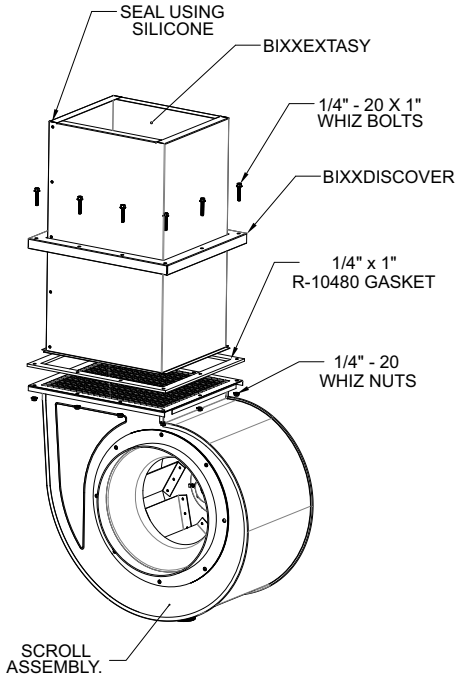
**Figure 19 - Inlet Service Duct Option**




| Fan Size | Duct Diameter | Inlet Connection Assembly | Duct LT | Quantity | Riser Rings | Quantity | Whiz Bolt (Inches) | Quantity | Whiz Nut (Inches) | Quantity |
|---|---|---|---|---|---|---|---|---|---|---|
| 11 | 12" | 12SERVICEDUCTKIT | DW1207LT | 2 | A0028896/ DW12RERI2PCS | 8 | A0023684/ 1/4"-20 x 1" | 16 | A005690/ 1/4"-20 | 16 |
| 13 | 14" | 14SERVICEDUCTKIT | DW1407LT | 2 | A0028897/ DW14RERI2PCS | 8 | A0023684/ 1/4"-20 x 1" | 16 | A005690/ 1/4"-20 | 16 |
| 15 | 16" | 16SERVICEDUCTKIT | DW1607LT | 2 | A0028898/ DW16RERI2PCS | 8 | A0023684/ 1/4"-20 x 1" | 16 | A005690/ 1/4"-20 | 16 |
| 18 | 20" | 20SERVICEDUCTKIT | DW2007LT | 2 | A0028900/ DW20RERI2PCS | 8 | A0023684/ 1/4"-20 x 1" | 16 | A005690/ 1/4"-20 | 16 |
| 20 | 20" | 20SERVICEDUCTKIT | DW2007LT | 2 | A0028900/ DW20RERI2PCS | 8 | A0023684/ 1/4"-20 x 1" | 16 | A005690/ 1/4"-20 | 16 |
| 24 | 24" | 24SERVICEDUCTKIT | DW2407LT | 2 | A0028903/ DW24RERI2PCS | 8 | A0023684/ 1/4"-20 x 1" | 16 | A005690/ 1/4"-20 | 16 |
| 30 | 24" | 24SERVICEDUCTKIT | DW2407LT | 2 | A0028903/ DW24RERI2PCS | 8 | A0023684/ 1/4"-20 x 1" | 16 | A005690/ 1/4"-20 | 16 |
| 36 | 30" | 30SERVICEDUCTKIT | DW3007LT | 2 | A0030878/ DW36RERI2PCS | 8 | A0024297/ 3/8"-16 x 1" | 16 | A005688/ 3/8"-16 | 16 |

## Up-blast Utility Set

**Figure 20 - Discharge Extension Options**

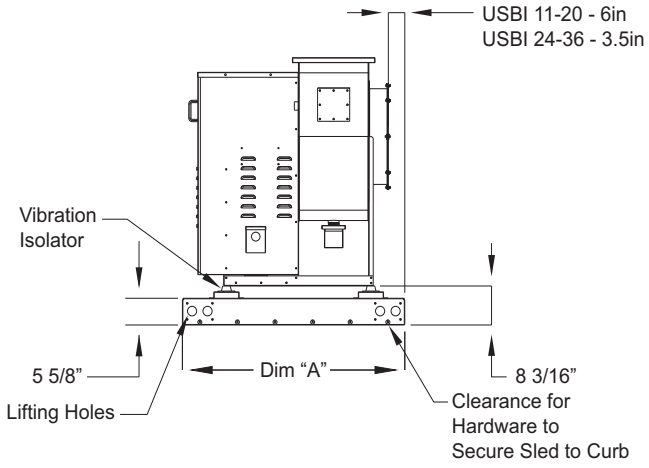


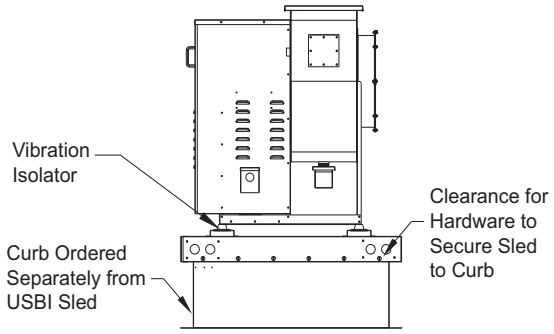

| Hardware Counts | |
|---|---|
| **Hardware # Bolt/Nut** | **Hardware Quantity** |
| 1/4”-20 x 1” (92323A518)/1/4”-20 (94831A029) | 8 |
| 1/4”-20 x 1” (92323A518)/1/4”-20 (94831A029) | 8 |
| 1/4”-20 x 1” (92323A518)/1/4”-20 (94831A029) | 8 |
| 1/4”-20 x 1” (92323A518)/1/4”-20 (94831A029) | 12 |
| 1/4”-20 x 1” (92323A518)/1/4”-20 (94831A029) | 12 |
| 1/4”-20 x 1” (92323A518)/1/4”-20 (94831A029) | 12 |
| 1/4”-20 x 1” (92323A518)/1/4”-20 (94831A029) | 12 |
| 1/4”-20 x 1” (92323A518)/1/4”-20 (94831A029) | 14 |

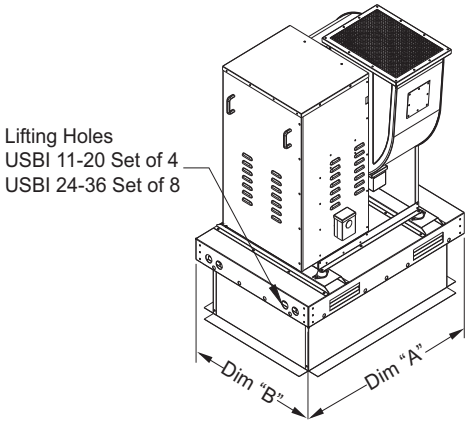
| BI - Discharge Extension | | | | | |
|---|---|---|---|---|---|
| **Fan Size** | **Extension #** | **L** | **W** | **H** | **Cover #** |
| 11 | BI11EXTASY | 12” | 11” | 24” | BI11DISCOVER |
| 13 | BI13EXTASY | 14” | 12” | 24” | BI13DISCOVER |
| 15 | BI15EXTASY | 16” | 13” | 24” | BI15DISCOVER |
| 18 | BI18EXTASY | 19” | 15” | 24” | BI18DISCOVER |
| 20 | BI20EXTASY | 21” | 15” | 24” | BI20DISCOVER |
| 24 | BI24EXTASY | 26” | 17” | 24” | BI24DISCOVER |
| 30 | BI30EXTASY | 32” | 19” | 24” | BI30DISCOVER |
| 36 | BI36EXTASY | 39” | 23” | 24” | BI26DISCOVER |

## Curb Mounted Sled Options (DD Only)

**Figure 21 - Vibration Isolators Option**

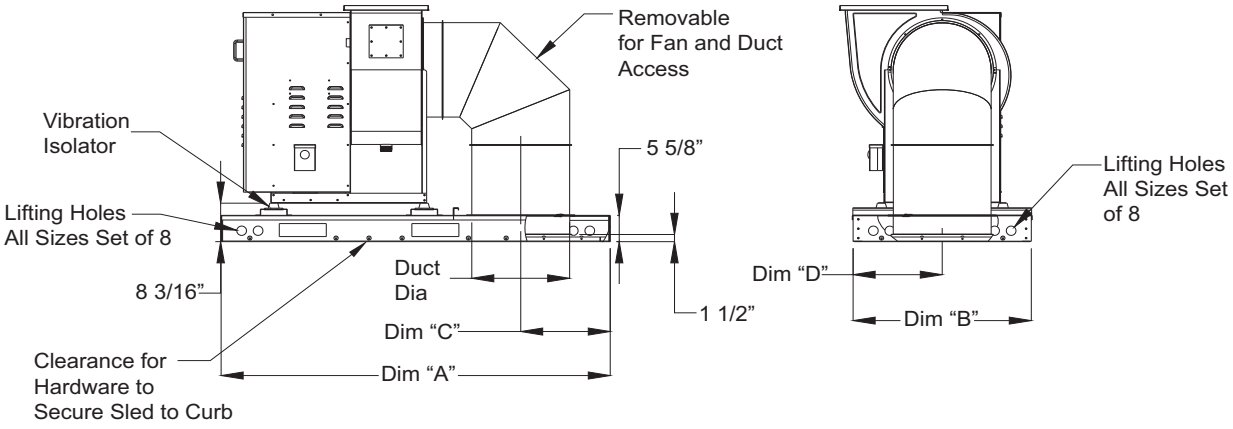


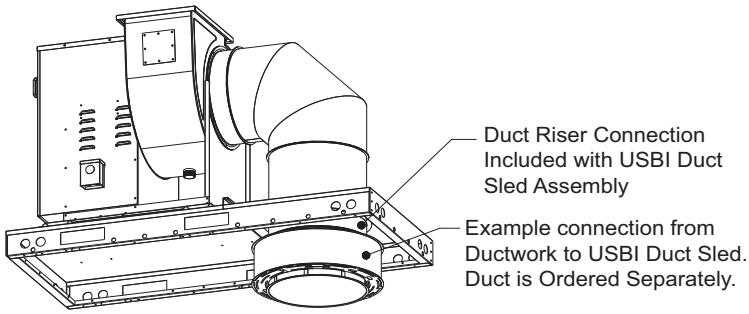




| Fan Size | Dim "A" | Dim "B" | Curb Size |
|---|---|---|---|
| 11 | 46 3/4" | 32 3/4" | 41" x 27" |
| 13 | 46 3/4" | 32 3/4" | 41" x 27" |
| 15 | 46 3/4" | 32 3/4" | 41" x 27" |
| 18 | 50 3/4" | 36 3/4" | 45" x 31" |
| 20 | 50 3/4" | 36 3/4" | 45" x 31" |
| 24 | 57 3/4" | 47 3/4" | 52" x 42.5" |
| 30 | 60 3/4" | 47 3/4" | 52" x 42.5" |
| 36 | 67 3/4" | 56 1/4" | 62" x 51" |

**Figure 22 - Vibration Isolator and Down Oriented Starter Duct Option**




| Fan Size | Dim "A" | Dim "B" | Curb Size | Dim "C" | Dim "D" | Duct Dia. |
|---|---|---|---|---|---|---|
| 11 | 63 3/4" | 32 1/4" | 59" x 27" | 16 3/8" | 16 3/8" | 12 |
| 13 | 63 3/4" | 32 1/4" | 61" x 27" | 16 3/8" | 16 3/8" | 14 |
| 15 | 69 3/4" | 32 1/4" | 64" x 27" | 16 3/8" | 16 3/8" | 16 |
| 18 | 79 3/4" | 36 1/4" | 74" x 31" | 18 3/8" | 18 1/4" | 20 |
| 20 | 79 3/4" | 36 1/4" | 74" x 31" | 18 7/8" | 18 1/4" | 20 |
| 24 | 99 3/4" | 47 3/4" | 94" x 42.5" | 23 1/4" | 23 7/8" | 24 |
| 30 | 99 3/4" | 47 3/4" | 94" x 42.5" | 24 1/8" | 24" | 24 |
| 36 | 113 3/4" | 56 1/4" | 108" x 51" | 27 7/8" | 28 1/4" | 30 |

## Up-blast Utility Set Indoor Installation

Some situations prevent the installation of exhaust fans on the roof or other outdoor location. An indoor installation may be the only alternative.

Of the various types of fans that might be employed, utility sets seem most appropriate because they readily accommodate the inlet and outlet duct connections. Fans designed for curb mounting would present outlet duct connection difficulties. Refer to **"Curb and Ductwork" on page 7** for installation details.

Most Authority Having Jurisdictions (AHJs) comply with IMC and UL 705 standards. Standard UL 705, "Power Roof Ventilators for Restaurant Exhaust Appliances", covers the utility set high temperature and grease fire testing.

**Testing to UL Standards:**

The exhaust fan moves air for several hours at the maximum temperature the manufacturer wishes to list the fan, such as 300°F. Another test imitates a grease fire by igniting grease in a pan near an inlet duct. If the fan keeps running and does not display any unsafe results, it passes those tests. Testing also examines the fan for any characteristics that might be unsuitable.

In the scope of section 1.1, it states, "these requirements cover roof or wall-mounted ventilators for restaurant exhaust appliances." It would seem at first that the phrase "roof or wall mounted" would preclude applicability of the label indoors. However, in the very next paragraph it goes on to say, "Power ventilators…covered by these requirements are intended for installation in accordance with … NFPA 96". NFPA 96 clearly defines how to install a traditional ventilator indoors.

**Standard NFPA 96 – 8.1.4* Utility Set Exhaust Fans.**

**8.1.4.2** Utility set exhaust fans installed within the building shall be located in an accessible area of adequate size to allow for service or removal.

**8.1.4.3** Where the duct system connected to the fan is in an enclosure, the space or room in which the exhaust fan is located shall have the same fire resistance rating as the enclosure.

**8.1.4.4** The fan shall be connected to the exhaust duct by flanges securely bolted, as shown in Figure 8.1.3.2 (a) through Figure 8.1.3.2 (d) or by a system specifically listed for such use, such as UL 1978 or UL 2221 listed duct systems.

**8.1.4.5** Flexible connectors shall not be used.

**8.1.4.6** Exhaust fans shall have a drain directed to a readily accessible and visible grease receptacle not to exceed 3.8 L (1 gallon).

**Manufacturer Recommendations for Indoor Installation:**

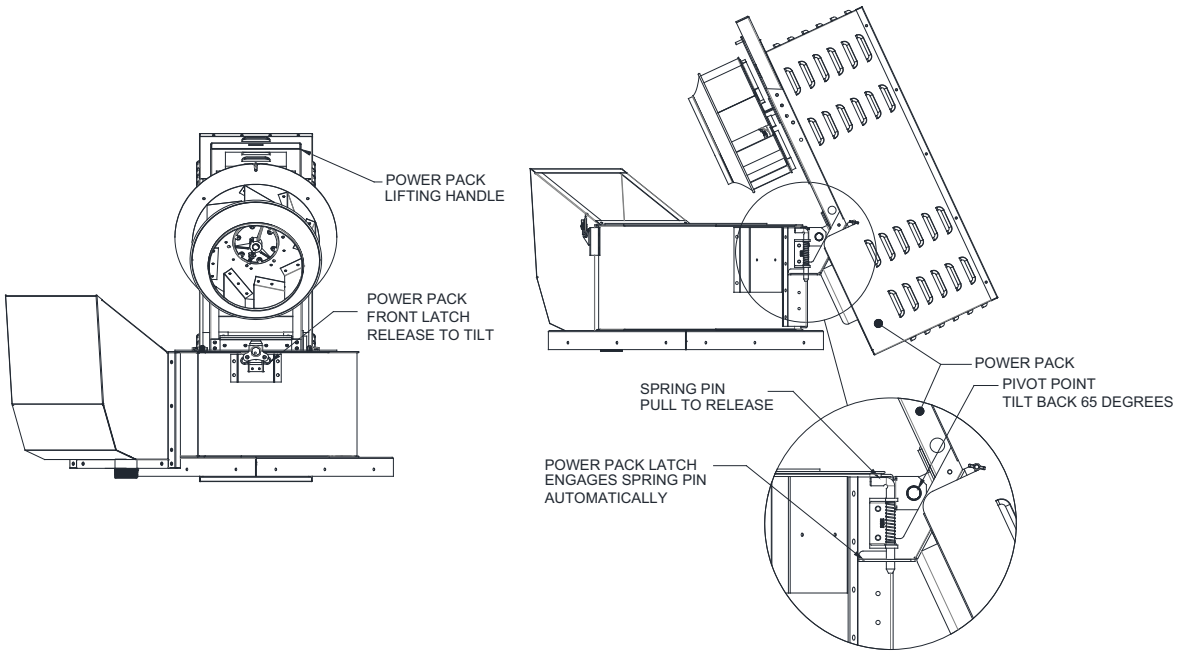
1. The fan inlet and outlet must be connected to the ducts using companion flanges and high temperature (1500F) gaskets or by a system specifically listed for such use, such as UL 1978 or UL 2221 listed duct systems.
2. Install the fan where there is room for service and removal.
3. Usually, the duct to the fan is in a shaft, and the shaft walls have a fire resistance rating. The space where the fan is located must have the same fire resistance rating as the shaft.
4. Flexible connectors are not allowed.
5. There must be a drain in the fan that is directed to a readily accessible and visible grease receptacle, ideally piped to the building grease trap.
6. The exhaust housing constructed of carbon steel not less than 1.52 mm (.060 in.), unless listed in accordance with the terms of the listing.
7. Inlet and outlet ducts will have access doors installed 3 feet from the fan for service and maintenance.
8. Minimum clearances are 18" inches to combustible, 3" inches to limited, 0" inches to non- combustibles.
9. All wiring and electrical equipment must comply with NFPA 70, National Electrical Code.

## Up-blast Curb Mounted Utility Set Hinging Instructions

1. Turn the disconnect switch to the off position.
2. Turn and release the latch from the power pack handle.
3. Lift the power pack using the front handle.
4. The power pack will tilt back 65 degrees.
5. The power pack latch will automatically engage the spring pin.
6. To close the power pack, hold the lifting handle and pull the spring pin up.
7. Lower the power pack down.
8. Engage the front latch into the lifting handle and twist to lock.
9. Inspect the power pack. Top plate should be sealed with top gasket.
10. Turn the wheel to make sure there is not any interference.

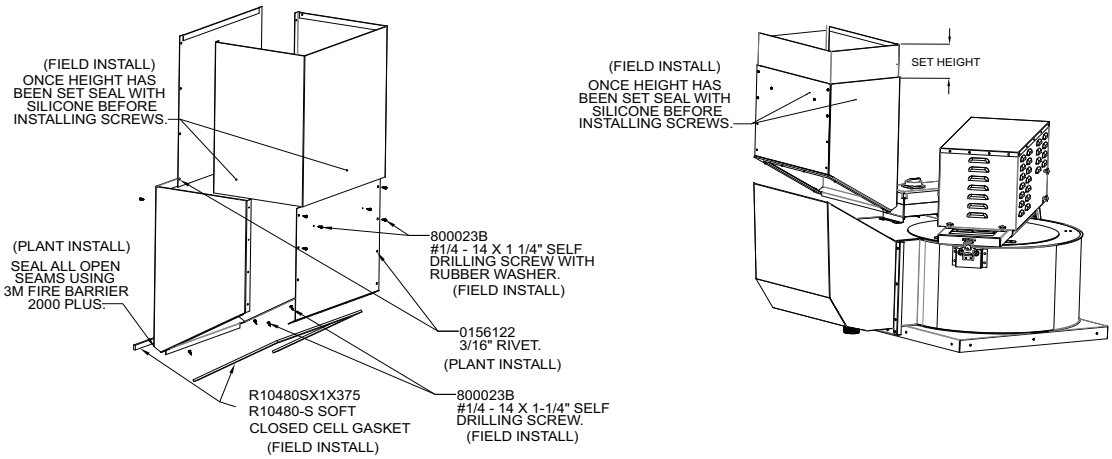
**NOTE: Utility sets may not be wall mounted.**

**Figure 23 - Up-blast Curb Mounted Utility Set Hinge**



## Up-blast Curb Mounted Utility Set Discharge Extension Option

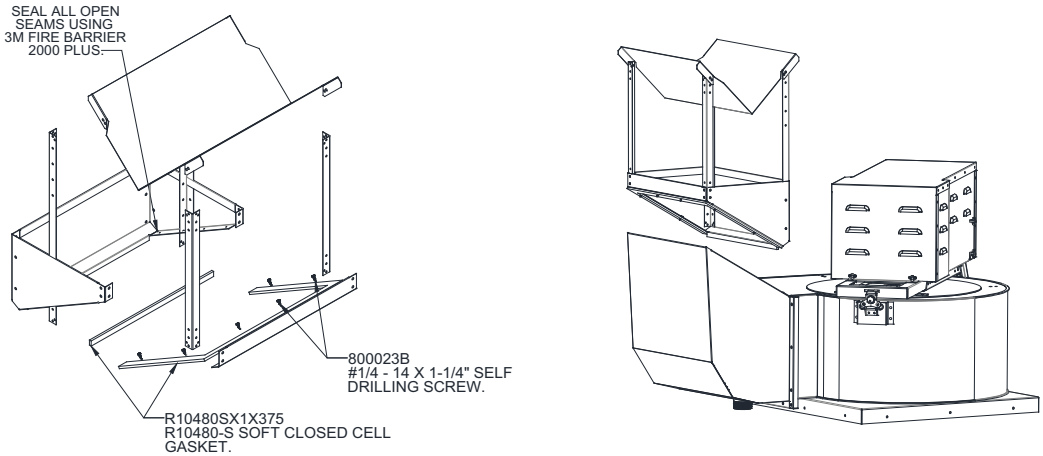
**Figure 24 - Discharge Extension Option**




| Utility Set Option - Extension Assembly | |
|---|---|
| **Part Number** | **Description** |
| RE13ADJEXTASY | RE13 - Extension Assembly Option |
| RE15ADJEXTASY | RE15 - Extension Assembly Option |
| RE18ADJEXTASY | RE18 - Extension Assembly Option |
| RE20ADJEXTASY | RE20 - Extension Assembly Option |
| RE24ADJEXTASY | RE24 - Extension Assembly Option |

## Up-blast Curb Mounted Utility Set Rain Cap Option

**Figure 25 - Rain Cap Option**

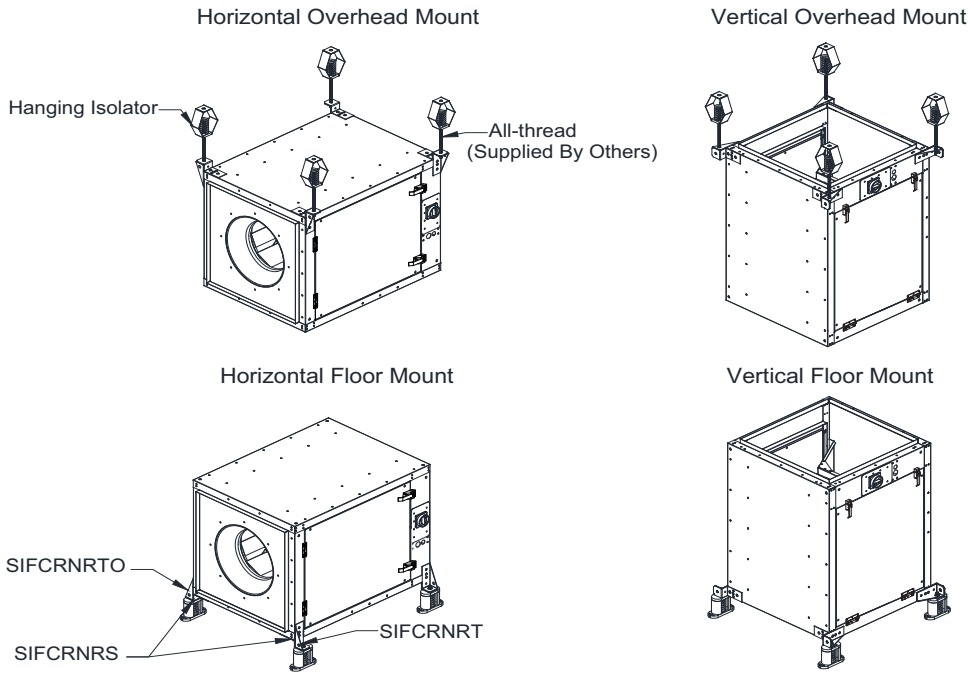



| Utility Set Option - Rain Cap Assembly | |
|---|---|
| **Part Number** | **Description** |
| RE11RAINCAP ASSY | RE11 - Extension Assembly Option |
| RE13RAINCAP ASSY | RE13 - Extension Assembly Option |
| RE15RAINCAP ASSY | RE15 - Extension Assembly Option |
| RE18RAINCAP ASSY | RE18 - Extension Assembly Option |
| RE20RAINCAP ASSY | RE20 - Extension Assembly Option |
| RE24RAINCAP ASSY | RE24 - Extension Assembly Option |

## Square Inline Mounting Configurations

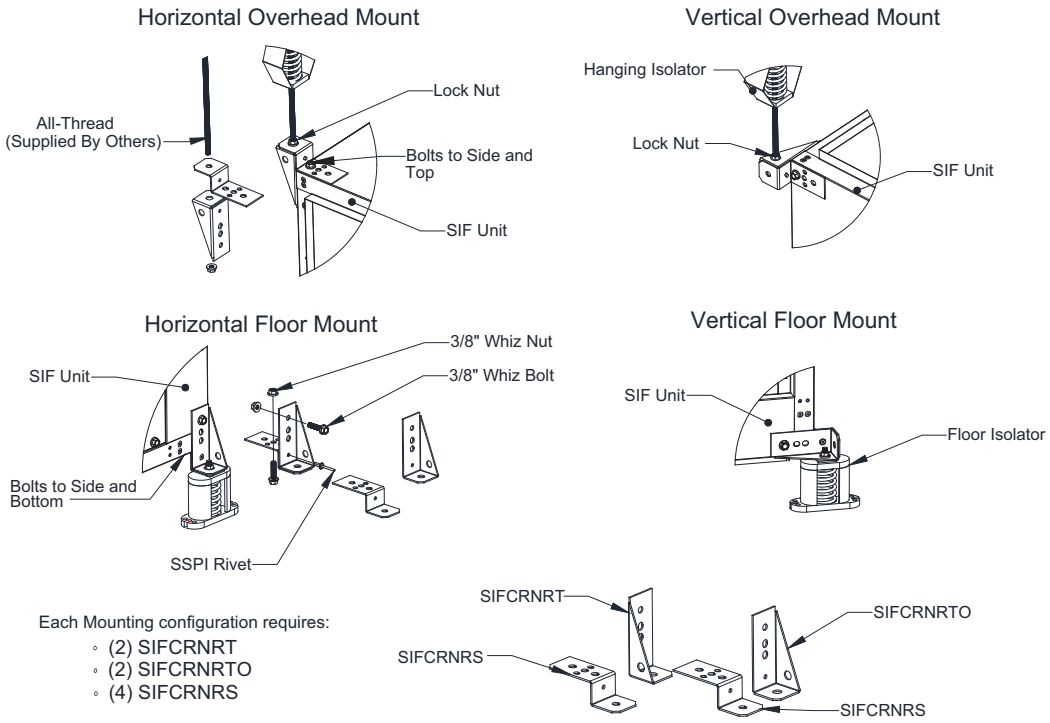
**IMPORTANT: Models containing cooling tubes and drains should not be mounted vertically. Drains must be oriented in the 6 o'clock position.**

**Figure 26 - Mount Configurations**




## Square Inline Mounting Bracket Detail

**Figure 27 - Square Inline Mount Details**

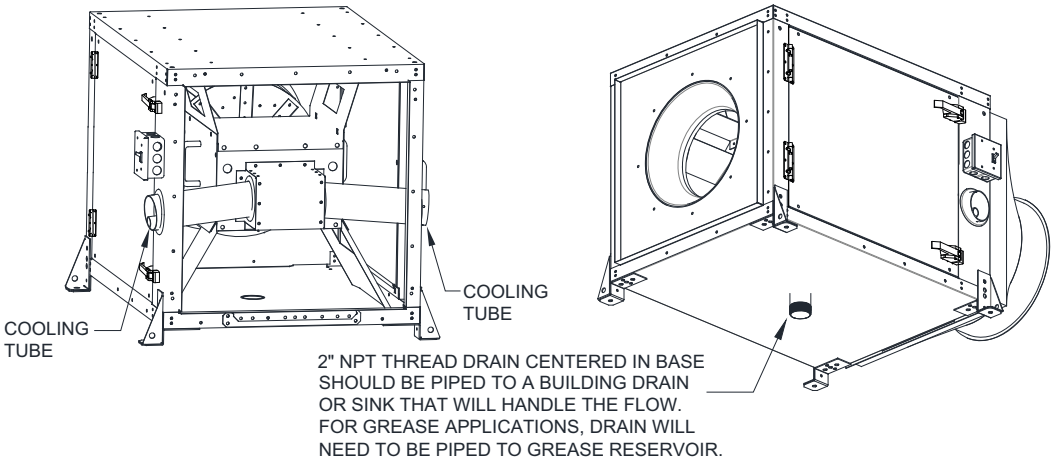



Each Mounting configuration requires:

- (2) SIFCRNRT
- (2) SIFCRNRTO
- (4) SIFCRNRS

## Square Inline Fan Drain

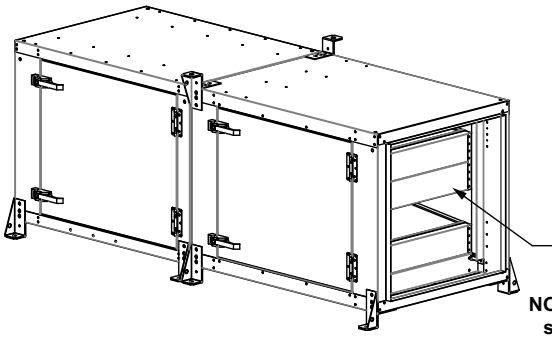
**Figure 28 - Direct Drive Stainless Steel Inline Fans**




*FAN MUST BE INSTALLED WITH DRAIN POINTING DOWN.

## Square Inline Filter Bank Option

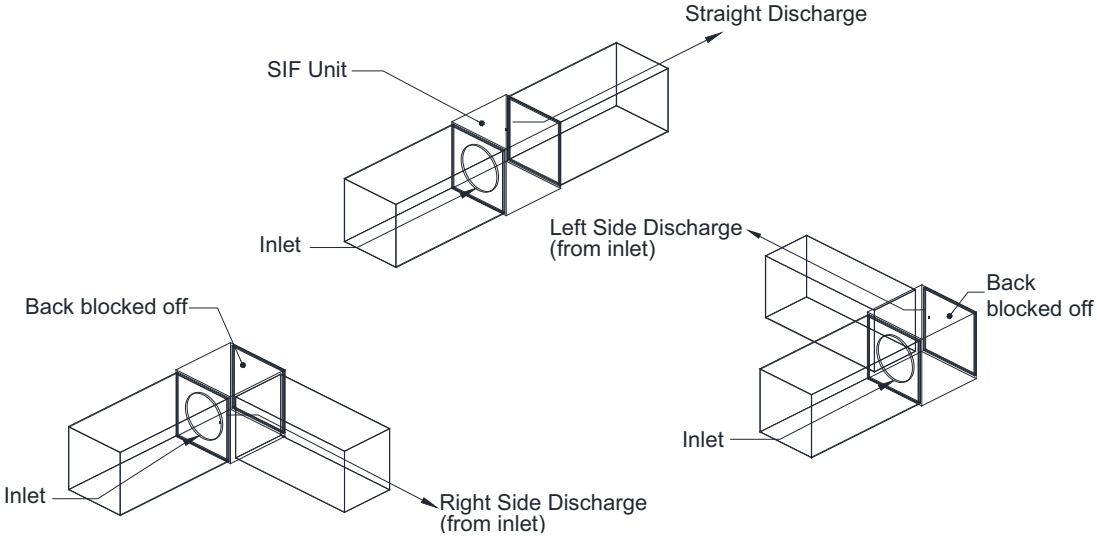
**Figure 29 - Filter Bank Option**




**NOTE: Minimum filter bank service clearance is 36”**

## Square Inlet Discharge Options

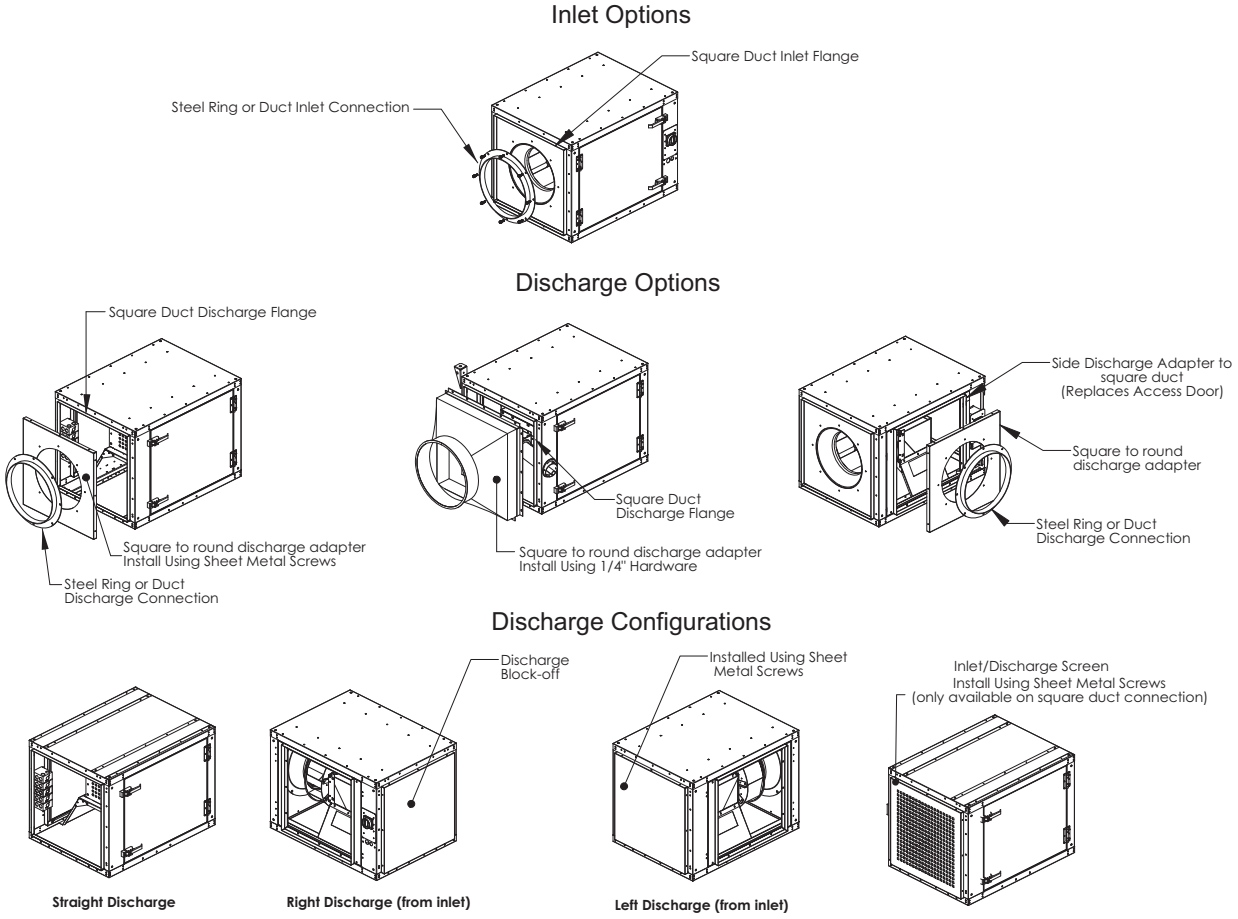
**Figure 30 - Square Inlet Discharge**




**Side Discharge is not available for UL762 rated fans.**

## Square Inline Discharge Configurations

**Figure 31 - Square Inline Discharge Details**




**Side Discharge is not available for UL762 rated fans.**

**NOTE: If the fan manufacturer's duct is not used, black iron grease duct will need to be welded directly to the unit. Refer to "Curb and Ductwork" on page 7 for duct installation details.**

| Inlet/Outlet Connections | | | |
|---|---|---|---|
| **Fan Size** | **Square Duct Dimension** | **Duct Diameter** | **Steel Ring O.D.** |
| 9-10 | 12" x 12" | 10" | N/A |
| 11 | 16" x 16" | 12" | 12.5" |
| 13 | 18" x 18" | 14" | 13.5" |
| 15 | 23" x 23" | 16" | 15.25" |
| 18 | 24" x 24" | 20" | 18.5" |
| 20 | 28" x 28" | 20" | 19.625" |
| 24 | 35" x 35" | 24" | 25.375" |
| 30 | 42" x 42" | 24" | 24.375" |
| 36 | 48" x 48" | 30" | 30.5" |

## Electrical

**WARNING!**
**Disconnect power before installing or servicing unit. High voltage electrical input is needed for this equipment. A qualified electrician should perform this work.**

Before connecting power to the fan, read and understand the entire section of this document. As-built wiring diagrams are furnished with each unit by the factory and are attached to the fan or provided with paperwork packet.

Electrical wiring and connections must be made in accordance with local ordinances and the National Electric Code, ANSI/NFPA 70. Verify the voltage and phase of the power supply. Confirm the wire amperage capacity is in accordance with the unit nameplate. For additional safety information, refer to AMCA publication 410-96, *Recommended Safety Practices for Users and Installers of Industrial and Commercial Fans.*

1. **Always disconnect power before working on or near this equipment. Lock and tag the disconnect switch and/or breaker to prevent accidental power-up**.
2. A dedicated branch circuit should supply the motor circuit with short circuit protection according to the National Electric Code. This dedicated branch should run to the junction box. Every branch circuit should include a properly sized ground connection.
3. A disconnect switch is shipped with every fan. The switch may be located on the exterior of the fan or in the interior of the fan. On down-blast direct drive fans, the disconnect function is built into the speed controller.
4. Verify that the power source is compatible with the requirements of your equipment. The nameplate identifies the **proper phase and voltage** of the equipment.
5. Before connecting the unit to the building's power source, verify that the power source wiring is de-energized. Refer to schematics.
6. Secure the power cable to prevent contact with sharp objects. Verify ground connection is secure.
7. Do not kink power cable and never allow the cable to encounter oil, grease, hot surfaces, or chemicals.
8. Before powering up the unit, make sure that the fan rotates freely. Make sure that the interior of the unit is free of loose debris or shipping materials.
9. Electrically Commutated Motors (ECMs) and Variable Frequency Drives (VFDs) should not be powered through a Ground Fault Circuit Interrupter (GFCI) breaker/outlet. Unnecessary and intermittent tripping may occur.
10. If any of the original wire supplied with the unit must be replaced, it must be replaced with type THHN wire or equivalent.

**IMPORTANT: FANS WITH HINGE KITS REQUIRE ENOUGH SLACK IN THE WIRING TO THE FAN TO ALLOW FAN TO TILT BACK TO THE OPEN POSITION. ELECTRICIAN MUST CHECK THIS AND ACCOUNT FOR THE RANGE OF MOTION OF THE FAN.**

**Table 3 - Copper Wire Ampacity**

| Wire Size AWG | Maximum Amps |
|---|---|
| 14 | 15 |
| 12 | 20 |
| 10 | 30 |
| 8 | 50 |
| 6 | 65 |
| 4 | 85 |
| 3 | 100 |
| 2 | 115 |
| 1 | 130 |

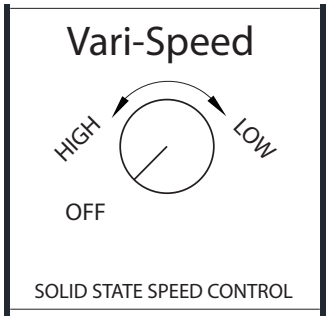
### Motorized Intake Damper

On units shipped with the optional motorized damper, power must be supplied to the damper according to the damper nameplate. The damper motor is controlled external to the fan. External wiring to the damper motor is required.

**NOTE: Some installations may require the use of a step-up or step-down transformer.**

### Permanent Split Capacitor (PSC) Motor Speed Control

**Figure 32 - PSC Motor Speed Control**




Some single-phase direct-drive fans contain speed controls that regulate the amount of voltage going to the motor. Specific PSC motors must be used in conjunction with speed controls. The speed control has a knob (**Figure 32**) with an off position along with high to low range. At high speed, the speed control allows all of the line voltage to pass directly to the motor.

A minimum speed adjustment is provided to allow independent control of the minimum speed setting. Minimum speed adjustment ensures the motor runs with sufficient torque to prevent stalling. To adjust this:

1. Motor must be in actual operating conditions to achieve proper speed adjustment. Motor will not slow down unless proper load is applied.
2. Turn main control knob to lowest speed position.
3. Locate and adjust minimum speed setting. This can be found under the speed control faceplate. Use a small screwdriver to adjust. Rotate clockwise to decrease minimum speed; counter-clockwise to increase minimum speed.
4. Motor will now operate from this preset minimum speed to full speed.

**The lowest minimum voltage that may be applied to these motors is 65V AC. Running lower voltages to the motor can cause premature failure and overheating problems.**

## Electronically Commutated Motor (ECM) Speed Control

An Electrically Commutated Motor (ECM) with speed control allows for an accurate manual adjustment of the fan's speed. The benefits of using an EC motor is exceptional efficiency, performance, and motor life. ECMs should not be powered through a Ground Fault Circuit Interrupter (GFCI) breaker/outlet. Unnecessary and intermittent tripping may occur.

## Unit Mount Controller

The RTC speed controller features a 4 digit LED display with a five button interface. All parameters can be accessed through the user menu. The percent of run speed can be changed by using the **Up** and **Down** buttons followed by pressing **Enter** (middle button) to save changes. Every **ten seconds** the display will toggle between current percentage of run speed and current RPMs. The flow index has a range of **0-100%** and is typically linear with motor RPM.

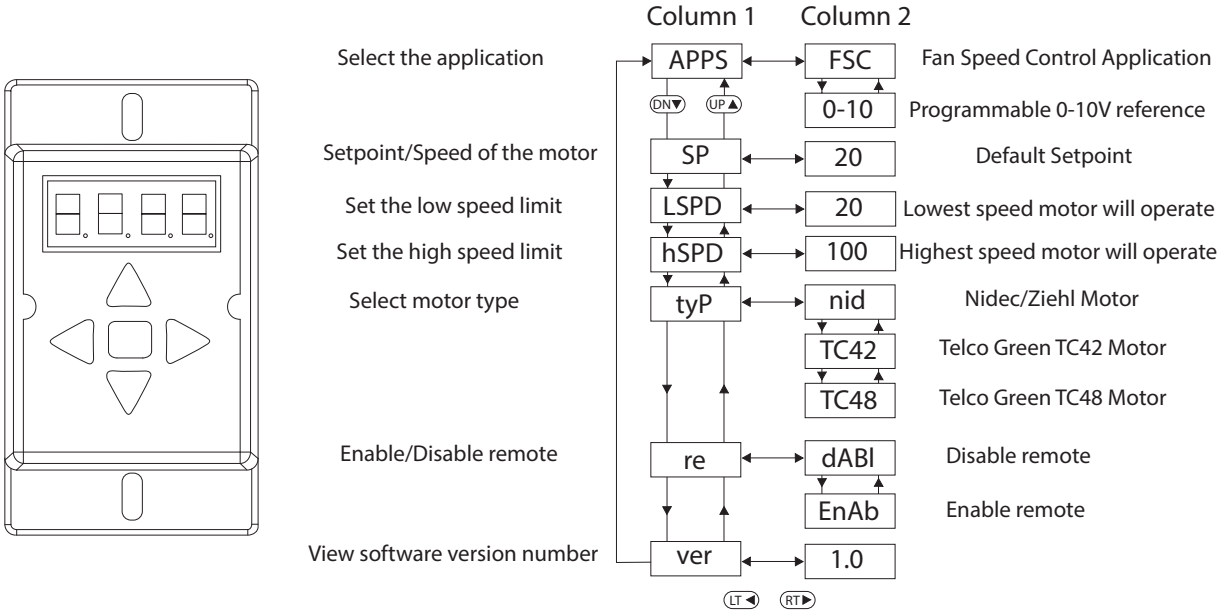
If the remote function (re) is enabled, the speed is controlled through a **0-10V** input. **0V = 0%** and **10V = 100%**, unless overridden by the low speed and high speed limits.

The speed controller requires a **24V AC** input and can locally turn the motor on and off. The motor RPM range is fully adjustable between the minimum and maximum setpoints, see LSPD and HSPD on the programming display. For more information, see the RTC control operating manual.

**For all motors except 16Z, 18Z, 20Z, 22Z, 25Z, 28Z:** If "oFF" is being displayed, and the speed is set above 300 RPM, the ECM is not receiving RPM feedback. Check that the ECM is wired correctly. Check that the motor "tyP" in the settings matches the motor manufacturer. 16Z, 18Z, 20Z, 22Z, 25Z, 28Z do not send RPM feedback.

**NOTE: A Variable Frequency Drive (VFD) is required to adjust the speed control of a non-electrically commutated 3-phase direct-drive motor.**

**Figure 33 - RTC Speed Controller and Menu**

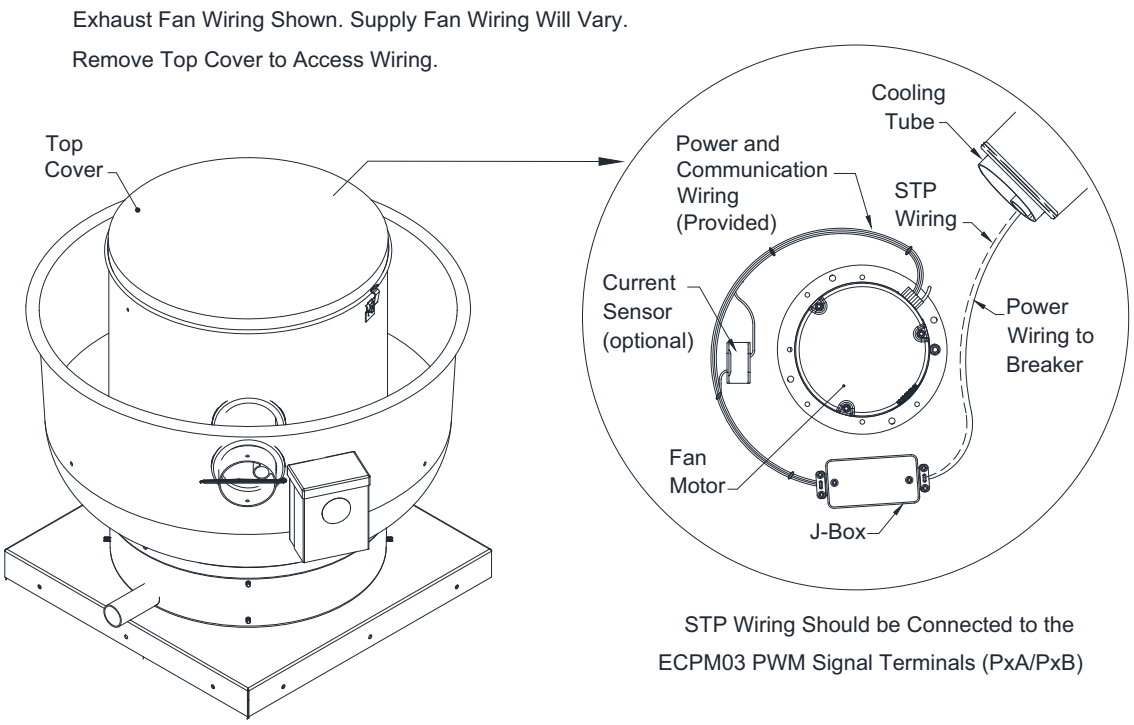


## External PWM Signal

**Figure 34** illustrates ECM fan wiring. The fan unit will be shipped with power wiring and communication wiring fed to an internal junction box (J-Box). The fan is shipped with Shielded Twisted Pair (STP) wire, which is used for wiring to a remote PWM signal. Power the unit off. Remove top cover from fan. Remove J-Box cover to access wiring connections.

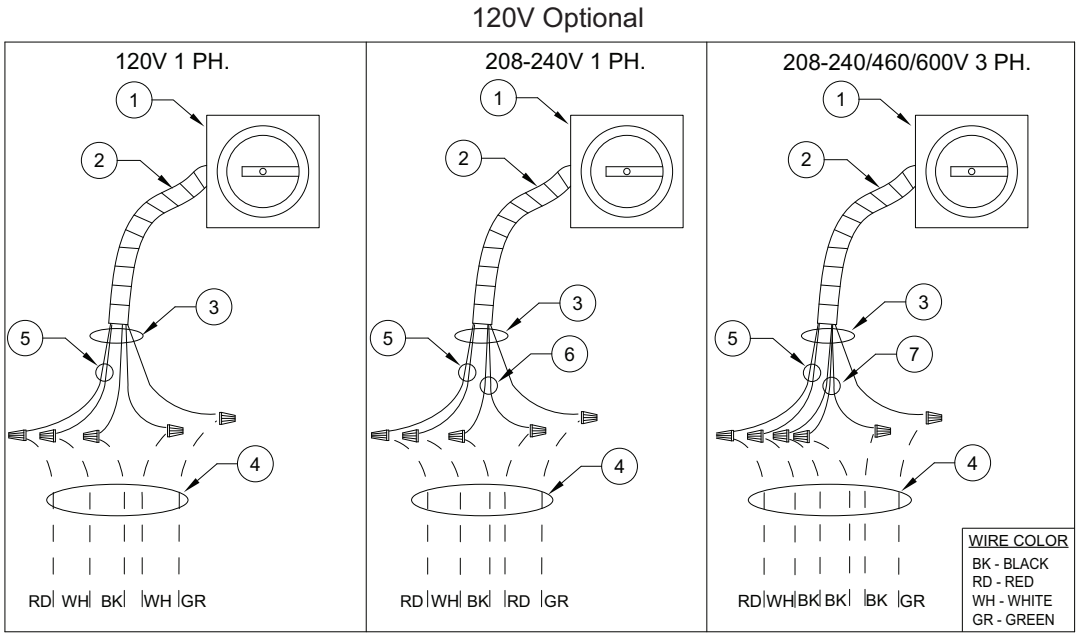
- The STP wire is connected to the communication wiring of the motor using wire nuts in the junction box. If a preset length of STP is provided, it will be connected to wiring located in junction box from the factory.
- If wiring is not connected from the factory, connect the red wire to the positive PWM signal and the black wire to the negative PWM signal. Reference schematics for all wiring connections (PxA and PxB).
- Run STP wiring through the cooling tube and along the power wiring of the fan, secure the two together with zip ties. Ensure there is enough slack for the fan to hinge open and close freely.
- Refer to wiring schematics to verify wiring and connections.

**Figure 34 - ECM Fan Wiring**



## Fan to Building Wiring Connection

**Figure 35 - Wiring Connection Details**




1. Disconnect Switch
2. Galflex Conduit (In Unit)
3. Factory Wiring
4. Field Supplied Wiring - From building power or pre-wired control panel.
5. 120V Single Phase Standing Power
6. 208-240 Single Phase
7. Three Phase

## Motor Speed Controller (MSC) Installation

The Motor Speed Controller (MSC) is a versatile device able to output various signal types to many different Electrically Commutated Motors (ECMs). The MSC signal output types can be selected under the 'Motor Type' section of the MSC menu. The MSC may be installed in a fan, remotely in a kitchen space, or in a mechanical room. While this device can be mounted remotely and powered using 24V, it may also be mounted with the fan where it will be exposed to higher voltages. If installed in the fan, the electrical installation must be carried out according to the appropriate regulations (e.g., cable cross-sections, circuit breaker, protective earth [PE] connection). National and local codes must be followed during the installation process.

The MSC board may be powered through a 120VAC/24VAC CLASS 2 transformer, 120V AC/24V DC CLASS 2 power supply, or through MODBUS connections.

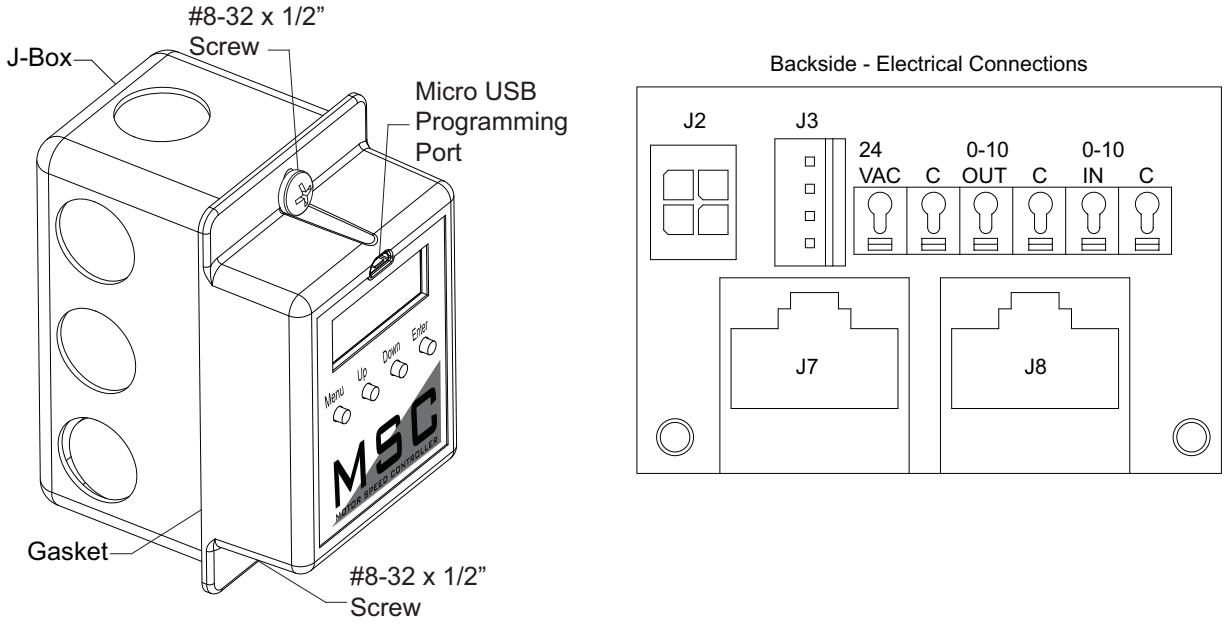
The MSC contains static sensitive components. Therefore, you must handle with care to avoid damage to these components. All operations concerning installation, commissioning, and maintenance must be carried out by qualified, skilled personnel who are familiar with the installation, assembly, commissioning, and operation of the electronic board and the application for which it is being used.

Ensure proper handling and avoid excessive mechanical stress. Do not bend any components when handling or installing component. **Do not touch any electronic components or contacts**.

Precautions must be adhered to during installation, testing, servicing, and repairing of this board. Component damage may result if proper procedures are not followed.

Do not install the MSC where it is subjected to adverse environmental conditions such as combustibles, oils, hazardous vapors, corrosive chemicals, excessive dust, moisture, direct sunlight, or extreme temperatures. When removing or installing the MSC to the j-box, verify the gasket is present. All electrical connections for the MSC are located on the backside of the controller. Refer to **Figure 36** for details on installation and electrical connections. When the micro USB programming port is not in use, place the weather-seal plug into the port location.

**Figure 36 - Installation/Electrical Connections**



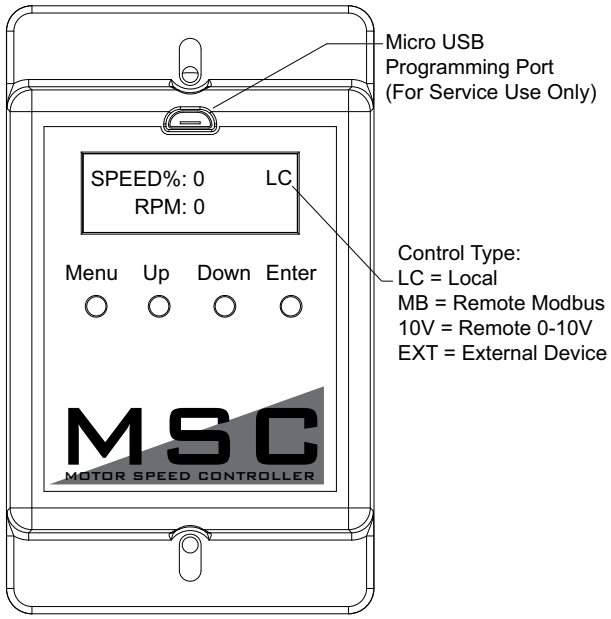
## MSC Controls Overview

There are four buttons to navigate through the menu screens, refer to **Figure 37**.

Press the **MENU** button to access menu settings/parameters, pressing **MENU** will also back out of the current menu screen. To scroll through menus, use **UP** and **DOWN** buttons. Press the **ENTER** button to change setting/parameter selection.

To enter password, press MENU, then press **ENTER** when “Board Config” is displayed. Use **UP** and **DOWN** to scroll through numbers, press **ENTER** to advance to the next numerical setting. To save changes, press **MENU** until the screen displays “SAVE CHANGES? [ENTER] TO SAVE.” Press the ENTER button to save changes.

**Figure 37 - MSC Front Detail View**




## MSC Menu

**Board Config** - Password (default is 0225)

- **Motor Type** - User may change motor type between Nidec, Telco 42, Telco 48, Ziehl, 0-10V, Other.
- **Control Type** - This setting adjusts how the fan will be controlled.
  - **Local** - The fan will be controlled by the MSC.
  - **Remote Modbus** - The fan will be controlled by another master board through the MSC. A connection between the 0-10V Out to 0-10V In must be made for start command.
  - **Remote 0-10V** - The fan will be controlled by an external 0-10V signal.
- **Speed Settings** - Provides access to speed and voltage settings.
  - **Low Speed** - Adjustable speed from 20% up to high speed setting, or 0-10V. Setting cannot go above High Speed parameter.
  - **High Speed** - Adjustable speed from 100% down to low speed setting, or 10-0V. Setting cannot go below Low Speed parameter.
  - **Set Speed%** - Adjustable speed range is dependent on Low Speed and High Speed settings. This controls the output of the motor.
  - **Voltage Range** - Only available when Motor Type “OTHER” is selected. Default setting is 24V. 5V, and 10V are also available.

- **Modbus #** - Adjustable Modbus ID. Exhaust Fan range 11-18, Supply Fan range 21 or 22. **A VFD and MSC cannot use the same Modbus #**.
- **Options**
  - **Feedback Fault** - If set to ENABLED, the MSC will monitor RPM feedback. If the MSC does not receive data for 30 seconds or 70% of the expected RPM, this fault will be displayed. **Ziehl motors do not provide feedback.**
  - **2 Speed** - The 0-10V output cannot be used when the 2 Speed or Manual Speed options are On, or if the "Control Type" is set to Modbus. When the 0-10V OUT and 0-10V IN terminals are **not** jumped together, the fan will operate at low speed. When 0-10V OUT and 0-10V IN terminals are jumped together, the fan will operate at high speed.
  - **Analog Speed** - The user may enable/disable the option, and calibrate a potentiometer for proper operation that is connected between the 0-10V OUT and 0-10V IN terminals. When enabled, you must calibrate the potentiometer. Follow the MSC's on-screen instructions. The speed will be adjustable between 0V (low speed) to 10V (high speed).
  - **Input Threshold** - When control type is set to Remote 0-10V, an input threshold will be created for motor control. Refer to **Figure 38 on page 41** for threshold examples.
    - **Zero Operation** - The user may select how the motor will operate when the 0-10V input is at 0V. The options will be Off or Low Speed (default).
    - **Threshold** - Increasing the threshold value will allow for the device to hold its voltage/RPM output while the input is between the 0 - threshold value.
- **Restore Settings** - Provides access to restore factory settings, and test & balance settings.
  - **Factory Settings** - This will reset all values back to factory settings.
  - **T & B Settings** - This will reset all values back to last saved test & balance settings.
- **Change Password** - Users may update the password setting to their own. Password 0225 will also be stored for backup. Both passwords will allow users to enter "Board Config" settings.

**Software Version** - Displays the current software version installed on the board.

**Faults** - This provides access to "Fault History," "Fault Totals," and "Clear Faults."

- **Fault History** - Displays fault history and board reboots in chronological order. Possible displayed faults are:
  - **No Faults** - There are no active faults with the system.
  - **Feedback Fault** - Only displayed for motors with feedback capabilities.
  - **Reboot** - Any time the fan goes from OFF to ON, this "fault" will be logged. This fault will only display in "Fault History."
  - **Modbus** - Issue with Modbus communication between the MSC and master board.
  - **Variable Device Fault** - When "Analog Speed" is selected and a potentiometer is connected, if the voltage drops below 1V, this fault will be displayed.
- **Fault Totals** - Displays amount of faults for Modbus, Feedback, Var Device, Reboot, and Total Faults.
- **Clear Faults** - Users may clear all faults from the board.

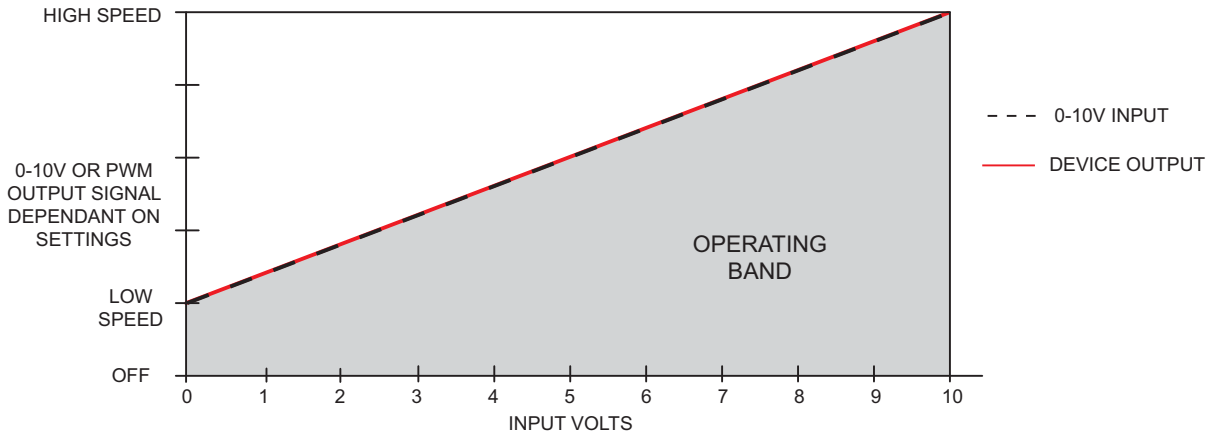
**Service** - This provides access to service settings. Password: 1234

- **Save T & B** - After the test & balance process has been completed, save adjustments under this menu.
- **IO Status** - Provides access to information about the inputs and outputs of the MSC board.
  - **V In** - Displays the incoming voltage (0-10V) to the MSC.
  - **V Out** - Displays the output voltage (0-10V) to the motor.
  - **RPM** - Displays motor RPM feedback. **Ziehl motors do not provide feedback.**
  - **PWM V** - Displays equivalent voltage reading of the PWM output to the motor.
  - **Speed%** - Displays PWM percentage output value to the motor.

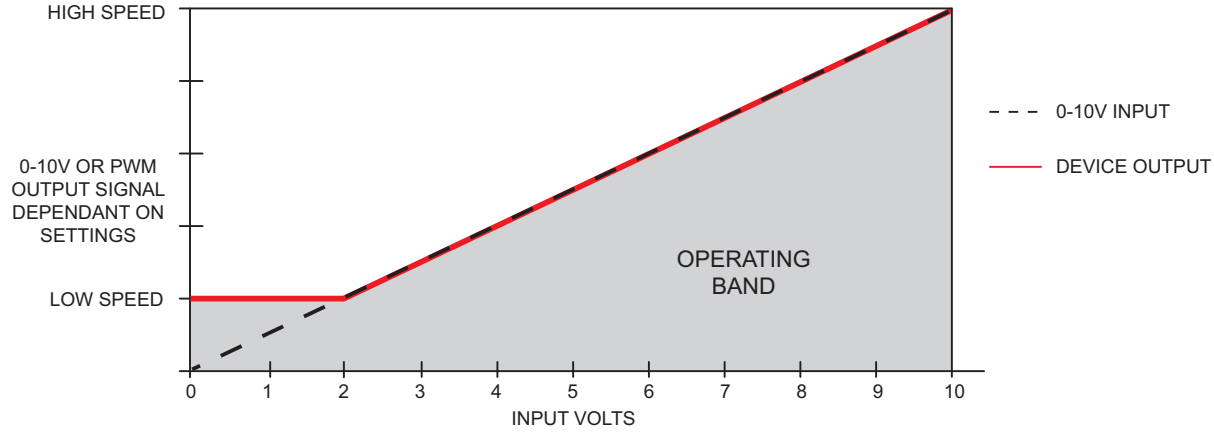
## Input Threshold

**Figure 38 - Input Threshold Examples**

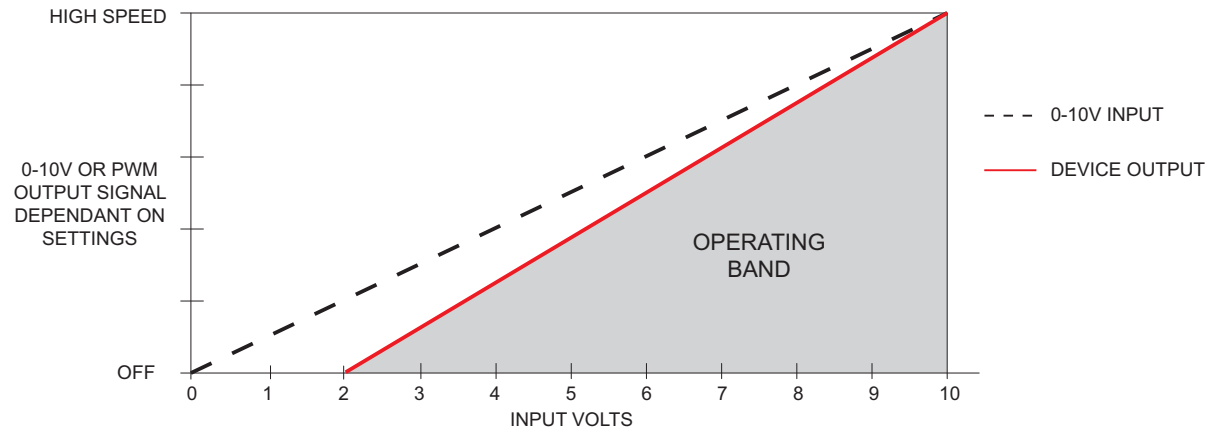
Factory Default: Zero operation set to low speed, threshold set to 0V.



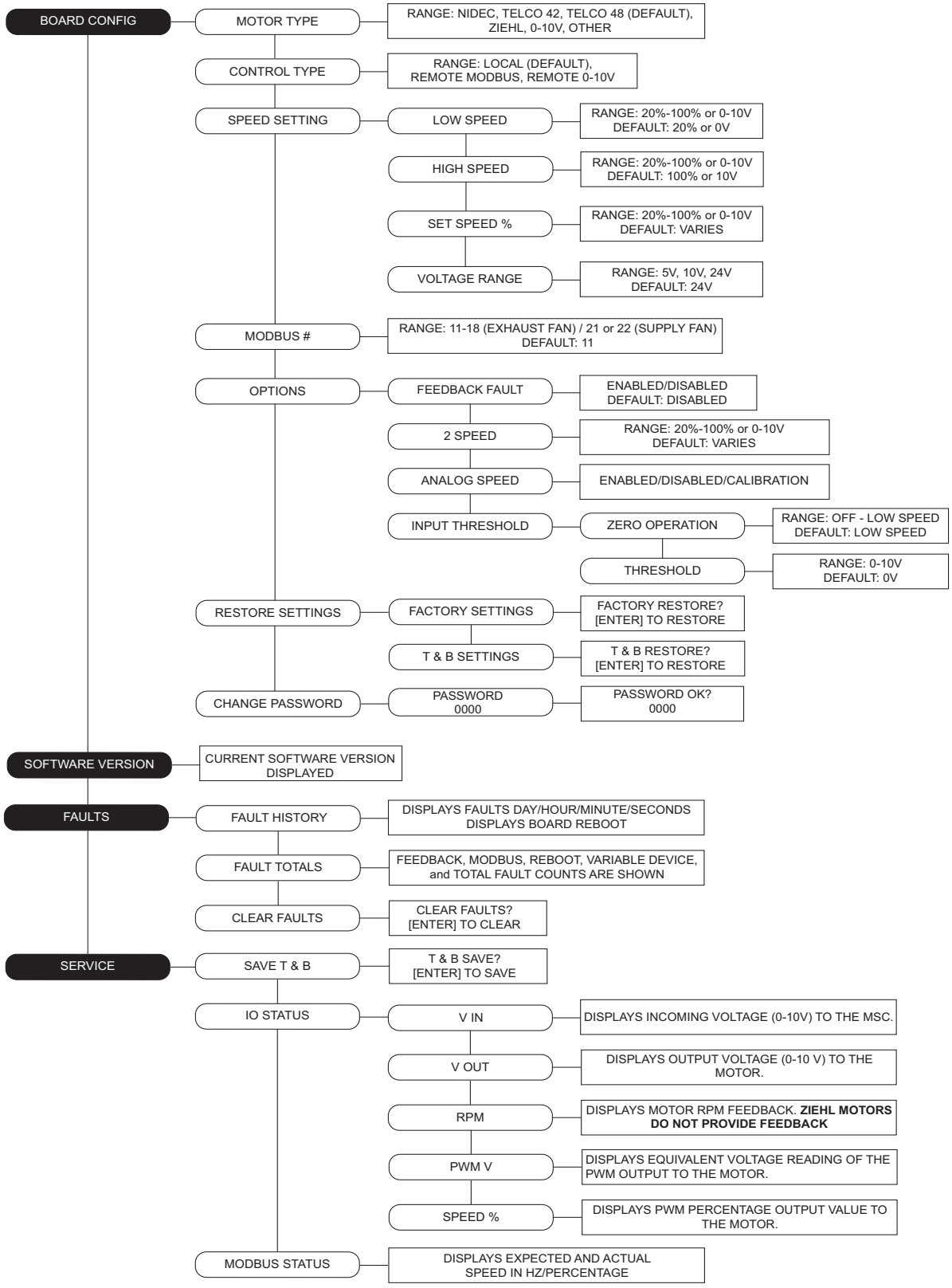

Zero operation set to low speed, threshold set to 2V.




Zero operation set to off, threshold set to 2V.



## MSC Menu Tree



## Variable Frequency Drive (VFD)

**WARNING!**
**- Before installing the VFD drive, ensure the input power supply to the drive is OFF.**
**- The power supply and motor wiring of the VFD must be completed by a qualified electrician.**
**- The VFD is factory programmed, only change if replaced or ordered separately.**

**Not suitable for corner grounded 3 phase input power.** Consult the VFD manual and all documentation shipped with the unit for proper installation and wiring of the VFD. The VFD has been programmed by the factory with ordered specific parameters. Use **Table 4** as a guide during installation.

**Table 4 - VFD Installation Check List**

| Check Off | Description |
|---|---|
| | The installation environment conforms to the VFD manual. |
| | The drive is mounted securely. |
| | Space around the drive meets the drive's specification for cooling. |
| | The motor and driven equipment are ready to start. |
| | The drive is properly grounded. |
| | The input power voltage matches the drive's nominal input voltage. |
| | The input power connections at L1, L2, and L3 are connected and tight. Verify correct size crimp fitting is used. |
| | The input power protection is installed. |
| | The motor's power connection at U, V, and W are connected and tight. Verify correct size crimp fitting is used. |
| | The input, motor, and control wiring are run in separate conduit runs. |
| | The control wiring is connected and tight. |
| | NO tools or foreign objects (such as drill shavings) are in the drive. |
| | NO alternative power source for the motor (such as a bypass connection) is connected - NO voltage is applied to the output of the drive. |

## VFD Installation

### Input AC Power

- Circuit breakers feeding the VFDs are recommended to be thermal-magnetic and fast-acting. They should be sized based on the VFD amperage. Refer to **“ACTECH SMV VFD” on page 46**. See installation schematic for exact breaker sizing.
- Every VFD should receive power from its own breaker. If multiple VFDs are to be combined on the same breaker, each drive should have its own protection measure (fuses or miniature circuit breaker) downstream from the breaker.
- Input AC line wires should be routed in conduit from the breaker panel to the drives. AC input power to multiple VFDs can be run in a single conduit if needed. **Do not combine input and output power cables in the same conduit.**
- The VFD should be grounded on the terminal marked PE. A separate insulated ground wire must be provided to each VFD from the electrical panel. This will reduce the noise being radiated in other equipment.
- VFDs should not be powered through a Ground Fault Circuit Interrupter (GFCI) breaker/outlet. Unnecessary and intermittent tripping may occur.

**ATTENTION: Do not connect incoming AC power to output terminals U, V, W. Severe damage to the drive will result. Input power must always be wired to the input L terminal connections (L1, L2, L3).**

### VFD Output Power

- Motor wires from each VFD to its respective motor MUST be routed in a **separate steel** conduit away from control wiring and incoming AC power wiring. This is to avoid noise and crosstalk between drives. An insulated ground must be run from each VFD to its respective motor. Do not run different fan output power cables in the same conduit.
- VFD mounted in ECP: A load reactor should be used and sized accordingly when the distance between the VFD and motor is greater than specified below. The load reactor should be installed within 10 feet of the VFD output:

  **208/230V** - Load reactor should be used when distance exceeds 250 feet.
  **460/480V** - Load reactor should be used when distance exceeds 50 feet.
  **575/600V** - Load reactor should be used when distance exceeds 25 feet.
- VFD mounted in fan: The load reactor should be sized accordingly when the VFD is mounted in the fan.

  **208/230V** - Load reactor is optional but recommended for 15 HP and above motors.
  **460/480V** - Load reactor is optional but recommended for 7.5 HP and above motors.
  **575/600V** - Load reactors are required for all HP motors.
- If the distance between the VFD and the motor is extremely long, up to 1000 FT, a dV/dT filter should be used, and the VFD should be increased by 1 HP or to the next size VFD. The dV/dT filter should be sized accordingly and installed within 10 feet of the output of the VFD.

  **208/230V** – dV/dT filter should be used when distance exceeds 400 feet.
  **460/480V** – dV/dT filter should be used when distance exceeds 250 feet.
  **575/600V** – dV/dT filter should be used when distance exceeds 150 feet.
- Do not install a contactor between the drive and the motor. Operating such a device while the drive is running can potentially cause damage to the power components of the drive.
- When a disconnect switch is installed between the drive and motor, the disconnect should only be operated when the drive is in a STOP state.

## VFD Programming

### Programming

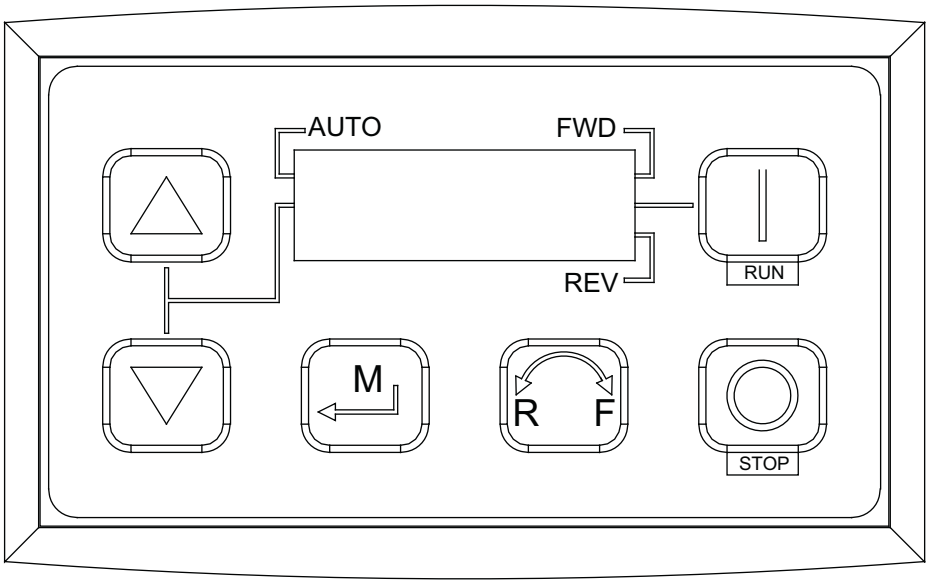
1. The Drive should be programmed for the proper motor voltage. P107 is set to 0 (Low) if motor voltage is 120V AC, 208V AC or 400V AC. P107 is set to 1 (High) if the motor voltage is 230V AC, 480V AC, or 575V AC.
2. The Drive should be programmed for the proper motor overload value. P108 is calculated as Motor FLA x 100 / Drive Output Rating (refer to **“ACTECH SMV VFD” on page 46**).

**To enter the PROGRAM mode to access the parameters:**

1. Use the buttons on the VFD screen (**Figure 39**) to adjust VFD settings. Press the Mode (M) button. This will activate the password prompt (PASS).
2. Use the Up and Down buttons to scroll to the password value (the factory default password is “0225”) and press the Mode (M) button. Once the correct password is entered, the display will read “P100”, which indicates that the PROGRAM mode has been accessed at the beginning of the parameter menu.
3. Use the Up and Down buttons to scroll to the desired parameter number.
4. Once the desired parameter is found, press the Mode (M) button to display the present parameter setting. The parameter value will begin blinking, indicating that the present parameter setting is being displayed. The value of the parameter can be changed by using the Up and Down buttons.
5. Pressing the Mode (M) button will store the new setting and exit the PROGRAM mode. To change another parameter, press the Mode (M) button again to re-enter the PROGRAM mode. If the Mode button is pressed within 1 minute of exiting the PROGRAM mode, the password is not required to access the parameters. After one minute, the password must be re-entered to access the parameters again.

P500 parameter provides a history of the last 8 faults on the drive. It can be accessed without entering PROGRAM mode.

**Figure 39 - VFD Screen**




**NOTE: When a parameter is changed in the drive, the drive should be de-energized. Wait for the display to go completely dark. Once the display is completely dark, the drive can be re-energized.**

## ACTECH SMV VFD

### Table 5 - Cross-Reference

| HP | Part Number | Volts | 1Ø Input | 3Ø Input | Input Amps 1Ø 120V AC | Input Amps 1Ø 240V AC | Output Amps | Breaker 1Ø 120V AC | Breaker 1Ø 240V AC |
|---|---|---|---|---|---|---|---|---|---|
| 0.33 | ESV251N01SXB | 120/240V | X | - | 6.8 | 3.4 | 1.7 | 15 | 15 |
| 0.5 | ESV371N01SXB | 120/240V | X | - | 9.2 | 4.6 | 2.4 | 15 | 15 |
| 1 | ESV751N01SXB | 120/240V | X | - | 16.6 | 8.3 | 4.2 | 25 | 15 |
| 1.5 | ESV112N01SXB | 120/240V | X | - | 20 | 10 | 6 | 30 | 20 |

| HP | Part Number | Volts | 1Ø Input | 3Ø Input | Input Amps 1Ø | Input Amps 3Ø | Output Amps | Breaker 1Ø | Breaker 3Ø |
|---|---|---|---|---|---|---|---|---|---|
| 0.5 | ESV371N02YXB | 240V | X | X | 5.1 | 2.9 | 2.4 | 15 | 15 |
| 1 | ESV751N02YXB | 240V | X | X | 8.8 | 5 | 4.2 | 15 | 15 |
| 1.5 | ESV112N02YXB | 240V | X | X | 12 | 6.9 | 6 | 20 | 15 |
| 2 | ESV152N02YXB | 240V | X | X | 13.3 | 8.1 | 7 | 25 | 15 |
| 3 | ESV222N02YXB | 240V | X | X | 17.1 | 10.8 | 9.6 | 30 | 20 |
| 5 | ESV402N02TXB | 240V | - | X | - | 18.6 | 16.5 | - | 30 |
| 7.5 | ESV552N02TXB | 240V | - | X | - | 26 | 23 | - | 40 |
| 10 | ESV752N02TXB | 240V | - | X | - | 33 | 29 | - | 50 |
| 15 | ESV113N02TXB | 240V | - | X | - | 48 | 42 | - | 80 |
| 20 | ESV153N02TXB | 240V | - | X | - | 59 | 54 | - | 90 |
| | | | | | | | | | |
| 1 | ESV751N04TXB | 480V | - | X | - | 2.5 | 2.1 | - | 15 |
| 1.5 | ESV112N04TXB | 480V | - | X | - | 3.6 | 3 | - | 15 |
| 2 | ESV152N04TXB | 480V | - | X | - | 4.1 | 3.5 | - | 15 |
| 3 | ESV222N04TXB | 480V | - | X | - | 5.4 | 4.8 | - | 15 |
| 5 | ESV402N04TXB | 480V | - | X | - | 9.3 | 8.2 | - | 15 |
| 7.5 | ESV552N04TXB | 480V | - | X | - | 12.4 | 11 | - | 20 |
| 10 | ESV752N04TXB | 480V | - | X | - | 15.8 | 14 | - | 25 |
| 15 | ESV113N04TXB | 480V | - | X | - | 24 | 21 | - | 40 |
| 20 | ESV153N04TXB | 480V | - | X | - | 31 | 27 | - | 50 |
| 25 | ESV183N04TXB | 480V | - | X | - | 38 | 34 | - | 70 |
| 30 | ESV223N04TXB | 480V | - | X | - | 45 | 40 | - | 80 |
| | | | | | | | | | |
| 1 | ESV751N06TXB | 600V | - | X | - | 2 | 1.7 | - | 15 |
| 2 | ESV152N06TXB | 600V | - | X | - | 3.2 | 2.7 | - | 15 |
| 3 | ESV222N06TXB | 600V | - | X | - | 4.4 | 3.9 | - | 15 |
| 5 | ESV402N06TXB | 600V | - | X | - | 6.8 | 6.1 | - | 15 |
| 7.5 | ESV552N06TXB | 600V | - | X | - | 10.2 | 9 | - | 20 |
| 10 | ESV752N06TXB | 600V | - | X | - | 12.4 | 11 | - | 20 |
| 15 | ESV113N06TXB | 600V | - | X | - | 19.7 | 17 | - | 30 |
| 20 | ESV153N06TXB | 600V | - | X | - | 25 | 22 | - | 40 |
| 25 | ESV183N06TXB | 600V | - | X | - | 31 | 27 | - | 50 |
| 30 | ESV223N06TXB | 600V | - | X | - | 36 | 32 | - | 60 |

# START-UP OPERATION

Before starting up or operating the unit, verify all fasteners are secure and tight. Check the set screw in the wheel hub. With power **OFF** to the unit or before connecting the unit to power, turn the fan wheel by hand. Verify it is not striking the inlet or any obstructions. If necessary, re-center.

**Special Tools Required:** Standard Hand Tools, AC Voltage Meter, Tachometer

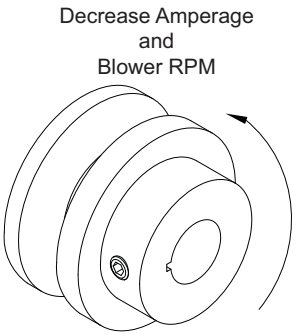
## Unit Start-up Procedure

1. Check all electrical connections are secure and tight.
2. For belt drive units, check pulley alignment and belt tension. Refer to **“Pulley Alignment/Proper Belt Tension” on page 49**.
3. Inspect the condition of the intake damper and damper linkage, if applicable.
4. Inspect the air-stream for obstructions or debris in wheel.
5. Compare the supplied **motor voltage** with the fan’s nameplate voltage. If this does not match, correct the problem.
6. Place the external disconnect to the **ON** position to start the unit. Immediately place the disconnect switch off. **Check the rotation of the fan** with the directional arrow on the blower scroll. Reversed rotation will result in poor air performance, motor overloading and possible burnout. For units equipped with a single-phase motor, check the motor wiring diagram to change rotation. For 3-phase motors, any two power leads can be interchanged to reverse motor direction.
7. When the fan is started, observe the operation and check for any unusual noises.
8. Place the external disconnect switch back to the **ON** position. The system should be in full operation with all ducts attached. Measure the system airflow.
9. Once the proper airflow is achieved, measure and record the fan speed with a reliable tachometer. **Caution - Excessive speed will result in motor overloading or bearing failure. Do not set fan RPMs higher than specified in the maximum RPM chart**. Refer to **“TROUBLESHOOTING” on page 53** for more information.
10. Measure and record the **voltage** and **amperage** to the motor. Compare with the motor’s nameplate to determine if the motor is operating under safe load conditions.

## Pulley Adjustment

The adjustable motor pulley is factory set for the RPM specified (**Table 6**). Speed can be increased by closing or decreased by opening the adjustable motor sheave. Two groove variable pitch pulleys must be adjusted to an equal number of turns open or closed. Any increase in speed represents a substantial increase in horsepower required by the unit. Motor amperage should always be checked to avoid serious damage to the motor when the speed is varied. Always torque set screws according to the torque specifications shown in **Figure 40**.

**Figure 40 - Adjustable Pulley**




| Setscrew Thread Size | Torque (in-lbs) |
|---|---|
| No. 10 (bushing) | 32 |
| 1/4” (bushing) | 72 |
| 5/16” | 130 |

**Table 6 - Maximum RPM and HP Chart**

| Blower Size | Max. RPM | Max. HP |
|---|---|---|
| 10” | 1800 | 2 |
| 12” | 1500 | 3 |
| 15” | 1400 | 5 |
| 18” | 1200 | 5 |
| 20” | 1000 | 10 |
| 25” | 900 | 20 |

## Pulley Alignment/Proper Belt Tension

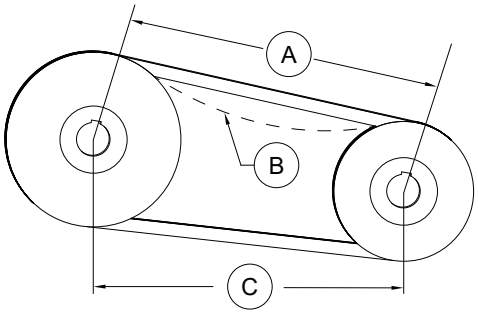
1. Belts tend to stretch and settle into pulleys after an initial start-up sequence. **Do not tension belts by changing the setting of the motor pulley**, this will change the fan speed and may damage the motor.
   - To re-tension belts, turn OFF power to the fan motor.
   - Loosen all fasteners that hold the blower motor plate to the blower housing.
   - Rotate the motor to the left or right to adjust the belt tension. Belt tension should be adjusted to allow 1/64” of deflection per inch of belt span. Use extreme care when adjusting V-belts as not to misalign pulleys. Any misalignment will cause a sharp reduction in belt life and produce squeaky noises. Over-tightening will cause excessive belt and bearing wear as well as noise. Too little tension will cause slippage at start-up and uneven wear.
   - **Whenever belts are removed or installed, never force belts over pulleys without loosening motor first to relieve belt tension.** When replacing belts, use the same type as supplied by the manufacturer. On units shipped with double groove pulleys, matched belts should always be used.
2. All fasteners should be checked for tightness each time maintenance checks are performed before restarting unit.

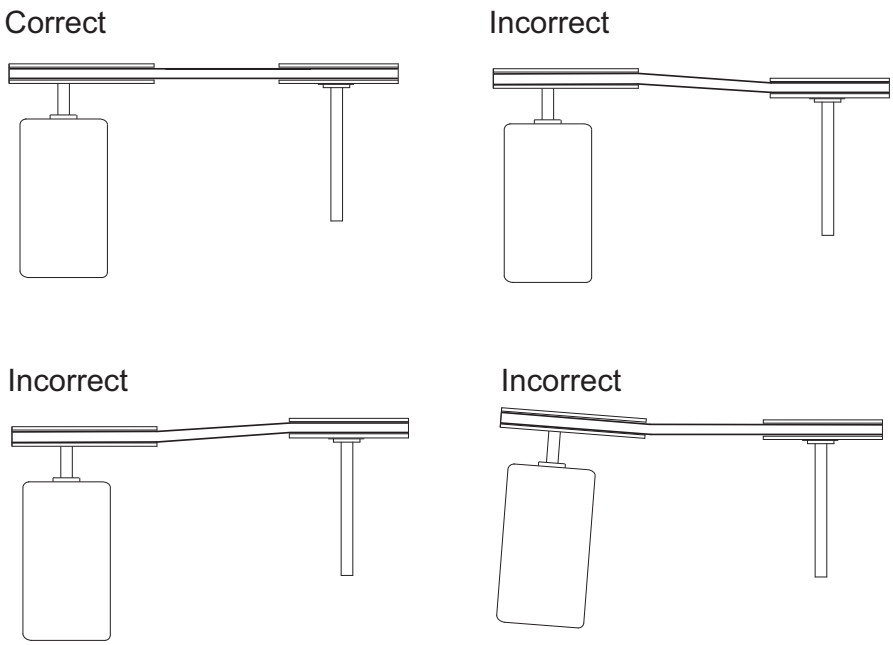
**Belt tension examples:**

- Belt span 12” = 3/16” deflection
- Belt span 32” = 1/2” deflection

**Figure 41 - Pulley Alignment/Belt Tension**

A. Belt Span Length
B. Deflection
C. Center Distance



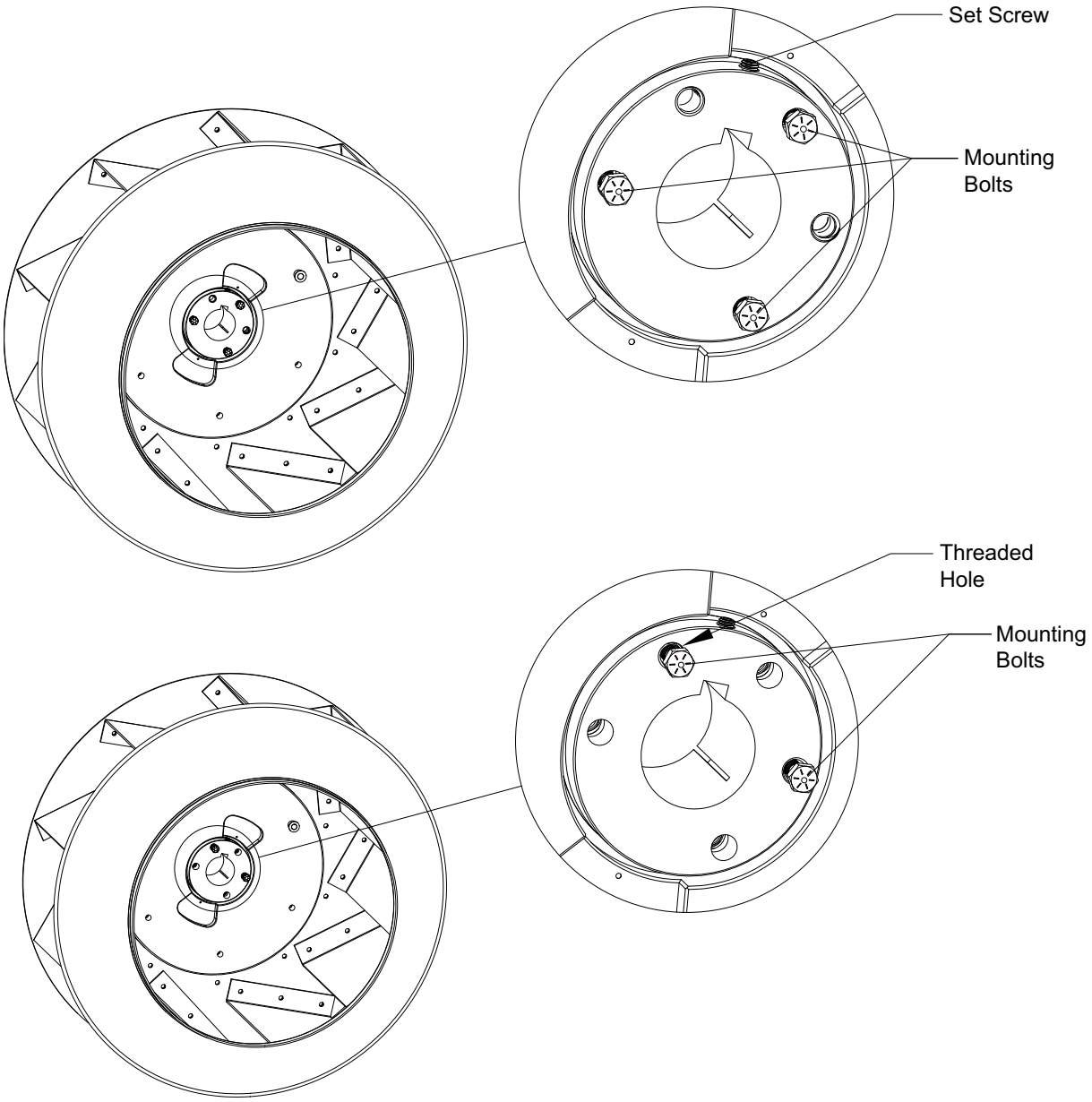
## Bushing Information

### Removing Fan Wheel

Location of hardware differs depending on hub configuration in **Figure 43 on page 51**. Refer to **Figure 42** for details on removing fan wheel from motor shaft.

1. Loosen set screw on bushing (excludes fan wheels that use H bushing).
2. Remove mounting bolts from bushing.
3. There are threaded holes provided on the bushing. These holes are used for removing the bushing. Using mounting bolts from previous step; slowly thread bolts into threaded holes in the bushing. Alternate tightening bolts after each full turn.
4. Continue until fan wheel can be removed by hand.
5. Remove mounting bolts on motor and remove motor shaft from fan wheel.

**Figure 42 - Fan Wheel Removal from Motor Shaft**



### Installing Fan Wheel

Refer to **Figure 43** for fan bushing assembly details. **Bushing type is stamped on the face of the bushing.**

1. Place bushing key into bushing slot **(A)**, excludes H bushing.
2. Install bushing into wheel hub. Align bushing key with hub keyway **(B)**.
3. Use blue Loctite on the mounting bolts.
4. Install wheel assembly so that the bushing keyway **(C)** is aligned with the motor's shaft key **(D)**.
5. For Direct Drive motors, make sure the bushing is flush to the tip of the motor shaft.
6. For Belt Drive motors, make sure the wheel is properly aligned to the inlet.
7. Tighten set screw to lock shaft key in place. Install bolts and torque to proper setting listed in **Table 7**.
8. There are threaded holes provided on the bushing. These holes are for removing the bushing when required.

**Figure 43 - Bushing Details**

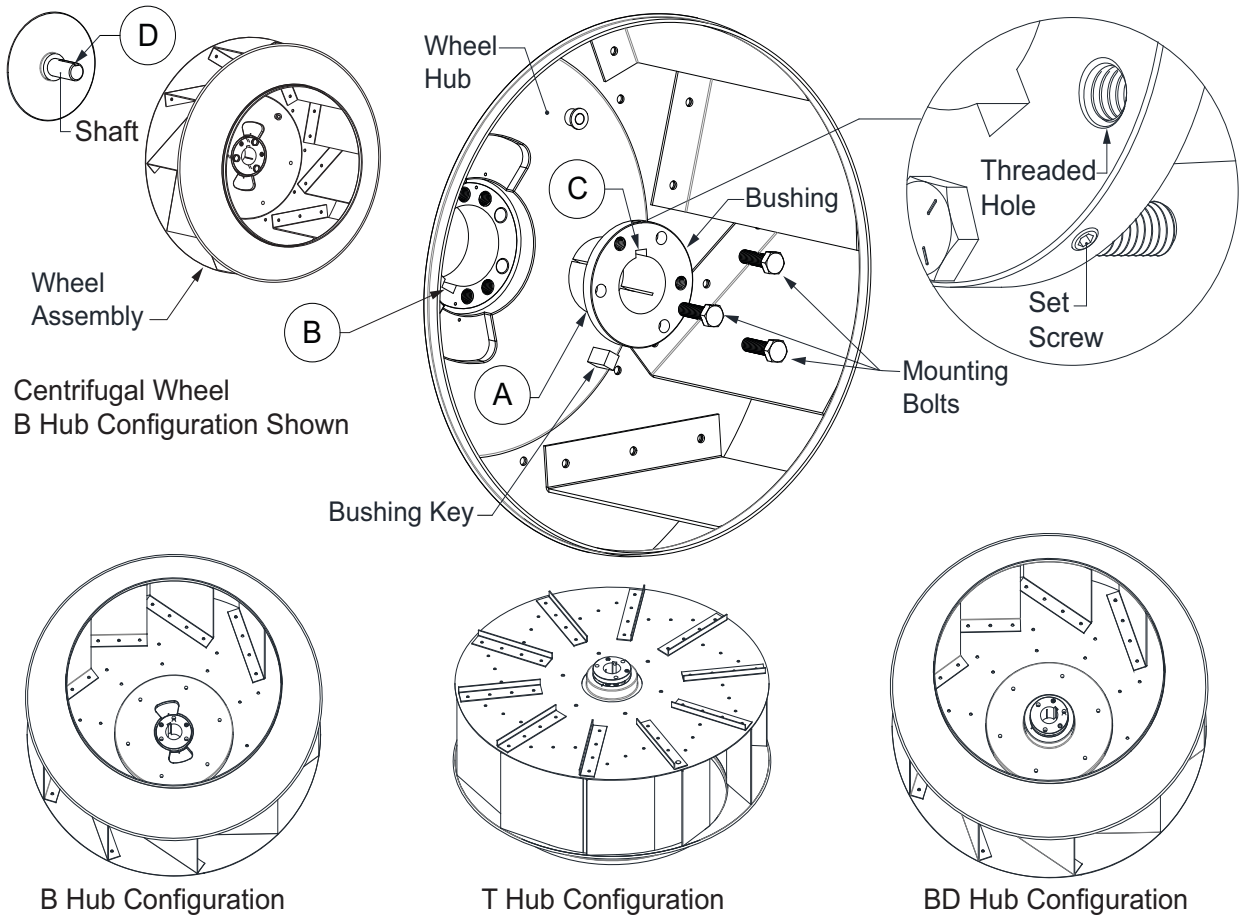



**Table 7 - Bushing Specifications**

| Bushing Type | Outer Diameter | Bolt Size | Torque (In-lbs) | Set-Screw (in-lbs) |
|---|---|---|---|---|
| H | 2-1/2" | 1/4" X 3/4" | 95 | 17 |
| P1 | 3" | 5/16" X 1" | 192 | 65 |
| Q1 | 4-1/8" | 3/8" X 1-1/4" | 348 | 115 |

# Pulley Combination Chart

| Motor RPM | | 1725 | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **1/3 to 1-1/2 HP** | | MOTOR PULLEY | Dd1 | Dd2 | Pd1 | Pd2 | | | | | | | | |
| **AX BELTS** | | 1VL34 | 1.9 | 2.9 | 2 | 3 | | | | | | | | |
| | | | Open | | | | | | TURNS ON MOTOR PULLEY | | | | | Closed |
| BLOWER PULLEY | DATUM DIAMETER | PITCH DIAMETER | 5 | 4 1/2 | 4 | 3 1/2 | 3 | 2 1/2 | 2 | 1 1/2 | 1 | 1/2 | 0 | |
| AK114 | 11 | 11.2 | 308 | 323 | 339 | 354 | 370 | 385 | 400 | 416 | 431 | 447 | 462 | |

| **1/3 to 1-1/2 HP** | | MOTOR PULLEY | Dd1 | Dd2 | Pd1 | Pd2 | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **AX BELTS** | | 1VL40 | 2.4 | 3.4 | 2.6 | 3.6 | | | | | | | | |
| | | | Open | | | | | | TURNS ON MOTOR PULLEY | | | | | Closed |
| BLOWER PULLEY | DATUM DIAMETER | PITCH DIAMETER | 5 | 4 1/2 | 4 | 3 1/2 | 3 | 2 1/2 | 2 | 1 1/2 | 1 | 1/2 | 0 | |
| AK114 | 11 | 11.2 | 400 | 416 | 431 | 447 | 462 | 477 | 493 | 508 | 524 | 539 | 554 | |
| AK94 | 9 | 9.2 | 488 | 506 | 525 | 544 | 563 | 581 | 600 | 619 | 638 | 656 | 675 | |
| AK79 | 7.5 | 7.7 | 582 | 605 | 627 | 650 | 672 | 694 | 717 | 739 | 762 | 784 | 806 | |
| AK66 | 6.2 | 6.4 | 701 | 728 | 755 | 782 | 809 | 836 | 863 | 889 | 916 | 943 | 970 | |
| AK54 | 5 | 5.2 | 863 | 896 | 929 | 962 | 995 | 1028 | 1062 | 1095 | 1128 | 1161 | 1194 | |
| AK46 | 4.2 | 4.4 | 1019 | 1059 | 1098 | 1137 | 1176 | 1215 | 1255 | 1294 | 1333 | 1372 | 1411 | |
| AK39 | 3.5 | 3.7 | 1212 | 1259 | 1305 | 1352 | 1399 | 1445 | 1492 | 1539 | 1585 | 1632 | 1678 | |
| AK32 | 3 | 3.2 | 1402 | 1455 | 1509 | 1563 | 1617 | 1671 | 1725 | 1779 | 1833 | 1887 | 1941 | |

| **2 to 5 HP** | | MOTOR PULLEY | Dd1 | Dd2 | Pd1 | Pd2 | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **BX BELTS** | | 2VP42 | 2.9 | 3.9 | 3 | 4 | | | | | | | | | |
| | | | Open | | | | | | | TURNS ON MOTOR PULLEY | | | | | Closed |
| BLOWER PULLEY | DATUM DIAMETER | PITCH DIAMETER | 6 | 5 1/2 | 5 | 4 1/2 | 4 | 3 1/2 | 3 | 2 1/2 | 2 | 1 1/2 | 1 | 1/2 | 0 |
| 2BK160H | 15.4 | 15.7 | 330 | 339 | 348 | 357 | 366 | 375 | 385 | 394 | 403 | 412 | 421 | 430 | 439 |
| 2BK140H | 13.4 | 13.7 | 378 | 388 | 399 | 409 | 420 | 430 | 441 | 451 | 462 | 472 | 483 | 493 | 504 |
| 2BK120H | 11.4 | 11.7 | 442 | 455 | 467 | 479 | 491 | 504 | 516 | 528 | 541 | 553 | 565 | 577 | 590 |
| 2BK110H | 10.4 | 10.7 | 484 | 497 | 511 | 524 | 537 | 551 | 564 | 578 | 591 | 605 | 618 | 631 | 645 |
| 2BK100H | 9.4 | 9.7 | 534 | 548 | 563 | 578 | 593 | 608 | 622 | 637 | 652 | 667 | 682 | 697 | 711 |
| 2BK90H | 8.4 | 8.7 | 595 | 611 | 628 | 644 | 661 | 677 | 694 | 710 | 727 | 744 | 760 | 777 | 793 |
| 2BK80H | 7.4 | 7.7 | 672 | 691 | 709 | 728 | 747 | 765 | 784 | 803 | 821 | 840 | 859 | 877 | 896 |
| 2BK70H | 6.4 | 6.7 | 772 | 794 | 815 | 837 | 858 | 880 | 901 | 923 | 944 | 965 | 987 | 1008 | 1030 |
| 2BK60H | 5.4 | 5.7 | 908 | 933 | 958 | 984 | 1009 | 1034 | 1059 | 1084 | 1110 | 1135 | 1160 | 1185 | 1211 |
| 2BK55H | 4.9 | 5.2 | 995 | 1023 | 1050 | 1078 | 1106 | 1133 | 1161 | 1189 | 1216 | 1244 | 1272 | 1299 | 1327 |
| 2BK50H | 4.4 | 4.7 | 1101 | 1132 | 1162 | 1193 | 1223 | 1254 | 1285 | 1315 | 1346 | 1376 | 1407 | 1438 | 1468 |

| **7-1/2 to 10 HP** | | MOTOR PULLEY | Dd1 | Dd2 | Pd1 | Pd2 | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **BX BELTS** | | 2VP60 | 4.3 | 5.5 | 4.7 | 5.9 | | | | | | | | | |
| | | | Open | | | | | | | TURNS ON MOTOR PULLEY | | | | | Closed |
| BLOWER PULLEY | DATUM DIAMETER | PITCH DIAMETER | 6 | 5 1/2 | 5 | 4 1/2 | 4 | 3 1/2 | 3 | 2 1/2 | 2 | 1 1/2 | 1 | 1/2 | 0 |
| 2BK160H | 15.4 | 15.7 | 516 | 527 | 538 | 549 | 560 | 571 | 582 | 593 | 604 | 615 | 626 | 637 | 648 |
| 2BK140H | 13.4 | 13.7 | 592 | 604 | 617 | 630 | 642 | 655 | 667 | 680 | 693 | 705 | 718 | 730 | 743 |
| 2BK120H | 11.4 | 11.7 | 693 | 708 | 722 | 737 | 752 | 767 | 781 | 796 | 811 | 826 | 840 | 855 | 870 |
| 2BK110H | 10.4 | 10.7 | 758 | 774 | 790 | 806 | 822 | 838 | 854 | 871 | 887 | 903 | 919 | 935 | 951 |
| 2BK100H | 9.4 | 9.7 | 836 | 854 | 871 | 889 | 907 | 925 | 943 | 960 | 978 | 996 | 1014 | 1031 | 1049 |
| 2BK90H | 8.4 | 8.7 | 932 | 952 | 972 | 991 | 1011 | 1031 | 1051 | 1071 | 1091 | 1110 | 1130 | 1150 | 1170 |
| 2BK80H | 7.4 | 7.7 | 1053 | 1075 | 1098 | 1120 | 1143 | 1165 | 1187 | 1210 | 1232 | 1255 | 1277 | 1299 | 1322 |

| **3 to 5 HP** | | MOTOR PULLEY | Dd1 | Dd2 | Pd1 | Pd2 | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **BX BELTS** | | 2VP42 | 2.9 | 3.9 | 3 | 4 | | | | | | | | | |
| | | | Open | | | | | | | TURNS ON MOTOR PULLEY | | | | | Closed |
| BLOWER PULLEY | DATUM DIAMETER | PITCH DIAMETER | 6 | 5 1/2 | 5 | 4 1/2 | 4 | 3 1/2 | 3 | 2 1/2 | 2 | 1 1/2 | 1 | 1/2 | 0 |
| 2B5V278 | 27.8 | 28.1 | 184 | 189 | 194 | 200 | 205 | 210 | 215 | 220 | 225 | 230 | 235 | 240 | 246 |
| 2B5V250 | 25 | 25.3 | 205 | 210 | 216 | 222 | 227 | 233 | 239 | 244 | 250 | 256 | 261 | 267 | 273 |
| 2B5V234 | 23.4 | 23.7 | 218 | 224 | 230 | 237 | 243 | 249 | 255 | 261 | 267 | 273 | 279 | 285 | 291 |
| 2B5V200 | 20 | 20.3 | 255 | 262 | 269 | 276 | 283 | 290 | 297 | 304 | 312 | 319 | 326 | 333 | 340 |
| 2B5V184 | 18.4 | 18.7 | 277 | 284 | 292 | 300 | 307 | 315 | 323 | 331 | 338 | 346 | 354 | 361 | 369 |
| 2B5V160 | 16 | 16.3 | 317 | 326 | 335 | 344 | 353 | 362 | 370 | 379 | 388 | 397 | 406 | 414 | 423 |
| 2B5V154 | 15.4 | 15.7 | 330 | 339 | 348 | 357 | 366 | 375 | 385 | 394 | 403 | 412 | 421 | 430 | 439 |
| 2B5V136 | 12.6 | 12.9 | 401 | 412 | 423 | 435 | 446 | 457 | 468 | 479 | 490 | 501 | 513 | 524 | 535 |
| 2B5V124 | 12.4 | 12.7 | 407 | 419 | 430 | 441 | 453 | 464 | 475 | 487 | 498 | 509 | 521 | 532 | 543 |
| 2B5V110 | 11 | 11.3 | 458 | 471 | 483 | 496 | 509 | 522 | 534 | 547 | 560 | 572 | 585 | 598 | 611 |

| **7-1/2 to 10 HP** | | MOTOR PULLEY | Dd1 | Dd2 | Pd1 | Pd2 | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **BX BELTS** | | 2VP60 | 4.3 | 5.5 | 4.7 | 5.9 | | | | | | | | | |
| | | | Open | | | | | | | TURNS ON MOTOR PULLEY | | | | | Closed |
| BLOWER PULLEY | DATUM DIAMETER | PITCH DIAMETER | 6 | 5 1/2 | 5 | 4 1/2 | 4 | 3 1/2 | 3 | 2 1/2 | 2 | 1 1/2 | 1 | 1/2 | 0 |
| 2B5V278 | 27.8 | 28.1 | 289 | 295 | 301 | 307 | 313 | 319 | 325 | 331 | 338 | 344 | 350 | 356 | 362 |
| 2B5V250 | 25 | 25.3 | 320 | 327 | 334 | 341 | 348 | 355 | 361 | 368 | 375 | 382 | 389 | 395 | 402 |
| 2B5V234 | 23.4 | 23.7 | 342 | 349 | 357 | 364 | 371 | 378 | 386 | 393 | 400 | 408 | 415 | 422 | 429 |
| 2B5V200 | 20 | 20.3 | 399 | 408 | 416 | 425 | 433 | 442 | 450 | 459 | 467 | 476 | 484 | 493 | 501 |
| 2B5V184 | 18.4 | 18.7 | 434 | 443 | 452 | 461 | 470 | 480 | 489 | 498 | 507 | 517 | 526 | 535 | 544 |
| 2B5V160 | 16 | 16.3 | 497 | 508 | 519 | 529 | 540 | 550 | 561 | 571 | 582 | 593 | 603 | 614 | 624 |
| 2B5V154 | 15.4 | 15.7 | 516 | 527 | 538 | 549 | 560 | 571 | 582 | 593 | 604 | 615 | 626 | 637 | 648 |
| 2B5V136 | 12.6 | 12.9 | 628 | 642 | 655 | 669 | 682 | 695 | 709 | 722 | 735 | 749 | 762 | 776 | 789 |
| 2B5V124 | 12.4 | 12.7 | 638 | 652 | 666 | 679 | 693 | 706 | 720 | 733 | 747 | 761 | 774 | 788 | 801 |
| 2B5V110 | 11 | 11.3 | 717 | 733 | 748 | 763 | 779 | 794 | 809 | 824 | 840 | 855 | 870 | 885 | 901 |

| **15 to 20 HP** | | MOTOR PULLEY | Dd1 | Dd2 | Pd1 | Pd2 | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **BX BELTS** | | 2VP75 | 5.8 | 7 | 6.2 | 7.4 | | | | | | | | | |
| | | | Open | | | | | | | TURNS ON MOTOR PULLEY | | | | | Closed |
| BLOWER PULLEY | DATUM DIAMETER | PITCH DIAMETER | 6 | 5 1/2 | 5 | 4 1/2 | 4 | 3 1/2 | 3 | 2 1/2 | 2 | 1 1/2 | 1 | 1/2 | 0 |
| 2B5V278 | 27.8 | 28.1 | 381 | 387 | 393 | 399 | 405 | 411 | 417 | 424 | 430 | 436 | 442 | 448 | 454 |
| 2B5V250 | 25 | 25.3 | 423 | 430 | 436 | 443 | 450 | 457 | 464 | 470 | 477 | 484 | 491 | 498 | 505 |
| 2B5V234 | 23.4 | 23.7 | 451 | 459 | 466 | 473 | 480 | 488 | 495 | 502 | 509 | 517 | 524 | 531 | 539 |
| 2B5V200 | 20 | 20.3 | 527 | 535 | 544 | 552 | 561 | 569 | 578 | 586 | 595 | 603 | 612 | 620 | 629 |
| 2B5V184 | 18.4 | 18.7 | 572 | 581 | 590 | 600 | 609 | 618 | 627 | 636 | 646 | 655 | 664 | 673 | 683 |
| 2B5V160 | 16 | 16.3 | 656 | 667 | 677 | 688 | 698 | 709 | 720 | 730 | 741 | 751 | 762 | 773 | 783 |
| 2B5V154 | 15.4 | 15.7 | 681 | 692 | 703 | 714 | 725 | 736 | 747 | 758 | 769 | 780 | 791 | 802 | 813 |
| 2B5V136 | 12.6 | 12.9 | 829 | 842 | 856 | 869 | 883 | 896 | 909 | 923 | 936 | 949 | 963 | 976 | 990 |

# TROUBLESHOOTING

The troubleshooting section lists causes and corrective actions for possible problems with the equipment. Review this section prior to consulting the manufacturer.

## Airflow Troubleshooting Chart

| Problem | Potential Cause | Corrective Action |
|---|---|---|
| Fan Inoperative | Blown fuse/Open circuit breaker | Check amperage. |
| | | Check fuse, replace if needed. |
| | | Check circuit breaker. |
| | Disconnect switch in “OFF” position | Place switch to the “ON” position. |
| | Incorrect wiring to motor | Inspect motor wiring. Verify connections with wiring diagram located on fan motor. |
| | Motor starter overloaded | Check amperage. |
| | | Reset starter. |
| Motor Overload | Incorrect fan rotation | Verify that the fan is rotating in the direction shown on rotation label. |
| | Fan speed is too high | Reduce fan RPM. |
| | Incorrect wiring to motor | Inspect motor wiring. Verify connections with wiring diagram located on fan motor. |
| | Overload in starter set too low | Set overload to motor’s FLA value. |
| | Motor HP too low | Determine if HP is sufficient for job. |
| | Duct static pressure lower than design | Reduce fan RPM. |
| Insufficient Airflow | Incorrect fan rotation | Verify that the fan is rotating in the direction shown on rotation label. |
| | Poor outlet conditions | Check duct and connections. There should be a straight duct connection to the outlet. |
| | Intake damper not fully open | Inspect damper linkage. If the linkage is damaged, replace damper motor. |
| | Duct static pressure higher than design | Check ductwork. Adjust/resize to eliminate or reduce duct losses. |
| | Blower speed too low | Increase fan RPM. Do not overload motor. |
| | Supply grills or registers closed | Open/Adjust. |
| | Dirty/clogged filters | Clean filters. Replace filters if they cannot be cleaned or are damaged. |
| Excessive Airflow | Fan speed is too high | Reduce fan RPM. |
| | Filters not installed | Install filters. |
| | Duct static pressure lower than design | Reduce fan RPM. |
| Excessive Vibration and Noise | Damaged/Unbalanced wheel | Replace wheel. |
| | Fan is operating in unstable region of fan curve | Refer to performance curve for fan. |
| | Bearings need lubrication/Damaged bearing | Lubricate bearings, replace if damaged. |
| | Fan speed is too high | Reduce fan RPM. |
| | Dirty/oily belt(s) | Clean belt(s). |
| | Belt(s) too loose | Adjust, replace if necessary. |
| | Worn belt(s) | Replace belt(s). |
| | Misaligned pulleys | Align pulleys. |

## MSC Troubleshooting

| Fault | Problem | Potential Cause | Corrective Action |
|---|---|---|---|
| Feedback Fault | Feedback Fault on MSC Display | Disconnected/faulty wiring | Secure connections to fan. If faulty wiring is found, repair or replace as required. |
| | | No feedback for 30 seconds | Check parameters. |
| | | Less than 70% of RPM | Check duct/fan for obstructions. |
| Modbus | Modbus fault on MSC Display | Faulty Cat 5 connection/cable | Find and replace faulty cable. |
| | | ECPM03 does not recognize device | Verify Modbus # on device is set correctly. |
| Variable Device Fault | Motor not responding to changes made on variable device (potentiometer) | Defective potentiometer | Replace potentiometer. |
| | | Faulty wiring to motor | Find and replace faulty wiring. |
| Motor not responding | Motor not functioning as expected | 2-Speed switch not working | Check switch and wiring. |
| | | Wiring to motor defective | Find and replace faulty wiring. |
| | | Check for other faults on MSC display | If no other faults are present, motor may be defective. |

**TURN OFF POWER TO THE MOTOR WHILE PROGRAMMING THIS DEVICE.**

- If the device has a potentiometer or a 2-Speed switch, a jumper wire can be placed in between the 10V In and 10V Out terminals to rule out a defective device. This will cause the motor to go to HIGH SPEED.
- The IO STATUS menu can be used to verify the inputs and outputs of the device are functioning as expected.
- The FAULT HISTORY menu can be used to keep track of faults while working on the device.

# MAINTENANCE

To guarantee trouble-free operation of this fan, the manufacturer suggests following these guidelines. Most problems associated with fan failures are directly related to poor service and maintenance.

Please record any maintenance or service performed on this fan in the documentation section located at the end of this manual.

## General Maintenance

- Fan inlet and approaches to ventilator should be kept clean and free from any obstruction.
- All fasteners and electrical connections should be checked for tightness each time maintenance checks are performed before restarting unit.
- These units require very little attention when moving clean air. Occasionally oil and dust may accumulate, causing imbalance. If the fan is installed in a corrosive or dirty atmosphere, periodically inspect and clean the wheel, inlet, and other moving parts to ensure smooth and safe operation.
- Motors are normally permanently lubricated. Check bearings periodically. If they have grease fittings lubricate each season. Use caution when lubricating bearings. Wipe the fittings clean and lubricate the unit while rotating with your hand. **CAUTION: Use care when touching the exterior of an operating motor. Components may be hot enough to burn or cause injury.**
- If bearings require lubrication, very little is needed. A general rule is one-half pump from a grease gun for 1/2” to 1-7/16” shaft diameters and one full pump for 1-11/16” and large diameter shafts for every 1500 to 3000 hours of operation. A lithium-based grease should be used. Bearings should be rotated as they are lubricated to evenly distribute the grease, either by hand or via extended grease lines. Do not attempt to grease bearings from inside the enclosure while the motor is energized. **CAUTION: Bearings are sealed, over-greasing can cause damage to the bearings. Do not grease until grease comes out of seals. Only add the appropriate amount of grease.**

## 2 Weeks After Start-up

- All fasteners should be checked for tightness each time maintenance checks are performed before restarting unit.
- For belt drive units, belt tension should be checked after the first 2 weeks of fan operation. **See “Pulley Alignment/Proper Belt Tension” on page 49.**

## Every 3 Months

- Filters need to be cleaned and/or replaced quarterly, and more often in severe conditions. Washable filters can be washed in warm soapy water. When re-installing filters, be sure to install with the **airflow in the correct direction** as indicated on the filter.
- All fasteners should be checked for tightness each time maintenance checks are performed before restarting unit.
- Belt tension should be checked quarterly. **See “Pulley Alignment/Proper Belt Tension” on page 49.** Over-tightening will cause excessive bearing wear and noise. Too little tension will cause slippage at start-up and uneven wear.

## Yearly

- Inspect bolts and set screws for tightness. Tighten as necessary.
- Inspect motor for cleanliness. Clean exterior surfaces only. Remove dust and grease from the motor housing to ensure proper motor cooling.
- Remove dirt and grease from the wheel and housing to prevent imbalance and damage.
- Inspect bearings for wear and deterioration. Replace if necessary.
- Inspect belt wear and replace torn or worn belts.

# Start-up and Maintenance Documentation

**START-UP AND MEASUREMENTS SHOULD BE PERFORMED AFTER THE SYSTEM HAS BEEN AIR BALANCED (Warranty will be void without completion of this form)**

### Job Information

| | | | |
|---|---|---|---|
| Job Name | | Service Company | |
| Address | | Address | |
| City | | City | |
| State | | State | |
| Zip | | Zip | |
| Phone Number | | Phone Number | |
| Fax Number | | Fax Number | |
| Contact | | Contact | |
| Purchase Date | | Start-up Date | |

### Fan Unit Information

Refer to the start-up procedure in this manual to complete this section.

| Name Plate and Unit Information | |
|---|---|
| Model Number | |
| Serial Number | |
| Volts | |
| Hertz | |
| Phase | |
| FLA | |
| HP | |
| Blower Pulley | |
| Motor Pulley | |
| Belt Number | |

| Blower Rotation | |
|---|---|
| Correct | |
| Incorrect | |

| Field Measure Information | |
|---|---|
| Voltage | |
| Amperage** | |
| RPM | |

### Cleaning and Maintenance

| Date | Service Performed | Date | Service Performed |
|---|---|---|---|
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |

**If measured amps exceed the FLA rating on the nameplate, fan RPM must be reduced to decrease the measured amps below the nameplate FLA rating.

**As a result of our dedication to constant improvements and quality, the MANUFACTURER reserves the right to update specifications without notice. Please refer to MANUFACTURER'S website for up to date documentation.**

## Technical Support Information

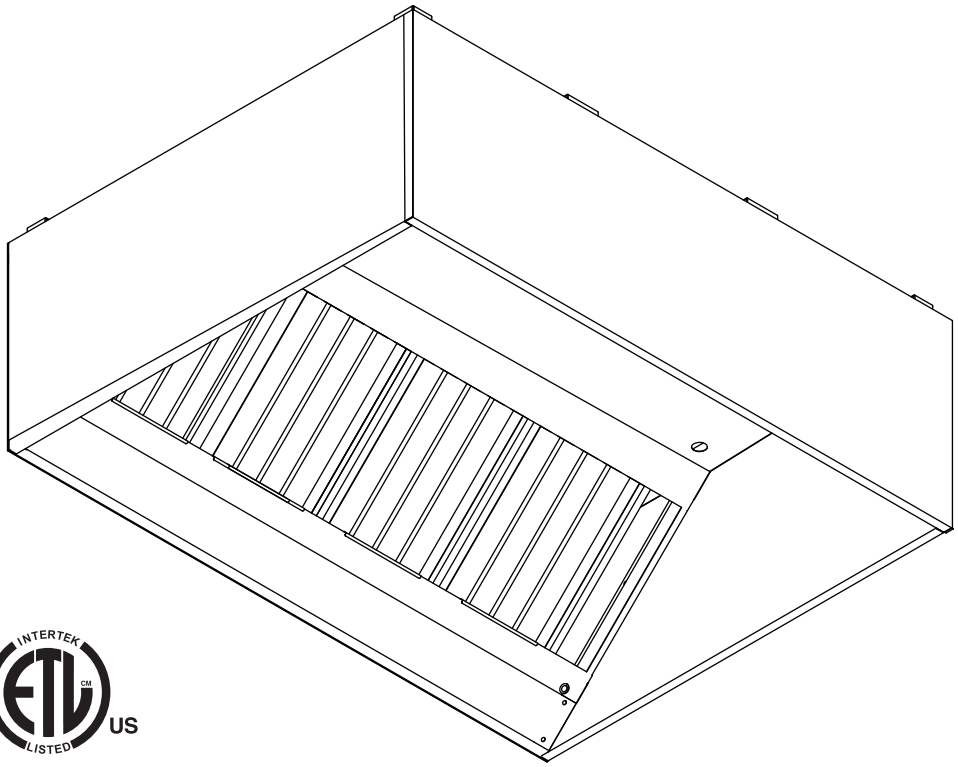
CASLink

Technical Support

Parts Store

Commercial Hoods

# Installation, Operation, and Maintenance Manual



**RECEIVING AND INSPECTION**

**Check for any signs of damage upon receipt, and if found, report it immediately to the carrier. Check that all items are accounted for and free of damage.**

**WARNING!!**

**Installation of this package should only be performed by a qualified professional who has read and understands these instructions and is familiar with proper safety precautions. Improper installation poses serious risk of injury due to electric shock, contact with rotating equipment, and other potential hazards. Read this manual thoroughly before installing or servicing this equipment. ALWAYS disconnect power prior to working on electrical equipment.**

**Save these instructions. This document is the property of the owner of this equipment and is required for future maintenance. Leave this document with the owner when installation or service is complete.**

# Hood, Duct, and Grease Fan Deep Cleaning Instructions

NFPA 96 and International Mechanical Code require hood, exhaust fan, and grease duct cleaning at regular intervals to prevent buildup of grease, creosote, and other contaminants in the hood plenum, duct and fan systems. The frequency of cleaning varies based on cooking load. Refer to **Table 1** for schedule of inspection for grease buildup.

**Table 1 - NFPA 96 Inspection for Grease Buildup**

| Type or Volume of Cooking | Inspection Frequency |
|---|---|
| Systems serving solid fuel cooking operations | Monthly |
| *Systems serving high-volume cooking operations | Quarterly |
| Systems serving moderate-volume cooking operations | Semiannually |
| **Systems serving low-volume cooking operations | Annually |

* High-volume cooking operations include 24-hour cooking, charbroiling, and wok cooking.

** Low-volume cooking operations include churches, day camps, seasonal businesses, and senior centers.

When cleaning, to avoid potential damage to hood and fan controls, the following order of operations is suggested:

1. Ensure that all cooking equipment is off, and all hood, duct and fan systems are cool to the touch.
2. Turn off the Hood Control Panel breaker to avoid signals to enable the fan during washing.

**WARNING: If the Hood Control Panel is left on, heated water on sensors in the hood may cause fans to activate**

3. Remove filters from hood. Place filters in soak tank overnight if heavily soiled. Pressure washing filters may not remove all internal grease.
4. Turn off fans at fan disconnect switch. Hinge all fans back carefully to give access for proper cleaning.
5. Protect all surfaces from water and grease damage from the cleaning process. Use tarps and catch basins as applicable.
6. Proceed to wash the system. Start at the fans, then move down through each duct access door, and finish at the hood plenum. Do not use any caustic or chlorine-based chemicals, which may lead to corrosion of metal surfaces.

**WARNING: Do not pressure wash hood controls, fire systems, or electrical cabinets. The hood's external surfaces should be washed by hand with a washcloth, mild soap and water only.**

7. Reinstall all access doors. Hinge fans back to their bases. Install appropriate hardware to lock in place, and reinstall hood filters.
8. Turn on fan disconnect switches.
9. Turn on hood control panel breaker. **NOTE: This must be done after all fan disconnect switches are back in the on position.**
10. Ensure no error messages are shown on Hood Control HMI Screen.

**WARNING: System may require a GAS reset and relighting of all pilot lights. Do not enable GAS without lighting all pilot lights.**

11. If any error messages are displayed on the HMI or additional support is needed, **Submit a ticket** to Technical Support.

Technical Support

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# WARRANTY

This equipment is warranted to be free from defects in materials and workmanship, under normal use and service, for a period of 2-years from date of shipment. This warranty shall not apply if:

1. The equipment is not installed by a qualified installer per the MANUFACTURER'S installation instructions shipped with the product.
2. The equipment is not installed in accordance with Federal, State, or Local codes and regulations.
3. The equipment is misused or neglected, or not maintained per the MANUFACTURER'S maintenance instructions.
4. The equipment is not installed and operated within the limitations set forth in this manual.
5. The invoice is not paid within the terms of the sales agreement.

The MANUFACTURER shall not be liable for incidental and consequential losses and damages potentially attributable to malfunctioning equipment. Should any part of the equipment prove to be defective in material or workmanship within the 2-year warranty period, upon examination by the MANUFACTURER, such part will be repaired or replaced by MANUFACTURER at no charge. The BUYER shall pay all labor costs incurred in connection with such repair or replacement. Equipment shall not be returned without MANUFACTURER'S prior authorization, and all returned equipment shall be shipped by the BUYER, freight prepaid to a destination determined by the MANUFACTURER.

## Certifications and Patents

This hood is ETL-listed to standard UL710, ULC710, and ULC-S646 when installed in accordance with these installation instructions and National Fire Protection Association Standard "NFPA 96, Standard for Ventilation Control and Fire Protection of Commercial Cooking Operations."

Approved for use in New York City per the Fire Department of New York Certificate of Approval #5804.

The dual supply plenum controlling Make-Up Air and Air Conditioned Air is covered under the following patents: System for Directing and Controlling Two Separate Streams of Air to a Kitchen: United States Patent No. 7963830 B2; Canadian Patent No. CA2820509; Patent No. CA2520330

Exhaust Hoods are covered under the following patent: Kitchen Exhaust Hood Assembly having Components secured together by Threaded Studs: Canadian Patent No. CA2520435C

# INSTALLATION

It is imperative that this unit is installed and operated with the designed airflow, filters, and construction in accordance with this manual. For warranty and technical support, refer to **page 48** for contact information.

**WARNING: IMPROPER INSTALLATION, ADJUSTMENT, ALTERATION, SERVICE, OR MAINTENANCE CAN CAUSE PROPERTY DAMAGE, INJURY, OR DEATH. READ THE INSTALLATION, OPERATION, AND MAINTENANCE INSTRUCTIONS THOROUGHLY BEFORE INSTALLING OR SERVICING THIS EQUIPMENT.**

**WARNING: TO REDUCE THE RISK OF FIRE, USE ONLY METAL DUCTWORK.**

## Site Preparation

1. For indoor use only.
2. Provide clearance around installation site to safely rig and lift equipment into its final position. Consider general service and installation space when locating unit.
3. Locate unit close to the space it will serve to reduce long, twisted duct runs.
4. Thoroughly review the plans and specifications of the project.
5. Determine the exact location in which the cooking hood will be installed and verify that there are no interferences that will prevent proper installation.
6. Verify that all overhead beams and angles are structurally strong enough to support the weight of the hood and hanging system. It is often necessary to strengthen existing structural beams, as they are not designed to carry the weight of a stainless-steel hood. Refer to the project submittal drawing for hood weight(s). It may also be necessary to create a support structure suspended from the ceiling joists to better align with the desired hood location.
7. Determine if adequate room is available to install the hood and all ductwork with proper clearances from combustible material. IMC, NFPA 96, and local Authorities Having Jurisdiction (AHJ) call for a minimum clearance (typically 18 inches for type 1, grease rated hoods) between the cooking hood(s), exhaust ducts, and building materials that are combustible. However, IMC and NFPA 96 outline acceptable clearance reduction methods; **most authorities accept the clearance reduction methods approved in the manufacturer's ETL listing for Type 1, grease rated hoods. See "Clearance Reduction Methods" on page 7.** It is important to check with the local AHJ to determine that the installation method is satisfactory to meet their requirements prior to installing the equipment.

**FOLLOW SMACNA GUIDELINES AND RECOMMENDATIONS FOR HANGING AND INSTALLATION OF HOODS.**

## Clearance Reduction Methods

Clearance reduction methods have been evaluated and tested, and are certified by ETL. The method of testing was derived from UL 710 with temperature criteria taken from appropriate standards. Refer to **Figure 1** through **Figure 3** for clearance reduction details.

The hood may be installed with a 0-inch clearance to combustible materials per ETL if constructed in one of the following methods:

- 1-inch thick minimum layer of insulation of type Owens Corning Type 475 or Johns Manville Type 475 or listed kitchen exhaust duct insulation.
- 1-inch thick minimum insulated backsplash, insulation of type listed above.

To comply with the ETL certification, the cooking appliance must be located:

- At least 6-inches from the rear wall.
- At least 24-inches below the bottom edge of the hood.
- Cooking surface must not exceed temperatures above 700°F.

The hood may be installed with a 3-inch clearance to limited combustible materials per NFPA 96 if constructed in one of the following methods:

- 3-inch factory installed rear uninsulated standoff.
- 3-inch factory installed top wrapper or enclosure panel system.
- 3-inch factory installed end standoff.
- Any insulated surface on the hood may be in contact with a combustible wall or structure.
- Hood surfaces perpendicular to combustible walls or structures do not need to be insulated to maintain the zero inch clearance rating.
- Only the surface of the hood against a combustible wall or structure must be insulated.

For example: On a combustible back wall, only the back of the hood needs to be insulated, even if the back wall extends beyond the back of the hood in any direction.

**Figure 1 - Top Clearance Reduction Options**

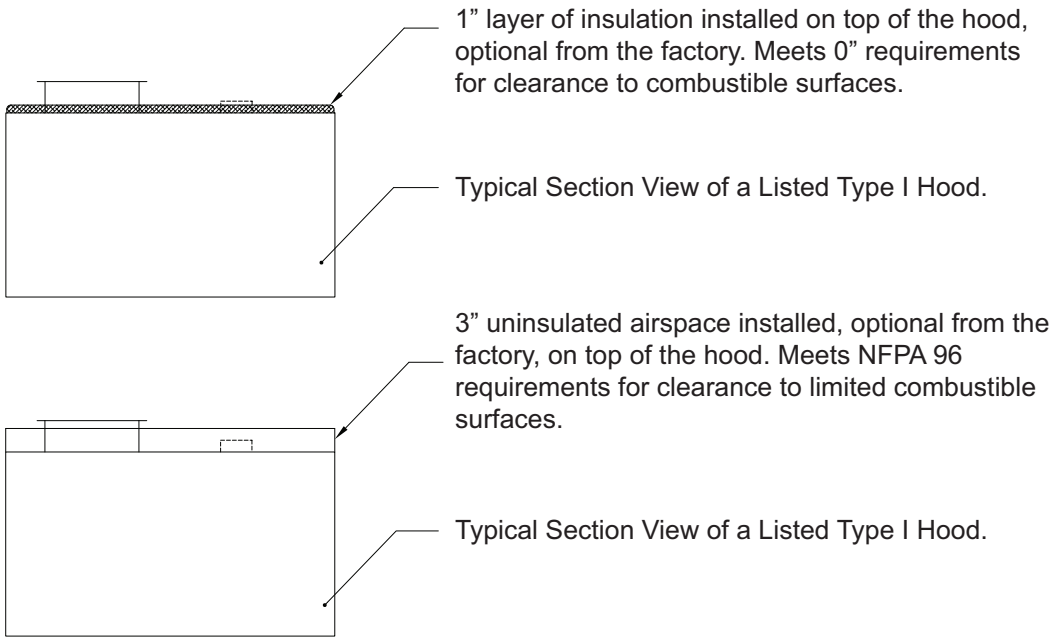


**Figure 2 - End Clearance Reduction Options**

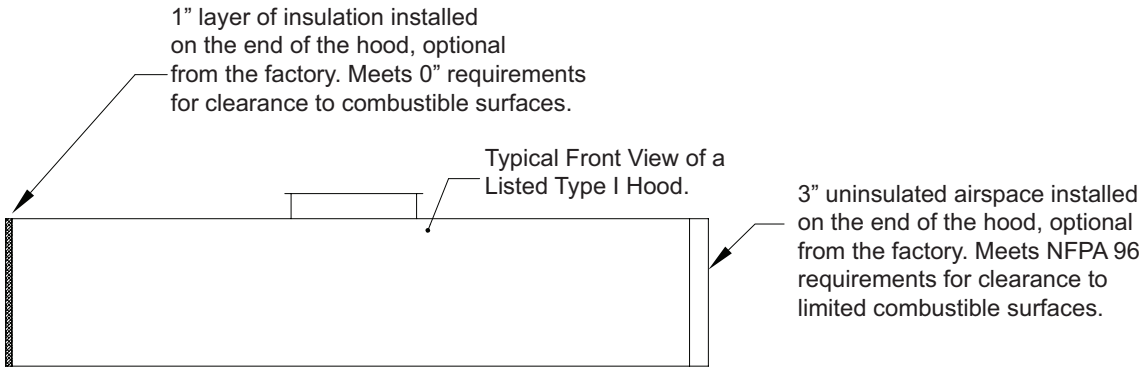
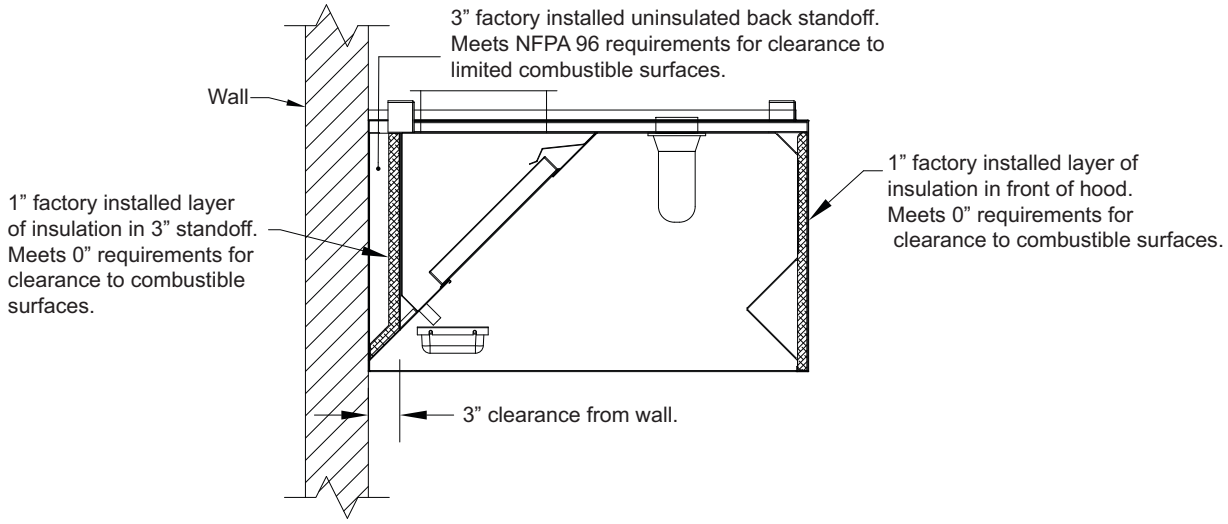



**Figure 3 - Front and Back Clearance Reduction Options**



## Installation of a Single Hood (Wall or Island)

**WARNING: VERTICALLY OR HORIZONTALLY LAGGING HOODS TO WOODEN JOISTS, TRUSSES, OR STUDS IS AN UNACCEPTABLE METHOD FOR HANGING HOODS. THIS WILL LEAD TO BOTH STRUCTURAL AND THERMAL FAILURE CAUSING INJURY AND/OR DEATH.**

The following is a step-by-step procedure for installation of the ventilation hood.

**NOTE: Report any damage to the delivering freight carrier and file a claim if appropriate.**

1. Remove hood from the crate. Be very careful not to dent or scratch the outer surface. Refer to the installation drawing for typical details of the ventilation system prior to hanging the hood. Check the nameplate on the equipment to verify it meets the specifications provided by the architect and/or engineer. **If discrepancies exist, notify the manufacturer immediately**.

   The nameplate will also give information regarding the following: Clearance from cooking surface to front lower edge of the hood, Minimum exhaust air flow, Maximum supply air flow (if applicable), Minimum front overhang from cooking surface, Minimum side overhang from cooking surface, Maximum cooking surface temperature, Replacing fusible links for exhaust and supply damper (if applicable), Replacing filters.
2. Determine the height at which the hood will be hung:
   - **Canopy hoods** are typically hung so that the front lower edge of the hood is within 6'-6" to 7'-0" Above Finished Floor (AFF). However, the hood should be hung so that the proper clearance from the cooking surface to the front lower edge of the hood is maintained. Refer to nameplate for clearance from cooking surface to front lower edge of hood. Exact hood hanging height should be verified with local Authorities Having Jurisdiction (AHJ).

   **NOTE: If there are wrappers (enclosure panels) with the order, measure down from the ceiling height of the wrappers. That will be the top hanging height of the hood as long as the following criteria are met: The front lower edge of the hood is within 6'-6" to 7'-0" AFF. The front lower edge of the hood is within the clearance requirement from the cooking surfaces. If the hanging height based on wrappers does not fall in this range, contact your local office.**

   - **Backshelf hoods** are typically hung at the maximum height allowed from the cooking surfaces. Refer to nameplate for clearance from cooking surface to front lower edge of hood. The exact hood hanging should be verified with local AHJ.

   **NOTE: If there are wrappers with the order, measure down from the ceiling height of the wrappers. That will be the top hanging height of the hood as long as the front lower edge of the hood is within the clearance requirement from the cooking surfaces. If the hanging height based on wrappers does not fall in this range, contact your local office.**
3. If the hood has a bolt-together standoff, install now. **See "Bolt-Together Standoff Installation" on page 19.**
4. If the hood has duct thermostats, install them now per the thermostat installation drawing.
5. Position hood on the floor in its approximate final position with the supply and exhaust risers on the hood located directly beneath the corresponding openings in the roof, if possible. It is advisable to finalize the location using a plumb-bob or laser. **Protect the hood when it is on the jacks to avoid dents, scratches, and other damage to the hood.**
6. Proceed to weld exhaust duct to hood while on the floor, if possible.
7. Use 1/2-inch threaded rod to hang hoods. Drill 9/16-inch holes in the structural support system or use Unistrut to line up with the welded-on angle mounting brackets on the hood. There are several types of mounting brackets depending upon the hood type; each has a pre-drilled hole. **The structural integrity of the structural support system is the responsibility of the contractor and the structural engineer**. Center hanging angles are provided on hoods 12 feet in length and longer. Center hanging angles must be used to support the hood weight and prevent filter fitment and grease drainage issues. Some backshelf hoods do not have hanging angles and must be anchored to a back

wall using the standing flange provided. Structural lag bolts must be used every 12-inches on center maximum and must be secured to studs behind wall. Refer to **Figure 4**.

8. The spacing on the hole for the modified support should line up with the mounting bracket on top of the hood. The top hanger should be 1/2-inch closer to the back wall than the mounting bracket on the hood to pull the hood against the wall. Refer to **Figure 5**. Some hoods are designed for island installations where a wall is not present.
9. With the hood well protected against possible scratching, raise the hood into position using high lifts or equipment jacks at each end to keep the hood level. When the hood is elevated to the proper height, install 1/2-inch threaded rod between each mounting bracket on the hood and the modified support. Secure rods with heavy duty nuts and appropriately sized fender washers above and below the hanging angle.
10. Make final adjustments as needed to ensure the hood is hung level. Maintain tension on all rods to ensure the hood weight is evenly distributed. If it is necessary to stand or work on top of the hood, use pieces of plywood to evenly distribute weight on the hood to prevent damage.
11. Brace hood to ceiling joists and wall(s), as applicable, so that the hood does not move. Secure hood to wall in a manner acceptable to the local AHJ.
12. If installing single PSP/AC-PSP to the hood, install now. **See "Single PSP/AC-PSP Installation" on page 20.**
13. If the hood has multiple Perforated Supply Plenums (PSPs) or AC-PSPs, install them now. **See "Multiple PSP/AC-PSP Installation" on page 21.**
14. Install the exhaust ductwork. The entire exhaust duct system must be continuously welded, liquid tight unless it is Listed Factory Built Grease Duct. The duct must be welded to the hood exhaust collar and the roof curb cap must be welded to the exhaust duct.
15. Install the supply ductwork. **See "Guidelines for Ductwork Installation" on page 18.**
16. If the hood is equipped with a control unit, an installation wiring diagram will be provided inside of the control unit. The jobsite electrician is responsible for making the appropriate field connections. This includes all lights and duct/hood mounted thermostats.

    All field wiring on top of the hood must use high temp wire and wire nuts (black). Wiring must be routed through hard or flex conduit. Route and attach all conduit on top of, or above, structural joists (Hat Channel) on top of hood. Conduit cannot contact the surface of the hood ceiling.
17. If the hood is equipped with a factory pre-piped fire suppression system, a certified fire system installer is responsible for completing the field hookup, testing, and certifying the system in accordance with the manufacturer's specifications and the local fire codes. If the hood is not pre-piped, a certified fire system installer is responsible for installing, testing and certifying the system in accordance with the manufacturer's specifications and the local fire codes.
18. If the hood is equipped with wrappers (enclosure panels), end panels and/or back-splash panels, install them now. **Refer to page 24 through page 33**.
19. Caulk the lower edge of the hood where it meets the wall. This does not apply to hoods installed in island configurations.
20. Install light bulbs, light globes, and grease filters in the hood.
21. Install grease cups in the brackets/slots provided.
22. Use a stainless-steel polish to clean the hood of dust or dirt acquired in transit.
23. It is recommended that the protective plastic sheeting remains on the installed hood until construction is complete, so as to avoid any damage to the equipment.

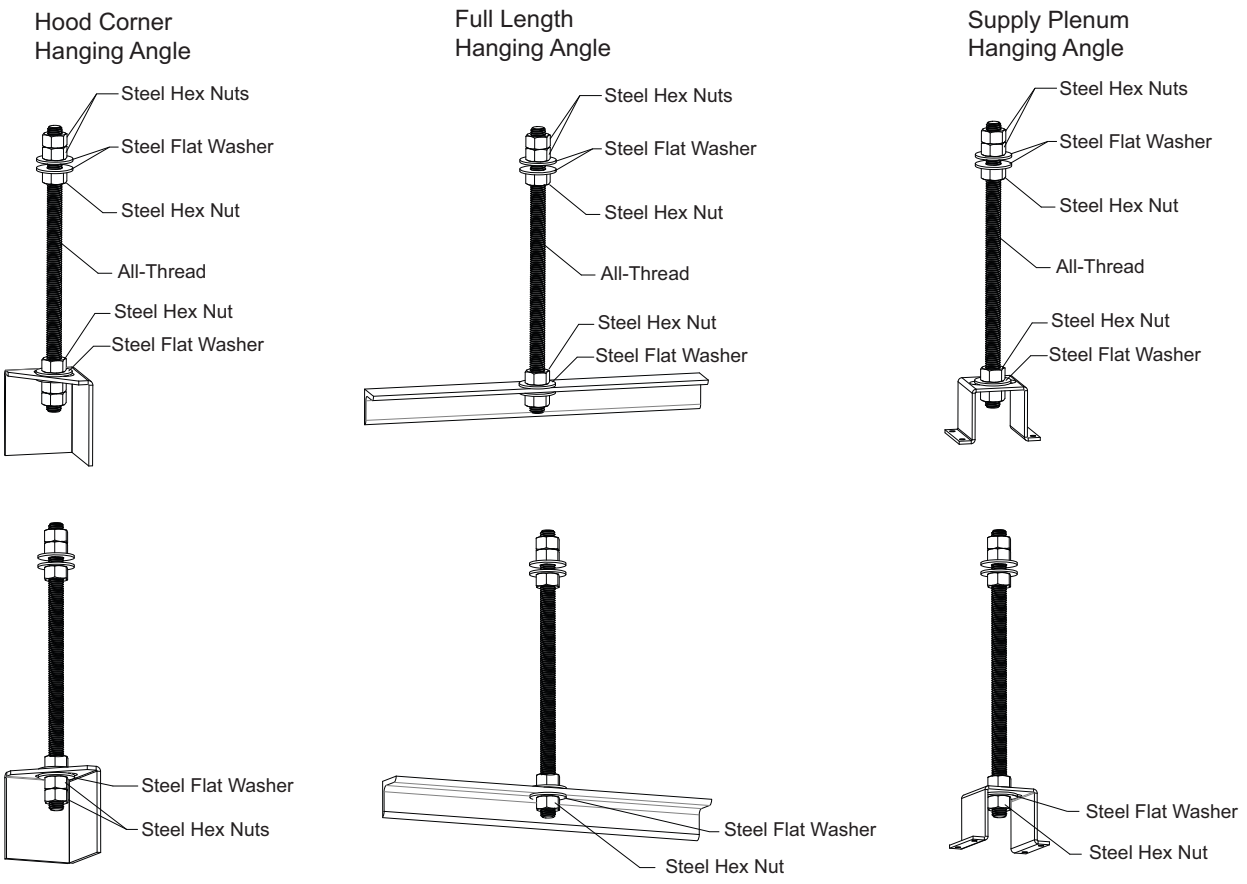
**WARNING: NEVER PUNCTURE THE HOOD GREASE CONTAINMENT AREA TO HANG HOOD OR TO HANG ITEMS FROM HOOD. PUNCTURING THE GREASE CONTAINMENT AREA WILL VOID WARRANTY AND LISTING ON HOOD.**

## Hanging Angle Assembly Instructions

**WARNING: VERTICALLY OR HORIZONTALLY LAGGING HOODS TO WOODEN JOISTS, TRUSSES, OR STUDS IS AN UNACCEPTABLE METHOD FOR HANGING HOODS. THIS WILL LEAD TO BOTH STRUCTURAL AND THERMAL FAILURE CAUSING INJURY AND/OR DEATH.**

- Hanging angle must be supported with 1/2"-13 TPI grade 5 (minimum) all-thread.
- Use 1/2" grade 5 (minimum) steel flat washers and 1/2"-13 TPI grade 5 (minimum) hex nuts to install hanging angles and ceiling anchor points. Refer to **Figure 4** for details.
- Must use doubled hex nut configuration beneath hood hanging angles and above ceiling anchors (single hex nut beneath hanging angle is only acceptable for full length and PSP hanging angle types).
- Maintain 1/4" of exposed threads beneath bottom hex nut.
- Torque all hex nuts to 57 ft-lbs.

**Figure 4 - Hanging Angle Assembly Details**



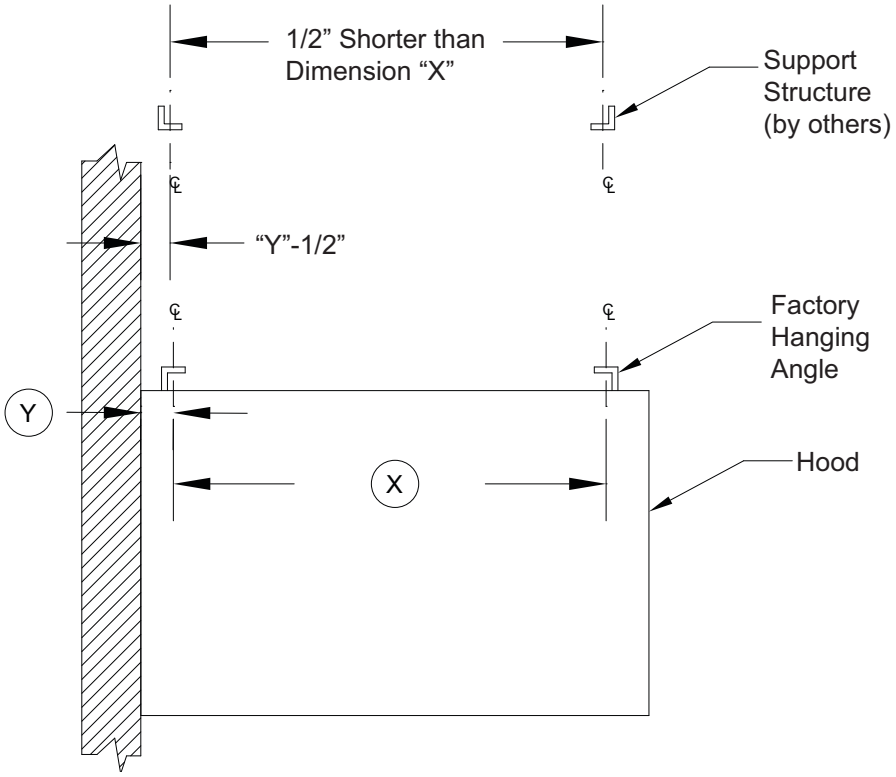
### Typical Hood Side View

Refer to **Figure 5** for side view hanging details.

X. Distance Measured Between Center of Rear Hanging Angle to Center of Front Hanging Angle

Y. Distance Measured from Wall to Center of Rear Hanging Angle

**Figure 5 - Side View**



## Wall-Mount Utility Cabinet (WMUC) Installation

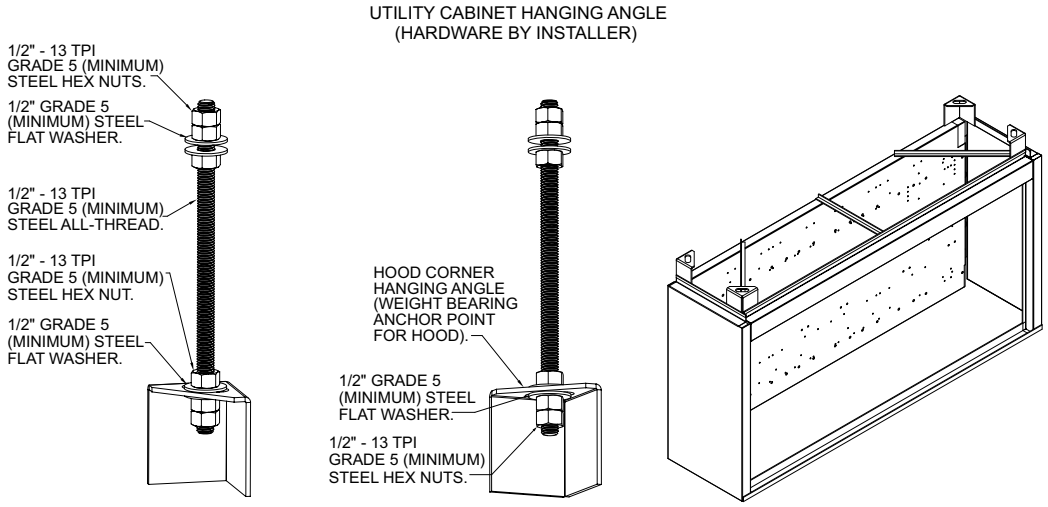
### WMUC Installation with Hanging Angles

The utility cabinet will be field installed by others. Refer to Utility Cabinet Schedule for cabinet size.

The hanging angle must be supported with 1/2”-13 TPI Grade 5 (minimum) All-Thread. Sandwich hanging angles and ceiling anchor points with 1/2” Grade 5 (minimum) steel flat washers and 1/2”-13 TPI Grade 5 (minimum) hex nuts. Refer to **Figure 6**. Hardware provided by others.

1. Must use doubled hex nut configuration beneath utility cabinet hanging angles and above ceiling anchors.
2. Maintain 1/4” of exposed threads beneath bottom hex nut.
3. Torque all hex nuts to 57 ft-lbs.

**Figure 6 - Hanging Angle Mount Details**




### WMUC Wall-Mount Option

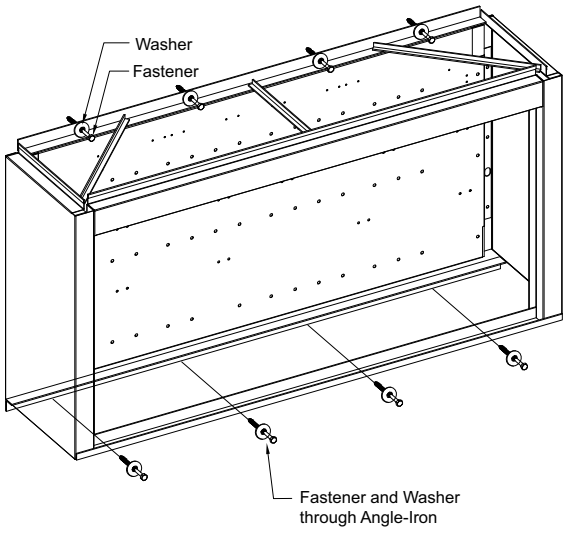
The utility cabinet will be field installed by others. Refer to Utility Cabinet Schedule for cabinet size.

The utility cabinet must be secured to the wall using a minimum of eight (8) fasteners and washers. Use four fasteners/washers on the top of the cabinet, and four fasteners/washers on the bottom. Refer to **Figure 7**.

1. Mark locations in the top and bottom angle-iron of the utility cabinet.
2. Drill pilot holes for fasteners.
3. When installing to the wall:
   - Concrete/Masonry - use 5/16” x 2-1/4” Tapcons.
   - Metal Studs - use 5/16” x 1-1/2” Self Drilling Screws.
   - Wooden Studs - use 5/16” x 3-1/2” Lag Bolts.
   - Drywall (only) - use 5/16” x 4” Long Toggle Bolts.

**NOTE: Wall-mounted utility cabinets up to 48” long, must be secured to 2 studs minimum (top and bottom of the utility cabinet). Wall-mounted utility cabinets over 48” long, must be secured to 3 studs minimum (top and bottom of the utility cabinet).**

**Figure 7 - Wall-Mount Details**



## End-To-End Hoods

1. Follow steps 1 through 9 of the **"Installation of a Single Hood (Wall or Island)" on page 9** for each hood.
2. Adjust tension on hanging rods to position hoods so they will fit flush with each other. Refer to **Figure 8** and **Figure 9**.
3. Bolt the top of the hoods together by sliding a threaded rod through the connection bracket slots and fastening it into position by using heavy duty nuts and washers. Refer to **Figure 10** and **Figure 11**.
4. Once all of the hoods are hung, follow steps 10 through 19 of the **"Installation of a Single Hood (Wall or Island)" on page 9**.

**NOTE: Hoods having more than a 1/8" gap between them must be repositioned so that the gap between the hoods is ≤ 1/8". Run a bead ≥ 1/8" of silicone sealant along the lower horizontal seam of the two hoods. Slip the U-channel trim, if applicable, over the seam as shown in Figure 8. Tape can be used to hold the U-channel in place until the silicone cures. U-channel is not required on hoods with flanged ends.**

5. Run a bead of the same silicone sealant along the front vertical seam between the two hoods. Slip the T-strip trim between the hoods, if applicable. Refer to **Figure 10**. **T-Strip is not required on hoods with flanged ends and fully welded, ground, and polished corners**.
6. Proceed with steps 20 through 23 of the **"Installation of a Single Hood (Wall or Island)" on page 9**.

### Hanging Detail for Multiple Hood Models Hung End-to-End

**Figure 8 - Hemmed Ends**

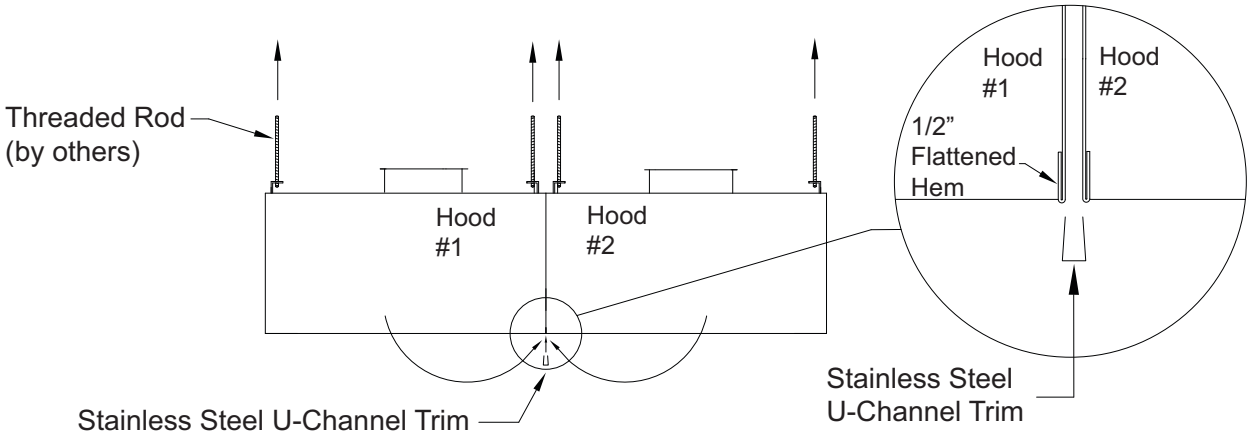
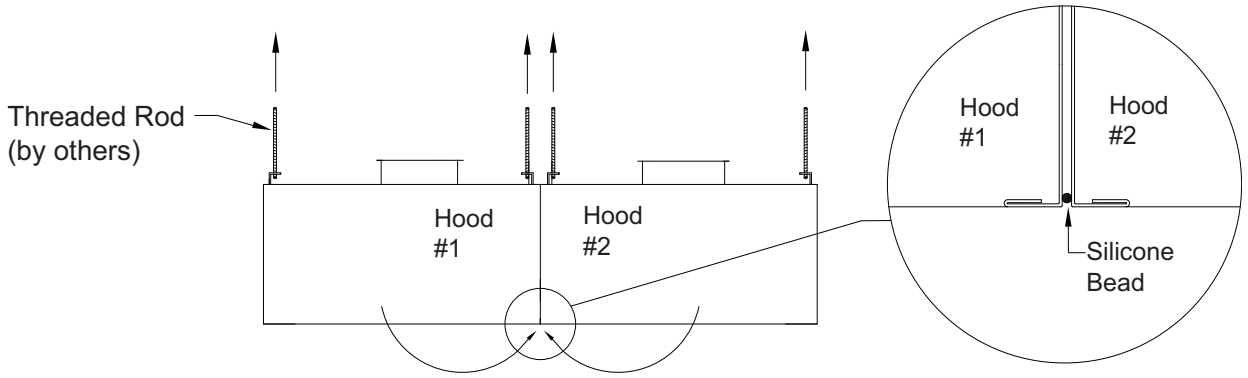


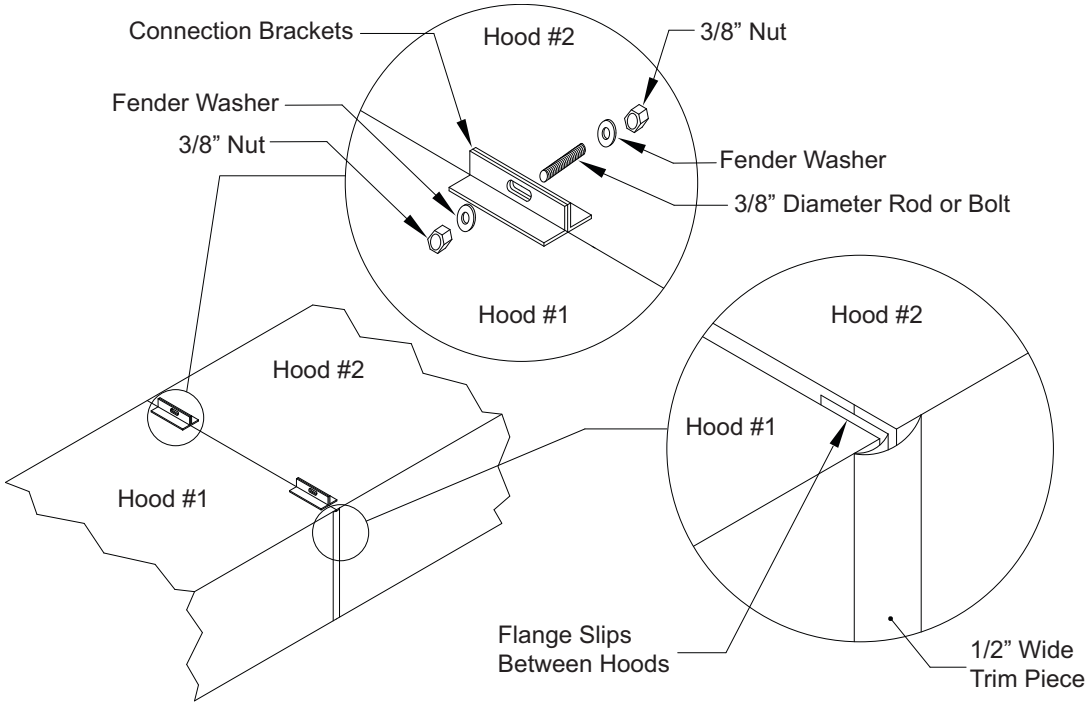

**Figure 9 - Flanged Ends**



## Hood Connection Detail for Multiple Hood Models

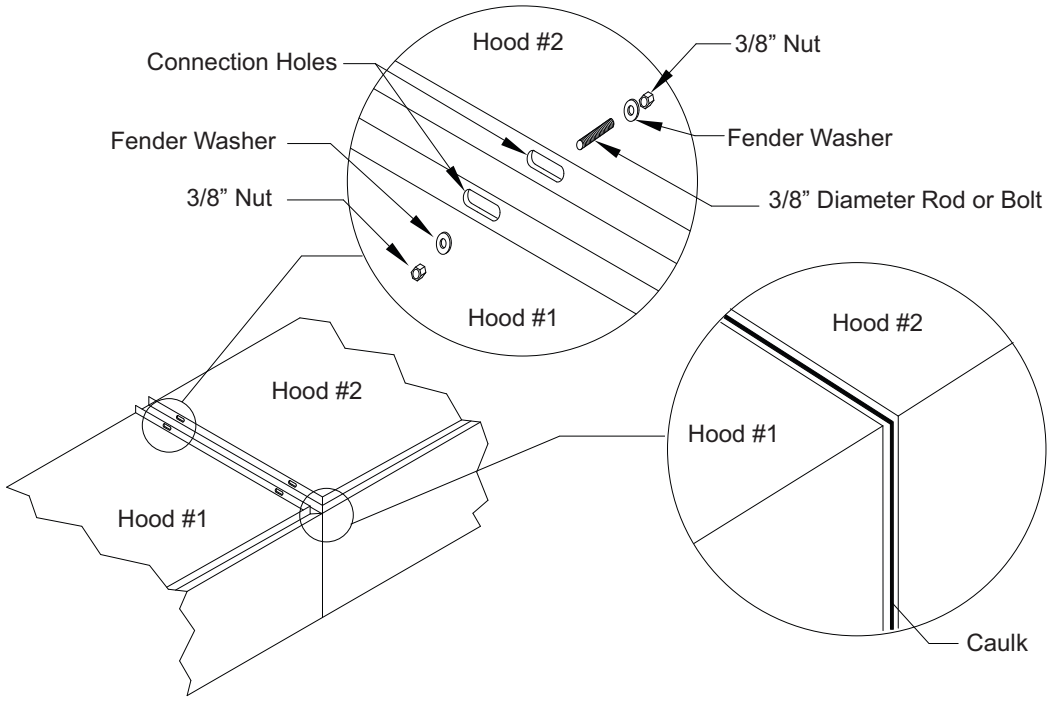
**NOTE: For Figure 10 and Figure 11, the 3/8” Nut, Fender Washer, and Threaded Rod/Bolts are provided by contractor.**

**Figure 10 - Hemmed Ends with Trim Strip**




**NOTE: For Figure 11, once the hoods have been installed, place the hoods back to back. Caulk between the edges prior to bolting them together.**

**Figure 11 - Flanged Ends without Trim Strip**



## Back-to-Back Hoods

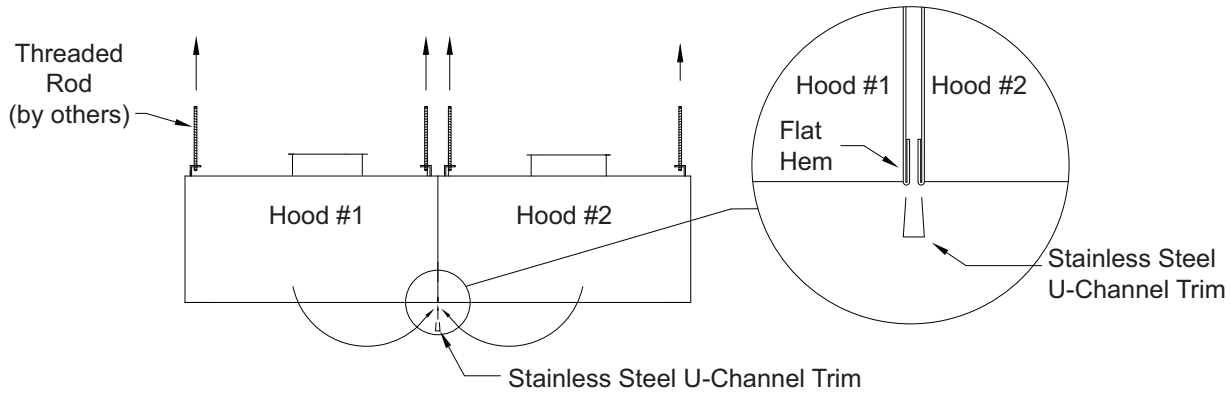
The following is a step-by-step procedure for installation of back-to-back ventilation hoods.

1. Follow steps 1 through 9 of the **"Installation of a Single Hood (Wall or Island)" on page 9** for each hood.
2. Adjust tension on hanging rods to position hoods so they fit flush with each other. Refer to **Figure 12**.
3. Bolt the top of the hoods together by sliding a threaded rod through the connection bracket slots and fastening it into position by using heavy duty nuts and washers. Refer to **Figure 10** and **Figure 11**
4. Once all of the hoods are hung, follow steps 10 through 19 of the **"Installation of a Single Hood (Wall or Island)" on page 9**.

**NOTE: Hoods having more than a 1/8" gap between them must be repositioned so that the gap between the hoods is ≤ 1/8". Run a bead ≥ 1/8" of silicone sealant along the lower horizontal seam of the two hoods. Slip the U-channel trim, if applicable, over the seam as shown in Figure 12. Tape can be used to hold the U-channel in place until the silicone cures.**

5. Run a bead of the same silicone sealant along the front vertical seam between the two hoods. Slip the T-strip trim between the hoods if applicable. Refer to **Figure 10**. **T-Strip is not required on hoods with flanged ends and fully welded, ground, and polished corners**.
6. Proceed with steps 20 through 23 of the **"Installation of a Single Hood (Wall or Island)" on page 9**.

**Figure 12 - Back-to-Back Hoods**



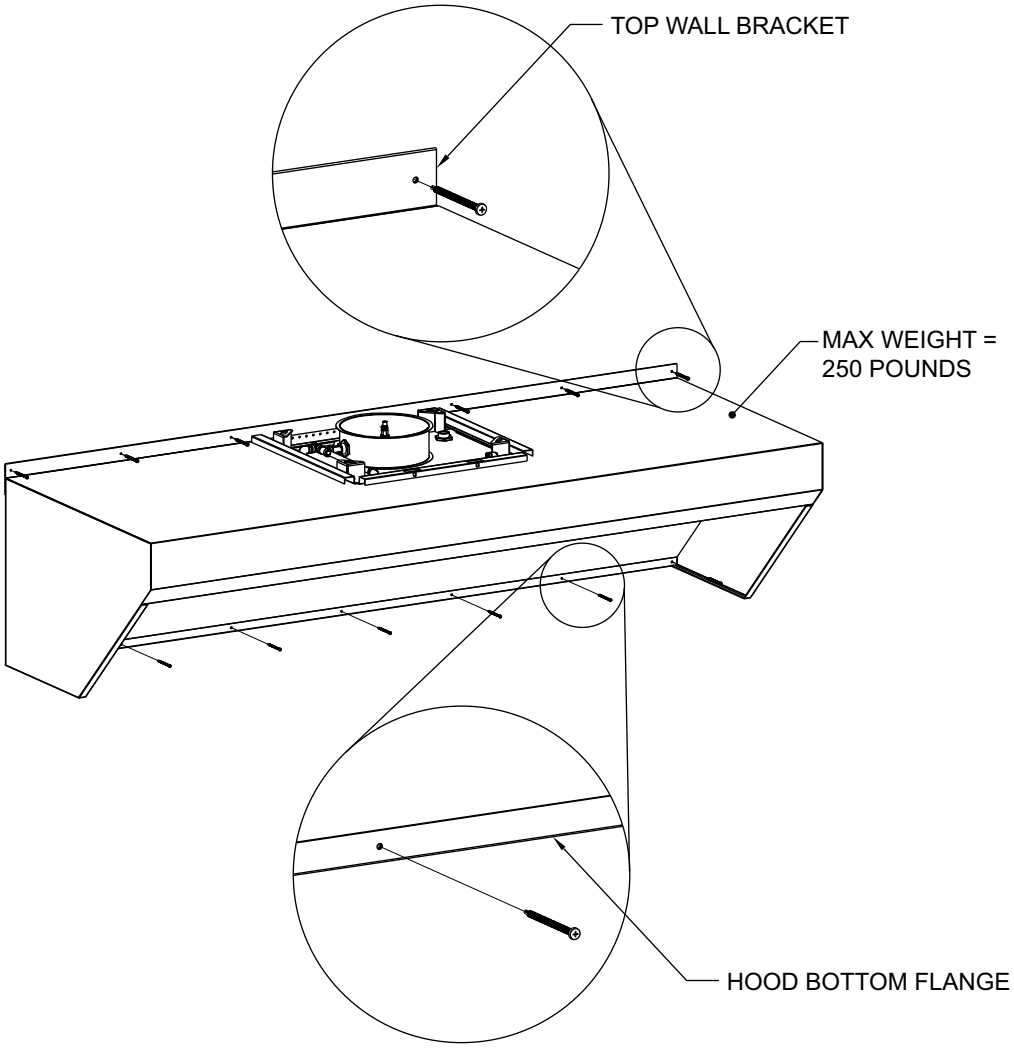
## Wall Mount Bracket for Backshelf Hoods

The wall mount bracket for backshelf hoods is an accessory that is only available for hoods that are 8-feet and under. The hood must be secured to the wall using the top wall bracket and hood bottom flange. The maximum weight for the top shelf is 250 pounds. Refer to **Figure 13** for backshelf wall mount details.

**NOTE: Wall mount bracket can only be used on non-combustible wall construction.**

1. Determine mounting location of the hood:
   - For walls made of concrete/masonry, mark the location of the hood. Drill 3/16” pilot holes in the top wall bracket and hood bottom flange for fasteners.
   - For walls with metal studs, determine location of wall studs relative to hood. Drill 3/16” pilot holes in the top wall bracket and hood bottom flange for fasteners.
2. Place hood in mounting location. Secure hood with provided hardware.
3. Use the following fasteners to secure hood to wall:
   - When installing into a concrete/masonry wall, use 3/16” x 2-3/4” hardware (pn: 90950A155).
   - When installing into metal studs, use #10 x 3” self-drilling screws (pn: 92364A260).
4. Use a minimum of 1 fastener every 16” on the top wall bracket and bottom flange of the hood. For walls with metal studs, use a minimum of 1 fastener on the top wall bracket and bottom flange of the hood at each wall stud.

**Figure 13 - Wall Mount**



## Guidelines for Ductwork Installation

Ductwork is furnished by supplier only if specified by the customer. The following information is provided as a guideline only. Ductwork should be installed in accordance with the local codes and restrictions. It is the responsibility of the installer to check local codes before installing ductwork.

1. All ductwork must be installed in the most direct manner possible.
2. Exhaust duct must be made of 16 gauge carbon steel, 18 gauge stainless-steel or must be listed for use with commercial kitchen hoods and follow the manufacturer's listing.
3. Per NFPA 96, all exhaust duct seams and joints must have a continuous liquid tight external weld; exception would be Listed Factory Built Grease Duct.
4. Exhaust risers on the hood have been sized to achieve a velocity of 500-2200 FPM, per NFPA 96, based upon the CFM required for the hood. Maintain the area of each riser when connecting duct offsets or transitions.
5. Branches should enter at gradual expansions and at a preferred angle of 30 degrees or 45 degrees if necessary.
6. When a "pantleg duct" is required to bring two ducts into one exhaust fan, observe the following in order to obtain desired performance:
    - Use ONLY radius back and radius throat elbows. 2 to 2.5-inch diameter center line radius is recommended.
    - Maintain the distance between the center lines of exhaust ducts at a maximum of 12-feet apart.
    - The main duct going to the exhaust fan must be the sum of the area of the separate legs.
7. Supply air risers are sized around a maximum of 600 FPM. Maintain this area when installing ducts.
8. Do not use "flexible" type duct for supply duct. Only rigid type duct installed in accordance with SMACNA Low Pressure requirements will be acceptable.
9. Access Doors should be provided at the sides or at the top of the duct, as well as changes of direction. Please refer to your Authority Having Jurisdiction (AHJ) if there are questions on requirements for horizontal and vertical duct runs.

**IMPORTANT:** When a fusible link is installed in the make-up air damper at the hood collar, an access door must be cut into the supply duct by the installer.

10. Duct sensor may ship loose on hoods with field cut risers. When double wall duct or ductwork with a diameter smaller than 10-inches is used, loose duct sensors should be installed in the top of the plenum near the riser in the path of the exhaust airflow.

## Installation of Hood Accessories

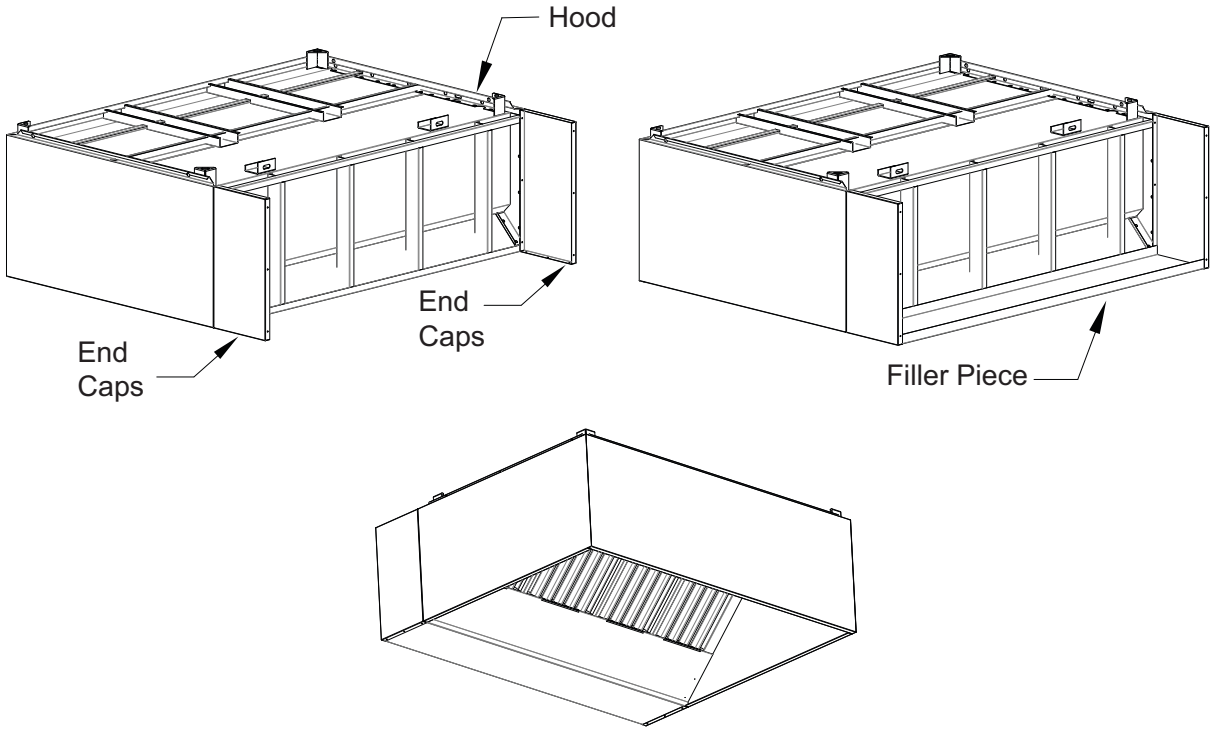
### Bolt-Together Standoff Installation

**NOTE: Report any damage to the delivering freight carrier and file a claim if appropriate.**

Refer to **Figure 14** for standoff details.

1. Unpack the standoff panels from the shipping container, be very careful not to dent or scratch the panels.
2. Mount the end caps for the back standoff to the hood. Clamp the end caps and the hood together before inserting screws so they do not shift. Insert screws through the end cap flanges into the flanges of the hood.
3. Place the back standoff filler piece flush with the rear bottom edge of the hood and secure with self-tapping sheet metal screws. Do not penetrate into the capture area. Once complete, no screws should be visible from the outside of the hood.
4. Continue with hood installation instructions, **See "Installation of a Single Hood (Wall or Island)" on page 9.**
5. After the hood installation is complete, secure the bolt-together standoff to the wall or other hoods as applicable in a manner acceptable by the Authority Having Jurisdiction (AHJ).

**Figure 14 - Bolt-Together Standoff**



## Single PSP/AC-PSP Installation

**NOTE: Report any damage to the delivering freight carrier and file a claim if appropriate.**

Refer to **Figure 15** for single PSP/AC-PSP installation details.

1. Locate the assembly and unpack it from the crate, be very careful not to dent or scratch the outer surface. If the supply risers are to be field cut, cut the risers in as desired.
2. Locate the ceiling joists which will support the assembly. If using Unistrut, then securely attach to the ceiling joist.
3. Use 1/2-inch threaded rod to hang the PSP/AC-PSP. Install the threaded rod and angle that will be used to hang the assembly from the ceiling joists. Drill 9/16-inch holes as needed in the angle for the threaded rod. Be sure to line up with the welded-on angle mounting brackets on the PSP/AC-PSP.
4. Peel the protective plastic coating on the hood down below where the bottom edge of the PSP/AC-PSP will rest against the hood.
5. Move the PSP/AC-PSP into position as indicated by the project submittal drawings. If flush mounted, lineup the top edge of the PSP/AC-PSP with the top edge of the hood. Remove the protective plastic coating from the back of the PSP/AC-PSP.

**NOTE: PSPs/AC-PSPs that are not flush mounted with the top of the hood will not use PSP/AC-PSP to Hood Attachment Bracket.**

6. Install the threaded rod into the PSP/AC-PSP hanging angles and use heavy-duty nuts to secure the connection. Adjust tension on hanging rods to position PSP/AC-PSP so it fits flush with the hood.

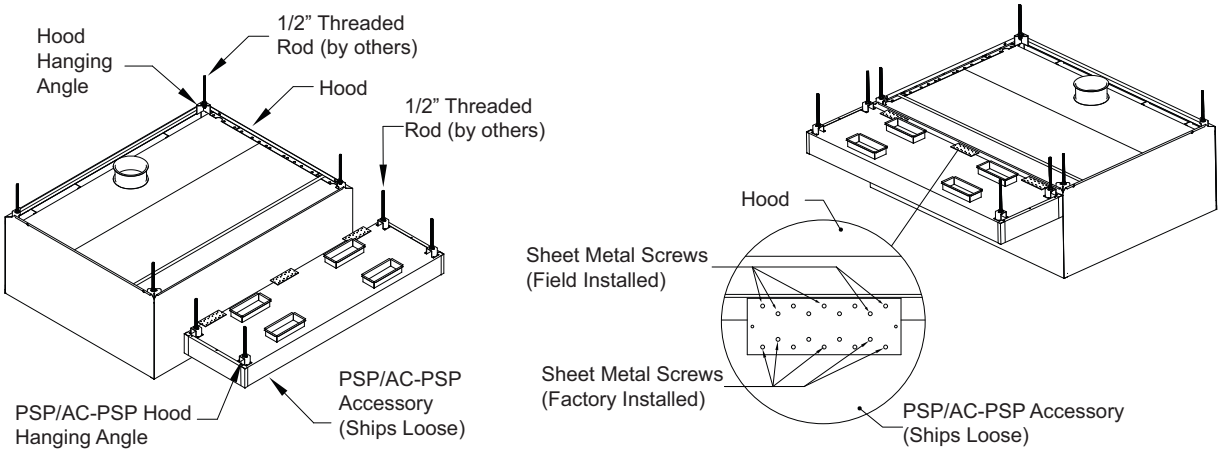
**NOTE: Do not apply too much tension; otherwise, a gap between the PSP/AC-PSP and Hood will be created at the bottom.**

7. Where applicable, use sheet metal screws provided from the factory to secure the PSP/AC-PSP attaching bracket to hood. **Use at least 5 sheet metal screws for full size attachment brackets. Use at least 3 sheet metal screws for 1/2 sized attachment brackets.**

**NOTE: Depending on PSP/AC-PSP length and damper placement, there may be 3 or 4 attachment brackets. Hoods and PSPs/AC-PSPs that are 12 feet or greater in length require additional hanging brackets located near the center of the PSP/AC-PSP.**

8. Caulk the seams between the hood(s) and the PSP/AC-PSP assembly, as well as between adjacent PSP/AC-PSP assemblies (if applicable) after the hood(s) and hood accessories have been installed.

**Figure 15 - Single PSP/AC-PSP**




CAUTION: ALL HOOD AND PSP/AC-PSP HANGING ANGLE BRACKETS MUST BE USED DURING INSTALLATION. VERIFY ALL CONNECTIONS ARE SECURED TO CEILING JOISTS OR UNISTRUT. IMPROPER INSTALLATION MAY LEAD TO INJURY AND/OR DEATH.

### Multiple PSP/AC-PSP Installation

**NOTE: Report any damage to the delivering freight carrier and file a claim if appropriate.**

Refer to **Figure 16** for multiple PSP/AC-PSP installation details.

1. Locate the assembly and unpack it from the crate, be very careful not to dent or scratch the outer surface. If the supply risers are to be field cut, cut the risers in as desired.
2. Upon completion of the hood install, install the back PSP/AC-PSP first. Then if applicable, install the side PSP/AC-PSP.
3. If the supply risers are to be field cut, cut the risers in as desired.
4. Locate the ceiling joists which will support the assembly. If using Unistrut, securely attach to the ceiling joist.
5. Use 1/2-inch threaded rod to hang the PSP/AC-PSP. Install the threaded rod and angle that will be used to hang the assembly from the ceiling joists. Drill 9/16-inch holes in the angle if not using Unistrut. Make sure to line up with the angle mounting brackets on the PSP/AC-PSP.
6. Peel the protective plastic coating on the hood down below where the bottom edge of the PSP/AC-PSP will rest against the hood.
7. Move the PSP/AC-PSP into position as indicated by the project submittal drawings. If flush mounted, lineup the top edge of the PSP/AC-PSP with the top edge of the hood. Remove the protective coating from the back of the PSP/AC-PSP.

**NOTE: PSPs/AC-PSPs that are not flush mounted with the top of the hood will not use PSP/AC-PSP to Hood Attachment Bracket.**

8. Install the threaded rod into the PSP/AC-PSP hanging angles and use heavy duty nuts to secure the connection. Adjust tension on hanging rods to position PSP/AC-PSP so it fits flush with the hood.

**NOTE: Do not apply too much tension, otherwise, a gap between the PSP/AC-PSP and Hood will be created at the bottom.**

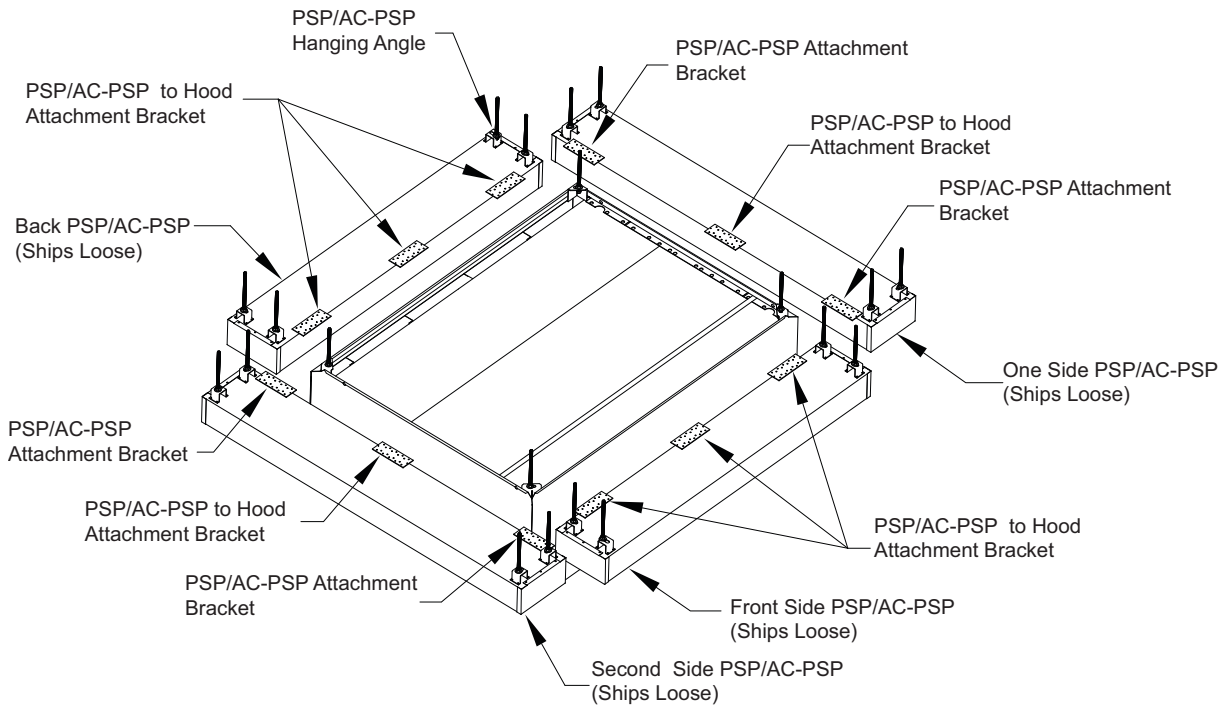
9. Install additional PSPs/AC-PSPs, if applicable, in the same manner.
10. Where applicable, use sheet metal screws provided from the factory to secure the PSP/AC-PSP attaching bracket to other assemblies/hood, **See “PSP/AC-PSP Attachment Brackets” on page 23. Use at least 5 sheet metal screws for full size attachment brackets. Use at least 3 sheet metal screws for 1/2 sized attachment brackets.**

**NOTE: Depending on PSP/AC-PSP length and damper placement, there may be 3 or 4 attachment brackets. Hoods and PSPs/AC-PSPs that are 12 feet or greater in length require additional hanging brackets located near the center of the PSP/AC-PSP.**

11. Caulk the seams between the hood(s) and each PSP/AC-PSP, as well as between adjacent PSPs/AC-PSPs (if applicable), after the hood(s) and hood accessories have been installed.

CAUTION: ALL HOOD AND PSP/AC-PSP HANGING ANGLE BRACKETS MUST BE USED DURING INSTALLATION. VERIFY ALL CONNECTION ARE SECURED TO CEILING JOISTS OR UNISTRUT. IMPROPER INSTALLATION MAY LEAD TO INJURY AND/OR DEATH.

**Figure 16 - Multiple PSP/AC-PSP**




CAUTION: ALL HOOD AND PSP/AC-PSP HANGING ANGLE BRACKETS MUST BE USED DURING INSTALLATION. VERIFY ALL CONNECTIONS ARE SECURED TO CEILING JOISTS OR UNISTRUT. IMPROPER INSTALLATION MAY LEAD TO INJURY AND/OR DEATH.

### PSP/AC-PSP Attachment Brackets

Refer to **Figure 17** and **Figure 18** for bracket attachment installation details.

- Once the PSPs/AC-PSPs are aligned in the field, use provided sheet metal screws to attach the other side PSP/AC-PSP attachment bracket to the hood and/or front/back PSP/AC-PSP.
- When attaching PSP/AC-PSP to hood or other PSPs/AC-PSPs; use at least 5 sheet metal screws for full size attachment brackets. Use at least 3 sheet metal screws for 1/2 sized attachment brackets.
- PSPs/AC-PSPs that are not flush mounted with the hood will not use PSP/AC-PSP to Hood Attachment Bracket.

**Figure 17 - Attachment of Side PSP/AC-PSP Bracket**

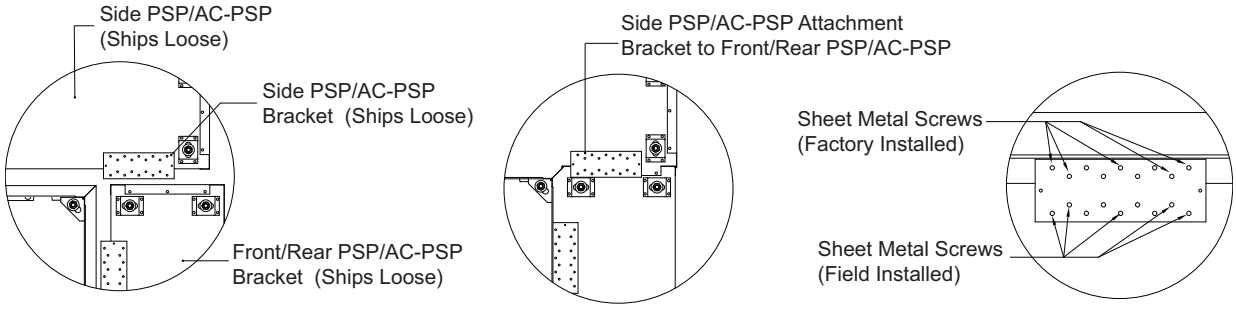
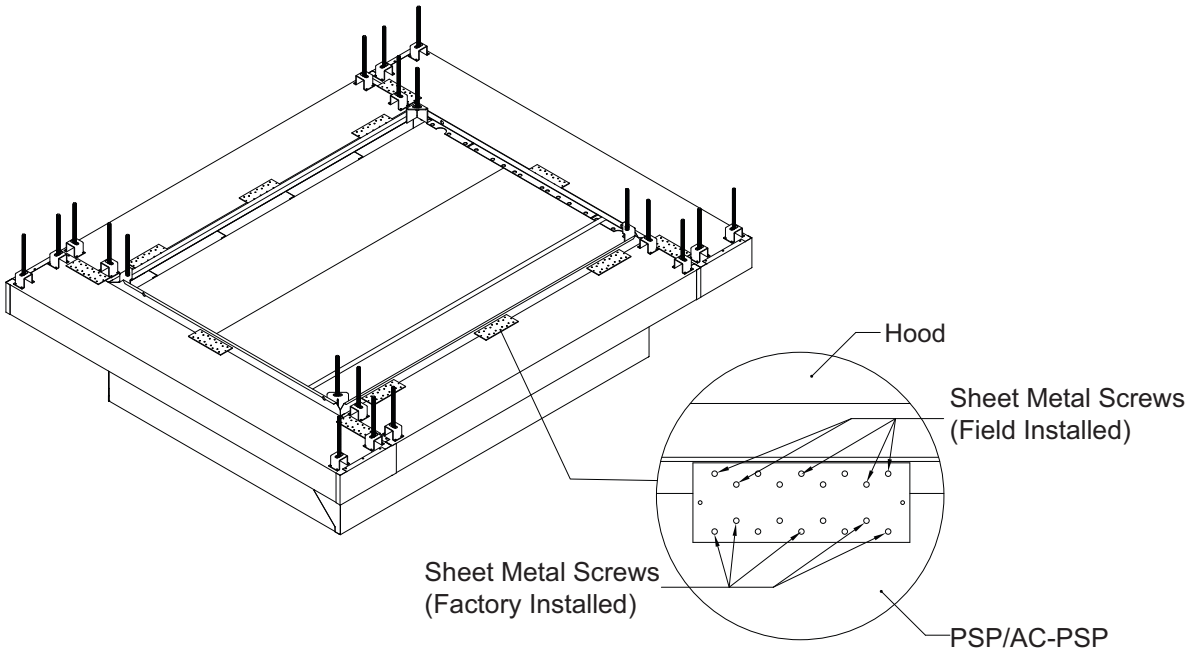



**Figure 18 - Attachment of PSP/AC-PSP to Hood**




CAUTION: ALL HOOD AND PSP/AC-PSP HANGING ANGLE BRACKETS MUST BE USED DURING INSTALLATION. VERIFY ALL CONNECTIONS ARE SECURED TO CEILING JOISTS OR UNISTRUT. IMPROPER INSTALLATION MAY LEAD TO INJURY AND/OR DEATH.

## Wrapper (Enclosure Panel) Installation

**NOTE: Report any damage to the delivering freight carrier and file a claim if appropriate.**

1. Unpack the wrapper panels from the shipping container, be very careful not to dent or scratch the panels.
2. Locate one of the side wrapper panels and position it on the hood so that the 1/2-inch flange on the bottom of the panel slips underneath the side channel on top of the hood. Refer to **Figure 19**.

**NOTE: A notch will have to be cut on the wrapper flange using shears (tin snips) where interference occurs, where applicable. Refer to Figure 20.**

3. Press fit panel into place until wrapper face is flush with hood face. Screw or pop-rivet wrapper to the side channel and wall. Refer to **Figure 21**.
4. Locate front wrapper panel. Position its lower 1/2-inch flange under front channel on hood and slide panel into position, so that the end of front panel is behind the 90 degree bend of the side panel. Refer to **Figure 22**. Once in place, press fit the lower flange of the front panel into the front channel in order to have wrapper face flush with the front of the hood. Screw or pop-rivet bottom of front panel to the front channel.
5. Drill appropriate holes, and rivet front to side wrapper panel. Refer to **Figure 22**.
6. If multiple panels are used, a stainless trim piece will be provided to attach multiple panels together (i.e. hood is side to side, hood is back to back to another, or the wrapper length exceeds 16 feet). Attach the panels by slipping them behind the stainless trim and fastening with screws or rivets, refer to **Figure 25**.

**NOTE: Trim will have to be cut to fit. In most instances, trim should extend from bottom of hood to top of wrapper panel.**

7. Locate the other side panel. Repeat steps 2 and 3. Attach side panel to the front wrapper panel as instructed in step 4.

**NOTE: In most instances where hood is located against a side wall, fasten the front wrapper panel to the wall. Refer to Figure 23.**

8. Caulk all gaps and seams after the hood(s) and hood accessories have been installed.

**Figure 19 - Wrapper Detail**

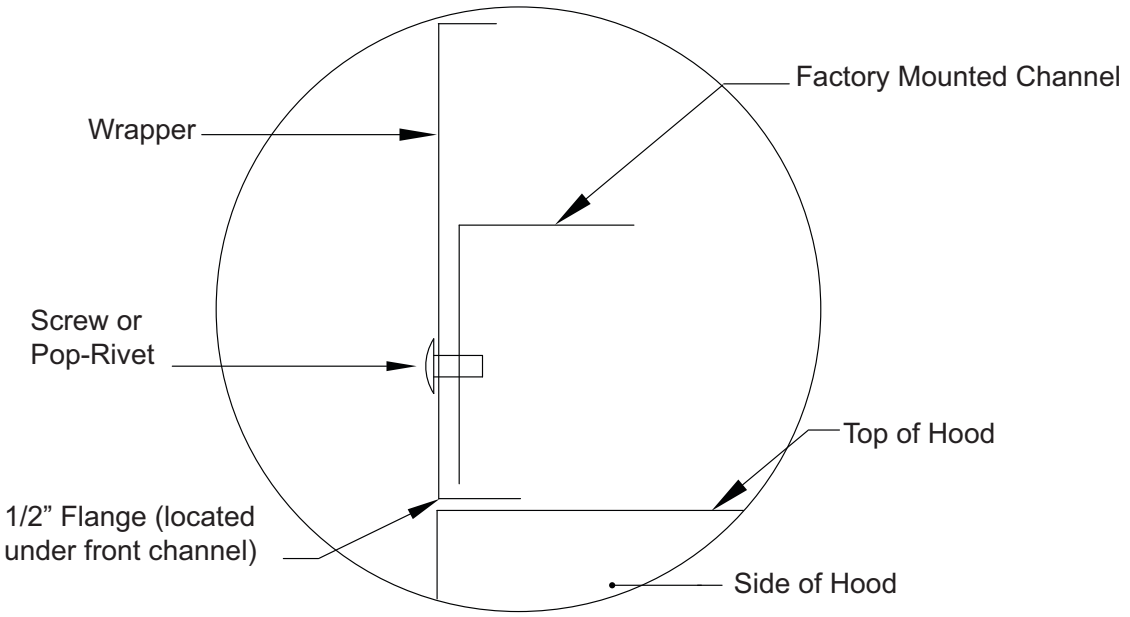
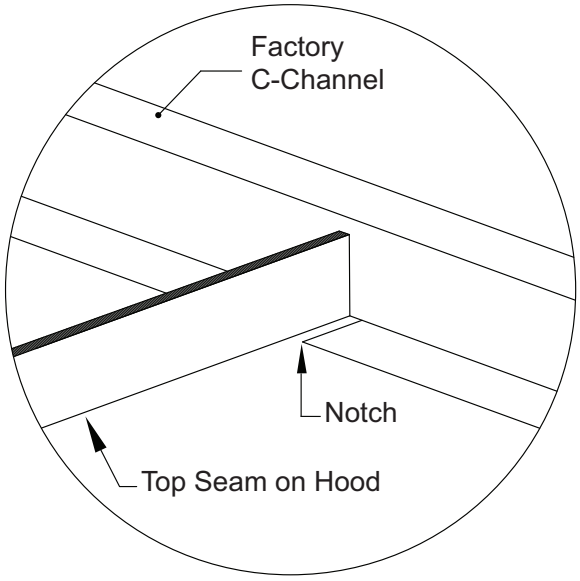


**Figure 20 - Top of Hood Seam Detail (Not on all models)**




Notch required where seams meet the wrapper

**Figure 21 - Rear Wall Attachment**

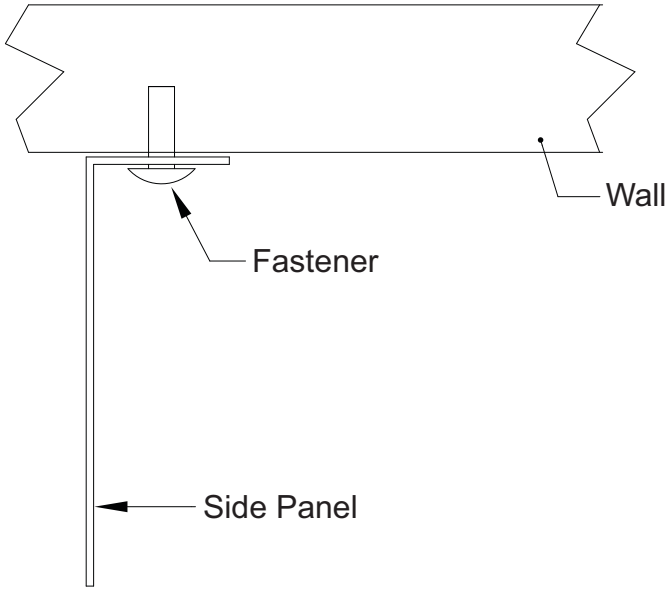
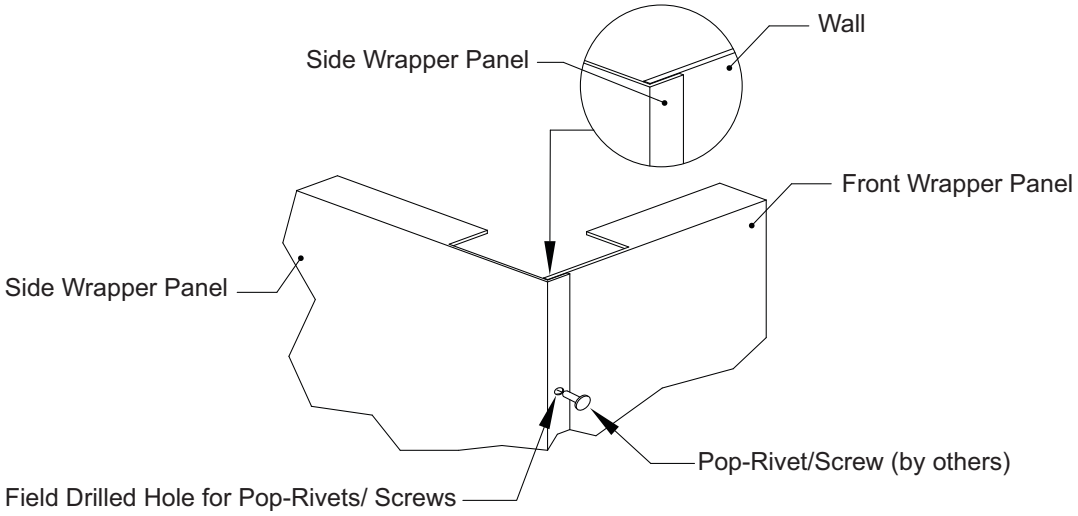


**Figure 22 - Front Corner Assembly**




**NOTE: Place front wrapper panel under 90 degree bend of the side wrapper panel. Screw or pop-rivet into position.**

**Figure 23 - Side Wall Attachment**

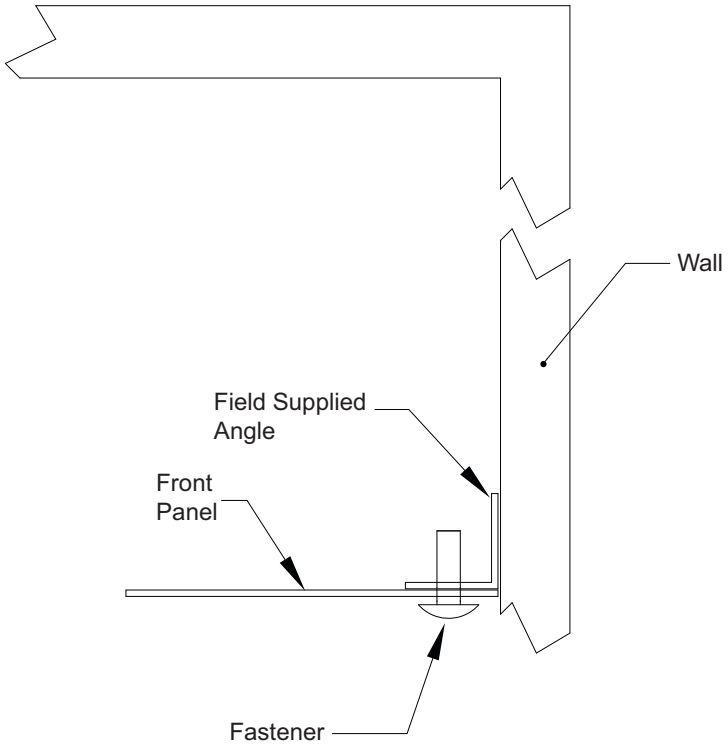
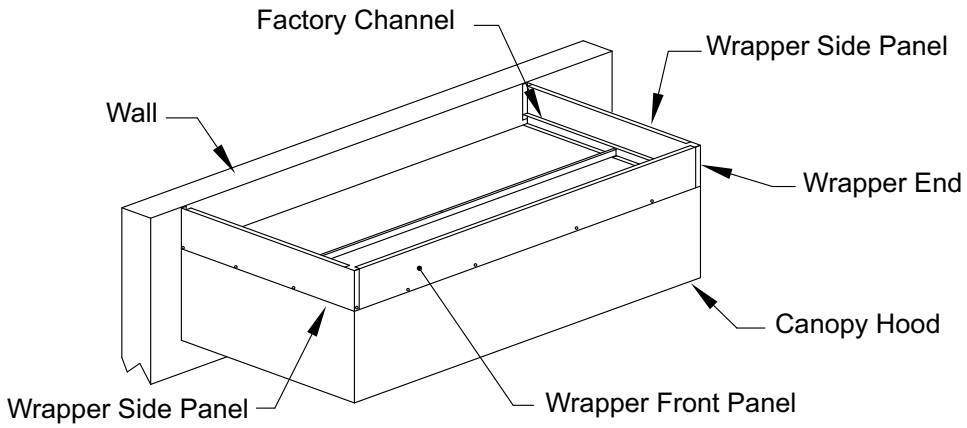


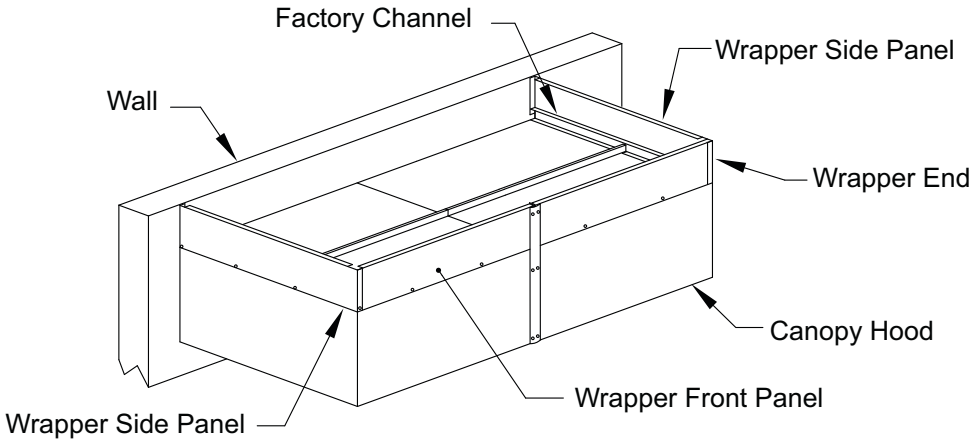
**Figure 24 - Completed Wrapper Assembly**




Factory Channel - Installer to secure wrapper panel to factory channel.

Wrapper Side Panel - Press fit until panel faces are flush with hood. Pop-rivet or screw panels to hood.

**Figure 25 - Completed Wrapper Assembly (End on End)**




Factory Channel - Installer to secure wrapper panel to factory channel.

Wrapper Side Panel - Press fit until panel faces are flush with hood. Pop-rivet or screw panels to hood.

## End Panel Installation

**NOTE: Report any damage to the delivering freight carrier and file a claim if appropriate.**

1. Unpack the end panel(s) from the shipping container. Be very careful not to dent or scratch the panels. Refer to the project submittal drawings to determine mounting location.
2. Position the end panel with the kinked top flush against the inside of the hood end, and the rear flange flush against the rear wall, facing toward the interior of the hood. Refer to **Figure 26** and **Figure 27**.
3. Attach the top edge of the end panel to the end of the hood using the acorn nuts provided. Hand tighten each acorn nut, use a wrench to tighten an additional 1/4 turn – **do not over-tighten**.
4. Secure the rear flange to the wall using stainless-steel sheet metal screws, make sure to keep the end panel straight vertically.
5. Caulk all seams between the end panel and the hood after the hood(s) and hood accessories have been installed.

**Figure 26 - End Panel Installation (Hoods with Hems on Ends)**

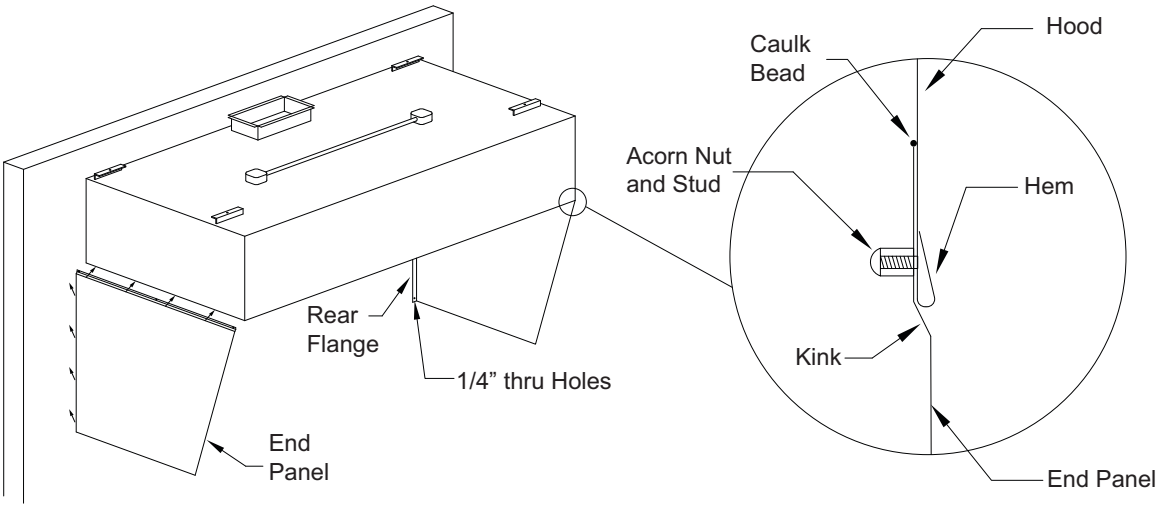
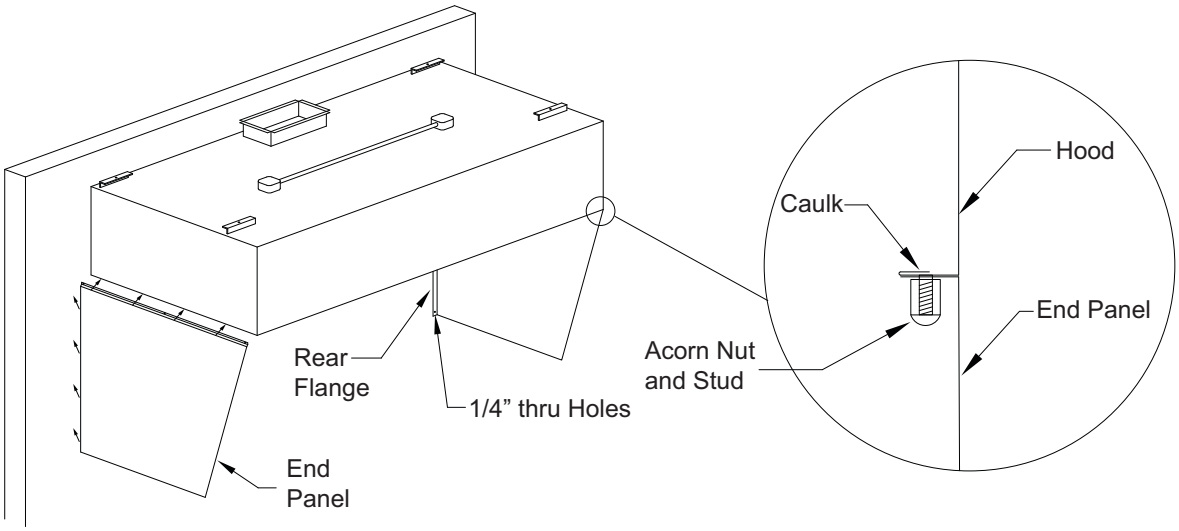



**Figure 27 - End Panel Installation (Hoods with Flanges on Ends)**




**Hood end panels or walls may be field installed or shipped loose from the factory. End panels allow the clearance from the cooking appliance to the end of the hood to be reduced to 0-inch.**

## Quarter End Panel Installation

1. Follow installation steps from **"End Panel Installation" on page 28**.
2. Refer to **Figure 28** and **Figure 29** for installation details.

**Figure 28 - Quarter End Panel Installation (Hoods with Hems on Ends)**

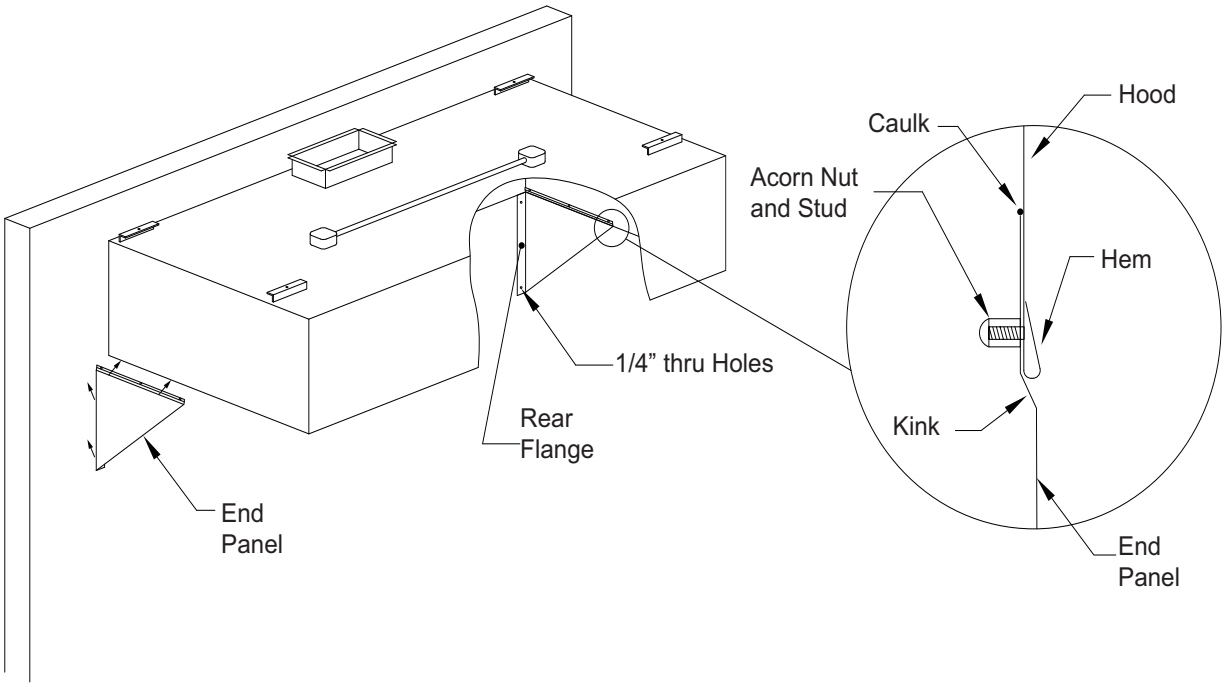
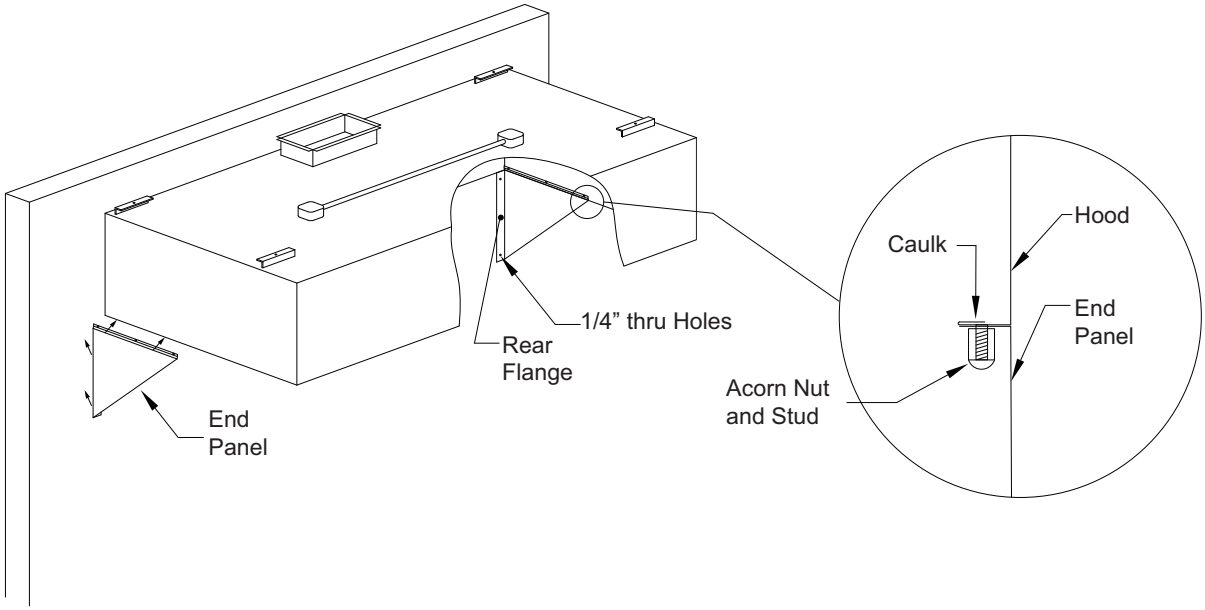



**Figure 29 - Quarter End Panel Installation (Hoods with Flanges on Ends)**




**Hood end panels or walls may be field installed or shipped loose from the factory. End panels allow the clearance from the cooking appliance to the end of the hood to be reduced to 0 inch.**

## Insulated End Panel Installation

1. Follow installation steps from **"End Panel Installation" on page 28**.
2. Refer to **Figure 30** and **Figure 31** for installation details.

**Figure 30 - Insulated End Panel Installation (Hoods with Hems on Ends)**

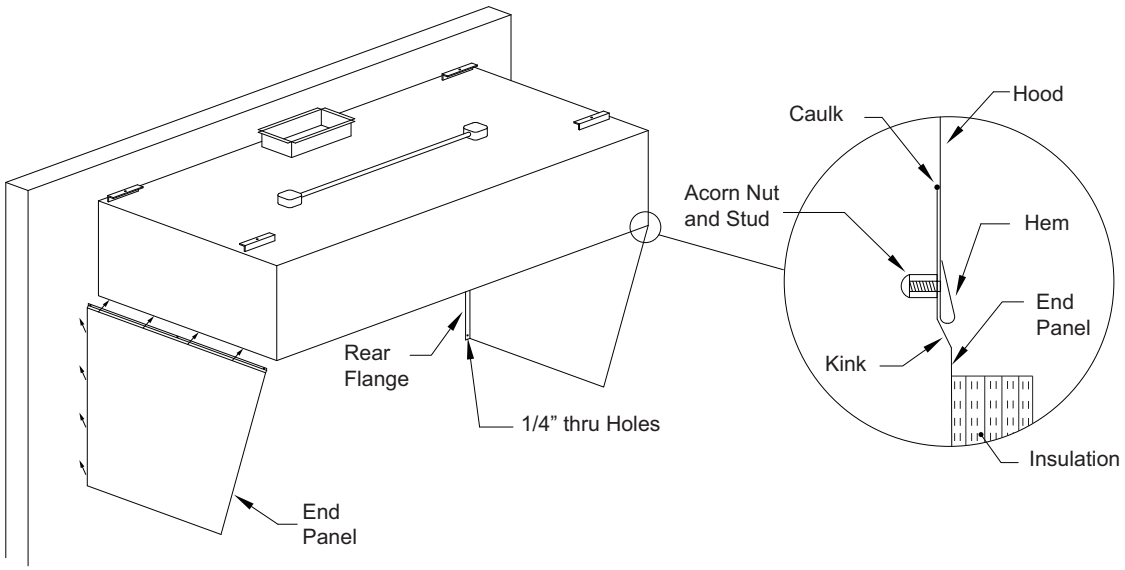
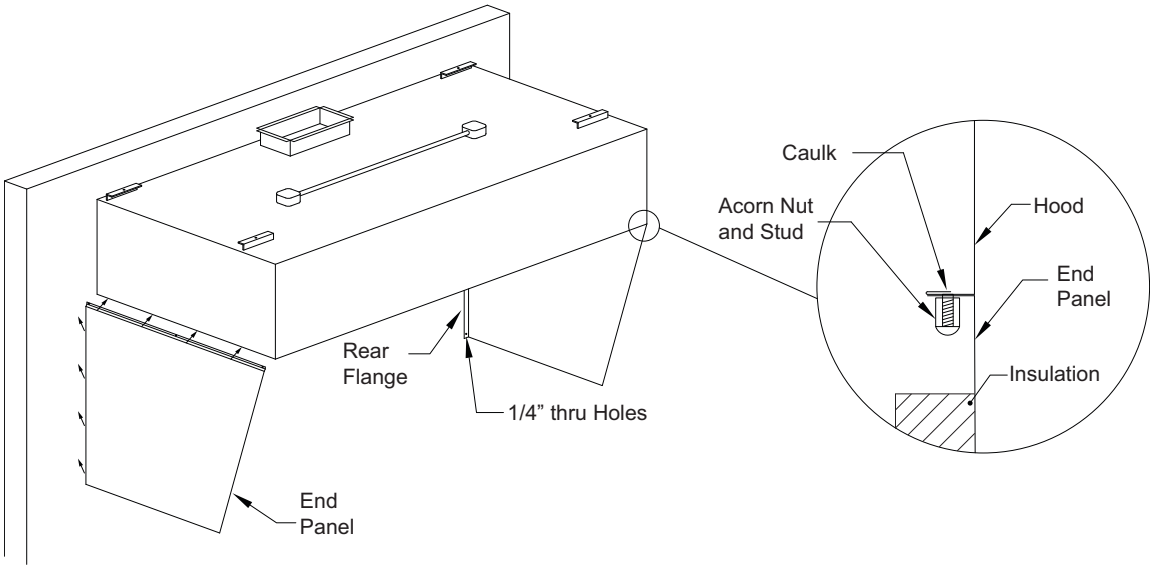



**Figure 31 - Insulated End Panel Installation (Flanges on Ends)**




**Hood end panels or walls may be field installed or shipped loose from the factory. End panels allow the clearance from the cooking appliance to the end of the hood to be reduced to 0 inch.**

## Vertical End Panel Installation

**NOTE: Report any damage to the delivering freight carrier and file a claim if appropriate.**

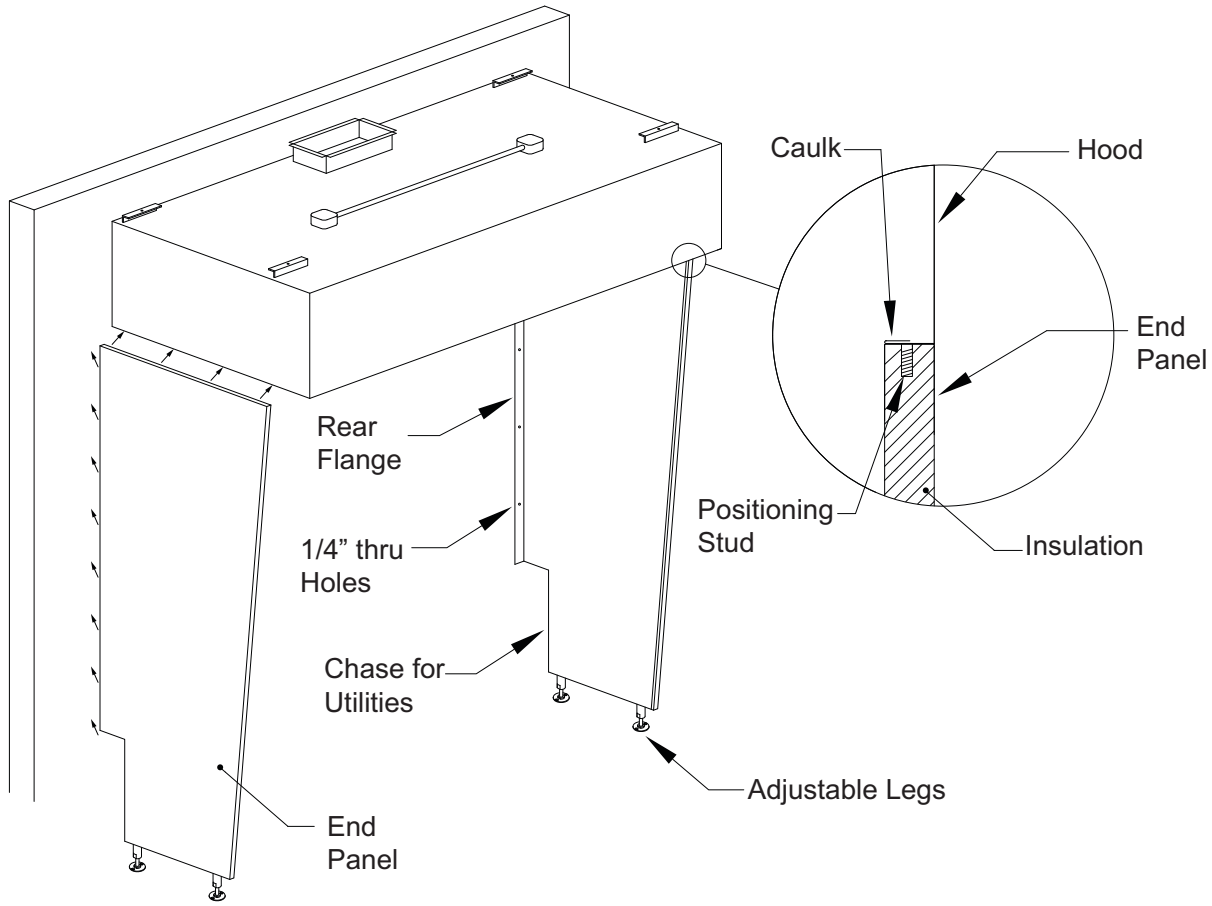
Refer to **Figure 32** for end panel installation details.

1. Unpack the end panel(s) from the shipping container. Be very careful not to dent or scratch the panels. Refer to the project submittal drawings to determine mounting location.
2. Position the end panel with the top located flush against the bottom of the hood end, and the rear flange located flush against the rear wall and facing toward the interior of the hood. Studs on bottom of hood ends should align with slots on top of vertical end panel.
3. Adjust legs to create slight tension between the vertical end panel and bottom of hood. Confirm that the top side of the vertical end panel is flush with the bottom of the hood.

**NOTE: Legs have anchoring points in the feet which are optional to secure to the floor.**

4. Secure the rear flange to the wall using stainless-steel sheet metal screws, make sure to keep the end panel straight vertically.
5. Caulk all seams between the vertical end panel and the hood after the hood(s) and hood accessories have been installed.

**Figure 32 - Vertical End Hoods with Flanges on Ends**




**Hood end panels or walls may be field installed or shipped loose from the factory. End panels allow the clearance from the cooking appliance to the end of the hood to be reduced to 0 inches.**

## Backsplash Installation

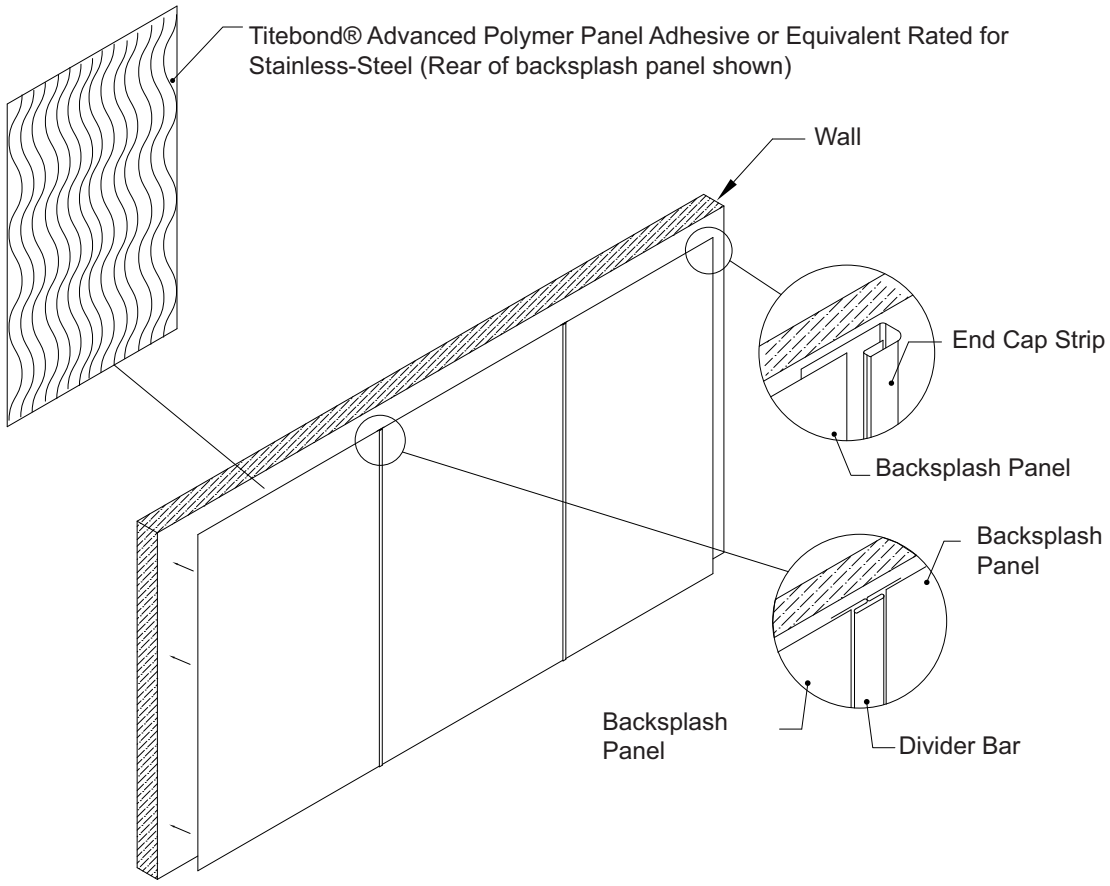
**NOTE: Report any damage to the delivering freight carrier and file a claim if appropriate.**

Refer to **Figure 33** for stainless-steel backsplash installation details.

1. Unpack the backsplash panels from the shipping container. Be very careful not to dent or scratch the outer surface.
2. Refer to the project submittal drawings to determine mounting orientation (vertical or horizontal) and mounting location. If backsplash panels intended for the same wall are of different widths, position them in a symmetrical arrangement.
3. Determine if cutouts are required to accommodate electrical outlets, pipes, etc. Make appropriate cutouts being careful not to crease the backsplash panels.
4. Make sure that the walls are clean and free of debris.
5. Apply Titebond® Advanced Polymer Panel Adhesive or equivalent recommended for stainless-steel to backsplash panels and trim pieces. Do not allow the adhesive to dry. Use a trowel to spread adhesive in a smooth, even manner to the edges and corners. **Do not allow clumping or bumps on the backside of the panel.**
6. Install the backsplash panels to the wall. When hanging multiple panels, install one at a time. Install trim pieces to the wall.
7. Once the panels are installed, immediately use a laminate roller to smooth the panel and adhesive out. **Do not press on the panel with hands or other foreign objects at all.**
8. Verify all backsplash panels are installed and have properly set before placing appliances or other objects in front of the panels.

**NOTE: Follow adhesive manufacturer's recommendations on setting and dry time.**

**Figure 33 - Stainless-Steel Backsplash**



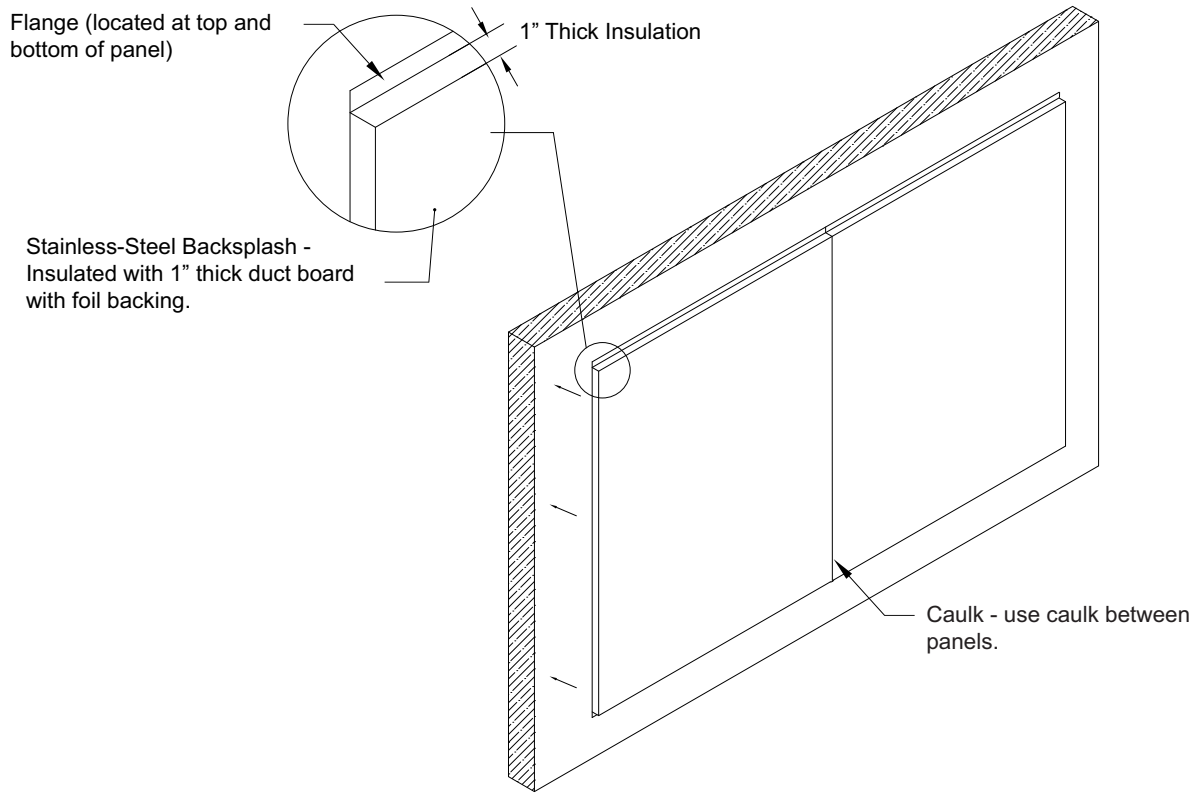
## Insulated Backsplash Installation

**NOTE: Report any damage to the delivering freight carrier and file a claim if appropriate.**

Refer to **Figure 34** for insulated backsplash installation details.

1. Unpack the backsplash panels from the shipping container. Be very careful not to dent or scratch the outer surface.
2. Refer to the project submittal drawings to determine mounting orientation (vertical or horizontal) and mounting location. If backsplash panels intended for the same wall are of different widths, position them in a symmetrical arrangement.
3. Determine if cutouts are required to accommodate electrical outlets, pipes, etc. Make appropriate cutouts being careful not to crease the backsplash panels.
4. Slide the top flange behind the lower rear edge of the hood. Secure the bottom flange to the wall using stainless-steel sheet metal screws.
5. If there are multiple insulated backsplash sections, install the others now.
6. Caulk the seams between the wall and the insulated backsplash panel after the hood(s) and hood accessories have been installed.

**Figure 34 - Insulated Backsplash**



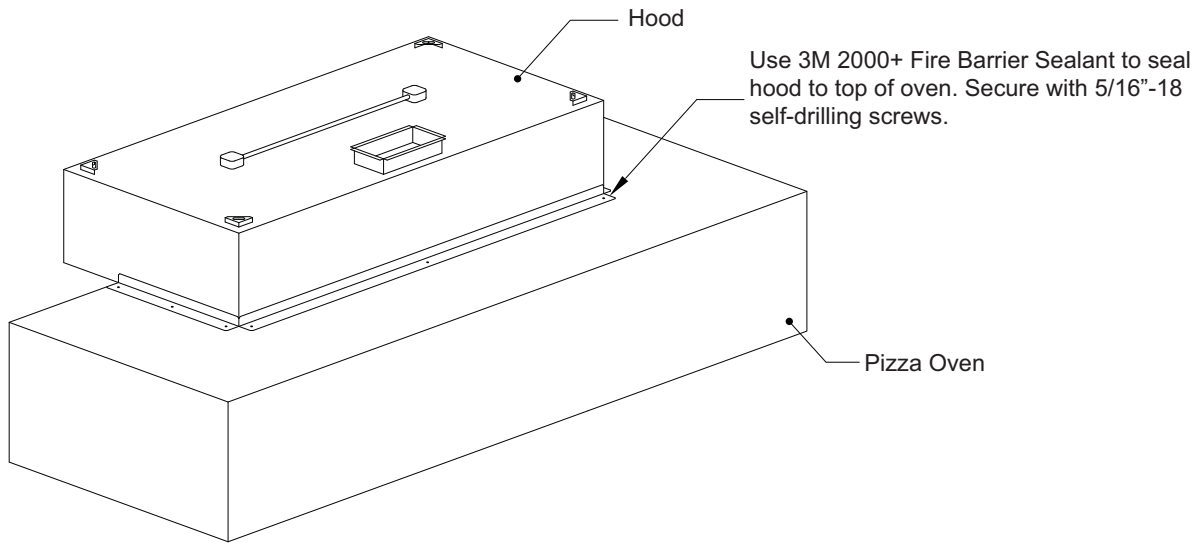
## Pizza Oven Top Mount Flange Installation

**NOTE: Report any damage to the delivering freight carrier and file a claim if appropriate.**

Refer to **Figure 35** for pizza oven top mount details.

1. Thoroughly inspect hood for damage including Pizza Oven Top Mount Flanges.
2. Carefully unpack hood, remove shipping screws from rear flange before moving hood.
3. Use supplied 3M 2000+ fire barrier sealant to apply a double bead to the underside of the flanges.
4. Centrally position the hood on top of the oven over the opening. The front edge of the side flanges should be flush with the front face of the oven.
5. Use supplied 5/16”-18 self-drilling screws to fasten hood to oven. Every mounting hole needs to be used.

**Figure 35 - Pizza Oven Top Mount**



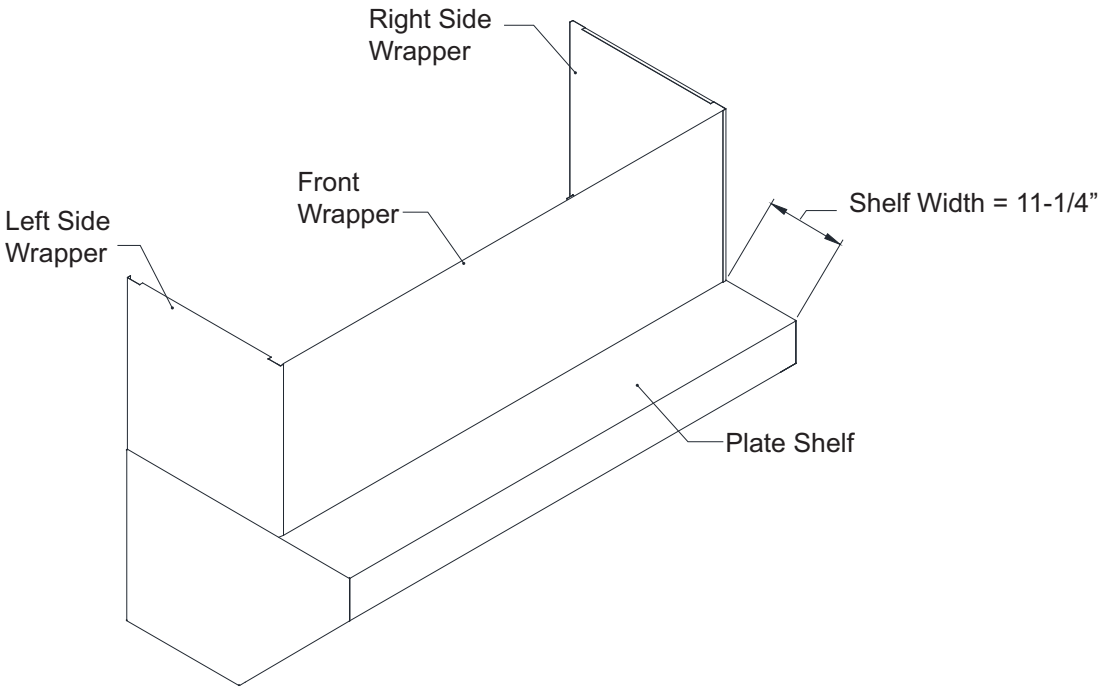
## Plate Shelf Option Installation

**NOTE: Report any damage to the delivering freight carrier and file a claim if appropriate.**

Refer to **Figure 36** for plate shelf installation details.

The plate shelf option may come with the wrapper installed from the factory or for field installation. For field installation, refer to **“Wrapper (Enclosure Panel) Installation” on page 24**.

**Figure 36 - Plate Shelf Option Installation**



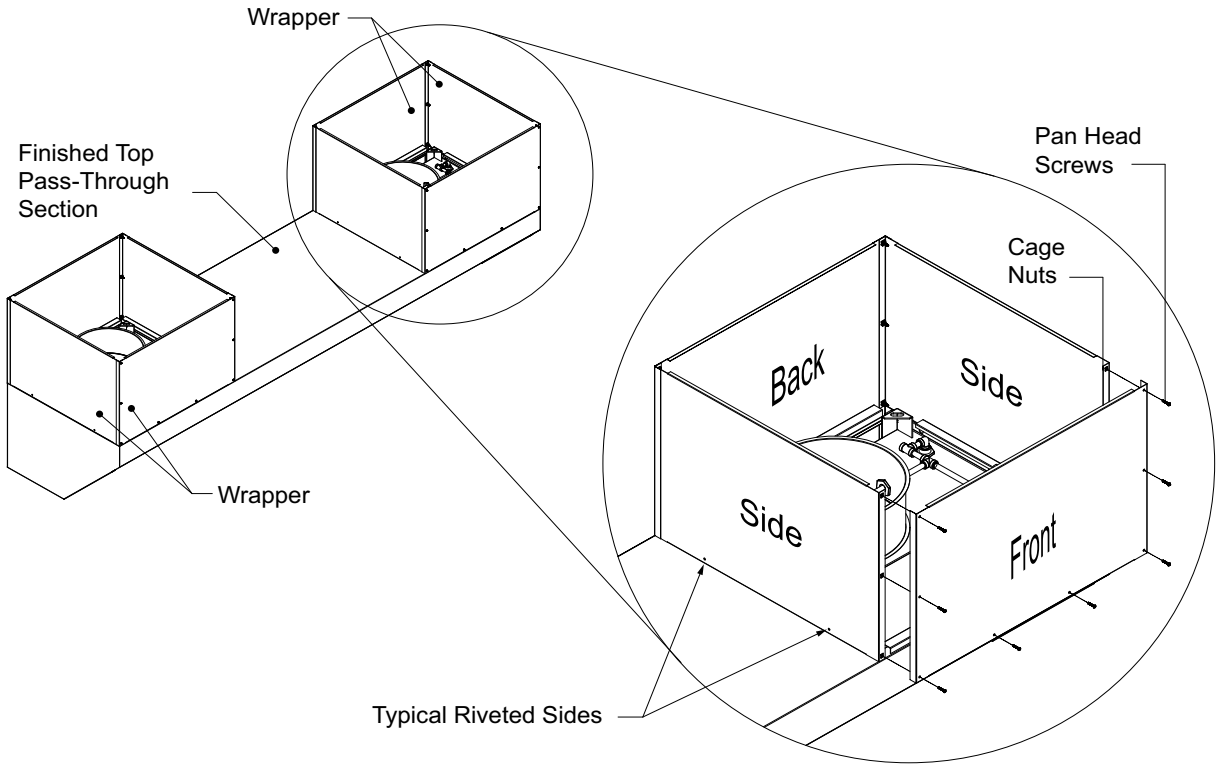
### Pass-Through Option Installation

Refer to **Figure 37** for pass-through installation details.

The pass-through option may come with the wrapper installed from the factory or for field installation. For field installation, refer to **"Wrapper (Enclosure Panel) Installation" on page 24**.

**NOTE: The front and optional back panel of this particular hood are NOT riveted in place. Instead, they use 10-32 cage nuts and pan head screws to secure them in place. This is so the front/back panels can be removed, and the internal duct and fire system components can be easily accessed for final installation and service.**

**Figure 37 - Pass-Through Hood Option**



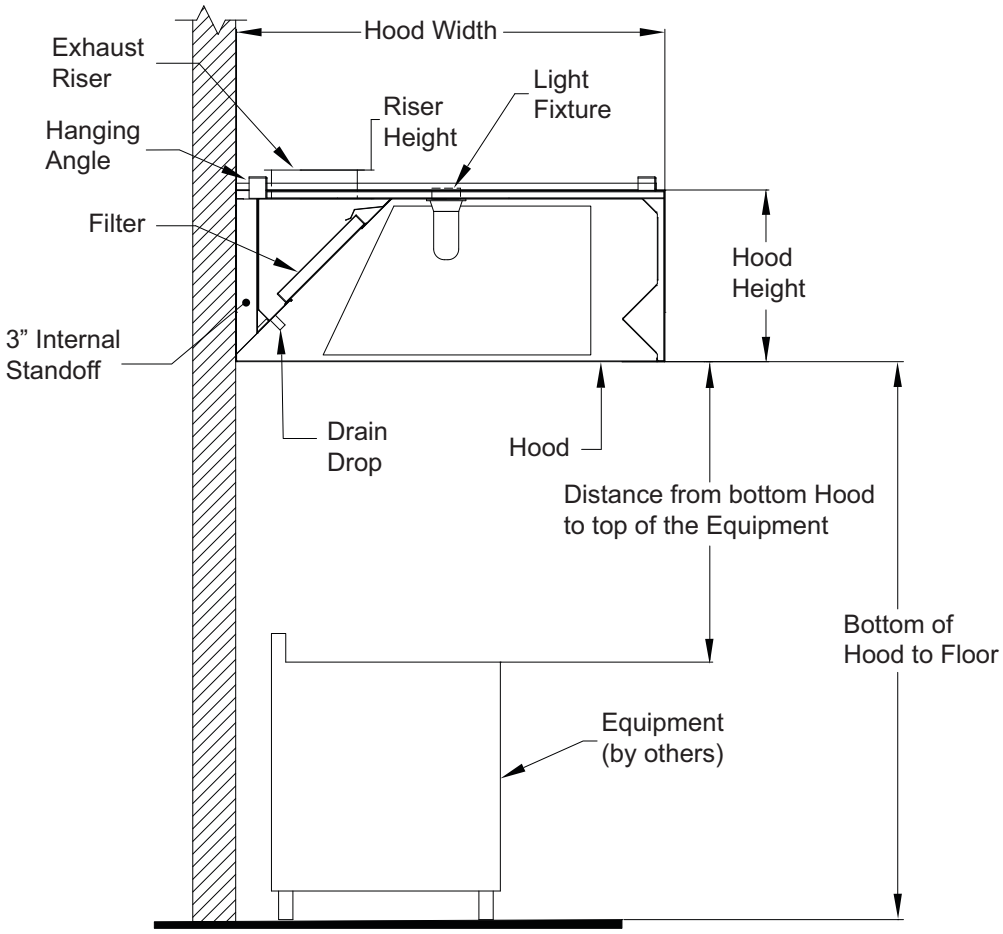
### Continuous Capture Option

The hood is shipped with a U-trim to cap the raw edges of the continuous capture cutout(s).

Refer to **Figure 38** for continuous capture details.

1. Remove U-trim from packaging.
2. Measure and cut U-trim to length for all four edges of the continuous capture cutout(s).
3. Dry fit the cut pieces of U-trim to verify a proper finished fit.
4. Remove fitted U-trim pieces and apply silver silicone caulking to raw edges of the continuous capture cutout(s).
5. Reinstall fitted U-trim pieces to seal the raw edges of the continuous capture cutout(s).
6. Wipe off any excess caulking with a cotton cloth and rubbing alcohol.

**Figure 38 - Continuous Capture**




**NOTE: It is the responsibility of the Architect/Owner to ensure that the hood clearance from limited-combustibles and combustible materials is in compliance with local codes requirements.**

**Engineer is responsible for drain line design beyond the hood. Drain line must be installed per local codes. The drain line must be sloped (minimum 1/4 inch per foot). Avoid unnecessary 90° turns; if combined with other drain lines then the pipe size should be increased accordingly. P-traps should not be used in the grease drain line, and heat tape must be used where the drain line will be routed in environments that would solidify grease. All necessary fittings from the ventilator to the building waste line, i.e. floor, sinks, air gaps, or other devices required by governing codes are furnished. Refer to drain kit details.**

# OPERATION

Commercial kitchen ventilation hoods are intended to be used in conjunction with ductwork and fans which have been properly sized and installed in accordance with manufacturer's specifications and local code requirements.

Before turning on cooking equipment, make sure that the make-up air and exhaust fans are on. Leave fans on for at least 30 minutes after cooking equipment is shut off.

Clean hood as needed to comply with local code requirements and as directed in **"MAINTENANCE" on page 44**.

## Performance Evaluation

A performance evaluation of the system can only be performed after all of the following items have been verified:

- All fans are operational. Visually inspect fan rotation with directional arrow.
- All filters are in place.
- Equipment under the hood is in place and operational.
- HVAC units are in place and operational with blowers operating correctly.

## Guidelines before Beginning

The testing and balancing of a system is necessary to ensure proper and efficient operation of the system as it was designed. In any building where effluent and hot air is removed, the mass of air must be replaced to maintain a constant pressure in the space. Any change in the pressure differential between inside and outside air will in some way affect the operation of a system; most commonly that affect is a negative one.

A test and balance, as well as the simple performance test in International Mechanical Code Section 507.6 should be included in all jobs; code inspectors are increasingly enforcing these requirements. Requirements in the 2021 IMC, which is currently effective in most parts of the United States, are as follows:

> *"507.6 Performance test. A performance test shall be conducted upon completion and before final approval of the installation of a ventilation system serving commercial cooking appliances. The test shall verify the rate of exhaust airflow required by Section 507.5, makeup airflow required by Section 508, and proper operation as specified in this chapter. The permit holder shall furnish the necessary test equipment and devices required to perform the tests.*
>
> *507.6.1 Capture and containment test. The permit holder shall verify capture and containment performance of the exhaust system. This field test shall be conducted with all appliances under the hood at operating temperatures, with all sources of outdoor air providing makeup air for the hood operating and with all sources of recirculated air providing conditioning for the space in which the hood is operating. Capture and containment shall be verified visually by observing smoke or steam produced by actual or simulated cooking, such as with smoke candles, smoke puffers, etc."*

The simplest means of doing the performance test is using a T-T smoke puffer. Activate the puffer and use it to trace effluent around the entire perimeter of the hood, emitting smoke every few inches under the lower edges of the hood.

## External Factors which may affect Hood Performance

1. HVAC units are generally specified to supply 25% outside air (OA) to the room ventilation. If RTUs are not supplying the proper amount of OA to the building, then negative pressure will exist.
2. HVAC return grilles located close to a hood can cause performance problems. The return grille competes with the hood to capture air in the room. For example, a return grille for a 10-ton HVAC unit can draw anywhere from 3000 to 4000 CFM. This is equivalent to the exhaust of a 10-foot to 13-foot canopy hood. As a result, a return air grille located within 6 feet of the hood can have a serious effect on the capture ability of the hood.

**NOTE: High velocity diffusers or HVAC returns should not be placed within 10 feet of the exhaust hood. Perforated diffusers are recommended.**

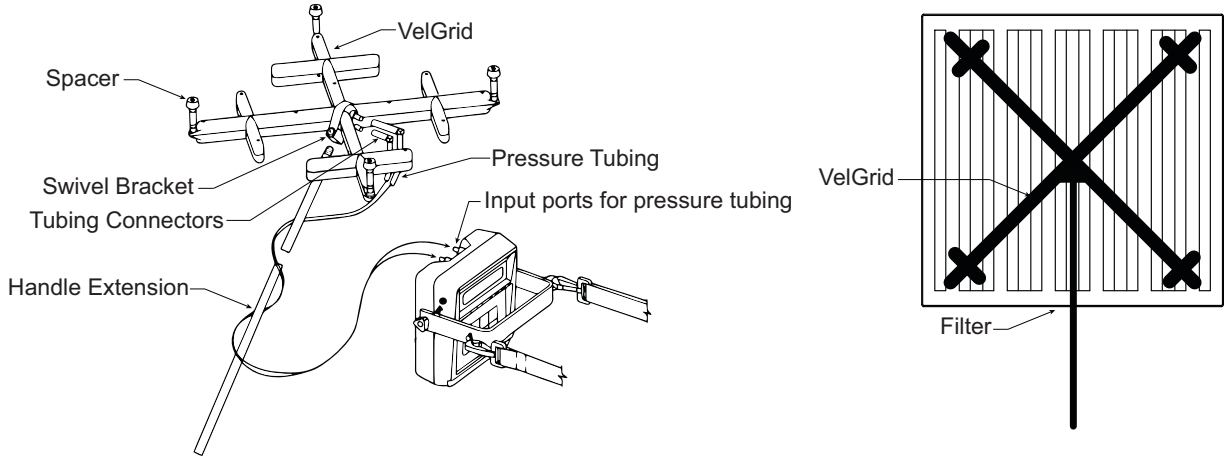
3. HVAC diffusers located near a hood can create flows in the room that detract from the capture ability of the hood. If the HVAC diffuser bounces air off the front of the hood or directs air along the hood and past the end, the air flow created can draw smoke and contaminants out of the hood.

## Air Measuring Multimeter

An air measuring multimeter is a sophisticated instrument that, with its built-in features, is basically a self-contained test and balance kit. It has a “velocity grid” for filter face readings, a “velocity probe” for ductwork readings, a “differential pressure” function to check room pressure and static pressure, as well as a “temperature probe.”

This instrument can calculate accurate values based on varying temperature (most equipment assumes standard temperature and pressure), and many other useful features. Refer to **“Calculating Exhaust Air CFM” on page 41** for information on exhaust air and K Factor calculations.

**Figure 39 - Air Measuring Multimeter Instrument**



Hood Information

Place the VelGrid exactly at the center of each filter, taking the average of 3 readings. Refer to **Figure 39**.

To calculate the CFM, the following information must first be acquired:

1. Hood size and length
2. Filter size and length
3. PSP width and length

Measuring Hood Static and Room Pressure

- Static Pressure - Measure hood static pressure at exhaust collar using the air measuring instrument.

**Static Pressure = _____**

- Room Pressure - For an exhaust hood to work properly, the kitchen should be at a slight negative pressure to the dining area (caused by its air removal) and the building overall slightly positive. The dining room should be a slight positive to the outdoors and the kitchen +0.02” w.c. or about 300 CFM positive. This will keep dust and bugs outside, and doors will be easy to open. The kitchen should be a slight negative to the dining room to keep the odors in the kitchen. The kitchen should be balanced to slightly negative, 0” to -0.02” w.c., to the dining room. Generally, if there is not enough negative, or if there is positive pressure there will be smoke roll out from the hood that occurs due to the wind currents from people moving around in the area, while if there is too much negative, there becomes a pressure problem on the building (opening doors, drafts, hot water heaters, etc.)

Measure room static pressure using the air measuring instrument. Adjust the supply fan to set room to 0.02” negative to dining area.

**Room Pressure = _____**

## Calculating Make-up Air CFM

### With an Air Measuring Multimeter Instrument and Spreadsheet

1. Use the Velgrid mode of the multimeter instrument to measure supply air velocity. Make sure to take measurements every twelve (12) inches along the length of the PSP/AC-PSP.
2. Locate the appropriate Excel spreadsheet for the PSP/AC-PSP Supply velocity and record all necessary data. This spreadsheet will calculate the total supply CFM for the hood.
3. The spreadsheet is located on the manufacturer’s website.

### Without an Air Measuring Multimeter Instrument

1. Compute the open area of the supply plenum of the hood. This area must be calculated at the same plane that velocity readings are taken. Area can be calculated using the following formula:

   **Area ($ft^2$) = Length (ft) x Width (ft)**

   If both the length and width are measured in inches, use the following formula:

   **Area ($ft^2$) = Length (in) x Width (in) / 144**
2. Record velocity of air through supply openings from left to right on raw data sheet.
3. Compute and record average velocity through supply openings.
4. Compute and record CFM through supply openings.

   **CFM = Free area x Average Velocity**
5. Compute total CFM through all supply openings for each hood.

## Calculating Exhaust Air CFM

1. Record all hood information on the TB Worksheet. This Excel Spreadsheet may be downloaded from the product website. Refer to **Figure 40**.
2. Select filer size from the drop down menu per filter. The spreadsheet will calculate the free area (ft²).
   **Examples: 16”x16” = 1.35 ft²**
   **16”x20” = 1.73 ft²**
3. Record velocity (airflow) through the center of the filter (3 reading/filter). Firmly hold the VelGrid to the face of the filter, inaccurate readings may occur. Refer to **Figure 39 on page 39**.
4. Calculate average velocity through each filter. Record value in the Velocity cell of worksheet. Refer to **Figure 40**.
5. Compute CFM through each filter. The spreadsheet will calculate CFM.
   **CFM = Free area x Average Velocity**
6. Total the exhaust CFM for each hood.
7. Multiply total exhaust CFM x K Factor
   **Examples: CFM x 1.2 (Shortridge Air Measuring Multimeter)**
   **CFM x 1.13 (Evergreen Air Measuring Multimeter)**

**NOTE: Air Measuring Multimeters other than noted above must be verified and calibrated.**

**Figure 40 - Worksheet Example**

Worksheet for Shortridge VelGrid Example

Job Number =

| Job Name = | | | | | | |
|---|---|---|---|---|---|---|
| Hood Number 1 Information | | | | | | |
| Model = | | Length = | | | | |
| | Filter #1 | Filter #2 | Filter #3 | Filter #4 | Filter #5 | Total CFM |
| Filter Size | 16” x 16” | 16” x 16” | 16” x 16” | 16” x 16” | 16” x 16” | |
| Velocity | 268 | 274 | 283 | 272 | 261 | |
| CFM | 434 | 444 | 458 | 441 | 423 | 2200 |

## Adjustments

1. A hood with multiple risers should be balanced according to the cooking load beneath it. For example, if a hood with multiple risers has a charbroiler in the center and several ovens on the ends, the risers should be evenly balanced. This will achieve the most efficient contaminant capture.
2. Perforated supply plenums discharging air around the hood should be set to the designed discharge velocity.
3. When fan pulleys are adjusted, belts should then be re-checked for correct tension and an amperage reading should be taken on the motor to make certain it is not overloaded.
4. The prime objective of balancing is to ensure that each hood will capture all the contaminants produced by the equipment it covers without causing undesirable conditions in the kitchen (i.e. excessive negative pressure, excessive quantities of hot or cold air in the kitchen, etc.)
5. If problems occur, refer to **"TROUBLESHOOTING" on page 43**.

## Conclusion

1. Compare specified data to the data recorded. Adjust exhaust as necessary using adjustable pulley on fan. Adjust supply as necessary using dampers on supply risers and adjustable pulley on supply fan.
2. After setting hoods to specified data, the room parameters should be checked.
3. If room parameters are not acceptable yet, the hood can be modified to improve them without decreasing hood performance. This is an acceptable condition.
4. Use smoke candles (cartridges) to verify that the hood captures adequately. This can be your final verification. **Only use non-toxic smoke with low chloride concentration <20%. Testing should be conducted with all exhaust fans running to dilute the air.**

## Complete Equipment List for Performance Evaluations

- Closed End Wrenches (9/16, 1/2, 7/16, 3/8, 5/16, 1/4)
- Socket Set & Ratchet (9/16, 1/2, 7/16, 3/8, 5/16, 1/4)
- Extension for Ratchet
- Cheater Bar
- Screwdrivers (Phillips & Standard, Short & Long)
- Adjustable Wrenches (Large & Small)
- 5/32" Allen Wrench 9" Long
- Multi-key Hex Set (Standard Assortment)
- Tape Measure, Hammers (Hard & Soft)
- 2-Channel Locks
- Vise-Grip Pliers (Medium Size)
- Air Measuring Multimeter Instrument
- Velometer or similar unit, Edra 5LV or Davis LCA6000 recommended
- Manometer or similar unit, Dwyer Magnehelic Model #2000-00 recommended
- Work Gloves
- 6' Step Ladder
- 20' Extension Ladder
- Tachometer (Mechanical)
- Amprobe (Volt & Amp Meter)

# TROUBLESHOOTING

The following chart lists causes and corrective actions for possible problems with exhaust hoods. Review this list prior to consulting manufacturer.

| Problem | Potential Cause | Corrective Action |
|---|---|---|
| Smoke is not being captured/ Low Exhaust | Filters are clogged | Clean filters, refer to **"MAINTENANCE" on page 44**. |
| | Extreme negative pressure in space | Increase MUA Quantity to balance building |
| | Exhaust Fan operating in incorrect direction | Check motor wiring to wiring diagram located on fan motor. |
| | Hood overhang on appliance is not correct | Hood should overhang cooking appliances adequately. |
| | Exhaust airflow too low | Increase exhaust fan RPM/HP. |
| | Exhaust duct static pressure higher than design | Increase exhaust fan RPM/HP or have ductwork re-worked. |
| No Exhaust | Exhaust Fan not running | Turn fan disconnect on.<br>Check fan belts<br>Check circuit breaker/voltage.<br>Check wiring connections. |
| | Exhaust Fan running backwards | Wheel should turn per rotation arrow on fan.<br>3 Phase Motor direction may be reversed by switching any 2 leads.<br>1 Phase Motors must be wired per their label. |
| | Fan is on incorrect hood | Make sure electrical package is controlling the correct fan |
| No Make-Up Air | Make-Up Air Fan not running | Turn fan disconnect on<br>Check fan belts<br>Check circuit breaker/voltage |
| | Make-Up Air Damper closed | Ensure blades open on damper |
| | Make-Up Air Fan running backwards | Wheel should turn per rotation arrow on fan.<br>3 Phase Motor direction may be reversed by switching any 2 leads.<br>1 Phase Motors must be wired per their label. |
| | Make-Up Air Duct Static Pressure higher than design | Eliminate flexible ductwork and remove number of elbows in duct. |
| | Clogged Make-Up Air Filters | Clean filters, refer to **"MAINTENANCE" on page 44** |
| | Fire System activated or not armed | Micro-switch on Fire System is keeping make-up air from operating and fire system must be armed |
| Exhaust/Make-Up Air motor cycles on and off | Motor Over-amping | Make sure motor amperage is below FLA of motor label<br>Ensure motor wiring is adequately sized |
| | Exhaust air temperature too high | Increase exhaust airflow or use higher temperature rated motor |
| Grease does not drain | Grease trough full | Clean grease trough behind hood filters. |
| Grease dripping from hood | Hood not being cleaned often enough | Clean surface of hood more frequently. |
| | Exhaust rate too low | Speed up exhaust fan. |
| Hood is vibrating | Vibrating exhaust or MUA Fan | Find source of vibration in fan(s) and correct. Verify a rag or other debris are not stuck in the exhaust fan wheel. |
| Light globes are full of fluid | Duct leak above hood | Check ductwork or fan to roof connection for leaks and seal where necessary |

# MAINTENANCE

To guarantee trouble-free operation of this hood, the manufacturer suggests following these guidelines. Most problems associated with hoods are directly related to poor service and maintenance such as not replacing or cleaning filters.

Please record any maintenance or service performed on this fan in the documentation section located at the end of this manual.

## General Maintenance

To order filters or hood parts, refer to **"Technical Support Information" on page 48**.

- Proper operation of the hood depends on how well the hood is maintained. All surfaces should be kept free of grease build-up for sanitation reasons and to reduce the risk of fire.
- Grease filters must always be installed and clean to reduce build-up of grease in the exhaust duct and to allow for proper exhaust airflow. Refer to **“Recommended Cleaning Supplies” on page 45** for cleaning methods. Maintain all belts, motors, and electrical connections on fans attached to the hood. Ensure grease filters are kept clean and there are no leaks in attached ductwork.

## Daily Maintenance

1. Remove the grease baffle filters and clean in a dishwasher or soak sink daily.
2. Empty and clean grease drain and grease collection cups.
3. Carefully wipe away gritty substances clinging to stainless-steel surfaces to avoid scratching.
4. Dilute 1/2 cup of laundry detergent (e.g. Tide) with one (1) gallon of warm water.
5. Soak a clean cloth in the water detergent solution and wring out the excess water.
6. Wipe the hood surfaces moving in the direction of the grain and periodically rinse the cloth in a detergent solution.
7. Using a different clean cloth soaked in clean warm water, wipe the hood surfaces to remove all traces of the detergent solution.
8. Wipe hood surfaces dry with a clean, dry cloth. Clean the hood temperature sensor in riser if equipped with one.
9. Reapply stainless-steel polish.

**CAUTION**

**DO NOT** use iron wool (Brillo or SOS pads), scrapers, or spatulas to clean hood!

**DO NOT** use the following substances on or around the hood:

1. Chlorine or chlorine based substances.
2. Acids (e.g. acetic, hydrochloric, sulfuric).
3. Chloride based substances (e.g. mercuric chloride, ferric chloride).

**Vapors of the above substances can corrode stainless-steel!**

## Quarterly Maintenance

- Inspect the unit and duct for grease or air leaks and repair leaks where required.
- Clean ductwork attached to hood to prevent a mass accumulation of grease.

## Recommended Cleaning Supplies

**Table 1 - Recommended Cleaning Agents**

| Cleaning Method/Agent Type | Supplier | Product |
|---|---|---|
| Dishwasher Detergent | Ecolab<br>Johnson Diversey | Solid Powder/Plus<br>Suma DiverPak/Plus |
| Soak Method – Pot and Pan Detergent | Ecolab | Powder Detergent |
| Soak Method – Commercial Degreaser | Ecolab<br>Johnson Diversey<br>Zep | Decarbonizer MPX<br>Soak Tank Solution<br>Zep FS Pot Scrub |
| Heavy Duty Commercial Degreaser | Ecolab<br>Johnson Diversey<br>Zep | Grease Cutter Plus<br>Suma Star<br>Zep FS C.I.P Cleaner |

**Table 2 - Recommended Commercial Soak Tanks**

| Description | Supplier | Product | Contact |
|---|---|---|---|
| Heated Soak Tank | Hyginix | FOG Tank®<br>(Use only Tiger Carbon Powder Remover®) | www.fogtank.com<br>858-566-6212<br>info@fogtank.com |

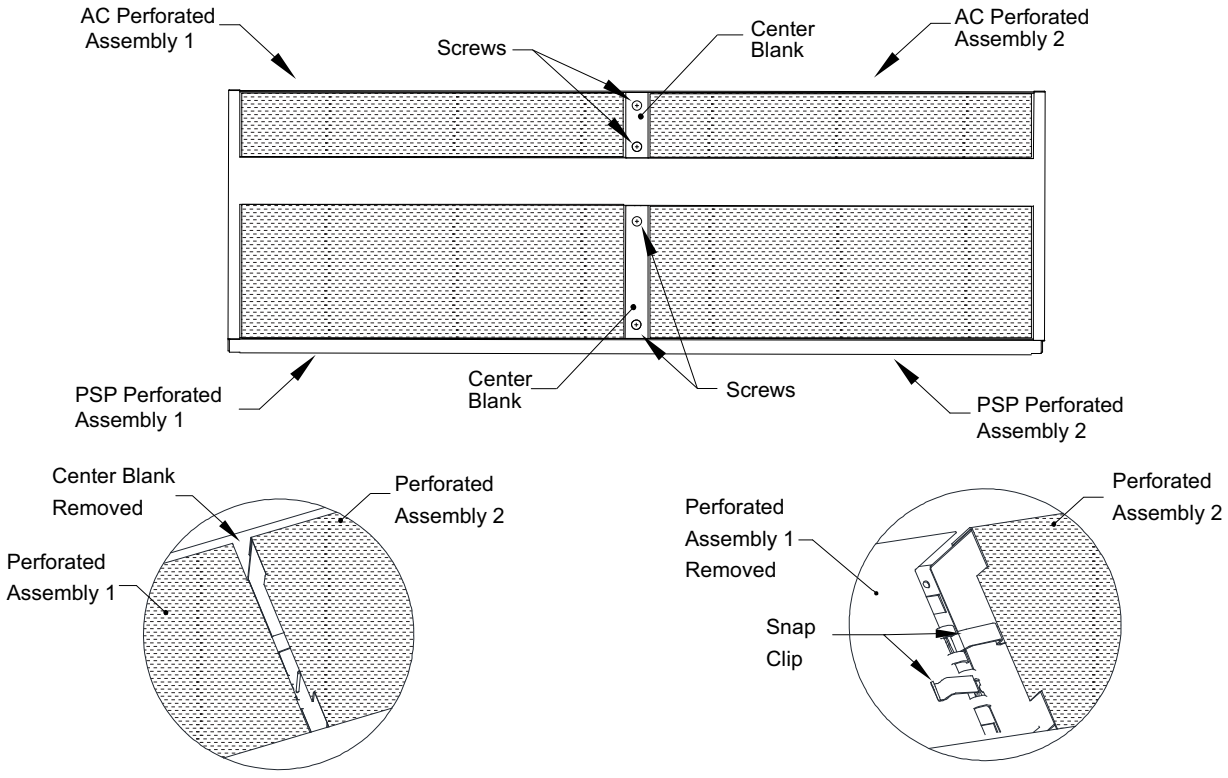
## PSP/AC-PSP Perforated Screen Cleaning and Maintenance

If airflow diminishes or the perforated assembly appears clogged or dirty, follow these steps to clean the area. Refer to **Figure 41** for perforated supply details.

**NOTE: You must wear protective gloves during this procedure.**

1. Check supply fan. Clean as needed, repair if any damage is found.
2. Check filters. Clean and replace as needed. Refer to **"General Maintenance" on page 44** for ordering parts.
3. Check volume dampers to ensure they are set correctly and have not been closed.
4. Remove perforated assemblies from PSP/AC-PSP.
   - Loosen the screws. The screws will have capture washers on the back. These are used to secure the center blank.
   - Remove the center blank. Grasp the perforated assembly and quickly pull, releasing the perforate assembly from the snap clips.
5. Clean perforated assemblies and wipe dry before reinstalling. **Do Not Use Chlorine, Bleach or Other Corrosive Cleaners.**
6. Carefully reinstall perforated assembly and secure with snap clip.
7. Place center blank back into location. Secure with capture washers and screws.

**Figure 41 - Perforated Supply (AC/PSP Shown)**



**Notes**

## Start-Up Documentation

**START-UP AND MEASUREMENTS SHOULD BE PERFORMED AFTER THE SYSTEM HAS BEEN AIR BALANCED (Warranty will be void without completion of this form)**

## Job Information

| | | | |
|---|---|---|---|
| Job Name | | Service Company | |
| Address | | Address | |
| City | | City | |
| State | | State | |
| Zip | | Zip | |
| Phone Number | | Phone Number | |
| Fax Number | | Fax Number | |
| Contact | | Contact | |
| Purchase Date | | Start-Up Date | |

**Hood Information**

Refer to the start-up procedure in this manual to complete this section.

| Name Plate and Unit Information | |
|---|---|
| Model Number | |
| Job Number | |

**As a result of our dedication to constant improvements and quality, the MANUFACTURER reserves the right to update specifications without notice. Please refer to MANUFACTURER'S website for up to date documentation.**

### Technical Support Information

CASLink

Technical Support

Parts Store

# MSZ-GS18NA & MUZ-GS18NA
## 18,000 BTU/H WALL-MOUNTED INDOOR UNIT
## 18,000 BTU/H HEAT PUMP OUTDOOR UNIT

MITSUBISHI ELECTRIC
HEATING & AIR CONDITIONING

Job Name:

System Reference: Date:





Indoor Unit ..... MSZ-GS18NA

Outdoor Unit ..... MUZ-GS18NA

INDOOR UNIT FEATURES

- Slim wall-mounted indoor units provide zone comfort control
- Dual Barrier Coating applied to the heat exchanger, vanes and fan to prevent hydrophilic and hydrophobic dirt build-up
- Optional Microparticle Filter designed to capture PM2.5
- The outdoor unit powers the indoor unit, and should a power outage occur, the system is automatically restarted when power returns
- Quiet operation
- Smart Set: recalls a preferred preset temperature setting at the touch of a button
- Built-in backup/auxiliary heater control available
- Multiple fan speed options: Quiet, Low, Medium, High, Super-high, Auto
- Multiple control options available:
  - Back-lit screen handheld remote controller (provided with the unit)
  - kumo cloud® smart device app for remote access
  - Third-party interface options
  - Wired or wireless controllers

OUTDOOR UNIT FEATURES

- INVERTER-driven compressor and LEV provide high efficiency and comfort while using only the energy needed to maintain maximum performance
- Blue Fin anti-corrosion treatment applied to the outdoor unit heat exchanger for increased coil protection and longer life
  - Rated for 2,000 hours spraying time per ASTM B117 Standard

Specifications are subject to change without notice.

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# SPECIFICATIONS: MSZ-GS18NA & MUZ-GS18NA

| | | | |
|---|---|---|---|
| Cooling at 95°F[1] | Maximum Capacity | BTU/H | 22,000 |
| | Rated Capacity | BTU/H | 18,000 |
| | Minimum Capacity | BTU/H | 5,800 |
| | Maximum Power Input | W | 2,150 |
| | Rated Power Input | W | 1,340 |
| | Moisture Removal | Pints/h | 3.8 |
| | Sensible Heat Factor | | 0.77 |
| | Power Factor [208V / 230V] | % | 97.0 / 97.0 |
| Heating at 47°F[2] | Maximum Capacity | BTU/H | 25,000 |
| | Rated Capacity | BTU/H | 21,600 |
| | Minimum Capacity | BTU/H | 5,400 |
| | Maximum Power Input | W | 2,500 |
| | Rated Power Input | W | 1,680 |
| | Power Factor [208V / 230V] | % | 97.0 / 97.0 |
| Heating at 17°F[3] | Maximum Capacity | BTU/H | 18,200 |
| | Rated Capacity | BTU/H | 13,300 |
| | Maximum Power Input | W | 2,080 |
| | Rated Power Input | W | 1,460 |
| Heating at 5°F[4] | Maximum Capacity | BTU/H | 14,780 |
| | Maximum Power Input | W | 1,910 |
| Efficiency | SEER2 | | 21.5 |
| | EER2[1] | | 13.45 |
| | HSPF2 [IV] | | 10.3 |
| | COP at 47°F[2] | | 3.77 |
| | COP at 17°F at Maximum Capacity[3] | | 2.56 |
| | COP at 5°F at Maximum Capacity[4] | | 2.27 |
| | ENERGY STAR® Certified | | Yes |
| Electrical | Voltage, Phase, Frequency | | 208/230, 1, 60 |
| | Guaranteed Voltage Range | V AC | 187 - 253 |
| | Voltage: Indoor - Outdoor, S1-S2 | V AC | 208/230 |
| | Voltage: Indoor - Outdoor, S2-S3 | V DC | 24 |
| | Short-circuit Current Rating [SCCR] | kA | 5 |
| | Recommended Fuse/Breaker Size (Outdoor) | A | 15 |
| | Recommended Wire Size [Indoor - Outdoor] | AWG | 14 |
| | Power Supply | | Indoor unit is powered by the outdoor unit |
| Indoor Unit | MCA | A | 1.0 |
| | Fan Motor Full Load Amperage | A | 0.74 |
| | Fan Motor Output | W | 40 |
| | Airflow Rate at Cooling, Dry | CFM | 250–325–407–511–629 |
| | Airflow Rate at Cooling, Wet | CFM | 225–292–367–460–566 |
| | Airflow Rate at Heating, Dry | CFM | 287–375–459–550–629 |
| | Sound Pressure Level [Cooling] | dB[A] | 28–33–38–44–49 |
| | Sound Pressure Level [Heating] | dB[A] | 28–34–39–43–48 |
| | Drain Pipe Size | In. [mm] | 5/8 [15.88] |
| | Coating on Heat Exchanger | | Dual Barrier Coating |
| | External Finish Color | | Munsell 1.0Y 9.2/0.2 |
| | Unit Dimensions | W x D x H: In. [mm] | 36-5/16 x 9-13/16 x 12 [923 x 250 x 305] |
| | Package Dimensions | W x D x H: In. [mm] | 39 x 13 x 15 [990 x 330 x 380] |
| | Unit Weight | Lbs. [kg] | 28 [12.4] |
| | Package Weight | Lbs. [kg] | 32 [14.2] |
| Indoor Unit Operating Temperature Range | Cooling Intake Air Temp [Maximum / Minimum]* | °F | 90 DB, 73 WB / 67 DB, 57 WB |
| | Heating Intake Air Temp [Maximum / Minimum] | °F | 80 DB / 70 DB |

NOTES:

| | | | |
|---|---|---|---|
| AHRI Rated Conditions (Rated data is determined at a fixed compressor speed) | [1]Cooling (Indoor // Outdoor) | °F | 80 DB, 67 WB // 95 DB, 75 WB |
| | [2]Heating at 47°F (Indoor // Outdoor) | °F | 70 DB, 60 WB // 47 DB, 43 WB |
| | [3]Heating at 17°F (Indoor // Outdoor) | °F | 70 DB, 60 WB // 17 DB, 15 WB |
| Conditions | [4]Heating at 5°F (Indoor // Outdoor) | °F | 70 DB, 60 WB // 5 DB, 4 WB |

*Indoor/Outdoor Unit Operating Temperature Range (Cooling Air Temp [Maximum / Minimum]):
- Applications should be restricted to comfort cooling only; equipment cooling applications are not recommended for low ambient temperature conditions.

**Outdoor Unit Operating Temperature Range (Cooling Thermal Lock-out / Re-start Temperatures; Heating Thermal Lock-out / Re-start Temperatures):
- System cuts out in heating mode to avoid thermistor error and automatically restarts at these temperatures.

Specifications are subject to change without notice.

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# SPECIFICATIONS: MSZ-GS18NA & MUZ-GS18NA

| | | | |
|---|---|---|---|
| Outdoor Unit | MCA | A | 12.0 |
| | MOCP | A | 15 |
| | Fan Motor Full Load Amperage | A | 0.93 |
| | Fan Motor Output | W | 50 |
| | Refrigerant Control | | Linear expansion valve |
| | Defrost Method | | N/A |
| | Sound Pressure Level, Cooling[1] | dB(A) | 54 |
| | Sound Pressure Level, Heating[2] | dB(A) | 55 |
| | Compressor Type | | DC inverter driven Twin Rotary |
| | Compressor Model | | SNB130FQBMT |
| | Compressor Rated Load Amps | A | 8.4 |
| | Compressor Locked Rotor Amps | A | 10.5 |
| | External Finish Color | | Munsell 3Y 7.8/1/1 |
| | Base Pan Heater | | Optional |
| | Unit Dimensions | W x D x H: In. [mm] | 33-1/16 x 13 x 34-5/8 [840 x 330 x 880] |
| | Package Dimensions | W x D x H: In. [mm] | 38-3/4 x 16-3/4 x 39 [980 x 420 x 990] |
| | Unit Weight | Lbs. [kg] | 119 [53.7] |
| | Package Weight | Lbs. [kg] | 137 [61.9] |
| Outdoor Unit Operating Temperature Range | Cooling Air Temp [Maximum / Minimum]* | °F | 115 DB / 14 DB |
| | Cooling Thermal Lock-out / Re-start Temperatures** | °F | -4 / 0 |
| | Heating Air Temp [Maximum / Minimum] | °F | 75 DB, 65 WB / -4 DB, -5 WB |
| | Heating Thermal Lock-out / Re-start Temperatures** | °F | -14 / -4 |
| Refrigerant | Type | | R410A |
| | Pre-Charged Refrigerant Amount | Lbs, oz | 3.0, 7.0 |
| | Maximum Pre-Charged Piping Length | Ft. [m] | 25.0 [7.5] |
| | Additional Refrigerant Charge Per Additional Piping Length | oz./Ft. [g/m] | 1.08 [20] |
| Piping | Gas Pipe Size O.D. [Flared] | In.[mm] | 1/2 [12.7] |
| | Liquid Pipe Size O.D. [Flared] | In.[mm] | 1/4 [6.35] |
| | Maximum Piping Length | Ft. [m] | 100 [30] |
| | Maximum Height Difference | Ft. [m] | 50 [15] |
| | Maximum Number of Bends | | 10 |

NOTES:

| | | | |
|---|---|---|---|
| AHRI Rated Conditions (Rated data is determined at a fixed compressor speed) | [1]Cooling (Indoor // Outdoor) | °F | 80 DB, 67 WB // 95 DB, 75 WB |
| | [2]Heating at 47°F (Indoor // Outdoor) | °F | 70 DB, 60 WB // 47 DB, 43 WB |
| | [3]Heating at 17°F (Indoor // Outdoor) | °F | 70 DB, 60 WB // 17 DB, 15 WB |
| Conditions | [4]Heating at 5°F (Indoor // Outdoor) | °F | 70 DB, 60 WB // 5 DB, 4 WB |

*Indoor/Outdoor Unit Operating Temperature Range (Cooling Air Temp [Maximum / Minimum]):
- Applications should be restricted to comfort cooling only; equipment cooling applications are not recommended for low ambient temperature conditions.

**Outdoor Unit Operating Temperature Range (Cooling Thermal Lock-out / Re-start Temperatures; Heating Thermal Lock-out / Re-start Temperatures):
- System cuts out in heating mode to avoid thermistor error and automatically restarts at these temperatures.

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# INDOOR UNIT ACCESSORIES: MSZ-GS18NA

| | | |
|---|---|---|
| Control Interface | Backup Heat Relay Kit Adapter for CN24 or CN152 on ducted models | ☐ CN24RELAY-KIT-CM3 |
| | IT Extender for kumo station™ | ☐ PAC-WHS01IE-E |
| | kumo station™ for kumo cloud® | ☐ PAC-WHS01HC-E |
| | M-Net & I/O Control Interface for M-Series | ☐ MAC-334IF-E |
| | Procon BACnet® and Modbus® Interface | ☐ PAC-UKPRC001-CN-1 |
| | USNAP Adapter for Demand Response | ☐ PAC-WHS01UP-E |
| | Wireless Interface for kumo cloud® | ☐ PAC-USWHS002-WF-2 |
| Remote Sensor | Wireless temperature and humidity sensor for kumo cloud® | ☐ PAC-USWHS003-TH-1 |
| Wired Remote Controller | Deluxe MA Wired Remote Controller† | ☐ PAR-41MAAU |
| | Simple Ductless Wired Remote Controller | ☐ PAC-SDW01RC-1 |
| | Simple MA Remote Controller | ☐ PAC-YT53CRAU-J |
| | Touch MA Wired Remote Controller | ☐ PAR-CT01MAU-SB |
| Wireless Remote Controller | kumo touch™ RedLINK™ Wireless Controller & Receiver kit | ☐ MHK2 |
| | Lockdown Bracket for Wireless Handheld Remote Controllers | ☐ RCMKP1CB |
| Condensate | Blue Diamond (Advanced) Mini Condensate Pump w/ Reservoir & Sensor (208/230V) [recommended] | ☐ X87-721 |
| | Blue Diamond (MaxiBlue Advanced) Mini Condensate Pump w/ Reservoir & Sensor (110V) up to 48,000 BTU/H [recommended] | ☐ X87-711 |
| | Blue Diamond (MegaBlue Advanced) Condensate Pump w/ Reservoir & Sensor | ☐ X87-835 |
| | Blue Diamond Alarm Extension Cable — 6.5 Ft. | ☐ C13-192 |
| | Blue Diamond MultiTank — collection tank for use with multiple pumps | ☐ C21-014 |
| | Blue Diamond Sensor Extension Cable — 15 Ft. | ☐ C13-103 |
| | Drain Pan Level Sensor/Control | ☐ SS610E |
| | Fascia Kit for MicroBlue Pump, mounts the MicroBlue and sensor directly beneath indoor unit | ☐ T18-016 |
| | Sauermann Condensate Pump | ☐ SI30-230 |
| Disconnect Switch | (30A/600V/UL) [fits 2” X 4” utility box] - Black | ☐ TAZ-MS303 |
| | (30A/600V/UL) [fits 2” X 4” utility box] - White | ☐ TAZ-MS303W |
| Filter | Anti-allergy Enzyme Filter | ☐ MAC-408FT-E |

NOTES:
†Requires MAC-334IF-E
- M-Series EZ FIT® Recessed Ceiling Cassette, Floor-mount and Wall-mount
  Allows indoor units to connect to an MA Controller:
  Deluxe MA Remote Controller
  Simple MA Controller
  Touch MA Controller

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# OUTDOOR UNIT ACCESSORIES: MUZ-GS18NA

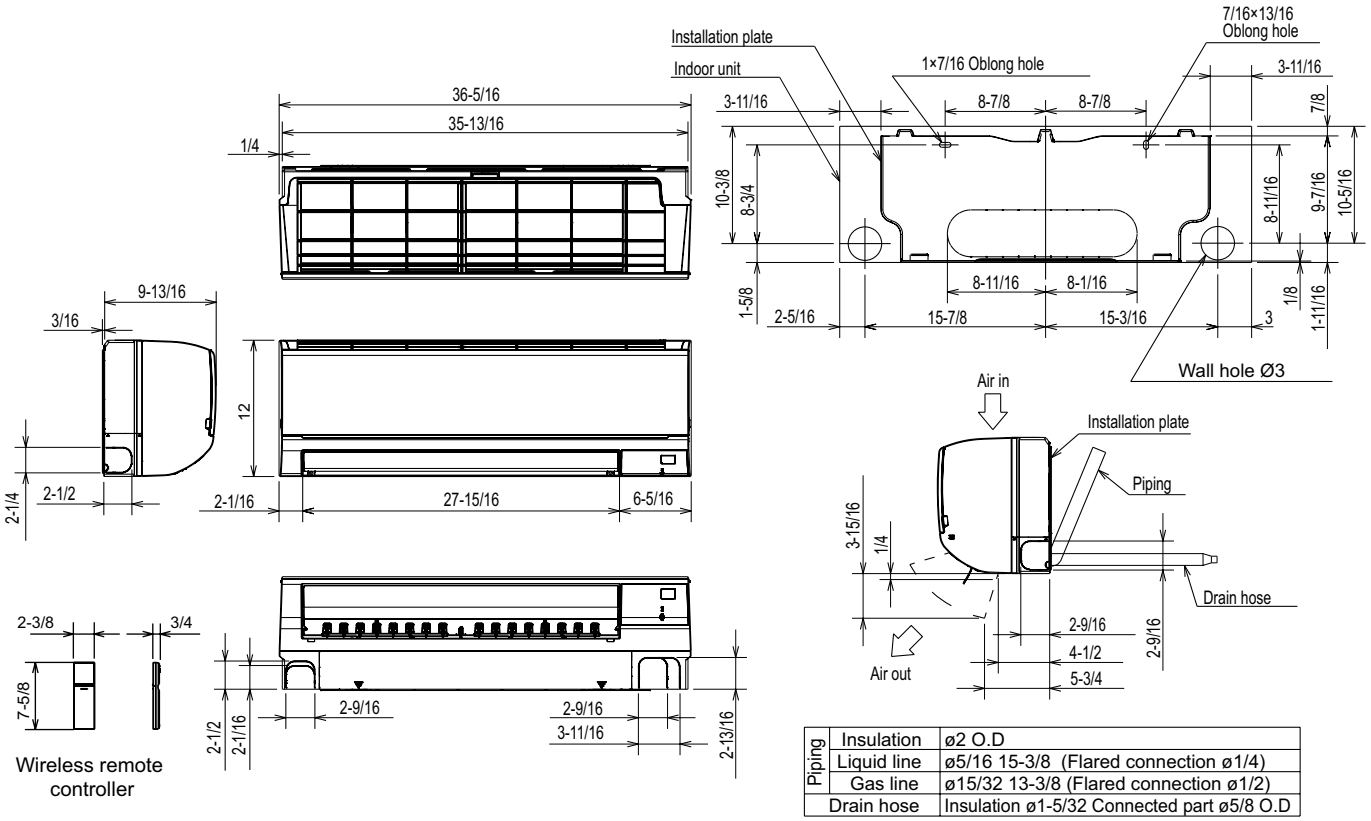
| | | |
|---|---|---|
| Air Outlet Guide | Air Outlet Guide | ☐ MAC-886SG-E |
| Hail Guards | Hail Guard | ☐ HG-A7 |
| Lineset | 100’ x 1/4” x 100’ / 1/2” Lineset (Twin-Tube Insulation) | ☐ MLS141212T-100 |
| | 15’ x 1/4” x 15’ / 1/2” Lineset (Twin-Tube Insulation) | ☐ MLS141212T-15 |
| | 30’ x 1/4” x 30’ / 1/2” Lineset (Twin-Tube Insulation) | ☐ MLS141212T-30 |
| | 50’ x 1/4” x 50’ / 1/2” Lineset (Twin-Tube Insulation) | ☐ MLS141212T-50 |
| | 65’ x 1/4” x 65’ / 1/2” Lineset (Twin-Tube Insulation) | ☐ MLS141212T-65 |
| Mounting Pad | Condensing Unit Mounting Pad: 16” x 36” x 3” | ☐ ULTRILITE1 |
| Optional Defrost Heater | Base Heater | ☐ MAC-642BH-U1 |
| Stand | 18” Single Fan Stand | ☐ QSMS1801M |
| | 24” Single Fan Stand | ☐ QSMS2401M |
| | Condenser Wall Bracket | ☐ QSWB2000M-1 |
| | Condenser Wall Bracket - Stainless Steel Finish | ☐ QSWBSS |
| | Outdoor Unit 3-1/4 inch Mounting Base (Pair) - Plastic | ☐ DSD-400P |
| | Outdoor Unit Stand — 12” High | ☐ QSMS1201M |

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# INDOOR UNIT DIMENSIONS: MSZ-GS18NA

**Unit: inch**



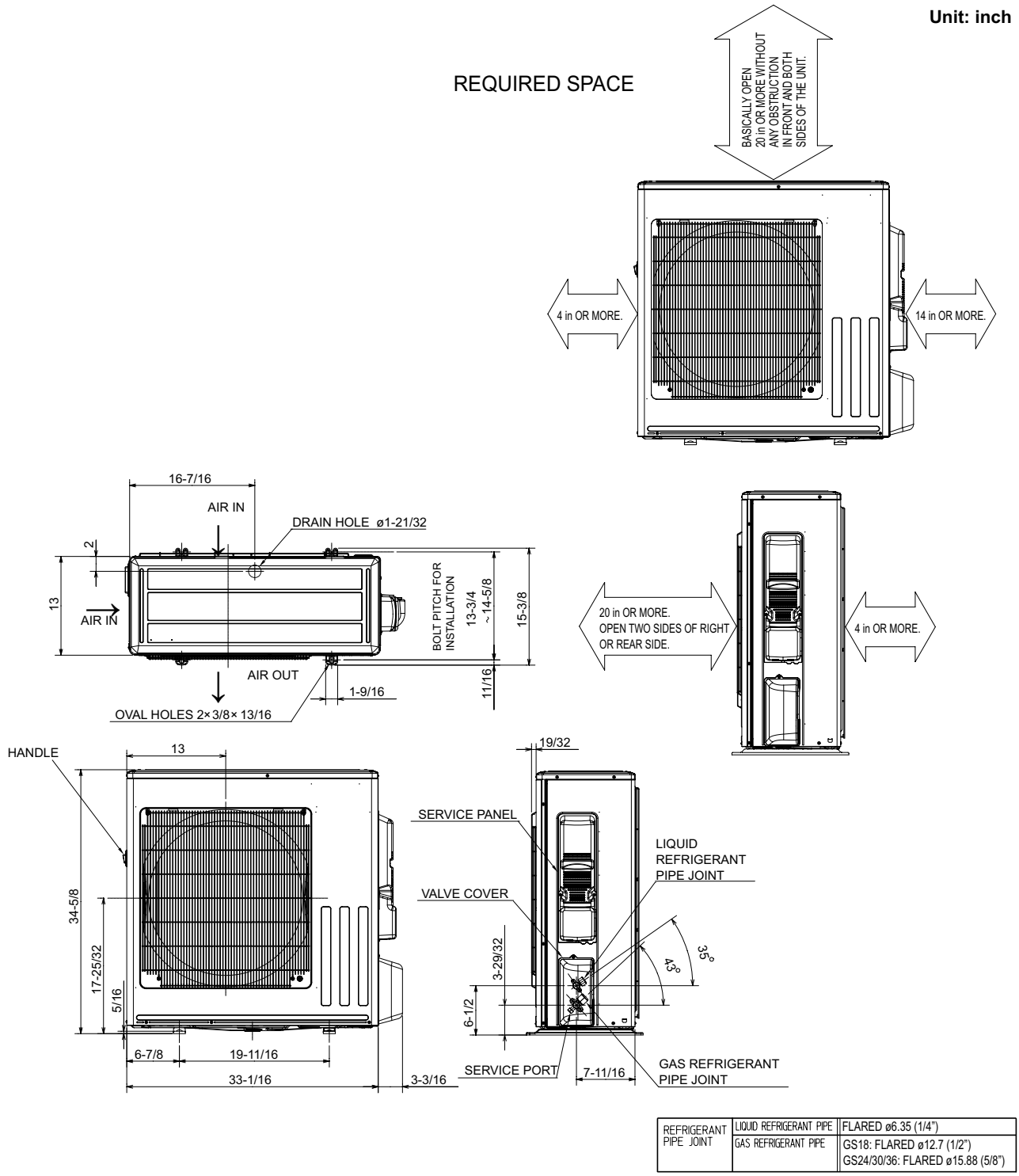

| | | |
|---|---|---|
| Piping | Insulation | ø2 O.D |
| | Liquid line | ø5/16 15-3/8 (Flared connection ø1/4) |
| | Gas line | ø15/32 13-3/8 (Flared connection ø1/2) |
| Drain hose | | Insulation ø1-5/32 Connected part ø5/8 O.D |

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# OUTDOOR UNIT DIMENSIONS: MUZ-GS18NA

**Unit: inch**




| | | |
|---|---|---|
| REFRIGERANT PIPE JOINT | LIQUID REFRIGERANT PIPE | FLARED ø6.35 (1/4") |
| | GAS REFRIGERANT PIPE | GS18: FLARED ø12.7 (1/2")<br>GS24/30/36: FLARED ø15.88 (5/8") |


1340 Satellite Boulevard Suwanee, GA 30024
Toll Free: 800-433-4822 www.mehvac.com



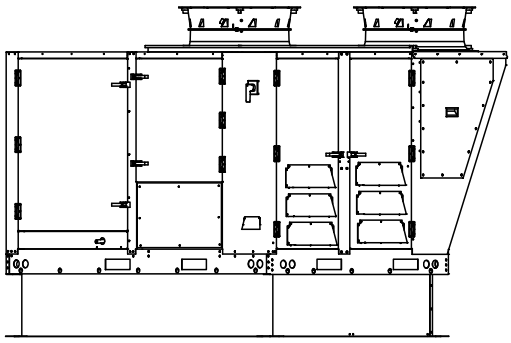
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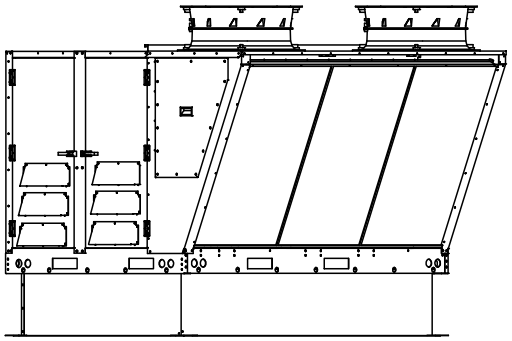


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# Installation, Operation, and Maintenance Manual





**WARNING! FIRE OR EXPLOSION HAZARD**

- **Failure to follow safety warnings exactly could result in serious injury, death or property damage.**
- **Make sure to read and understand the installation, operation and service instructions in this manual.**
- **Improper installation, adjustment, alteration, service or maintenance can cause serious injury, death or property damage.**
- **Do not use means to accelerate the defrosting process or to clean, other than those recommended by the manufacturer.**
- **The appliances shall be stored in a room without continuously operating ignition sources (for example: open flames, an operating gas appliance or an operating electric heater.**
- **Refrigerating pipe or components are installed in a position where they are unlikely to be exposed to any substance which may corrode refrigerant containing components, unless the components are constructed of materials which are inherently resistant to being corroded or are suitably protected against being so corroded.**
- **Do not pierce or burn refrigeration piping.**
- **Be aware that refrigerants may not contain an odor.**
- **Read the installation, operating and maintenance instructions thoroughly before installing or servicing this equipment. ALWAYS disconnect power and gas prior to working on unit.**

**FOR YOUR SAFETY**

**Do not store or use gasoline or other flammable vapors and liquids in the vicinity of this or any other appliance. Installation and service must be performed by a qualified installer, service agency or gas supplier.**

**WHAT TO DO IF YOU SMELL GAS:**

- **Do not try to light any appliance. Do not touch any electrical switch; do not use any phone in your building.**
- **Leave the building immediately. Immediately call your gas supplier from a phone remote from the building.**
- **Follow the gas supplier's instructions. If you cannot reach your gas supplier, call the fire department.**

**IMPORTANT**

**Some units may contain an energy recovery wheel. By virtue of their design, all energy recovery wheels allow a level of return/exhaust air and contaminants to be recirculated into the supply airstream. Accepting and operating this unit with or without the energy recovery wheel in operation increases the risk of airborne bacteria, virus and contaminant spread between the return/exhaust air, into the fresh airstream.**

**In accordance with ANSI/ASHRAE/ASHE Standard 170-2017, energy recovery wheel technology should not be used as a means of ventilation for certain Health Care Facilities. An ASHRAE Position Document on Infectious Aerosols, approved by ASHRAE Board of Directors, dated April 14, 2020, also recommends that energy recovery devices be bypassed for non-health care facility ventilation to help reduce the spread of virus.**

**Any reduction of outdoor air % or volume below what this unit was designed for elevates the risk of airborne bacteria, virus and contaminant recirculation back into the fresh airstream and the space.**

**Operating this unit with an exhaust level less than 50% of the supply level nullifies all return on investment statements and limits the amount of energy recovery.**

**This unit, including the energy recovery wheel, must be serviced and maintained as per the Installation and Operation Manual's recommended frequencies.**

**RECEIVING AND INSPECTION**

**Upon receiving unit, check for any interior and exterior damage, and if found, report it immediately to the carrier. Check that all accessory items are accounted for and free of damage. Turn the blower wheel by hand to verify free rotation and check the damper (if supplied) for free operation.**

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# WARRANTY

This unit comes with a standard 5-year parts warranty from date of shipment to be free from defects in materials and workmanship, under normal use and service. An extended 10-year non-prorated parts warranty is available at no extra charge when units are remotely monitored and maintained through a Service Preventative Maintenance subscription (terms and conditions apply).

This warranty shall not apply if:

1. The equipment is not installed by a qualified installer per the MANUFACTURER'S installation instructions shipped with the product.
2. The equipment is not installed in accordance with Federal, State, and/or Local codes and regulations.
3. The equipment is misused or neglected, or not maintained per the MANUFACTURER'S maintenance instructions.
4. The equipment is not operated within its published capacity.
5. The invoice is not paid within the terms of the sales agreement.

The MANUFACTURER shall not be liable for incidental and consequential losses and damages potentially attributable to malfunctioning equipment. Should any part of the equipment prove to be defective in material or workmanship within the standard 5-year warranty period or the extended 10-year Preventative Maintenance subscription, upon examination by the MANUFACTURER, such part will be repaired or replaced by MANUFACTURER at no charge. The BUYER shall pay all labor costs incurred in connection with such repair or replacement. Equipment shall not be returned without MANUFACTURER'S prior authorization, and all returned equipment shall be shipped by the BUYER, freight prepaid to a destination determined by the MANUFACTURER.

## Coastal Applications

Units installed within 1-mile of salt-water coasts and waterways must be equipped with an E-Coated Outdoor Coil. Position the unit so the fresh air inlet and outdoor coil are protected from direct salt spray. Failure to protect the fresh air inlet and outdoor coil from direct salt spray will void the unit's warranty.

## Furnace Warranty

Subject to all terms stated herein, the MANUFACTURER warrants to BUYER the stainless steel heat exchanger to be free from defects in material and workmanship under normal use and service for 25-years from the date of manufacture and warranty is limited to replacement of the heat exchanger only.

# CERTIFICATIONS

## Listings and Standards

This unit is ETL-listed to the following standards:

- Standard for Safety Heating and Cooling Equipment ANSI/UL 60335-2-40, CSA 22.2 no. 236
- American National Standard/CSA Standard for Gas Unit Heaters and Gas-Fired Duct Furnaces ANSI Z83.8-2016, CSA 2.6-2016

This unit has been tested in accordance to the following standards:

- ANSI/AHRI Standard 340/360 – 2007
- ANSI/ASHRAE Standard 37 – 2009

# INSTALLATION

It is imperative that this unit is installed and operated with the designed airflow, gas, and electrical supply in accordance with this manual. Maximum installation altitude = 10,000 feet. For questions about installation, warranty, or service, go to **support.captiveaire.com** or **"Technical Support Information" on page 168** for more information.

**IMPORTANT**

**For gas units, to prevent premature heat exchanger failure, do not locate any gas fired unit in areas where chlorinated, halogenated, or acid vapors are present in the atmosphere.**

## Mechanical

### Inspection on Arrival

1. Inspect unit on delivery.
2. Photograph any visible damage.
3. Report any damage to the delivery carrier.
4. Request a written inspection report from the Claims Inspector to substantiate a claim.
5. File a claim with the delivery carrier.
6. Check unit's rating plate to verify proper electric and fuel type to meet job requirements.
7. Compare unit received with description of product ordered.

### Unloading/Moving Unit

**WARNING!**

**Verify the forklift's rated capacity can handle the equipment's weight. Operators are not to pick up and move loads that are unbalanced or too heavy.**

- For size 1 through 3 units, use forks that extend through the opposite side of the unit. Use minimum 60" length forks for size 1 units. Use minimum 72" length forks for size 2 and 3 units. **FAILURE TO DO SO COULD RESULT IN EQUIPMENT DAMAGE.**
- For size 4 units, use minimum 72" length forks. The unit must be lifted from the blower side only. **FAILURE TO DO SO COULD RESULT IN EQUIPMENT DAMAGE.**
- Blank off plates are installed at the factory to ensure the unit is lifted as its proper center of gravity.
- The unit must be moved slowly, approximately raised 6-8" off of the ground.

### Unit Location - Site Preparation

- Do not locate any gas-fired equipment near corrosive, explosive vapors such as chlorinated or acid vapors.
- Unit should not be accessible to the public.
- **Do Not Allow Children Around the Unit Supervised/Unsupervised.**
- The unit is not to be used by persons (including children) with reduced physical, sensory or mental capabilities, or lack of experience or knowledge, unless they have been given supervision or instruction.
- Avoid overhead power lines, or other utility access points to prevent accidental contact or damage.
- Provide clearance around the installation site to safely rig and lift the equipment into its final position onto adequate supports. Refer to the manufacturer's estimated weights.
- Consider general service and installation space when locating the unit.
- Locate the unit close to the space it will serve to reduce long and twisted duct runs.
- Do not allow the air intake to face prevailing winds. The airflow switch may trip in high winds.
- Situate the unit above ground or at roof level high enough to prevent precipitation from being drawn into its inlet.
- The inlet must also be located at least 10 feet away from any exhaust vents.
- The inlet must be in accordance with the applicable building code provisions for ventilation air.
- The unit must have adequate structural support, or the equipment or building could be damaged.
- Do not alter or otherwise restrict combustion or ventilation openings.

## CLEARANCE TO COMBUSTIBLE MATERIALS

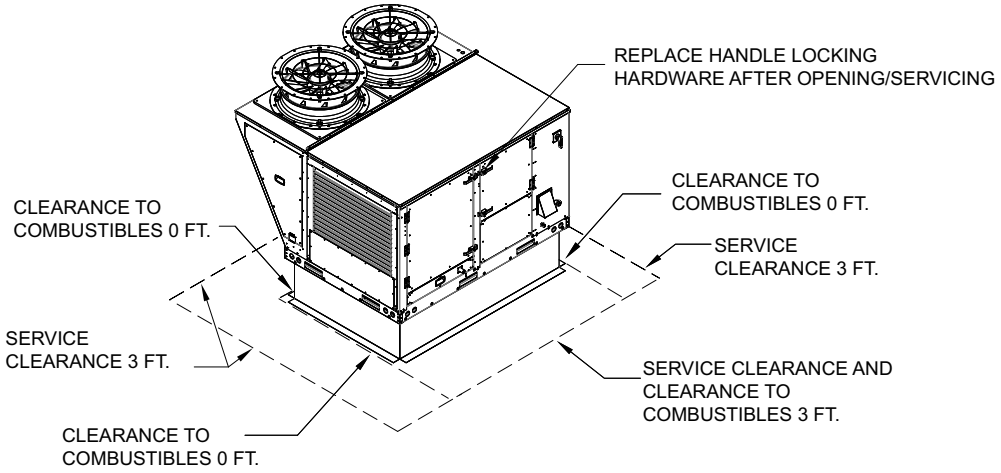
**This equipment may be installed with clearances from the equipment to combustible material not less than 0 inches from the top, bottom, condenser side, front and back. The flue side must be installed 3 feet from combustible materials. Refer to Figure 1 for clearance details.**

## SERVICE CLEARANCE

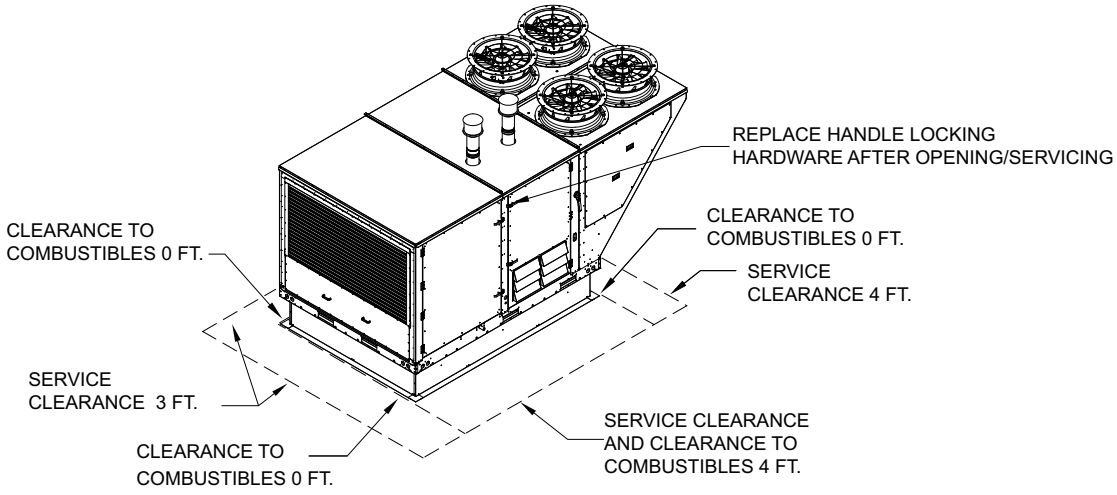
**For service accessibility and performance, this unit must have at least 3 feet of clearance on the intake and supply sides. Size 1, 2, and 3 units should have 3 feet of clearance on the condensing coil side, and size 4 units should have 4 feet. Clearance above condenser fans should be at least 10 feet. Refer to Figure 1 for clearance details.**

### Figure 1 - Unit Clearance

**Size 1, 2, and 3 Unit Clearance**




**Size 4 Unit Clearance**



## CLEARANCE TO COMBUSTIBLE MATERIALS

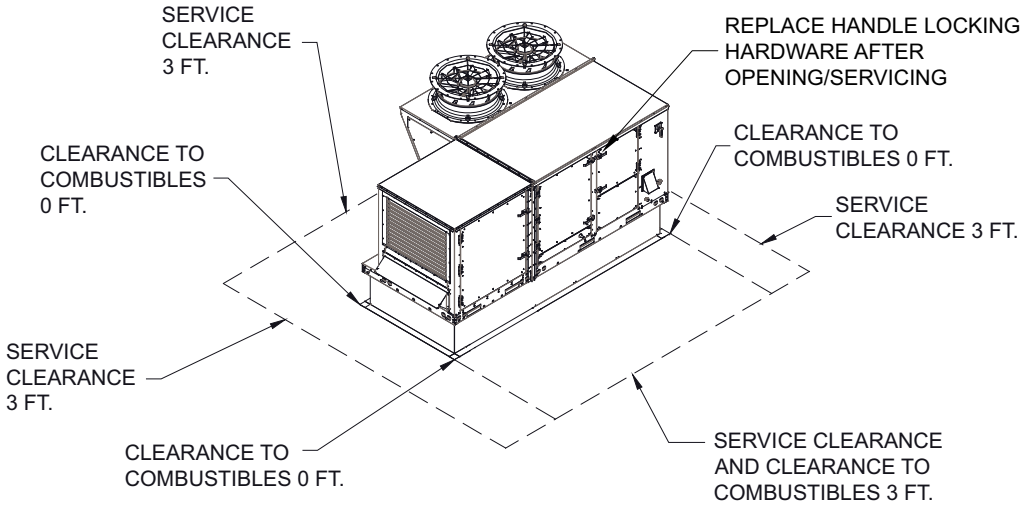
**This equipment may be installed with clearances from the equipment to combustible material not less than 0 inches from the top, bottom, condenser side, front and back. The flue side must be installed 3 feet from combustible materials. Refer to Figure 2 for clearance details.**

## SERVICE CLEARANCE

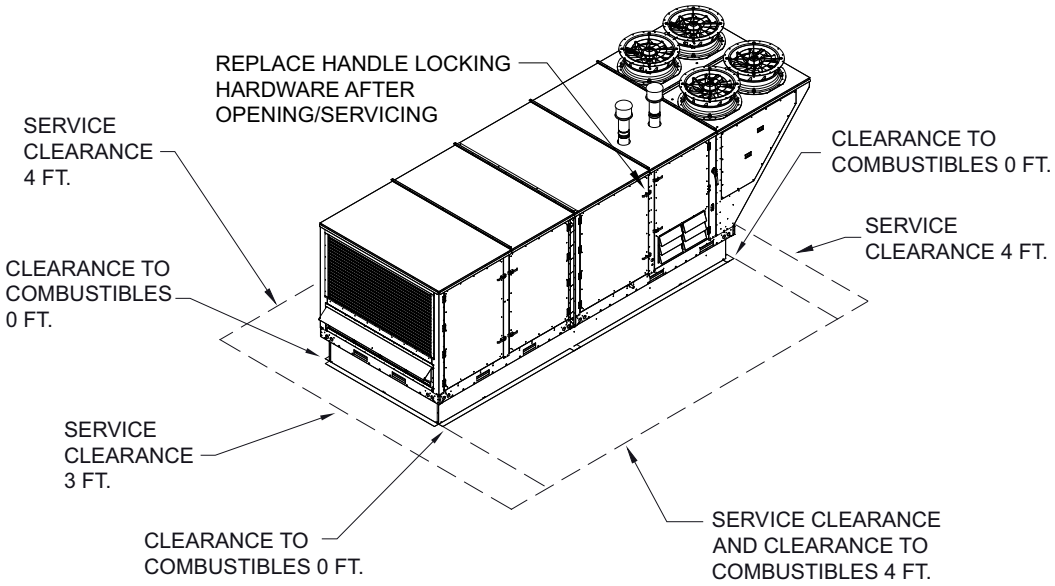
**For service accessibility and performance, this unit must have at least 3 feet of clearance on the intake and supply sides. Size 2 and 3 ERV units should have 3 feet of clearance on the condensing coil side, and size 4 ERV units should have 4 feet. Clearance above condenser fans should be at least 10 feet. Refer to Figure 2 for clearance details.**

**Figure 2 - ERV Unit Clearances**

**Size 2 and 3 Unit Clearance**




**Size 4 Unit Clearance**



## Rigging

**WARNING!**

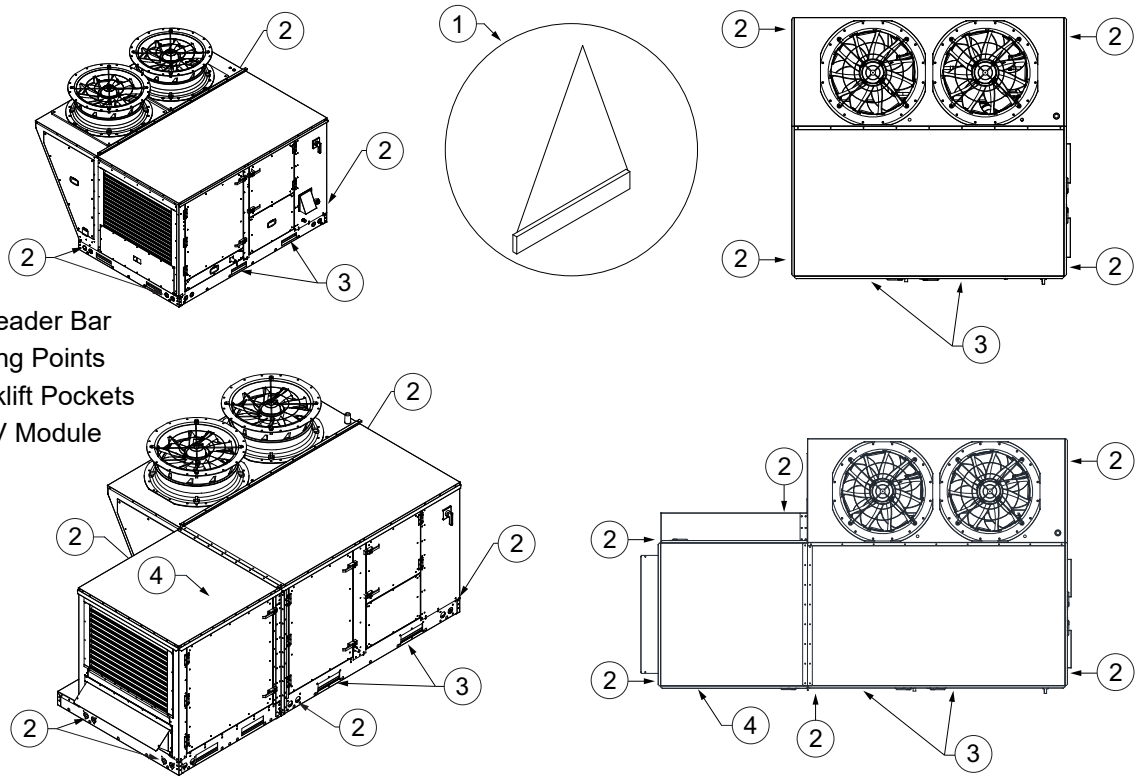
**Ensure that all the lifting equipment used is properly rated for the weight of the unit being lifted. Each of the cables (chains or slings), hooks, and shackles used to lift the unit must be capable of supporting the entire weight of the unit. Lifting cables (chains or slings) may not be of the same length. Adjust as necessary for even unit lift. Other lifting arrangements could cause equipment or property damage. Failure to follow instructions above or properly lift unit could result in unit dropping and possibly crushing operator/ technician which could result in death or serious injury.**

Spreader bars must be used and should extend past the edges of the equipment to avoid damage to the casing. Not using spreader bars may cause damage to the unit casing. Refer to **Figure 3** for rigging details.

**WARNING: DO NOT LIFT UNIT BY THE INTAKE LOUVER, OR DOOR OPENINGS – USE ALL LIFTING POINTS PROVIDED WITH A SPREADER BAR OR SLINGS UNDER THE UNIT – USE CARE NOT TO DAMAGE COILS, SWITCHES OR PROTRUDING SHEET METAL COMPONENTS.**

- Units are supplied with multiple lifting points (eyes) on the bottom corners of the structural rails.
- Always use spreader bars to prevent damage to the unit casing.
- Test lift the unit approximately **2 feet** to verify proper center of gravity lift point. To avoid dropping unit, re-position lifting point if unit is not level. Failure to properly lift unit could result in unit dropping and possibly crushing operator/technician, which could result in death or serious injury and possible equipment or property damage.

**Figure 3 - Rigging (Size 2 Unit Shown)**




1. Spreader Bar
2. Lifting Points
3. Forklift Pockets
4. ERV Module

**NOTE: For units without ERV, you must use at least four lifting point locations. For ERV units, at least 6 lifting points are required when raising the unit.**

## Indoor Hanging Assembly Instructions

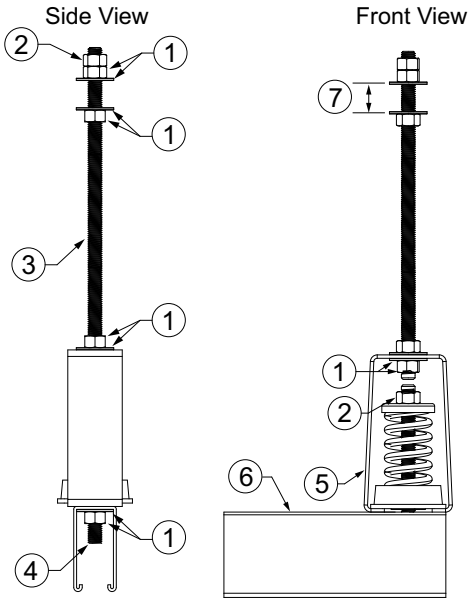
**WARNING!**

**VERTICALLY OR HORIZONTALLY LAGGING INDOOR UNITS TO WOODEN JOISTS, TRUSSES, OR STUDS IS AN UNACCEPTABLE METHOD FOR INDOOR HANGING. THIS WILL LEAD TO STRUCTURAL FAILURE CAUSING INJURY AND/OR DEATH.**

- For mounting the unit to the Unistrut, use 1/2"-13 TPI grade 5 (minimum) steel bolts, 1/2" grade 5 (minimum) steel flat washers and 1/2"-13 TPI grade 5 (minimum) hex nuts.
- Unistrut and Isolators must be supported with 1/2"-13 TPI grade 5 (minimum) all-thread.
- Use 1/2" grade 5 (minimum) steel flat washers and 1/2"-13 TPI grade 5 (minimum) hex nuts to install the isolators on the Unistrut and the isolators to the ceiling anchor points with all-thread.
- Maintain 1/4" of exposed threads beneath bottom hex nut.
- Must use doubled hex nut configuration on the all-thread above ceiling anchors for indoor hanging (single hex nut will be used connecting the unit to the Unistrut as well as for connecting the all-thread to the isolators and the isolators to the Unistrut).
- Torque all hex nuts to 57 ft-lbs.

**Figure 4 - Indoor Hanging Hardware**

1. Steel flat washers/hex nuts
2. Hex nut
3. All-thread (Upper)
4. All-thread (Lower)
5. Isolator
6. Unistrut
7. Ceiling Mounting



## Minimum Room Area (A2L Refrigerant)

The total factory charge of the unit can be located on the ETL label. If the charge needs to be trimmed in the field from factory charge, the total charge will need updated with a label on the unit. Do not exceed the refrigerant charge based on room area and lowest duct discharge height, refer to **Table 2 on page 11.**

- For ventilated spaces, all ventilation openings must remain clear of obstructions.
- Supply ducts should not contain any potential ignition sources.
- All dampers located in the supply duct and/or VAV boxes must be wired to fully open in the event of a refrigerant leak.
- All duct systems connected to one or more rooms must duct directly into the space. Open areas such as false ceilings may not be used as duct.
- If the minimum room area being served by the unit is less than the minimum area referenced in **Table 2 on page 11**, the room should be without continuously operating open flames or other potential ignition sources. A flame producing device may be installed in the same space if the device is provided with an effective flame arrest.

In the event of a refrigeration leak within the airstream, the indoor blower will be enabled, the compressor will be disabled, and an alarm output will be activated from the mitigation board. This operation will continue for 5 minutes after the leak is no longer detected. A normally open, remote A2L sensor input is available on pin J32-10.

For VAV applications and applications utilizing zone dampers, the VAV boxes and zone dampers must be wired to the mitigation board output in order to open all VAV boxes and zone dampers to allow for the required circulation airflow to prevent stagnation of leaked refrigerant.

Verify functionality of Refrigerant Detection System by removing sensor connection at the mitigation board and ensuring that all sequences above take place, including the opening of VAV boxes and zone dampers if applicable.

**Table 2 on page 11** provides minimum room area per unit charge and duct discharge height specifications. Refer to unit label for specific minimum room area and Max Charge volume.

The calculated minimum room area on the ETL label/submittal information is based on the unit's designed elevation. The adjustment factor in **Table 1** only applies if the unit was ordered at 0 ft elevation and needs to be adjusted. The minimum room area is multiplied by the "Adjustment Factor" to calculate the new minimum room area per unit's installed "Altitude."

**Table 1 - Minimum Room Area Multipliers by Altitude**

| Altitude (Feet) | Adjustment Factor |
|---|---|
| <0-1000 | 1 |
| 1001-2000 | 1.04 |
| 2001-3000 | 1.08 |
| 3001-4000 | 1.12 |
| 4001-5000 | 1.16 |
| 5001-6000 | 1.22 |
| 6001-7000 | 1.25 |
| 7001-8000 | 1.30 |
| 8001-9000 | 1.35 |
| 9001-10,000 | 1.4 |
| >10,000 | 1.45 |

## Table 2 - Minimum Room Area per Unit Charge and Duct Discharge Height

**Lowest Duct Discharge Height (feet)**

| Unit Charge (lbs.) | 7.2 | 8 | 10 | 12 | 14 | 16 | 18 | 20 |
|---|---|---|---|---|---|---|---|---|
| **15** | 225 | 203 | 162 | 135 | 116 | 101 | 90 | 81 |
| **16** | 241 | 216 | 173 | 144 | 124 | 108 | 96 | 87 |
| **17** | 256 | 230 | 184 | 153 | 131 | 115 | 102 | 92 |
| **18** | 271 | 244 | 195 | 162 | 139 | 122 | 108 | 97 |
| **19** | 286 | 257 | 206 | 171 | 147 | 129 | 114 | 103 |
| **20** | 301 | 271 | 216 | 180 | 155 | 135 | 120 | 108 |
| **21** | 316 | 284 | 227 | 189 | 162 | 142 | 126 | 114 |
| **22** | 331 | 298 | 238 | 198 | 170 | 149 | 132 | 119 |
| **23** | 346 | 311 | 249 | 207 | 178 | 156 | 138 | 124 |
| **24** | 361 | 325 | 260 | 216 | 186 | 162 | 144 | 130 |
| **25** | 376 | 338 | 271 | 225 | 193 | 169 | 150 | 135 |
| **26** | 391 | 352 | 281 | 235 | 201 | 176 | 156 | 141 |
| **27** | 406 | 365 | 292 | 244 | 209 | 183 | 162 | 146 |
| **28** | 421 | 379 | 303 | 253 | 216 | 189 | 168 | 152 |
| **29** | 436 | 392 | 314 | 262 | 224 | 196 | 174 | 157 |
| **30** | 451 | 406 | 325 | 271 | 232 | 203 | 180 | 162 |
| **31** | 466 | 419 | 336 | 280 | 240 | 210 | 186 | 168 |
| **32** | 481 | 433 | 346 | 289 | 247 | 216 | 192 | 173 |
| **33** | 496 | 446 | 357 | 298 | 255 | 223 | 198 | 179 |
| **34** | 511 | 460 | 368 | 307 | 263 | 230 | 204 | 184 |
| **35** | 526 | 474 | 379 | 316 | 271 | 237 | 210 | 189 |
| **36** | 541 | 487 | 390 | 325 | 278 | 244 | 216 | 195 |
| **37** | 556 | 501 | 400 | 334 | 286 | 250 | 222 | 200 |
| **38** | 571 | 514 | 411 | 343 | 294 | 257 | 228 | 206 |
| **39** | 586 | 528 | 422 | 352 | 302 | 264 | 235 | 211 |
| **40** | 601 | 541 | 433 | 361 | 309 | 271 | 241 | 216 |
| **41** | 616 | 555 | 444 | 370 | 317 | 277 | 247 | 222 |
| **42** | 631 | 568 | 455 | 379 | 325 | 284 | 253 | 227 |
| **43** | 646 | 582 | 465 | 388 | 332 | 291 | 259 | 233 |
| **44** | 661 | 595 | 476 | 397 | 340 | 298 | 265 | 238 |
| **45** | 676 | 609 | 487 | 406 | 348 | 304 | 271 | 244 |
| **46** | 691 | 622 | 498 | 415 | 356 | 311 | 277 | 249 |
| **47** | 707 | 636 | 509 | 424 | 363 | 318 | 283 | 254 |
| **48** | 722 | 649 | 520 | 433 | 371 | 325 | 289 | 260 |
| **49** | 737 | 663 | 530 | 442 | 379 | 331 | 295 | 265 |
| **50** | 752 | 676 | 541 | 451 | 387 | 338 | 301 | 271 |
| **51** | 767 | 690 | 552 | 460 | 394 | 345 | 307 | 276 |
| **52** | 782 | 704 | 563 | 469 | 402 | 352 | 313 | 281 |
| **53** | 797 | 717 | 574 | 478 | 410 | 359 | 319 | 287 |
| **54** | 812 | 731 | 584 | 487 | 417 | 365 | 325 | 292 |
| **55** | 827 | 744 | 595 | 496 | 425 | 372 | 331 | 298 |
| **56** | 842 | 758 | 606 | 505 | 433 | 379 | 337 | 303 |
| **57** | 857 | 771 | 617 | 514 | 441 | 386 | 343 | 308 |
| **58** | 872 | 785 | 628 | 523 | 448 | 392 | 349 | 314 |
| **59** | 887 | 798 | 639 | 532 | 456 | 399 | 355 | 319 |
| **60** | 902 | 812 | 649 | 541 | 464 | 406 | 361 | 325 |
| **61** | 917 | 825 | 660 | 550 | 472 | 413 | 367 | 330 |
| **62** | 932 | 839 | 671 | 559 | 479 | 419 | 373 | 336 |
| **63** | 947 | 852 | 682 | 568 | 487 | 426 | 379 | 341 |
| **64** | 962 | 866 | 693 | 577 | 495 | 433 | 385 | 346 |
| **65** | 977 | 879 | 704 | 586 | 503 | 440 | 391 | 352 |
| **66** | 992 | 893 | 714 | 595 | 510 | 446 | 397 | 357 |
| **67** | 1007 | 906 | 725 | 604 | 518 | 453 | 403 | 363 |
| **68** | 1022 | 920 | 736 | 613 | 526 | 460 | 409 | 368 |
| **69** | 1037 | 934 | 747 | 622 | 533 | 467 | 415 | 373 |
| **70** | 1052 | 947 | 758 | 631 | 541 | 474 | 421 | 379 |
| **71** | 1067 | 961 | 768 | 640 | 549 | 480 | 427 | 384 |
| **72** | 1082 | 974 | 779 | 649 | 557 | 487 | 433 | 390 |
| **73** | 1097 | 988 | 790 | 658 | 564 | 494 | 439 | 395 |
| **74** | 1112 | 1001 | 801 | 667 | 572 | 501 | 445 | 400 |
| **75** | 1127 | 1015 | 812 | 676 | 580 | 507 | 451 | 406 |

## Curb and Ductwork

**WARNING!!**

**Failure to properly size ductwork may cause system effects and reduce the performance of the equipment.**

This unit was specified for a specific CFM and static pressure. The ductwork attached to this unit will significantly affect airflow performance. When using rectangular ductwork, elbows must be radius throat, radius back with turning vanes. Flexible ductwork and square throat/square back elbows should not be used. Any transitions and/or turns in the ductwork near the fan outlet will cause system effect. System effect will drastically increase the static pressure and reduce airflow. **Table 3** and **Table 4** detail the minimum fan outlet duct sizes required for optimal fan performance.

**Table 3 - Recommended Supply Ductwork Sizes Up/Down Discharge**

| Unit Size | Up/Down Discharge Duct Size (Inches) | Down Return Duct Size (Inches) | Side Return Duct Size (Inches) | Straight Duct Length |
|---|---|---|---|---|
| 1 | 21-1/4” x 19-1/4” | 28” x 10” | 29” x 10-1/2” | 54” |
| 2 | 20-1/4” x 30-1/4” | 36” x 9” | 36-1/4” x 11-1/4” | 54” |
| 3 | 39” x 21-1/2” | 45-1/2” x 13-1/2” | 45-1/2” x 10-3/4” | 78” |
| 4 | 39-3/4” x 39.5” (Up)<br>46-1/2” x 38-9/16” (Down) | 74 x 12-1/4” | 76-1/2” x 16-1/4” | 96” |

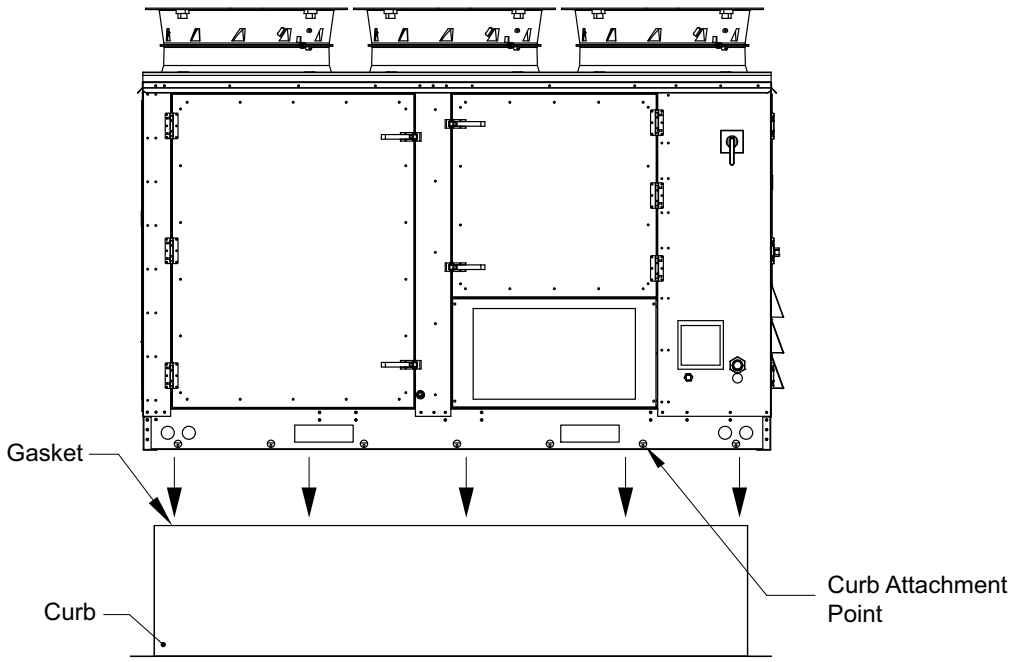
**Table 4 - Recommended Supply Ductwork Sizes Side Discharge**

| Unit Size | Side Discharge Duct Size (Inches) | Down Return Duct Size (Inches) | Side Return Duct Size (Inches) | Straight Duct Length |
|---|---|---|---|---|
| 1 | 20” x 19-1/4” | 28” x 10” | 29” x 10-1/2” | 48” |
| 2 | 20” x 14” | 36” x 9” | 36-1/4” x 11-1/4” | 48” |
| 3 | 25” x 14” | 45-1/2” x 13-1/2” | 45-1/2” x 10-3/4” | 54” |
| 4 | 42” x 21-1/4” | 74” x 12-1/4” | 76-1/2” x 16-1/4” | 78” |

**NOTE: Size 4 units will be equipped with two fork channels. These channels must be removed before the unit is mounted to the curb.**

- **Follow SMACNA guides and manufacturer’s requirements for the remaining duct run.** Units designed for rooftop installation should be installed on a prefabricated or factory-built roof curb. Follow curb manufacturer’s instructions for proper curb installation.
- **Do not use unit to support ductwork in any way. This may cause damage to the unit**.
- If installed in a geographical area where snow accumulates, the unit should be installed on a curb and/or rail elevated not less than **12-inches** above any surface. Verify installation meets local code height requirements.
- Verify duct connection and unit supply outlet are properly aligned and sealed. Use gasket between the curb and unit (**Figure 6 on page 13**).
- The curb and unit must be level, or the unit may leak or be damaged. If necessary, use shims to level the unit. Shims may be required depending upon curb installation and roofing material.
- Secure unit to curb with all available mounting points through vertical portion of the base assembly rails (**Figure 6**). Use lug screws, anchor bolts, or other suitable fasteners (not furnished).
- Check all fasteners are secure and tight.

**Figure 5 - Curb**



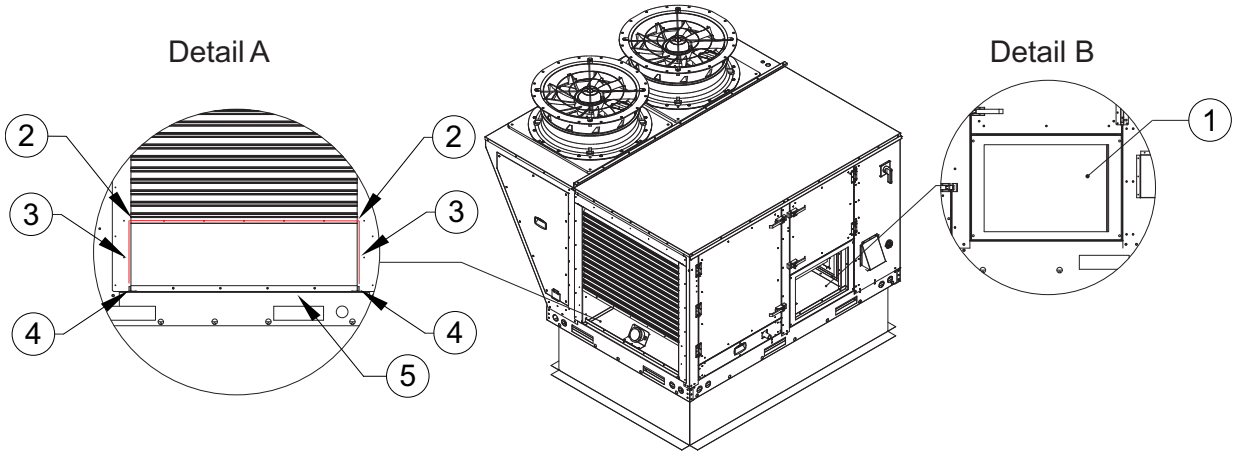

Side Return Duct/Access Panel Install, refer to **Figure 6** Detail A.

- Install gasket material around the upper and side edges.
- Install ductwork using self-tapping screws.
- Use caulk/sealant around the upper and side edges.
- Do not use caulk/sealant on the lower edge. Use only self-tapping screws to mount ductwork.

Side Discharge Duct Install, refer to **Figure 6** Detail B.

- Mount ductwork to the lip of the side discharge opening.
- Use self-tapping screws to secure ductwork.
- Verify the ductwork is clear for opening the top access panel door.

**Figure 6 - Side Discharge, Side Return**




1. Discharge Outlet
2. Upper Edge - Use gasket/sealant for side return duct or access panel.
3. Side Edges - Use gasket/sealant for side return duct or access panel.
4. Damper Drain Holes - DO NOT COVER.
5. Lower Edge - DO NOT USE gasket/sealant.

## Duct Hanger Dimensions

**Figure 7** provides details for standard curbs, and **Figure 8** provides details for ERV curbs. Refer to **Table 5** and **Table 6 on page 15** for Bill of Materials and curb dimensions.

Use 1/4”-20 x 5/8” Phillips pan head screws and nuts when assembling duct hangers, refer to **Figure 9 on page 15**.

**Figure 7 - Standard Curb**

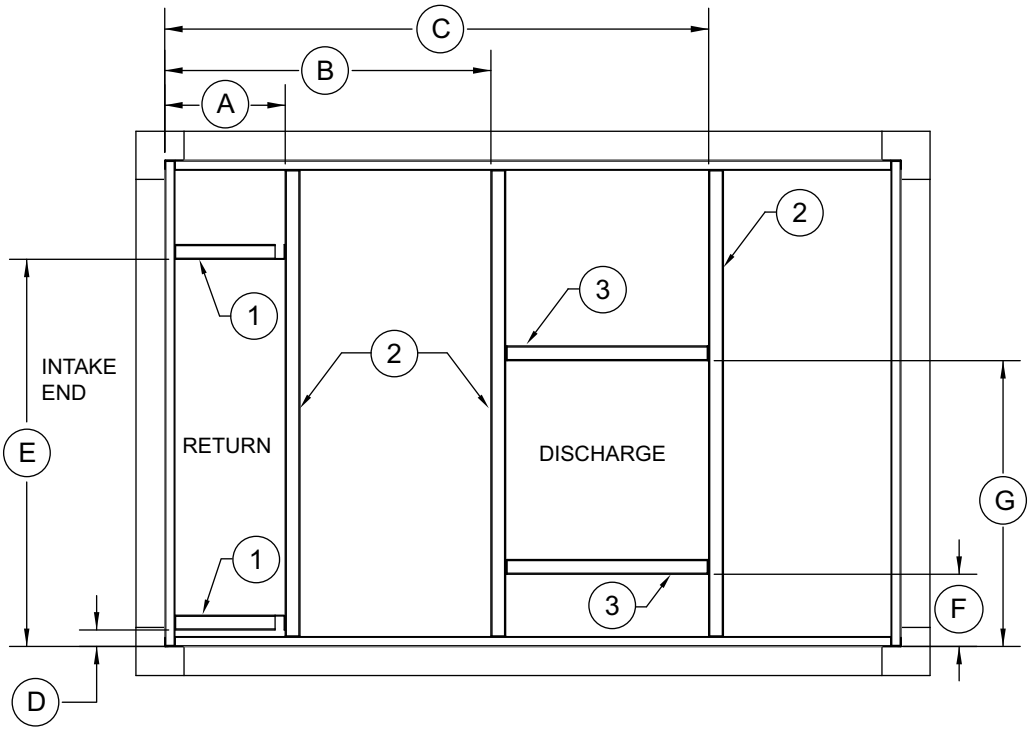
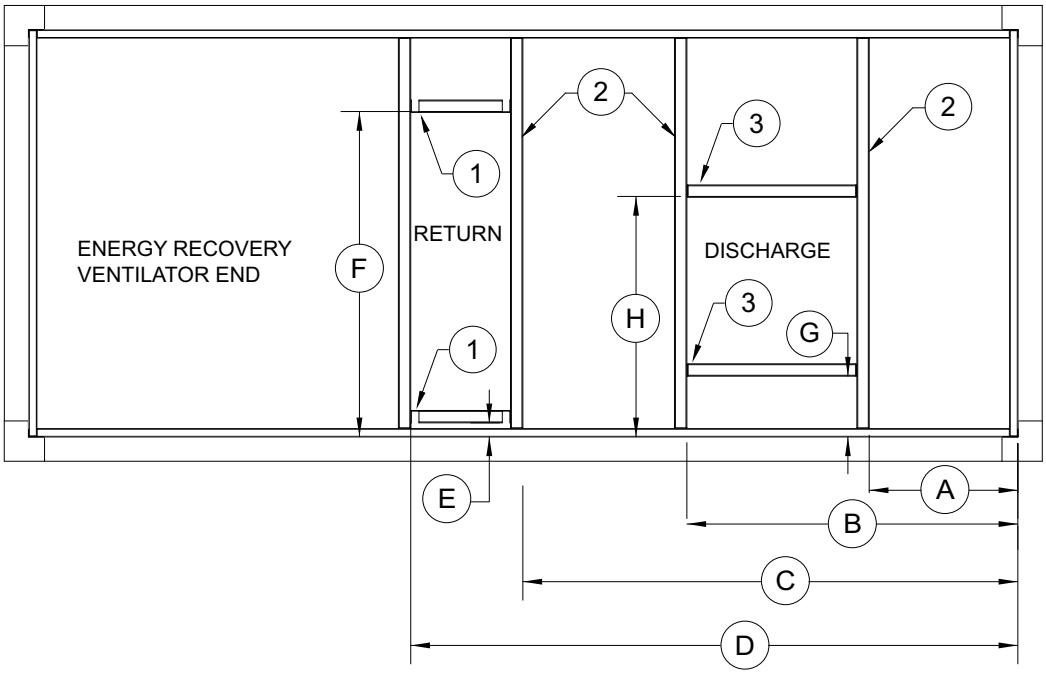



**Figure 8 - ERV Curb**



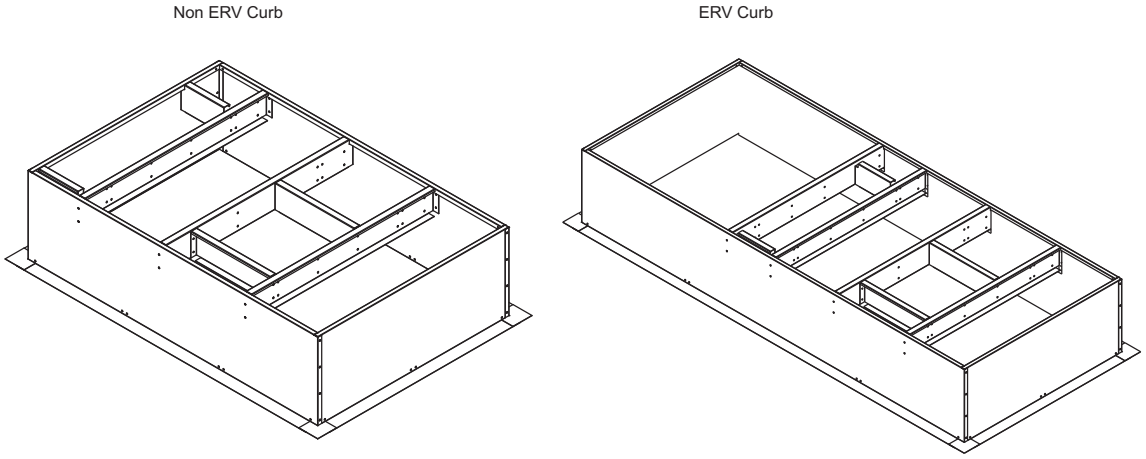
## Table 5 - Duct Hanger Bill of Materials

| Ref | Size 1 | Size 2 | Size 3 | Size 4 |
|---|---|---|---|---|
| 1 | RTU1DHR = Quantity x 1 | RTU2DHR = Quantity x 2 | RTU3DHR = Quantity x 1 | N/A |
| 2 | RTU1DHL = Quantity x 3 | RTU2DHL = Quantity x 3<br>NOTE: ERV Quantity x 4 | RTU3DHL = Quantity x 3<br>NOTE: ERV Quantity x 4 | RTU4DHL = Quantity x 3<br>NOTE: ERV Quantity x 4 |
| 3 | RTU1DHD = Quantity x 2 | RTU2DHD = Quantity x 2 | RTU3DHD = Quantity x 2 | RTU4DHD = Quantity x 2 |

## Table 6 - Duct Hanger Curb Dimensions

| Reference | Size 1 | Size 2 | Size 2 ERV | Size 3 | Size 3 ERV | Size 4 | Size 4 ERV |
|---|---|---|---|---|---|---|---|
| A | 12-3/4” | 12-1/4” | 14-1/2” | 16-5/8” | 16-3/8” | 15-1/2” | 13-1/2” |
| B | 36-1/4” | 33-3/8” | 40-1/4” | 48-1/8” | 41-3/8” | 54-7/8” | 54-5/8” |
| C | 59-1/4” | 59” | 60-1/4” | 73-1/8” | 72” | 96” | 93-13/16” |
| D | N/A | 1-3/4” | 73-7/8” | N/A | 90” | N/A | 109-15/16” |
| E | 31-1/4” | 39-1/2” | 1-3/4” | 48-3/8” | N/A | N/A | N/A |
| F | 5-1/4” | 1-5/8” | 39-1/2” | 1-1/8” | 40-3/8” | 29-3/8” | N/A |
| G | 27-3/4” | 36-1/4” | 1-5/8” | 45-1/2” | 1-1/8” | 77-1/2” | 29-3/8” |
| H | N/A | N/A | 36-1/4” | N/A | 45-1/2” | N/A | 77-7/16” |

## Figure 9 - Duct Hanger Assembled




## Figure 10 - Plenum Curb Installation

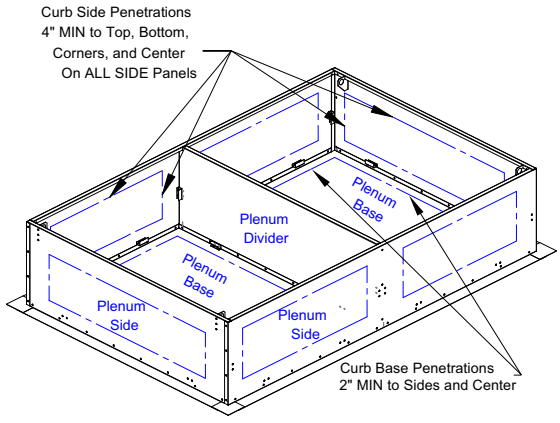
The plenum curbs (**Figure 10**) have a divider installed separating the discharge from the return.

*When cutting the plenum curb, do not cut through the plenum divider.*

*Avoid cutting two adjacent sides at the same corner of the curb. This may weaken the curb structure.*

Mark and cut through the plenum panels and insulation to fit up with the ductwork connections.
-Do NOT cut the side panels within 4" of each corner, top, bottom, or center.
-Do NOT cut the base panels within 2" of each side or center.
-Cutting outside of the allowable boxes shown above may weaken the curb structure.
Secure the duct to the plenum curb opening(s). Verify all seams have been fully sealed.

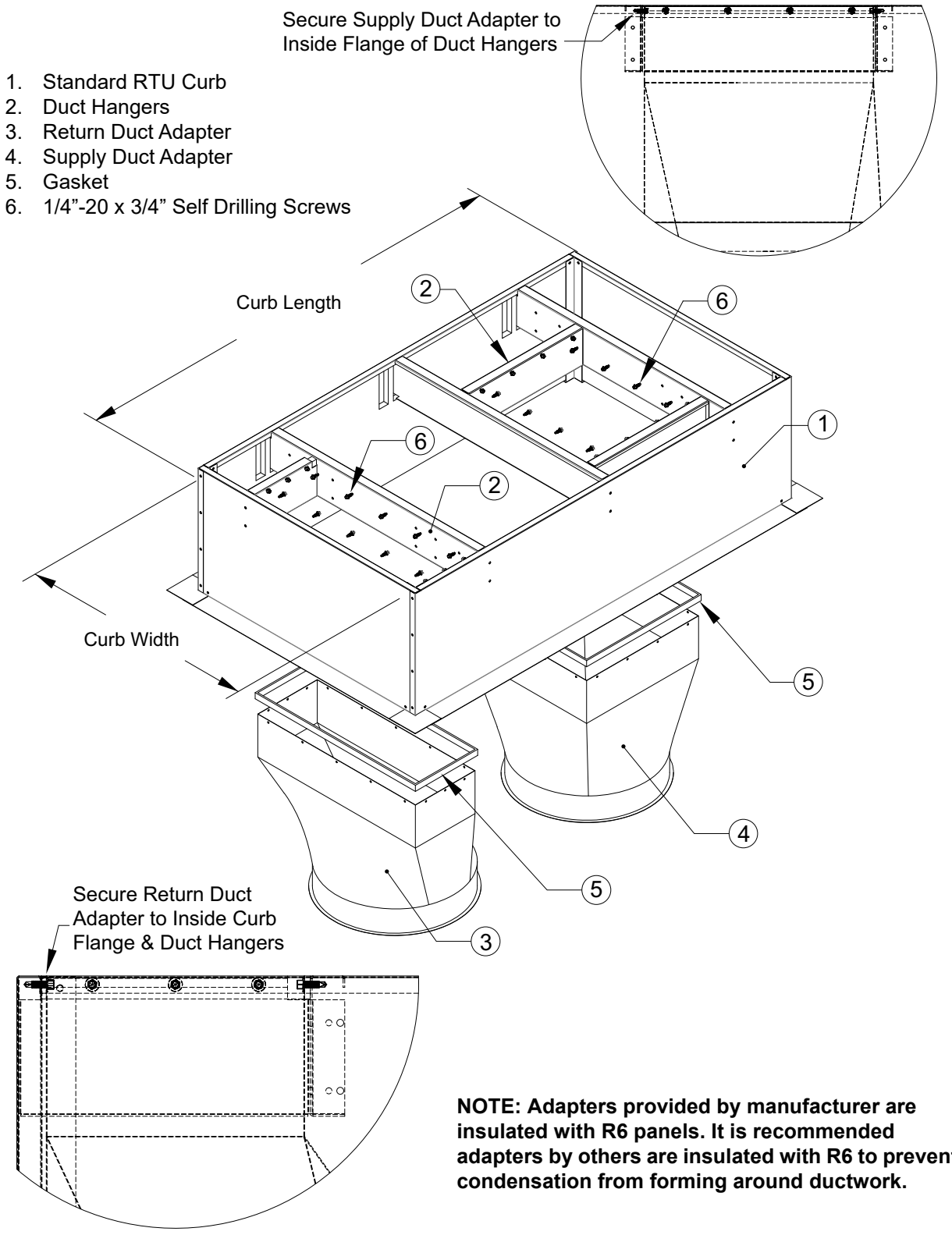
Tape all cut edges of the insulation to secure it to the curb.



## Curb and Adapter

**Figure 11** provides details when mounting return and supply duct adapters to an RTU curb.

**Figure 11 - Curb and Adapter Details**




**NOTE: Adapters provided by manufacturer are insulated with R6 panels. It is recommended adapters by others are insulated with R6 to prevent condensation from forming around ductwork.**

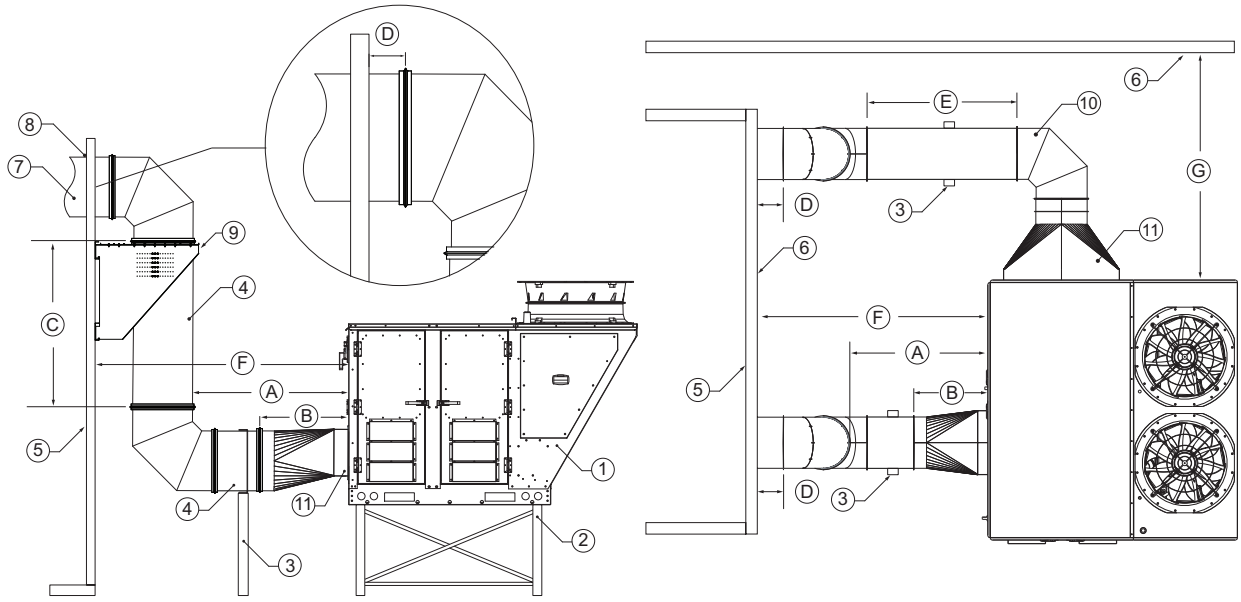
## Supply Duct Pad Mount Clearances

When a unit will be pad mounted, refer to **Figure 12** for details on installation. Always verify the distance from the wall(s) to the unit. For the supply side of the unit, there must be adequate distance between the door and duct to service components.

The minimum unsupported distance for vertical ductwork is 20’. Anything over 20’ requires a wall support bracket. 40’ of vertical ductwork requires two wall support brackets, 60’ would require three wall supports, etc.

A saddle support is required for horizontal duct runs. Center the saddle support to prevent stress on connections. Additional saddle supports are recommended every 15’.

**Figure 12 - Supply Duct Installation Details**




1. RTU
2. RTU Stand
3. Saddle Support
4. Double Wall Supply Duct
5. Interior Space
6. Exterior Wall
7. Adjustable Duct (Recommended)
8. Closure Plate (Inside/Outside)
9. Wall Support Bracket - Required for vertical ductwork lengths over 20’.
10. Double Wall Return Duct
11. Discharge Adapter - Verify the adapter is installed properly. The door above should be able to open without any interference.

A. Door Opening Distance:
   - Size 1 = 24-1/2”
   - Size 2/3 = 25- 1/2”
   - Size 4 = 48-1/2”

B. Adapter Height = 24”

C. Minimum Unsupported Distance = 10’

D. Minimum Exterior Duct Penetration = 4”

E. Horizontal Support Recommended = Every 15’ for Single Wall, every 8’ for Double Wall

F. Minimum Distance Unit to Wall (Supply Side)
   - Size 1 = 62”
   - Size 2/3 = 70”
   - Size 4 = 98”

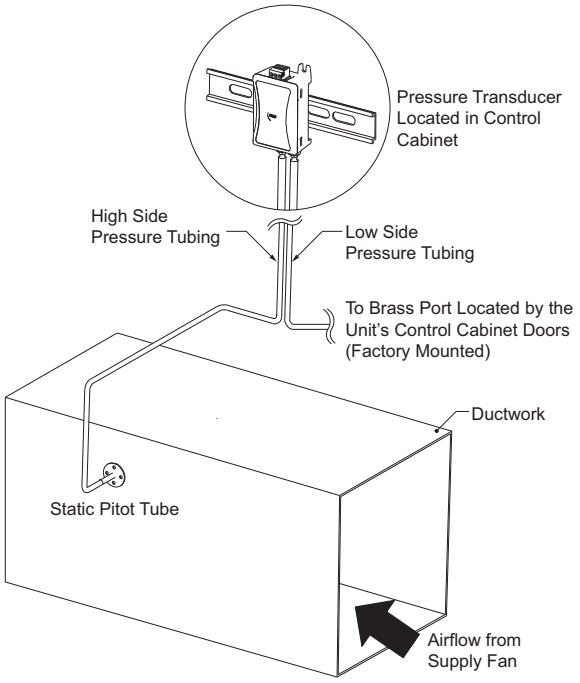
G. Minimum Distance Unit to Wall (Return Side)
   - Size 1 = 62”
   - Size 2/3 = 70”
   - Size 4 = 98”

## Duct Static Pressure Control

Units equipped with an Electrically Commutated Motors (ECMs) or Variable Frequency Drives (VFDs) driven supply fan, the duct static pressure control option can be used to monitor duct pressure.

1. Locate where the pressure transducer is installed in the control cabinet.
2. Install the static pitot tube in a straight section of ductwork where the airflow is laminar and consistent.
3. Connect the high side tubing to the static pitot tube.
4. Route the tubing through the bottom of the unit to the high side port on the pressure transducer.
5. The low side pressure tubing will be connected to a brass port, measuring outdoor ambient pressure. The port is located by the unit's control cabinet doors. This will be connected from the factory.

**Figure 13 - Duct Static Pressure Control**

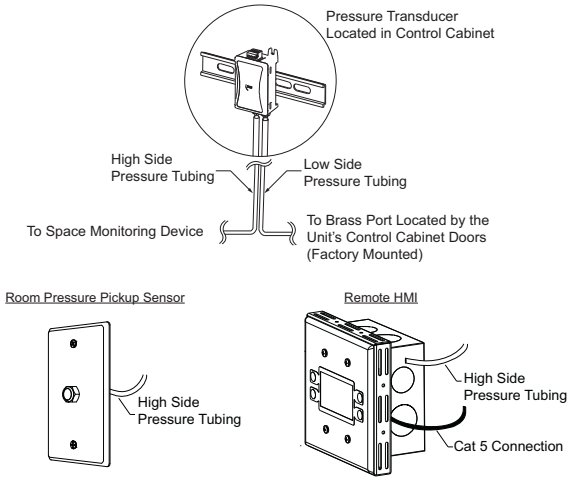



## Building Static Pressure Control

Units equipped with an Electrically Commutated Motors (ECMs) or Variable Frequency Drives (VFDs) driven supply fan, the building static pressure control option can be used to monitor space pressure.

1. Locate where the pressure transducer is installed in the control cabinet.
2. Determine the space monitoring device:
   - Room Pressure Pickup Sensor
   - Remote HMI, refer to **"HMI and Remote Room Sensor Installation" on page 19**
3. Install the space monitoring device in the space.
4. Connect the high side tubing to the space monitoring device.
5. Route the tubing through the bottom of the unit to the high side port on the pressure transducer.
6. The low side pressure tubing will be connected to a brass port, measuring outdoor ambient pressure. The port is located by the unit's control cabinet doors. This will be connected from the factory.

**Figure 14 - Building Static Pressure Control**



## HMI and Remote Room Sensor Installation

The HMI (Human Machine Interface) is used to change settings, view operating information, and view fault history. Remote HMI faceplates (**Figure 15**), remote room sensors (**Figure 16**), and smart controls may be ordered and shipped separately. These components measure temperature and humidity and assist in controlling the unit. These components should be installed in a safe location, free of influence from external heat sources. Sensors must be installed in areas indicative of the average room temperature. Mounting the sensor(s) to interior walls will provide reliable measurements. Keep the sensor away from heat-producing appliances, direct sunlight, and away from operable windows/doors.

HMIs and remote room sensors can be installed directly to industry-standard junction boxes, either surface mounted or recessed mounted. HMIs have a built-in temperature/relative humidity (RH) sensor, which is typically used to help control the automatic function of the unit.

The HMI can also be configured to control the unit from a remote location manually. They can be configured not to use the internal temperature/relative humidity sensor. In this configuration, the sensor in the HMI is ignored in automatic operation. Multiple HMIs can be connected to one unit for temperature and R/H averaging. All combination temperature/humidity HMIs will use a vented standoff. Mount the static pressure tube close to the HMI to obtain proper room conditions.

A max of 4 additional HMIs can be daisy-chained together. Place an End-of-Line (EOL) device in the last HMI connected.

**Figure 15 - HMI with Standoff**

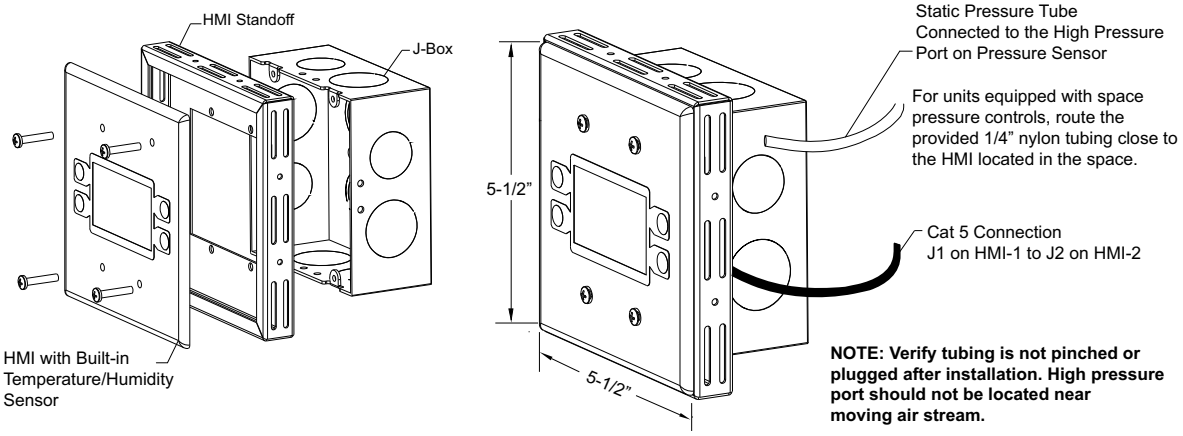
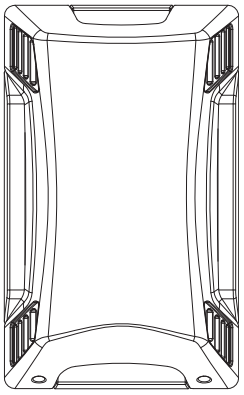



**Figure 16 - Remote Temp/RH Sensor**



The room temperature/humidity sensor is a 10K ohm thermistor. When connected to the 0-10V humidity sensor connection, the sensor provides constant room temperature and humidity (RH) readings to the controller. The sensor should be installed on a wall somewhere in the room, but not directly in the HVAC diffuser's path or close to heat-producing appliances so that the reading is not affected by heat.

Room sensors are not required for proper control operation, but still can be configured as remote sensors or averaging sensors.

**Do not install the room sensor on the ceiling**.

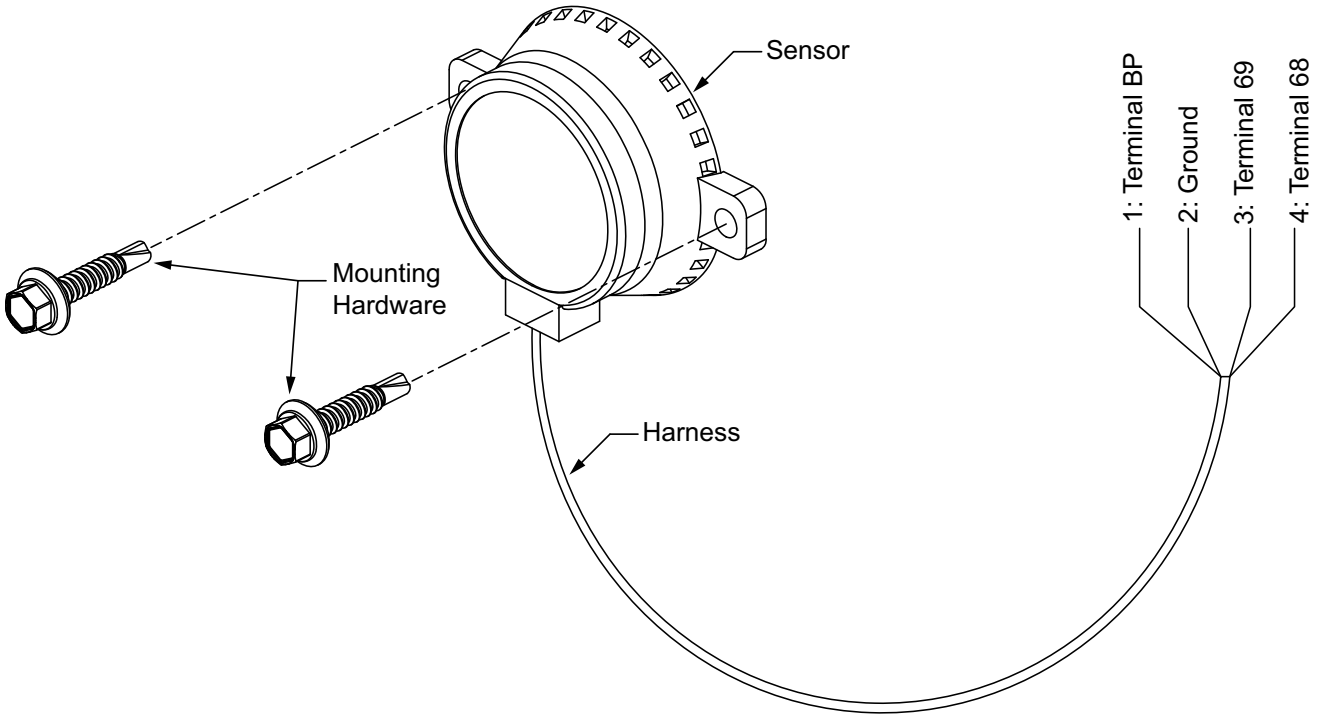
## Remote A2L Leak Detector Installation

Units equipped with DX cooling using R454B refrigerant use an A2L leak detector that is factory mounted in the evaporator cabinet. When additional A2L leak detectors are remote mounted in the space, the installation procedure is shown in **Figure 17**.

### Factory Provided Remote Leak Detector

The factory provided leak detector uses Modbus communication with the board. When remote mounted leak detectors are used, the sensor's Modbus is set from the factory. The total number of leak detectors must be updated to match in the factory settings. The leak detector must be mounted using the two mounting holes with the wiring connection facing directly down to prevent any water infiltration. The 20' harness can be run directly to the unit or to a junction box. From the junction box, the wiring must run to the unit's terminal blocks 68, 69, and ground using twisted shielded paired wire. The Board Power (BP) wire must be at least 14 AWG.

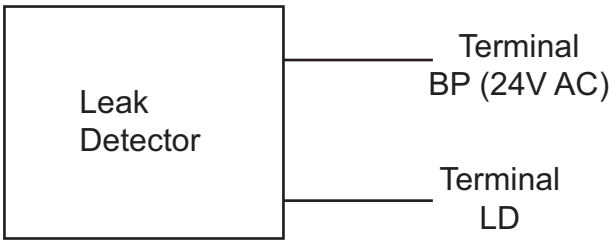
**Figure 17 - Leak Detector**




### Third-Party Remote Leak Detector

When a third-party leak detector is used, normally open dry contacts must be present. The BP terminal should be run to the common terminal of the leak detector. The LD terminal should be run to the normally open of the leak detector.

**Figure 18 - Third-Party Leak Detector Wiring**

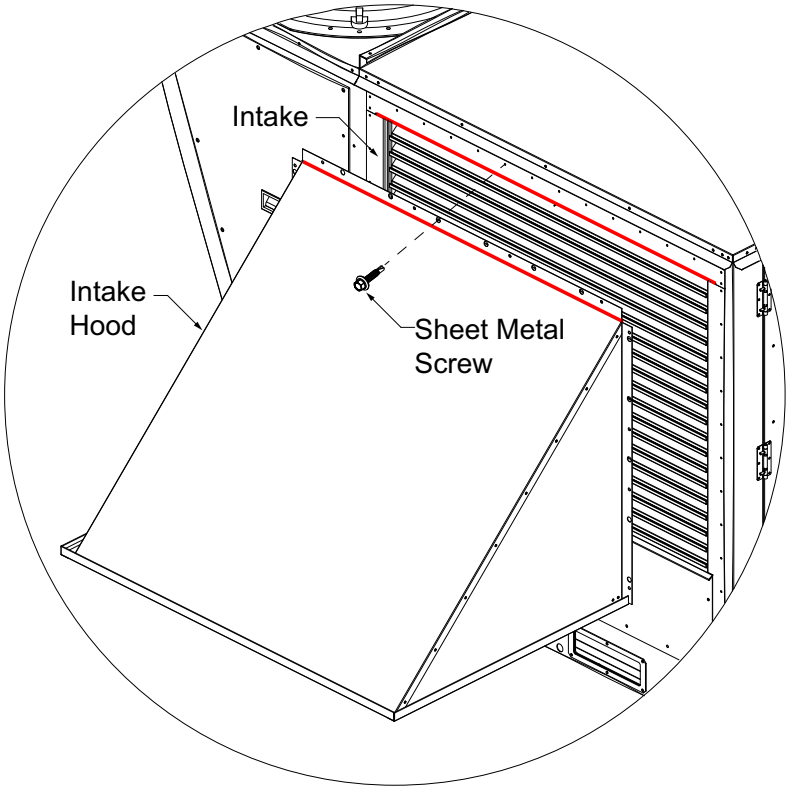


## Intake Hood Installation

Intakes hoods are shipped on a separate skid. Upon unit arrival, perform the following steps to assemble the unit.

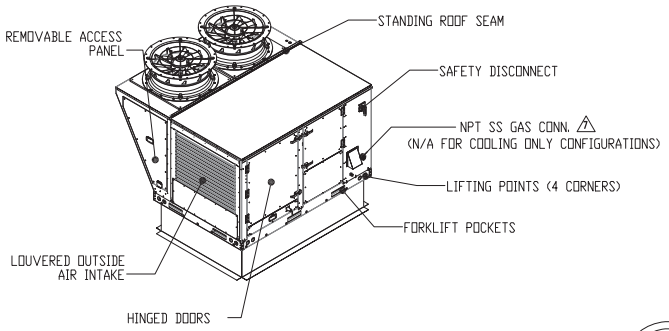
1. Apply weather-proof gasketing to the intake hood flanges. Apply silicone or weather-proof gasketing to the backside of the flanges on the intake hood.
2. Align the intake hood to the intake. Refer to the red lines in **Figure 19** for height. Center the hood left to right.
3. Secure the flanges of the intake hood to the unit with the supplied sheet metal screws with rubber washers.
4. Use caulk on the outside of the screws to prevent water leaks.

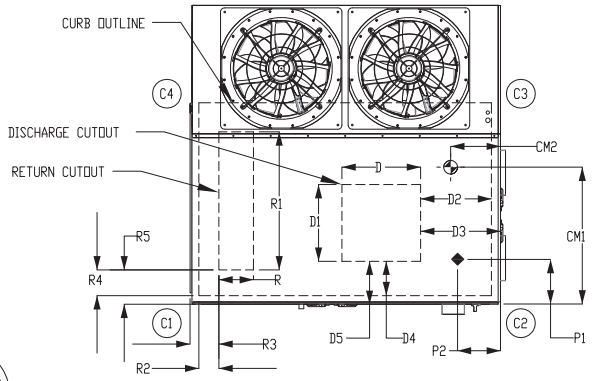
**Figure 19 - Intake Hood**

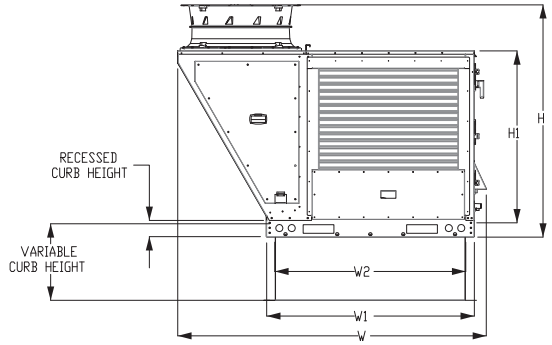


ROOFTOP UNIT DOWN DISCHARGE DOWN RETURN

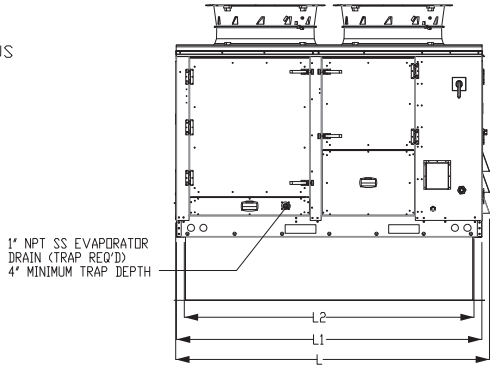
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| RTU INFORMATION* | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| UNIT SIZE | NOMINAL TONNAGE | INTAKE FILTERS | SUPPLY FILTERS 4 | FURNACE CAPACITY (MBH) 5 | ELECTRIC CAPACITY (KW) 5 | APPROXIMATE WEIGHT (LBS) 6 | CENTER OF MASS | | CORNER WEIGHTS (LBS) | | | | ENTERING POWER | |
| | | | | | | | CM1 | CM2 | C1 | C2 | C3 | C4 | P1 | P2 |
| 2 | 8, 10 | 25 X 20 X 2 (2) | 16 X 20 (8) | 50 - 200 | 15 - 60 | 1650 | 32 | 36 | 441 | 537 | 369 | 303 | 5 1/4 | 7 1/4 |
| 3 | 12.5, 15, 20 | 16 X 25 X 2 (4) | 25 X 20 (8) | 150 - 500 | 15 - 100 | 2500 | 37 1/4 | 44 | 472 | 572 | 798 | 658 | 5 1/2 | 7 1/2 |

NOTES:
1. ROOF OPENING MUST BE 2" SMALLER THAN CURB DIMENSIONS IN BOTH DIRECTIONS
2. DO NOT OBSTRUCT OUTSIDE AIR INLET, OUTSIDE AIR COIL OR OUTSIDE AIR FAN
3. FLOOR MOUNT ISOLATORS LOCATED 1" FROM END OF BASE IN EITHER DIRECTION. ACCOUNT FOR AN ADDITIONAL 5" FOR ISOLATOR HEIGHT
4. QUANTITIES SUBJECT TO CHANGE DEPENDING ON FILTER TYPES
5. ONLY APPLICABLE FOR INDIRECT HEAT OR ELECTRIC HEAT CONFIGURATIONS
6. SUBTRACT 100 LBS. FOR COOLING ONLY CONFIGURATIONS
7. 3/4" NPT SS GAS CONN. FOR 50-200 MBH FURNACES
   1" NPT SS GAS CONN. FOR 300-500 MBH FURNACES

| RTU DIMENSIONS* | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| UNIT SIZE | UNIT LENGTH (L) | OUTSIDE BASE LENGTH (L1) | INSIDE BASE LENGTH (L2) | UNIT HEIGHT (H) | MOUNTED HEIGHT (H1) | UNIT WIDTH (W) | BASE WIDTH (W1) | INSIDE BASE WIDTH (W2) | RECESSED CURB HEIGHT | DISCHARGE DIMENSIONS | | | | | | RETURN DIMENSIONS | | | | | | CURB SIZE |
| | | | | | | | | | | D | D1 | D2 | D3 | D4 | D5 | R | R1 | R2 | R3 | R4 | R5 | |
| 2 | 81 3/4 | 79 3/4 | 75 3/4 | 60 | 45 | 80 3/4 | 54 | 49 3/4 | 3 1/2 | 20 1/2 | 20 | 19 3/4 | 22 | 9 | 12 | 9 | 36 | 3 1/4 | 5 1/2 | 3 1/4 | 6 1/2 | 75 x 49 1/2 |
| 3 | 99 | 96 3/4 | 91 3/4 | 68 1/4 | 52 3/4 | 89 3/4 | 65 1/4 | 60 | 4 1/4 | 21 1/2 | 39 | 20 | 23 1/4 | 4 1/4 | 8 | 13 1/2 | 45 1/2 | 3 1/2 | 6 1/4 | 2 1/2 | 6 1/4 | 91 x 59 1/2 |

*ALL DIMENSIONS IN INCHES UNLESS OTHERWISE SPECIFIED

**Typical Submittal Drawing**

## Furnace Condensation Drain

In some applications, condensation can form in the flue collection box, especially when furnaces are located downstream of cooling coils or operate in a high-efficiency range. If condensation occurs in the flue collection box, there are fittings in the bottom of the flue collection box to drain condensation out of the box. The burner in the unit is provided with a condensation drain assembly located underneath this fitting for the condensation to collect. The drain will need to be connected to field piping to handle the condensation properly.

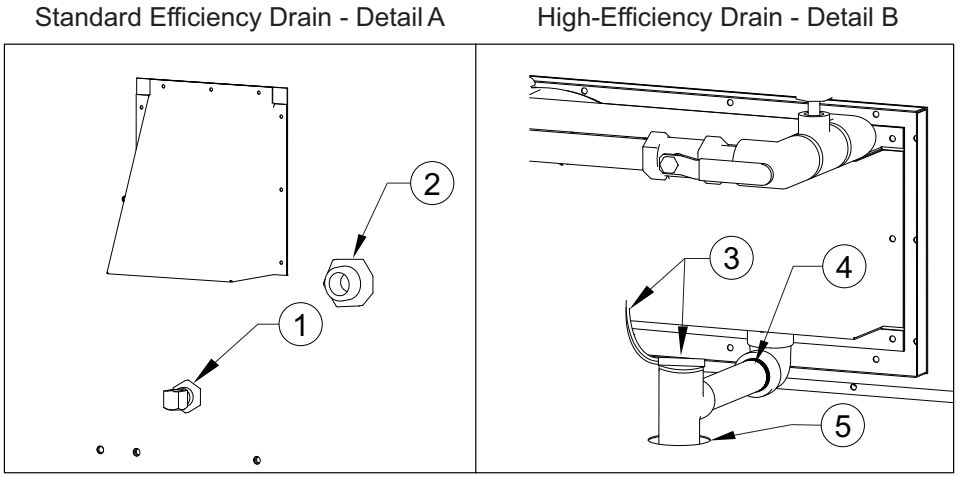
Consult your local code as to the proper drainage regulations of the condensation. A heated drain option is available to prevent the internal drain piping from freezing. If drains are field piped, ensure that the field piping is piped in a fashion to prevent the condensation from freezing. Do not plug the holes under any circumstance as it will cause the burners to overflow.

The standard efficiency furnace drain (**Figure 20,** detail A) is piped to the exterior of the unit via 5/16" silicone tubing. A 1/4" female NPT fitting is provided external to the unit to allow for field piping if required. If piping is added to the unit, freeze protection should be added to prevent damage to the field-installed piping.

The high-efficiency furnace drain (**Figure 20,** detail B) is fitted with a condensation float switch assembly, located in the bottom main cabinet, from the factory. A condensation drain must be field piped through the base of the unit using 3/4" PVC schedule 80 smooth fittings per the above requirements. A 2" deep trap must be field installed downstream of the unit to ensure adequate flow.

**NOTE: Seal <u>ALL</u> base penetrations with appropriate filler (caulk or all-purpose putty) to prevent water from entering the space.**

**Figure 20 - Condensation Drain(s)**




1. Standard efficiency drain connection. 1/4" NPT trap recommended.
2. 1/2", 3/4", 1", or 1 1/4" NPT gas connection depending on furnace size.
3. Factory-installed high-efficiency condensation float switch assembly and wiring.
4. High-efficiency drain connection. 3/4" PVC schedule 80.
5. After drain pipe installation, seal base penetrations with an appropriate filler.

To test the factory-installed condensation float switch assembly:

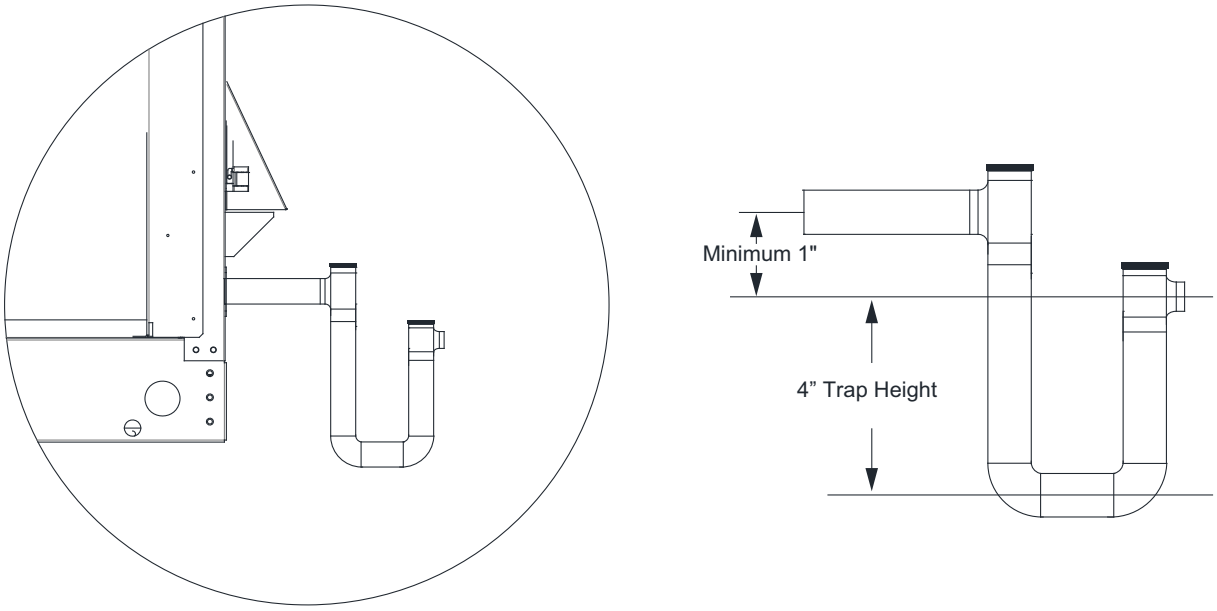
- Turn the unit on, start the heating system. If the heating system does not run, verify the condensation float switch assembly wiring is correct.
- Remove the condensation float switch from the assembly. Lift the switching arm with a screwdriver. The heating system should shut off immediately. If not, check that the condensation float switch assembly's wiring connections are secure and tight. Re-check the float switch for proper operation.

## Cooling Coil Trap

There is a field plumbing connection that is required for the DX/cooling coil. This connection is for the drain pan located under the DX/cooling coil. Also, it is recommended that all plumbing connections be sealed with Teflon tape or pipe dope.

Install Condensate Trap Assembly to 1” threaded drain pan connection. Use low-profile couplings and 1” PVC piping to connect on-site drainage to the Condensate Trap Assembly. **DO NOT USE UNIONS**. The Condensate Trap Assembly is important for two reasons. First, it will allow drainage to be piped to the most convenient area. Second, it will keep air from being drawn into the system, impeding drainage. The top lids of the Condensate Trap Assembly should be removable to allow for cleaning of the trap.

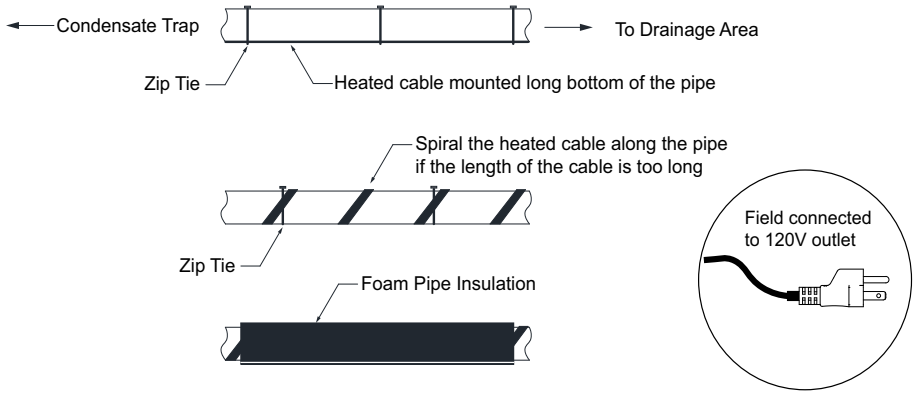
**Figure 21 - Condensate Trap Assembly Details**




## Heat Drain Kit

Units equipped with the Extreme Low Ambient option will include 50 feet of self-regulated heated cable. The heated cable will ship loose, and will need to be field-wired. The entire length of pipe exposed to ambient air should be wrapped in heated cable and insulated with foam pipe insulation, starting from the drain pan nipple and including the condensate drain assembly. The cable should run along the length of the pipe to be heated. If the cable is longer than the pipe, then the cable can be spiraled along the length of the pipe. The heat cable should be installed with zip ties. Wiring will be the responsibility of the installer.

**Figure 22 - Heated Drain Kit Details**



## Gas

Installation of gas piping must conform with local building codes, or in the absence of local codes to the National Fuel Gas Code, ANSI Z223.1 (NFPA 54) – latest edition. In Canada, installation must be in accordance with CAN/CGA-B149.1 for natural gas units and CAN/CGA-B149.2 for propane units.

**WARNING: Inlet gas pressure must not exceed pressure indicated on nameplate. See unit nameplate for proper gas supply pressure and gas type.**

1. **Always disconnect power before working on or near a heater. Lock and tag the disconnect switch and/or breaker to prevent accidental power-up**.
2. Piping to the unit should conform to local and national requirements for type and volume of gas handled, and pressure drop allowed in the line. Refer to the Gas Engineer's Handbook for gas line capacities.
3. The incoming pipe near the heater should be sized to match the connection on the outside of the unit. Connection size is **1/2", 3/4", 1", or 1 1/4" NPT** depending on furnace size. **Refer to Detail "A" "Condensation Drain(s)" on page 23.** Verify unit inlet size to job-specific sheet. Avoid multiple taps in the gas supply, so the unit always has a steady supply of gas.
4. Install a ground joint union with brass seat and a manual shut-off valve external to the unit casing. Install shut-off valve adjacent to the unit for emergency shut-off and easy servicing of controls. Refer to **Figure 23 on page 26**.
5. Provide a sediment trap, as shown in **Figure 23**, before each unit and where low spots in the pipeline cannot be avoided.
6. A minimum 1/8" NPT plugged tapping, accessible for test gauge connection, must be installed immediately upstream of the gas supply connection to the appliance.
7. Locate gas regulators away from the flue vent. Positioning the regulator underneath or nearby the flue may cause the regulator to freeze and prevent heating from properly operating.
8. Clean out the gas line to remove debris before making connections. Purge line to remove air before attempting to start unit. Purging air from gas lines should be performed as described in ANSI Z223.1-latest edition "National Fuel Gas Code," or in Canada as described in CAN/CGA-B149.
9. All field gas piping must be pressure/leak tested before unit operation. Use a non-corrosive bubble forming solution or equivalent for leak testing. The heater and its individual shut-off valve must be disconnected from the gas supply piping system during any pressure testing of that system at test pressures over 1/2 psi. The heater must be isolated from the gas supply piping system by closing its individual manual shutoff valve during any pressure testing of the gas supply piping system at test pressures equal to or less than 1/2 psi.
10. This unit requires a constant **7" water column (wc) minimum for natural gas supply** (**LP 11 in. wc minimum**) when the unit is operating at maximum gas flow. If the gas supply exceeds **14" wc**, it will damage the internal valve components. If the gas supply drops below **7" wc** (**LP 11 in. wc**), the heater may not perform to specifications. Refer to **Table 7** for gas pressure type and pressure rating.

**NOTICE**

**Refer to the heater rating plate for determining the minimum gas supply pressure for obtaining the maximum gas capacity for which this heater is specified.**

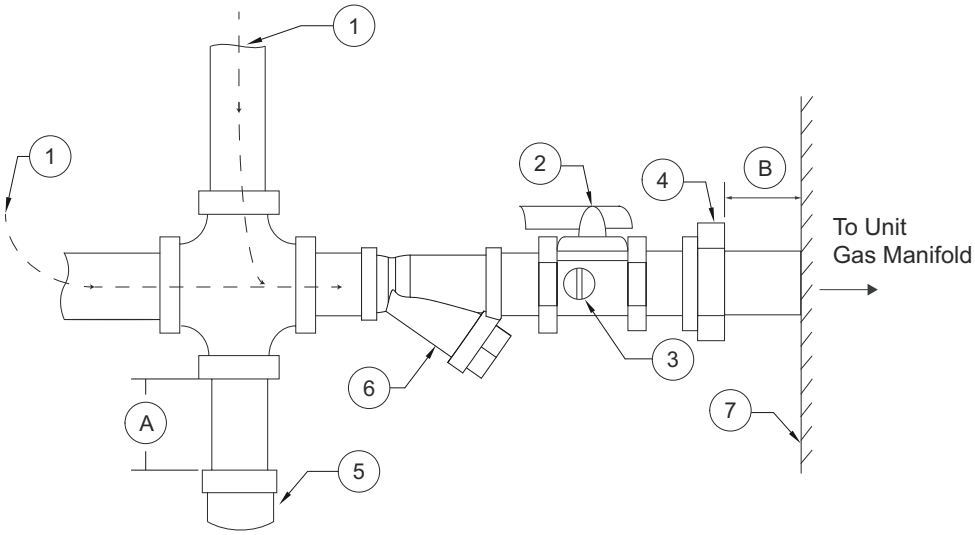
### High Turndown Furnace

The high turndown furnace will be divided into two separate furnace assemblies within the same cabinet. This results in a two stage heat source that can stage up and down to meet demand. Since the furnace is split unevenly, staging on the smallest will result in significantly higher turndown and greater control over building conditions. An additional Flame Safety Controller (FSC), safety valve, modulating valve, and high pressure switch (if equipped) will be installed. Refer to **Figure 34 on page 62**.

## Gas Train

A strainer must be installed to prevent debris from entering the gas train. Only use new piping. Properly ream and clean metal burrs. Proper care is needed to ensure that the gas flow is in the same direction as indicated on the strainer. Do not over-tighten pipe connections. Use pipe dope on male threads only. Install a drip leg in the gas line in accordance with the Authority Having Jurisdiction (AHJ) guidelines.

**Figure 23 - Gas Connection Diagram**




1. Gas Supply Line Connection
2. Manual Gas Shut-off Valve
3. Plugged 1/8” NPT Test Gauge Connection
4. Ground Joint Union with Brass Seat
5. Sediment Trap
6. Strainer
7. Unit

A. Minimum Depth = 6”
B. Maximum Length = 12”

Proper clearance must be provided in order to service the strainer. A minimum of a 4” clearance distance must be provided at the base of the strainer.

**Table 7 - Gas Train Details**

| Gas Pressure Type | Gas Pressure |
|---|---|
| Inlet Pressure - Natural Gas | 7 - 14 Inches WC |
| Inlet Pressure - Propane (LP) | 11 - 14 Inches WC |
| Maximum Manifold Pressure - Natural Gas | 3.5 Inches WC Maximum |
| Maximum Manifold Pressure - Propane (LP) | 10 Inches WC Maximum |
| Minimum Manifold Pressure - Natural Gas | 0.15 Inches WC Maximum |
| Minimum Manifold Pressure - Propane (LP) | 0.75 Inches WC Maximum |
| **Strainer** | **Size** |
| 4417K64 | 3/4” |
| 4417K65 | 1” |
| 4417K66 | 1-1/4” |
| 4417K67 | 1-1/2” |
| 4417K68 | 2” |
| 4417K69 | 2-1/2” |
| 4417K71 | 3” |

## Indoor Flue Venting

**IMPORTANT**

**Furnace Only Modules must be installed in a positive pressure airstream. Do not install in a duct on the suction side of a fan.**

This appliance requires a Category III venting system. Refer to appliance manufacturer's installation instructions for proper vent installation. Indoor gas fired heating equipment must be vented. **Do not operate unvented**. Gas fired heating equipment which has been improperly vented, or which experiences a blocked vent condition may emit flue gases into heated spaces.

**Use only venting materials and components that are UL listed and approved for Category III venting systems. Do not mix pipe, fittings, or joining methods from different manufacturers.**

### General Venting Guidelines

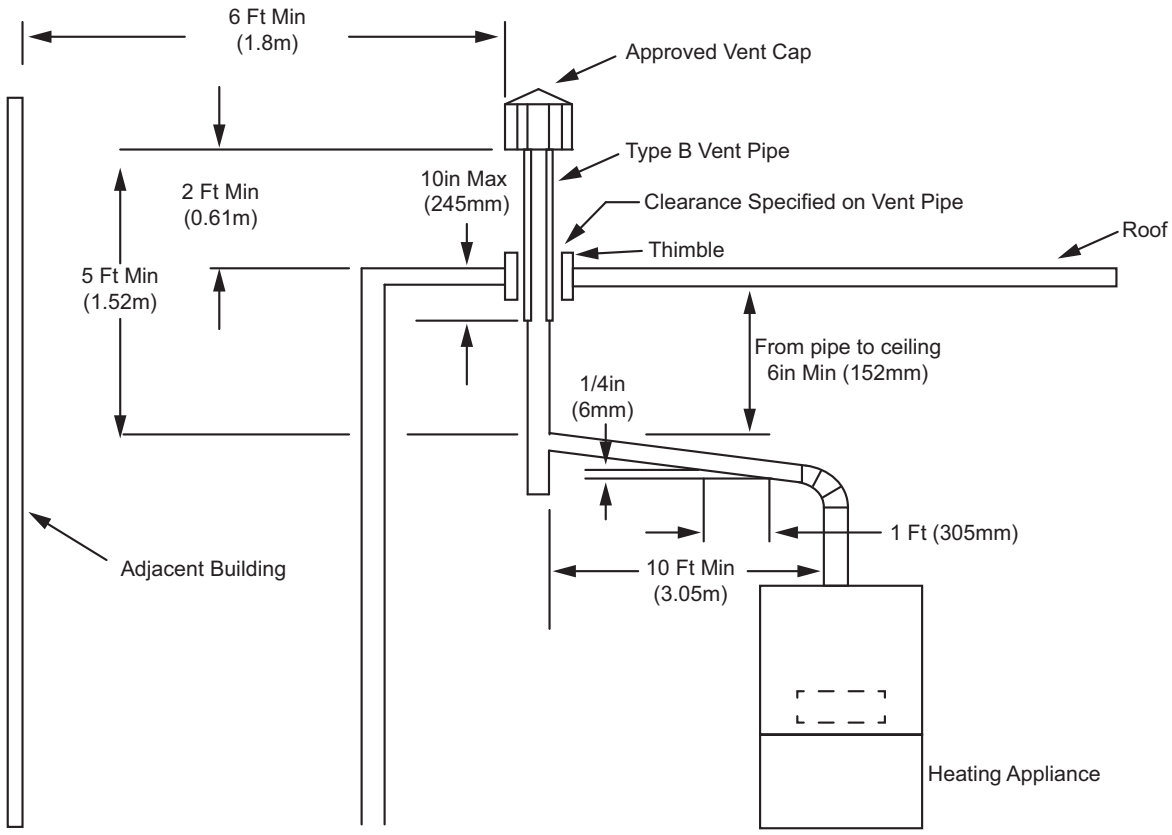
1. Installation of venting must conform to local building codes, or in the absence of local codes, follow the National Fuel Gas Code.
2. On Units with multiple furnaces, each furnace must be ducted to the outside using its own isolated duct run. Ducts used on each single furnace MUST NOT be connected together in any fashion. Failure to adhere to this may result in a build-up of Carbon-Monoxide in the space when the furnace is operating with less than all of its furnaces powered.
3. Do not use a vent pipe smaller than the size of the outlet on the heater.
4. Install with a minimum upward slope from unit of ¼ inch per foot and suspend from overhead structure at points no greater than 3 feet apart. For best venting, put as much vertical vent as close to the unit as possible.
5. Fasten individual lengths of vent together with at least three corrosion resistant sheet metal screws.
6. Vent pipes should be fitted with a tee with a drip leg and clean out tap at the low point in the vent run. This should be inspected and cleaned out periodically during the heating season.
7. Do NOT use dampers or other devices in the vent or combustion air pipes.
8. Use a vent terminal to reduce downdrafts and moisture in the vent line.
9. A vent system that terminates vertically but has a horizontal run that exceeds 75% of the vertical rise is considered horizontal.
10. Pressures in Category III venting systems are positive, and therefore care must be taken to prevent flue products from entering the heated space. 11. Vent pipes must all be sealed and gas tight.

| | |
|---|---|
| **National Fuel Gas Code Venting Pipe Requirement:** | Use 5-inch pipe for 0 - 251,000 BTUs<br>Use 6-inch pipe for 251,000 - 375,000 BTUs<br>Use 7-inch pipe for 375,000 - 524,000 BTUs<br>Use 8-inch pipe for 524,000 - 698,000 BTUs |

## Vertically Vented Furnaces

1. Use single wall or double wall (Type B) vent pipe of a diameter listed in **Table 8 on page 29** for the appropriate model. Refer to **Figure 24** for assemble example.
2. Maximize the height of the vertical run of vent pipe. A minimum of five (5) feet (1.5m) of vertical pipe is required. The top of the vent pipe must extend at least two (2) feet (0.61m) above the highest point on the roof. Use Listed Type B vent for external runs. An approved weatherproof vent cap must be installed on the vent termination.
3. Horizontal runs should be pitched upward ¼ in. per foot (21mm/m) and should be supported at three (3) foot (1m) maximum intervals.
4. Design vent pipe runs to minimize the use of elbows. Each $90^0$ elbow is equivalent to five (5) feet (1.5m) of straight vent pipe.
5. Vent pipe should not be run through unheated spaces. If such runs cannot be avoided, insulate the vent pipe to prevent condensation. Insulation should be a minimum of 1/2-in. (12.7mm) thick foil faced fiberglass minimum of 1 1/2 # density.
6. Dampers must not be used in vent piping runs, as spillage of flue gases into the occupied space could result.
7. Vent connectors serving Category 1 heaters must not be connected into any portion of a mechanical draft system operating under positive pressure.

**Figure 24 - Vertical Venting**



## Horizontally Vented Furnaces – Category III

Horizontal vent systems terminate horizontally (sideways).

**WARNING: Do not use Type B vent within a building on horizontally vented units.**

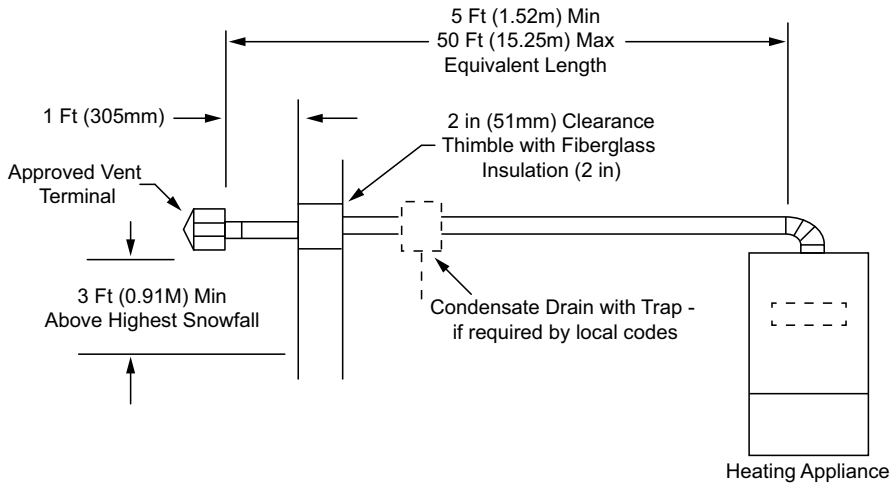
1. All vent pipe joints must be sealed to prevent leakage. Follow the instructions provided with the approved venting materials. Refer to **Figure 25** for an assembly example.
2. The total equivalent length of vent pipe must not exceed 50 ft. (15.25m). Equivalent length is the total length of straight sections, plus 5 ft. (1.52m) for each 90º elbow and 2.5 ft. (0.76m) for each 45° elbow.
3. The vent system must also be installed to prevent collection of condensates. Horizontal runs should be pitched upward ¼ in. per foot (21mm/m) and should be supported at three (3) foot (1m) maximum intervals.
4. Insulate vent pipe exposed to cold air or routed through unheated areas. Insulate vent pipe runs longer than 10 ft. (3m). Insulation should be a minimum of ½ in. (12mm) thick foil faced fiberglass of 1 ½ # density. Maintain 6 in. (152mm) clearance between vent pipe and combustible materials.
5. An approved Breidert Type L, Field Starkap or equivalent vent cap must be provided. Vent cap inlet diameter must be the same as the vent pipe diameter.
6. The vent terminal must be at least 12 in. (305mm) from the exterior wall that it passes through to prevent degradation of building material by flue gases.
7. The vent terminal must be located at least 12 in. (305mm) above grade, or in snow areas, at least 3 ft. (1m) above snow line to prevent blockage.
8. The vent terminal must be installed with a minimum horizontal clearance of 4 ft. (1.2m) from electric meters, gas meters, regulators, or relief equipment.

Through-the-wall vents shall not terminate over public walkways or over an area where condensate or vapor could create a nuisance or hazard. Provide vent termination clearances to building or structure features per **Table 8**:

**Table 8 - Vent Termination Clearances**

| Structure | Minimum Clearance |
|---|---|
| Door, Window, or Gravity Vent | 4 ft. (1.2 m) Below<br>4 ft. (1.2 m) Horizontally<br>1 ft. (305 mm) Above |
| Forced Air Inlet within 10 ft. (3 m) | 3 ft. (0.91 m) Above |
| Adjoining Building or Parapet | 6 ft. (1.8 m) |
| Adjacent Public Walkways | 7 ft (2.1 m) Above Grade |

**Figure 25 - Horizontal Venting**




**EACH APPLIANCE MUST HAVE ITS OWN INDIVIDUAL VENT PIPE AND TERMINAL**. Do not connect vent system from horizontally vented units to other vent systems or a chimney.

## High Altitude and Gas Type Orifice Sizing

The burner orifices should be sized per **Table 9** and **Table 10**, depending on fuel type, furnace size, and altitude. Standard orifice sizes are for sea level. The unit should be ordered with the altitude specific orifices, or the parts should be ordered through the manufacturer (**Table 11 on page 32**). Refer to main gas valve documentation for instructions to convert gas valve spring from Natural to LP and vice versa.

**NOTE: 50,000 - 100,000 BTU High-Efficiency Natural Gas furnaces use 2.3mm Drill Size at 0 - 3999 ft. Follow charts for all other altitudes.**

**Table 9 - Natural Gas High Altitude Charts**

| Size 1, 2, and 3 | | | | | Size 1 | | Size 2 and 3 | |
|---|---|---|---|---|---|---|---|---|
| High Altitude: 150,000 to 300,000 BTU | | | | | 260,000 BTU | | 400,000 BTU | |
| Altitude (Feet) | Input Rate | Input Rate | Input Rate | Drill Size | Input Rate | Drill Size | Input Rate | Drill Size |
| 0 - 1,999 | 150,000 | 200,000 | 300,000 | #3/32 | 260,000 | 2.6mm | 400,000 | #41 |
| 2,000 - 2,999 | 144,000 | 192,000 | 288,000 | 2.35mm | 249,600 | #38 | 384,000 | #42 |
| 3,000 - 3,999 | 138,240 | 184,320 | 276,480 | 2.3mm | 239,616 | #39 | 368,640 | 2.35mm |
| 4,000 - 4,999 | 132,710 | 176,947 | 265,421 | #43 | 230,031 | #39 | 353,894 | 2.3mm |
| 5,000 - 5,999 | 127,402 | 169,869 | 254,804 | 2.25mm | 220,830 | #40 | 339,739 | #43 |
| 6,000 - 6,999 | 122,306 | 163,075 | 244,612 | #44 | 211,997 | #41 | 326,149 | 2.25mm |
| 7,000 - 7,999 | 117,414 | 156,552 | 234,827 | 2.15mm | 203,517 | #42 | 313,103 | #44 |
| 8,000 - 8,999 | 112,717 | 150,290 | 225,434 | #46 | 195,376 | #42 | 300,579 | #45 |
| 9,000 - 10,000 | 108,209 | 144,278 | 216,417 | #47 | 187,561 | #43 | 288,556 | #46 |

| Size 2 | | | Size 3 | | Size 3 | |
|---|---|---|---|---|---|---|
| High Altitude: 440,000 BTU | | | 500,000 BTU | | 685,000 BTU | |
| Altitude (Feet) | Input Rate | Drill Size | Input Rate | Drill Size | Input Rate | Drill Size |
| 0 - 1,999 | 440,000 | #37 | 500,000 | #36 | 685,000 | #33 |
| 2,000 - 2,999 | 422,400 | #38 | 479,998 | #37 | 657,600 | #35 |
| 3,000 - 3,999 | 405,504 | #39 | 460,797 | #38 | 631,296 | #35 |
| 4,000 - 4,999 | 389,284 | #39 | 442,668 | #38 | 606,044 | #36 |
| 5,000 - 5,999 | 373,712 | #40 | 424,668 | #39 | 581,802 | #36 |
| 6,000 - 6,999 | 358,764 | #41 | 407,680 | #40 | 558,530 | #37 |
| 7,000 - 7,999 | 344,413 | #42 | 391,372 | #41 | 536,189 | #38 |
| 8,000 - 8,999 | 330,637 | #42 | 375,716 | #41 | 514,742 | #38 |
| 9,000 - 10,000 | 317,411 | #43 | 360,686 | #42 | 494,152 | #40 |

| Size 4 | | | | | | Size 4 | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| High Altitude: 200,000 to 500,000 BTU | | | | | | 600,000-800,000 BTU | | | | 1,100,000 BTU | |
| Altitude (Feet) | Input Rate | | | | Drill Size | Input Rate | | | Drill Size | Input Rate | Drill Size |
| 0 - 1,999 | 200,000 | 300,000 | 400,000 | 500,000 | 3.3mm | 600,000 | 700,000 | 800,000 | 3.4mm | 1,100,000 | #38 |
| 2,000 - 2,999 | 192,000 | 288,000 | 384,000 | 479,998 | #30 | 576,000 | 672,000 | 768,000 | #30 | 1,056,000 | #39 |
| 3,000 - 3,999 | 184,320 | 276,480 | 368,640 | 460,797 | #31 | 552,960 | 645,120 | 737,280 | #30 | 1,013,760 | #40 |
| 4,000 - 4,999 | 176,947 | 265,421 | 353,894 | 442,668 | #31 | 530,482 | 619,315 | 707,789 | #30 | 973,210 | #41 |
| 5,000 - 5,999 | 169,869 | 254,804 | 339,739 | 424,668 | #31 | 509,608 | 594,543 | 679,477 | #30 | 934,281 | #41 |
| 6,000 - 6,999 | 163,075 | 244,612 | 326,149 | 407,680 | #31 | 489,224 | 570,761 | 652,298 | #30 | 896,910 | #42 |
| 7,000 - 7,999 | 156,552 | 234,827 | 313,103 | 391,372 | #32 | 469,654 | 547,930 | 626,206 | #31 | 861,034 | #42 |
| 8,000 - 8,999 | 150,290 | 225,434 | 300,579 | 375,716 | #32 | 450,868 | 526,013 | 601,158 | #31 | 826,592 | #43 |
| 9,000 - 10,000 | 144,278 | 216,417 | 288,556 | 360,686 | #33 | 432,834 | 504,973 | 577,112 | #32 | 793,529 | #43 |

## Table 10 - LP Gas High Altitude Conversion

| Size 1, 2, and 3 | | | | | Size 1 | | Size 2 and 3 | |
|---|---|---|---|---|---|---|---|---|
| High Altitude: 150,000 to 300,000 BTU | | | | | 260,000 BTU | | 400,000 BTU | |
| Altitude (Feet) | Input Rate | Input Rate | Input Rate | Drill Size | Input Rate | Drill Size | Input Rate | Drill Size |
| 0 - 1,999 | 150,000 | 200,000 | 300,000 | #54 | 260,000 | 1.6mm | 400,000 | 1.45mm |
| 2,000 - 2,999 | 144,000 | 192,000 | 288,000 | #54 | 249,600 | #1/16 | 384,000 | #54 |
| 3,000 - 3,999 | 138,240 | 184,320 | 276,480 | #55 | 239,616 | #53 | 368,640 | #54 |
| 4,000 - 4,999 | 132,710 | 176,947 | 265,421 | #55 | 230,031 | #54 | 353,894 | #54 |
| 5,000 - 5,999 | 127,402 | 169,869 | 254,804 | #55 | 220,830 | #54 | 339,739 | #54 |
| 6,000 - 6,999 | 122,306 | 163,075 | 244,612 | #55 | 211,997 | #54 | 326,149 | #55 |
| 7,000 - 7,999 | 117,414 | 156,552 | 234,827 | #56 | 203,517 | #54 | 313,103 | #55 |
| 8,000 - 8,999 | 112,717 | 150,290 | 225,434 | #56 | 195,376 | #54 | 300,579 | #55 |
| 9,000 - 10,000 | 108,209 | 144,278 | 216,417 | #57 | 187,561 | #55 | 288,556 | #56 |

| Size 2 | | | Size 3 | | Size 3 | |
|---|---|---|---|---|---|---|
| High Altitude: 440,000 BTU | | | 500,000 BTU | | 685,000 BTU | |
| Altitude (Feet) | Input Rate | Drill Size | Input Rate | Drill Size | Input Rate | Drill Size |
| 0 - 1,999 | 440,000 | 1.65mm | 500,000 | #51 | 685,000 | 1.8mm |
| 2,000 - 2,999 | 422,400 | #52 | 479,998 | #51 | 657,600 | #51 |
| 3,000 - 3,999 | 405,504 | #53 | 460,797 | #52 | 631,296 | #51 |
| 4,000 - 4,999 | 389,284 | #53 | 442,668 | #52 | 606,044 | #51 |
| 5,000 - 5,999 | 373,712 | #53 | 424,668 | #52 | 581,802 | #51 |
| 6,000 - 6,999 | 358,764 | #53 | 407,680 | #52 | 558,530 | #52 |
| 7,000 - 7,999 | 344,413 | #53 | 391,372 | #53 | 536,189 | #52 |
| 8,000 - 8,999 | 330,637 | #54 | 375,716 | #53 | 514,742 | #52 |
| 9,000 - 10,000 | 317,411 | #54 | 360,686 | #53 | 494,152 | #53 |

| Size 4 | | | | | | Size 4 | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| High Altitude: 500,000 to 200,000 BTU | | | | | | 600,000-800,000 BTU | | | | 1,100,000 BTU | |
| Altitude (Feet) | Input Rate | | | | Drill Size | Input Rate | | | Drill Size | Input Rate | Drill Size |
| 0 - 1,999 | 200,000 | 300,000 | 400,000 | 500,000 | #45 | 600,000 | 700,000 | 800,000 | #45 | 1,100,000 | 1/16” |
| 2,000 - 2,999 | 192,000 | 288,000 | 384,000 | 479,998 | #46 | 576,000 | 672,000 | 768,000 | #46 | 1,056,000 | #53 |
| 3,000 - 3,999 | 184,320 | 276,480 | 368,640 | 460,797 | #47 | 552,960 | 645,120 | 737,280 | #47 | 1,013,760 | #53 |
| 4,000 - 4,999 | 176,947 | 265,421 | 353,894 | 442,668 | #47 | 530,482 | 619,315 | 707,789 | #47 | 973,210 | #54 |
| 5,000 - 5,999 | 169,869 | 254,804 | 339,739 | 424,668 | #47 | 509,608 | 594,543 | 679,477 | #47 | 934,281 | #54 |
| 6,000 - 6,999 | 163,075 | 244,612 | 326,149 | 407,680 | #48 | 489,224 | 570,761 | 652,298 | #48 | 896,910 | #54 |
| 7,000 - 7,999 | 156,552 | 234,827 | 313,103 | 391,372 | #48 | 469,654 | 547,930 | 626,206 | #48 | 861,034 | #54 |
| 8,000 - 8,999 | 150,290 | 225,434 | 300,579 | 375,716 | #49 | 450,868 | 526,013 | 601,158 | #49 | 826,592 | #55 |
| 9,000 - 10,000 | 144,278 | 216,417 | 288,556 | 360,686 | #49 | 432,834 | 504,973 | 577,112 | #49 | 793,529 | #55 |

## Table 11 - Orifice Part Numbers and Quantity Charts

| Orifice Part Numbers | | | | | | Orifice Quantity per Furnace | | | |
|---|---|---|---|---|---|---|---|---|---|
| Size | Part # | AX # | Size | Part # | AX # | Size 1, 2, and 3 | Qty | Size 4 | Qty |
| #30 | BG100-30 | A0029277 | #51 | BG100-51 | A0042653 | 50,000 BTU | 2 | N/A | - |
| #31 | BG100-31 | A0029278 | #52 | BG100-52 | A0042654 | 75,000 BTU | 3 | N/A | - |
| #32 | BG100-32 | A0029279 | #53 | BG100-53 | A0030724 | 100,000 BTU | 4 | N/A | - |
| #33 | BG100-33 | A0029280 | #54 | BG100-54 | A0023048 | 125,000 BTU | 5 | N/A | - |
| #35 | BG100-35 | A0029281 | #55 | BG100-55 | A0023049 | 150,000 BTU | 6 | N/A | - |
| #36 | BG100-36 | A0030719 | #56 | BG100-56 | A0023057 | 200,000 BTU | 8 | 200,000 BTU | 4 |
| #37 | BG100-37 | A0030721 | #57 | BG100-57 | A0028803 | 260,000 BTU | 9 | N/A | - |
| #38 | BG100-38 | A0030722 | 1/16” | BG100-116 | A0030725 | 300,000 BTU | 12 | 300,000 BTU | 6 |
| #39 | BG100-39 | A0042652 | 1.45mm | BG101-16 | A0023052 | 400,000 BTU | 15 | 400,000 BTU | 8 |
| #40 | BG100-40 | A0030723 | 1.6mm | BG101-25 | A0043619 | 440,000 BTU | 14 | N/A | - |
| #41 | BG100-41 | A0023045 | 1.65mm | BG101-24 | A0043620 | 500,000 BTU | 15 | 500,000 BTU | 10 |
| #42 | BG100-42 | A0023050 | 1.8mm | BG101-10 | A0043621 | N/A | - | 600,000 BTU | 11 |
| #43 | BG100-43 | A0023047 | 2.15mm | BG101-21 | A0023055 | 685,000 BTU | 18 | N/A | - |
| #44 | BG100-44 | A0023046 | 2.25mm | BG101-20 | A0023054 | N/A | - | 700,000 BTU | 13 |
| #45 | BG100-45 | A0028800 | 2.3mm | BG101-05 | A0023051 | N/A | - | 800,000 BTU | 15 |
| #46 | BG100-46 | A0028801 | 2.35mm | BG101-19 | A0023053 | N/A | - | 1,100,000 BTU | 36 |
| #47 | BG100-47 | A0028802 | 2.6mm | BG101-23 | A0043622 | | | | |
| #48 | BG100-48 | A0029282 | 3.3mm | BG101-08 | A0029285 | | | | |
| #49 | BG100-49 | A0029283 | 3.4mm | BG101-09 | A0030726 | | | | |
| #50 | BG100-50 | A0029284 | #3/32 | BG101-3/32 | A0023044 | | | | |

## LP Conversion Kit for RTU Series

LP/Natural Gas conversion kits are used to convert from one gas type to another in the field. This kit is used on all RTUs, and the part numbers in **Table 12** should be used on furnace sizes listed.

Kits contain:

- Main Safety Gas Valve Regulator Spring
- Furnace orifices marked with orifice size

This unit is configured for the gas type listed on the nameplate. To convert gas types, you must use the following parts listed in **Table 12**. The size-specific parts include the orifice conversion parts and the combination gas valve spring(s). These parts are available by contacting your local sales office.

All field gas piping must be pressure/leak tested before unit operation. Use a noncorrosive bubble forming solution or equivalent for leak testing. The equipment and its individual shut-off valve must be disconnected from the gas supply piping system during any pressure testing of that system at test pressures in excess of 1/2 psi. The equipment must be isolated from the gas supply piping system by closing its individual manual shutoff valve during any pressure testing of the gas supply piping system at test pressures equal to or less than 1/2 psi. This must be performed on an annual basis.

**Table 12 - Gas Conversion Kit Part Numbers**

| Size 1 Units | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Furnace Size** | **50 MBH** | **75 MBH** | **100 MBH** | **125 MBH** | **150 MBH** | **200 MBH** | **260 MBH** |
| **Natural Gas** | NAT-HMG50 | NAT-HMG75 | NAT-HMG100 | NAT-HMG125 | NAT-HMG150 | NAT-HMG200 | NAT-HMG260 |
| **LP Gas** | LP-HMG50 | LP-HMG75 | LP-HMG100 | LP-HMG125 | LP-HMG150 | LP-HMG200 | LP-HMG260 |
| **Modulating Valve** | E50-1/2” | | | | | | |

| Size 2 and 3 Units | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| **Furnace Size** | **50 MBH** | **100 MBH** | **150 MBH** | **200 MBH** | **250 MBH** | **300 MBH** | **400 MBH** | **440 MBH** | **500 MBH** | **685 MBH** |
| **Natural Gas** | NAT-HMG50 | NAT-HMG100 | NAT-HMG150 | NAT-HMG200 | NAT-HMG250 | NAT-HMG300 | NAT-HMG400 | NAT-HMG440 | NAT-HMG500 | NAT-HMG685 |
| **LP Gas** | LP-HMG50 | LP-HMG100 | LP-HMG150 | LP-HMG200 | LP-HMG250 | LP-HMG300 | LP-HMG400 | LP-HMG440 | LP-HMG500 | LP-HMG685 |
| **Modulating Valve** | E50-3/4” | | | | | | | | E60-1” | E50-3/4” |

| Size 4 Units | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Furnace Size** | **200 MBH** | **300 MBH** | **400 MBH** | **500 MBH** | **600 MBH** | **700 MBH** | **800MBH** | **1100MBH** |
| **Natural Gas** | NAT-HMA200 | NAT-HMA300 | NAT-HMA400 | NAT-HMA500 | NAT-HMA600 | NAT-HMA700 | NAT-HMA800 | NAT-HMA1100 |
| **LP Gas** | LP-HMA200 | LP-HMA300 | LP-HMA400 | LP-HMA500 | LP-HMA600 | LP-HMA700 | LP-HMA800 | LP-HMA1100 |
| **Modulating Valve** | E50-3/4” | | | E60-1” | | | | |

## Pre-Conversion Unit Check-Out

The following procedure is intended as a guide to aid in determining that the appliance is properly installed and is in a safe condition for continuing use. It should be recognized that generalized test procedures cannot anticipate all situations. Accordingly, in some cases, deviation from this procedure may be necessary to determine safe operation of the equipment:

- This procedure should be performed before any attempt at modification of the appliance or the installation.
- If it is determined there is a condition that could result in unsafe operation, the appliance should be shut off, and the owner advised of the unsafe condition.

Follow these steps when making a safety inspection:

1. Conduct a gas leakage test of the appliance piping and control system downstream of the shut-off valve in the supply line to the appliance.
2. Visually inspect the venting system for proper size and horizontal pitch and determine there is no blockage or restrictions, leakage, corrosion, or other deficiencies that could cause an unsafe condition.
3. Shut off all gas to the appliance and shut off any other fuel-burning appliance within the same room. Use the shut-off valve in the supply line to each appliance.
4. Inspect burners and crossovers for blockage and corrosion.
5. Inspect heat exchangers for cracks, openings, or excessive corrosion.
6. Insofar as is practical, close all windows and all doors between the space where the appliance is located and other spaces of the building. Turn on any exhaust fans so that they will operate at maximum speed. If it is believed sufficient combustion air is not available, refer to the section covering air for combustion, venting, and ventilation of *Natural Gas and Propane Installation Code*, *CSA B149.1,* or *National Fuel Gas Code*, *ANSI Z223.1/NFPA 54,* for guidance.
7. Place the appliance in operation following the lighting instructions. Adjust thermostat so the appliance will operate continuously. Other fuel-burning appliances shall be placed in operation.
8. Determine that the main burner ignition is satisfactory by interrupting and re-establishing the electrical supply to the appliance in any convenient manner.
   - Visually determine that main burner gas is burning properly.
   - If the appliance is equipped with high- and low-flame control or flame modulation, check the main burner for proper operation at low flame.
9. Test for spillage at the draft hood relief opening after 5 minutes of main burner operation. Use a draft gauge, the flame of a match, or candle.
10. Return doors, windows, exhaust fans, and all other fuel-burning appliances to their previous conditions of use.
11. Check both limit control and fan control for proper operation. Limit control operation can be checked by temporarily disconnecting the electrical supply to the supply motor and determining that the limit control acts to shut off the main burner gas.

## Gas Conversion Instruction

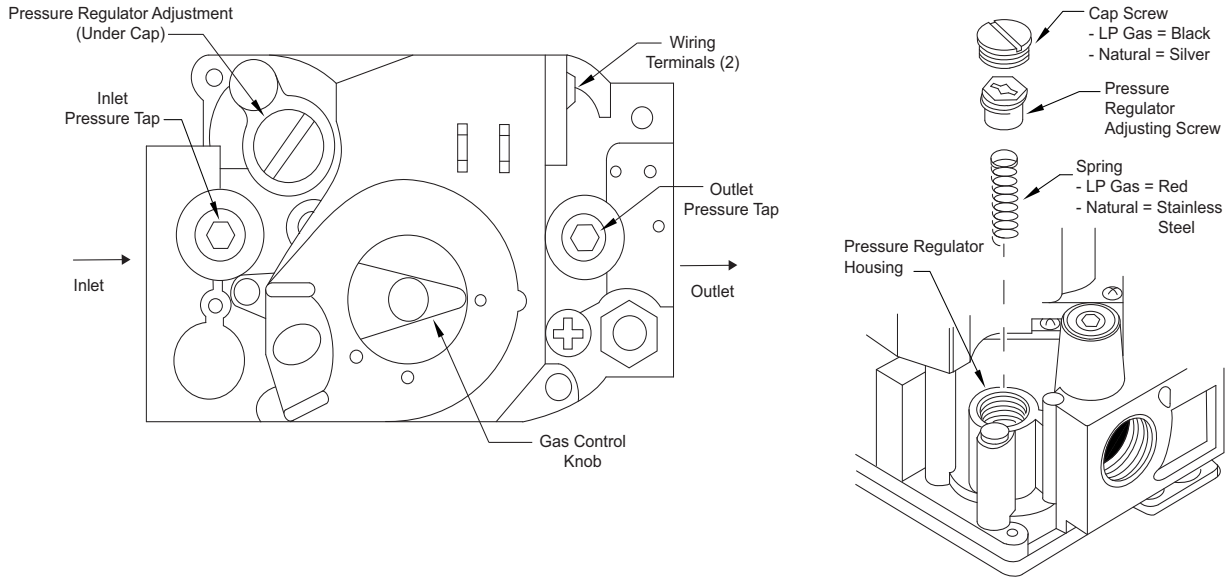
**Warning**

**This conversion kit shall be installed by a qualified service agency in accordance with the manufacturer's instructions and all applicable codes and requirements of the authority having jurisdiction. If the information in these instructions is not followed exactly, a fire, explosion or production of carbon monoxide may result causing property damage, personal injury or loss of life. The qualified service agency performing this work assumes the responsibility for the proper conversion of the appliance with this kit.**

Follow the below steps when converting gas types, refer to **Figure 26** for details:

1. Before proceeding with the conversion, shut off all gas supply to the unit at the manual shut-off valve.
2. Disconnect or shut off all electrical power to the unit.
3. Turn the thermostat to the lowest temperature setting.
4. Remove screws holding manifold pipe assembly to burner assembly.
5. Loosen and remove natural gas orifices, remove from manifold.
6. Install propane gas orifices provided with kit. Verify orifice sizes are correct.
7. Open Gas Valve Regulator conversion kit and follow instructions provided for conversion of gas valve regulator. **Make sure to apply the label provided in the kit indicating that the valve has been converted. The spring tension is different for LP and Natural Gas. This is the main component difference.**
8. Secure manifold assembly to burner assembly. Check that all orifices are aligned with the opening on each burner.
9. Turn on gas supply at manual shut-off valve.
10. Leak check union fitting and connection at gas valve using a soap solution.
11. Turn power to the unit "On."
12. Initiate a heating cycle. Check inlet and manifold gas pressures.
13. A label is included in this kit to attach to the manifold indicating this assembly has been converted to LP gas.
14. Attach label to manifold where it is readily visible when this assembly is accessed for service.
15. Verify proper sequence of operation for appliance after conversion is completed.
16. Verify proper gas inlet supply pressure and information on maximum and minimum supply pressures.

**Figure 26 - On/Off Gas Valve**



## Electrical

**WARNING!!**

**Disconnect power before installing or servicing control. High voltage electrical input is needed for this equipment. A qualified electrician should perform this work.**

Before connecting power to the unit, read and understand the entire section of this document. As-built wiring diagrams are furnished with each control by the factory and are attached to the module's door.

**When installed, the appliance must be electrically grounded in accordance with local codes, or in the absence of local codes, with the National Electrical Code (NEC), ANSI/NFPA 70, and/or the Canadian Electrical Code, CSA C22.1, if an external electrical source is utilized.** Verify the voltage and phase of the power supply, and the wire amperage capacity is in accordance with the unit nameplate. Refer to **Table 13** for wire size and amperage ratings.

- **Always disconnect power before working on or near a unit. Lock and tag the disconnect switch and/or breaker to prevent accidental power-up**.
- The main electrical feed should be brought through one of the conduit openings located in the base of the unit, within the perimeter of the curb. When installing wiring and conduit, make sure to route in front of the gas train. Refer to **Figure 27 on page 37.**
- **DO NOT ROUTE WIRING WITHIN THE SUPPLY OR RETURN DUCT. KEEP WIRING AND CONDUIT AT LEAST 1" AWAY FROM THE BURNER EXHAUST VENT.**
- A dedicated branch circuit should supply the unit with short circuit protection according to NEC.
- Make certain that the power source is compatible with the requirements of your equipment. The unit nameplate identifies the proper phase and voltage of the equipment.
- Units shipped with an optional remote HMI panel have separate wiring requirements. It is important to run the main electrical wires in a separate conduit from the remote control HMI wiring. The HMI wiring is Cat-5 and separate from power cable. Maximum distance on any low voltage wire is 1000 feet.
- Before connecting the unit to the building power source, verify power line wiring is de-energized.
- Do not kink power cable. Secure the power cables to prevent contact with sharp objects.
- Never allow the cable to come in contact with oil, grease, hot surfaces, or chemicals.
- Electrically Commutated Motors (ECMs) and Variable Frequency Drives (VFDs) should not be powered through a Ground Fault Circuit Interrupter (GFCI) breaker/outlet. Unnecessary and intermittent tripping may occur.
- Before powering up the unit, check fan wheel for free rotation and make sure that the interior of the heater is free of loose debris or shipping materials.
- If any of the original wire supplied with the appliance needs to be replaced, it must be replaced with wiring material having a temperature rating of at least 149°F and type TW wire or equivalent.
- **Seal ALL base penetrations with an appropriate filler (caulk or all-purpose putty) to prevent water from entering the space. Refer to Figure 27**.

**WARNING: Low Voltage Wiring Should Never Route Together With High Voltage Wiring.**

**Table 13 - Copper Wire Ampacity**

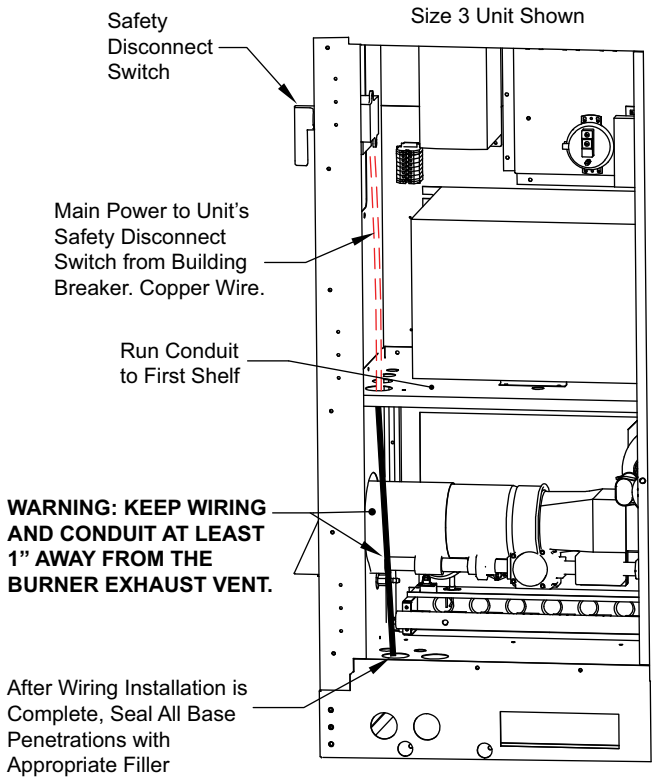
| Wire Size | Maximum Amps |
|---|---|
| 14 AWG | 15 |
| 12 AWG | 20 |
| 10 AWG | 30 |
| 8 AWG | 50 |
| 6 AWG | 65 |
| 4 AWG | 85 |
| 3 AWG | 100 |
| 2 AWG | 115 |
| 1 AWG | 130 |

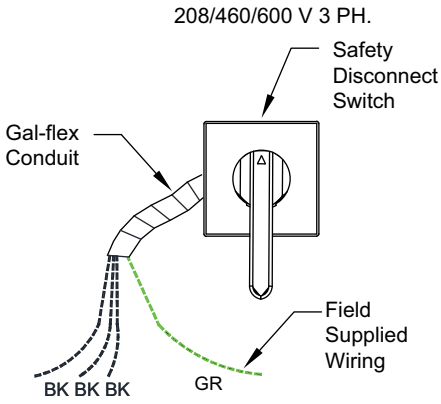
| Wire Size | Maximum Amps |
|---|---|
| 1/0 AWG | 150 |
| 2/0 AWG | 175 |
| 3/0 AWG | 200 |
| 4/0 AWG | 230 |
| 250 MCM | 255 |
| 300 MCM | 285 |
| 350 MCM | 310 |
| 400 MCM | 335 |
| 500 MCM | 380 |
| 600 MCM | 420 |

## Building to Unit Power Wiring Connection

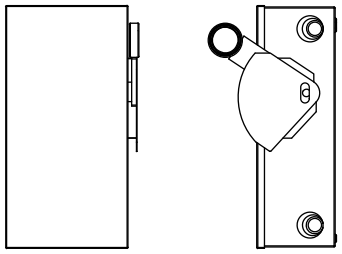
**NOTE: Only Use Copper Wiring for Disconnect.**

**Figure 27 - Conduit Termination/Disconnect Switch Wiring**




Fused Disconnect Option

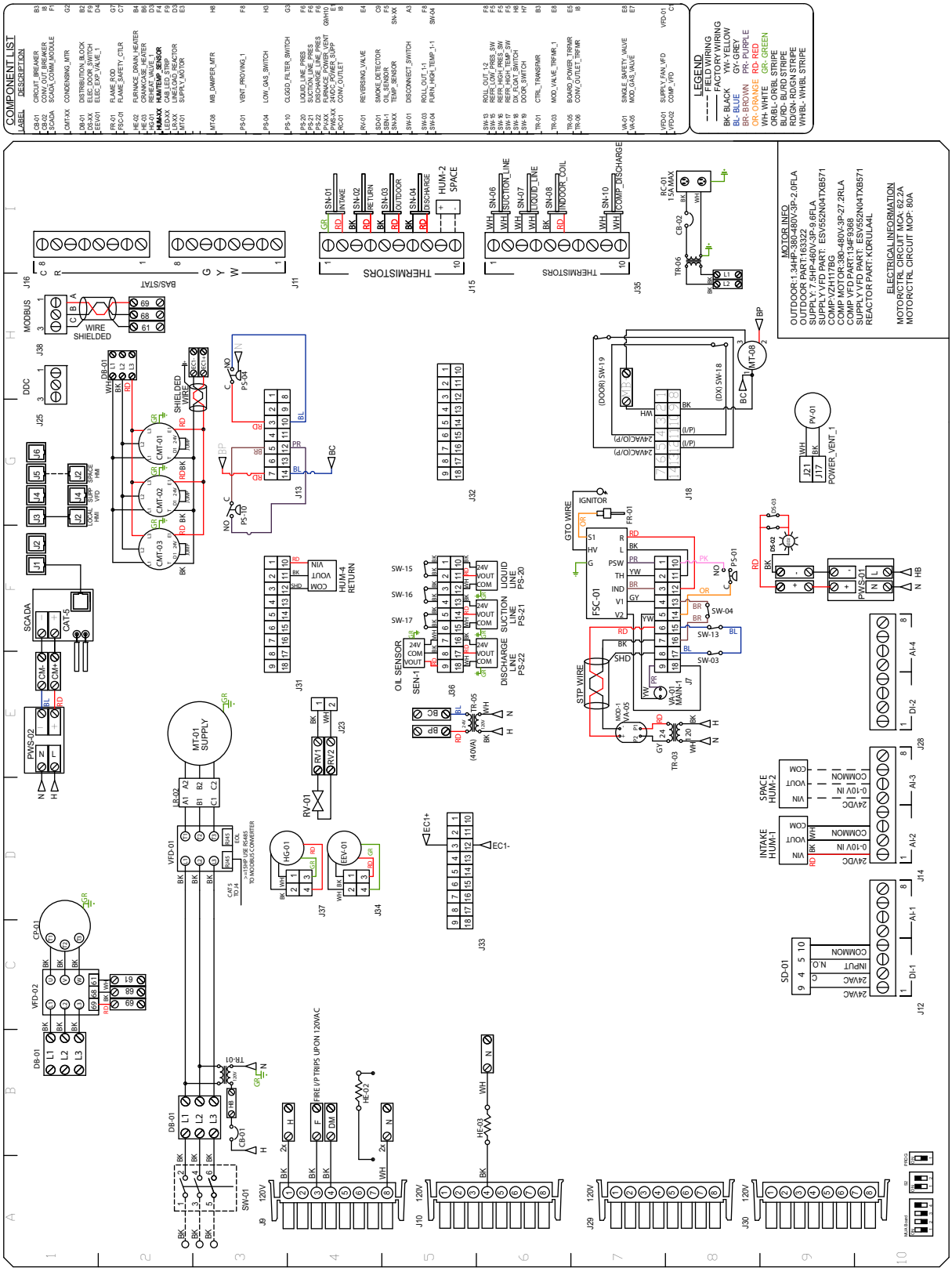


| Fused Disconnect Options | | | |
|---|---|---|---|
| | 250V | 480/600V | Size |
| 30A | DG321NRB | DG321NRB | 1 |
| 60A | DG322NRB | DG322NRB | 1, 2, 3 |
| 100A | DG323NRB | DG323NRB | 1, 2, 3 |

## Site Preparation – Controls

- Consider general service and installation space when locating the remote temperature control.
- Locate the control as close to the space/fan that it will serve to reduce long, unnecessary wire runs.
- Install thermostats in locations that will produce a good representation of the air being moved by the fan in the space. Avoid thermostat installations in direct sunlight, near HVAC supplies, or abnormal temperature airstreams.

## Typical Wiring Schematic



## Variable Frequency Drive (VFD)

**WARNING!**
**- Before installing the VFD drive, ensure the input power supply to the drive is OFF.**
**- The power supply and motor wiring of the VFD must be completed by a qualified electrician.**
**- The VFD is factory programmed, only change if replaced or ordered separately.**

**Not suitable for corner grounded 3 phase input power.** Consult the VFD manual and all documentation shipped with the unit for proper installation and wiring of the VFD. The VFD has been programmed by the factory with ordered specific parameters. Refer to **Table 14** during installation.

**Table 14 - VFD Installation Check List**

| Check Off | Description |
|---|---|
| | The installation environment conforms to the VFD manual. |
| | The drive is mounted securely. |
| | Space around the drive meets the drive's specification for cooling. |
| | The motor and driven equipment are ready to start. |
| | The drive is properly grounded. |
| | The input power voltage matches the drive's nominal input voltage. |
| | The input power connections at L1, L2, and L3 are connected and tight. |
| | The input power protection is installed. |
| | The motor power connection at U, V, and W are connected and tight. |
| | The input, motor, and control wiring are run in separate conduit runs. |
| | The control wiring is connected and tight. |
| | NO tools or foreign objects (such as drill shavings) are in the drive. |
| | NO alternative power source for the motor (such as a bypass connection) is connected - NO voltage is applied to the output of the drive. |

### Variable Frequency Drive (VFD) Installation

### Input AC Power

- Circuit breakers feeding the VFDs are recommended to be thermal-magnetic and fast-acting. They should be sized based on the VFD amperage and according to **"ACTECH SMV VFD" on page 41**. Refer to the installation schematic for exact breaker sizing.
- Every VFD should receive power from its own breaker. If multiple VFDs are to be combined on the same breaker, each drive should have its own protection measure (fuses or miniature circuit breaker) downstream from the breaker.
- Input AC line wires should be routed in conduit from the breaker panel to the drives. AC input power to multiple VFDs can be run in a single conduit if needed. **Do not combine input and output power cables in the same conduit.**
- The VFD should be grounded on the terminal marked PE. A separate insulated ground wire must be provided to each VFD from the electrical panel. This will reduce the noise being radiated in other equipment.

**ATTENTION: Do not connect incoming AC power to output terminals U, V, W. Severe damage to the drive will result. Input power must always be wired to the input L terminal connections (L1, L2, L3).**

## VFD Output Power

- Motor wires from each VFD to its respective motor MUST be routed in a **separate steel** conduit away from control wiring and incoming AC power wiring. This is to avoid noise and crosstalk between drives. An insulated ground must be run from each VFD to its respective motor. Do not run different fan output power cables in the same conduit.
- VFD mounted in fan: The load reactor should be sized accordingly when the VFD is mounted in the fan.

  **208/230V** - Load reactor is optional but recommended for 15 HP and above motors.
  **460/480V** - Load reactor is optional but recommended for 7.5 HP and above motors.
  **575/600V** - Load reactors are required for all HP motors.
- Do not install a contactor between the drive and the motor. Operating such a device while the drive is running can potentially cause damage to the power components of the drive.
- When a disconnect switch is installed between the drive and motor, the disconnect should only be operated when the drive is in a STOP state.
- VFDs should not be powered through a Ground Fault Circuit Interrupter (GFCI) breaker/outlet. Unnecessary and intermittent tripping may occur.

## VFD Programming

### Programming

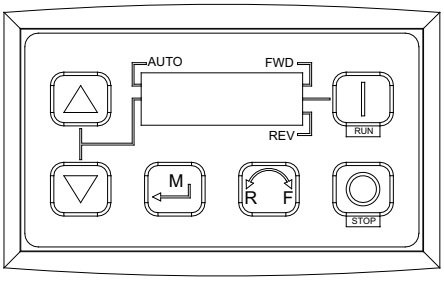
1. The Drive should be programmed for the proper motor voltage. P107 is set to 0 (Low) if motor voltage is 120V AC, 208V AC or 400V AC. P107 is set to 1 (High) if the motor voltage is 230V AC, 480V AC, or 575V AC.
2. The Drive should be programmed for the proper motor overload value. P108 is calculated as Motor FLA x 100 / Drive Output Rating (available in **“ACTECH SMV VFD” on page 41**).

**To enter the PROGRAM mode to access the parameters:**

1. Use the buttons on the VFD screen to adjust VFD settings (**Figure 28**). Press the Mode (M) button. This will activate the password prompt (PASS).
2. Use the Up and Down buttons to scroll to the password value (the factory default password is “0225”) and press the Mode (M) button. Once the correct password is entered, the display will read “P100”, which indicates that the PROGRAM mode has been accessed at the beginning of the parameter menu.
3. Use the Up and Down buttons to scroll to the desired parameter number.
4. Once the desired parameter is found, press the Mode (M) button to display the present parameter setting. The parameter value will begin blinking, indicating that the present parameter setting is being displayed. The value of the parameter can be changed by using the Up and Down buttons.
5. Pressing the Mode (M) button will store the new setting and exit the PROGRAM mode. To change another parameter, press the Mode (M) button again to re-enter the PROGRAM mode. If the Mode button is pressed within 1 minute of exiting the PROGRAM mode, the password is not required to access the parameters. After one minute, the password must be re-entered to access the parameters again.

P500 parameter provides a history of the last 8 faults on the drive. It can be accessed without entering PROGRAM mode.

**Figure 28 - VFD Screen**



## ACTECH SMV VFD

### Table 15 - Cross-Reference

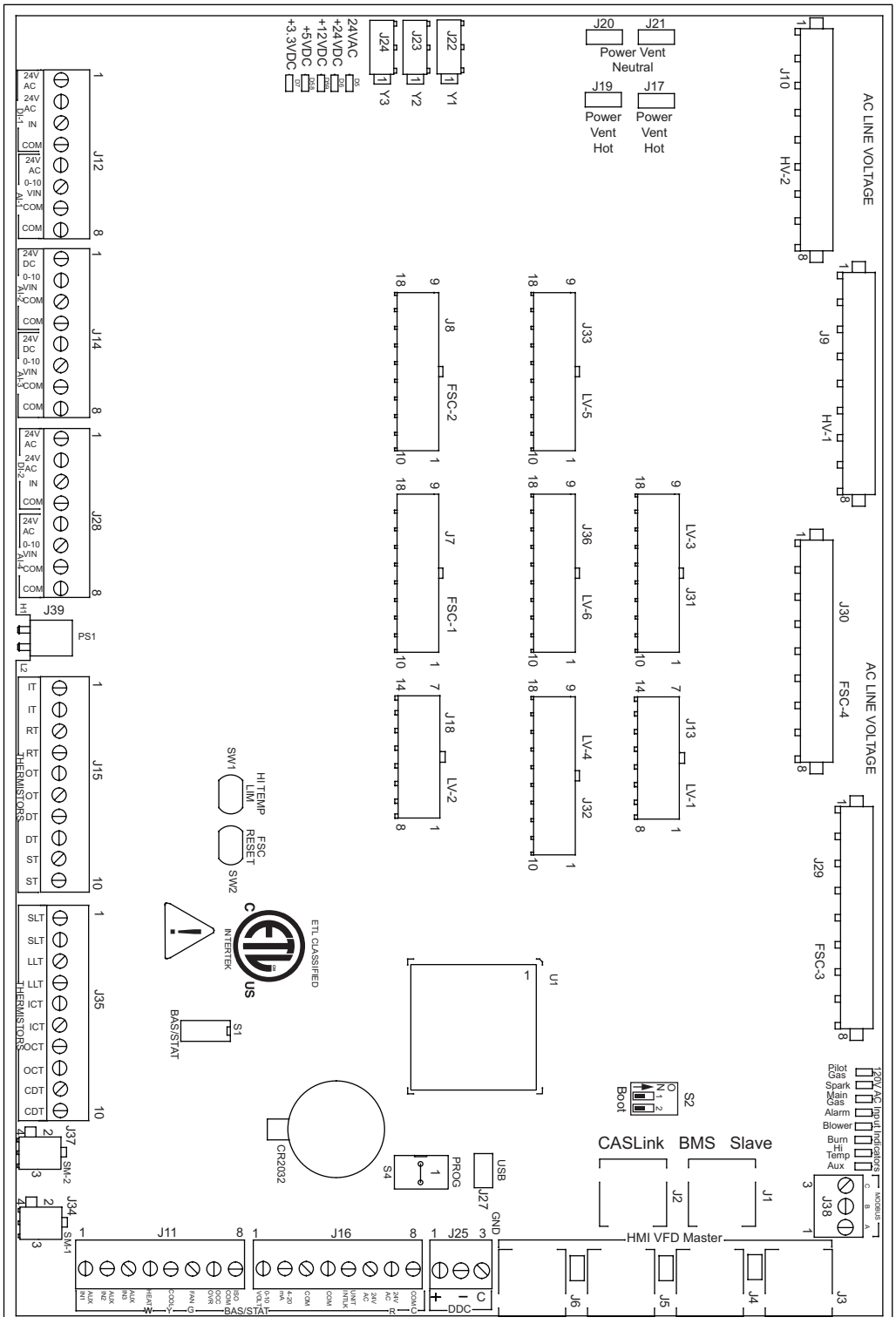
| HP | Part Number | Volts | 1Ø Input | 3Ø Input | Input Amps 1Ø 120V AC | Input Amps 1Ø 240V AC | Output Amps | Breaker 1Ø 120V AC | Breaker 1Ø 240V AC |
|---|---|---|---|---|---|---|---|---|---|
| 0.5 | ESV371N01SXB571 | 120/240V | X | - | 9.2 | 4.6 | 2.4 | 15 | 15 |
| 1 | ESV751N01SXB571 | 120/240V | X | - | 16.6 | 8.3 | 4.2 | 25 | 15 |
| 1.5 | ESV112N01SXB571 | 120/240V | X | - | 20 | 10 | 6 | 30 | 20 |

| HP | Part Number | Volts | 1Ø Input | 3Ø Input | Input Amps 1Ø | Input Amps 3Ø | Output Amps | Breaker 1Ø | Breaker 3Ø |
|---|---|---|---|---|---|---|---|---|---|
| 0.5 | ESV371N02YXB571 | 240V | X | X | 5.1 | 2.9 | 2.4 | 15 | 15 |
| 1 | ESV751N02YXB571 | 240V | X | X | 8.8 | 5 | 4.2 | 15 | 15 |
| 1.5 | ESV112N02YXB571 | 240V | X | X | 12 | 6.9 | 6 | 20 | 15 |
| 2 | ESV152N02YXB571 | 240V | X | X | 13.3 | 8.1 | 7 | 25 | 15 |
| 3 | ESV222N02YXB571 | 240V | X | X | 17.1 | 10.8 | 9.6 | 30 | 20 |
| 5 | ESV402N02TXB571 | 240V | - | X | - | 18.6 | 16.5 | - | 30 |
| 7.5 | ESV552N02TXB571 | 240V | - | X | - | 26 | 23 | - | 40 |
| 10 | ESV752N02TXB571 | 240V | - | X | - | 33 | 29 | - | 50 |
| 15 | ESV113N02TXB571 | 240V | - | X | - | 48 | 42 | - | 80 |
| 20 | ESV153N02TXB571 | 240V | - | X | - | 59 | 54 | - | 90 |
| | | | | | | | | | |
| 1 | ESV751N04TXB571 | 480V | - | X | - | 2.5 | 2.1 | - | 15 |
| 1.5 | ESV112N04TXB571 | 480V | - | X | - | 3.6 | 3 | - | 15 |
| 2 | ESV152N04TXB571 | 480V | - | X | - | 4.1 | 3.5 | - | 15 |
| 3 | ESV222N04TXB571 | 480V | - | X | - | 5.4 | 4.8 | - | 15 |
| 5 | ESV402N04TXB571 | 480V | - | X | - | 9.3 | 8.2 | - | 15 |
| 7.5 | ESV552N04TXB571 | 480V | - | X | - | 12.4 | 11 | - | 20 |
| 10 | ESV752N04TXB571 | 480V | - | X | - | 15.8 | 14 | - | 25 |
| 15 | ESV113N04TXB571 | 480V | - | X | - | 24 | 21 | - | 40 |
| 20 | ESV153N04TXB571 | 480V | - | X | - | 31 | 27 | - | 50 |
| 25 | ESV183N04TXB571 | 480V | - | X | - | 38 | 34 | - | 70 |
| 30 | ESV223N04TXB571 | 480V | - | X | - | 45 | 40 | - | 80 |
| 40 | ESV303N04TXB571 | 480V | - | X | - | 59 | 52 | - | 100 |
| 50 | ESV373N04TXB571 | 480V | - | X | - | 74 | 65 | - | 125 |
| 60 | ESV453N04TXB571 | 480V | - | X | - | 87 | 77 | - | 150 |
| | | | | | | | | | |
| 1 | ESV751N06TXB571 | 600V | - | X | - | 2 | 1.7 | - | 15 |
| 2 | ESV152N06TXB571 | 600V | - | X | - | 3.2 | 2.7 | - | 15 |
| 3 | ESV222N06TXB571 | 600V | - | X | - | 4.4 | 3.9 | - | 15 |
| 5 | ESV402N06TXB571 | 600V | - | X | - | 6.8 | 6.1 | - | 15 |
| 7.5 | ESV552N06TXB571 | 600V | - | X | - | 10.2 | 9 | - | 20 |
| 10 | ESV752N06TXB571 | 600V | - | X | - | 12.4 | 11 | - | 20 |
| 15 | ESV113N06TXB571 | 600V | - | X | - | 19.7 | 17 | - | 30 |
| 20 | ESV153N06TXB571 | 600V | - | X | - | 25 | 22 | - | 40 |
| 25 | ESV183N06TXB571 | 600V | - | X | - | 31 | 27 | - | 50 |
| 30 | ESV223N06TXB571 | 600V | - | X | - | 36 | 32 | - | 60 |
| 40 | ESV303N06TXB571 | 600V | - | X | - | 47 | 41 | - | 70 |
| 50 | ESV373N06TXB571 | 600V | - | X | - | 59 | 52 | - | 90 |
| 60 | ESV453N06TXB571 | 600V | - | X | - | 71 | 62 | - | 110 |

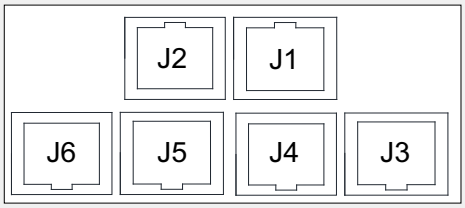
## Make-up Air (MUA) Board Connectors

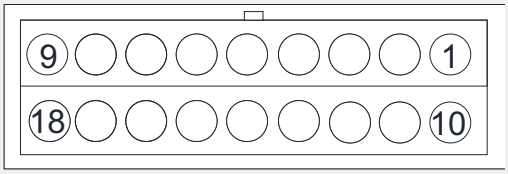
The Make-up Air Board (**Figure 29**) is located in the main cabinet, refer to **“Component Location” on page 59** for location. Circuit 1 Cooling inputs/outputs are located on the MUA Board. Circuit 2/3 Cooling inputs/outputs are located on the Advanced Cooling Board (ACB).

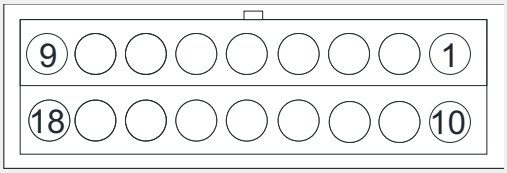
**Figure 29 - MUA Board**

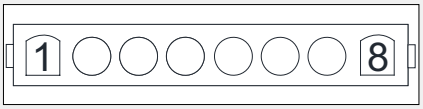


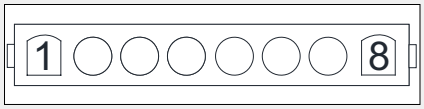
**NOTE: Some connections may not be used dependent on system configurations**

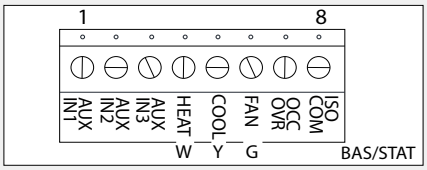
| | |
|---|---|
| RJ45 connectors<br>**Connector J1** and **J2** are associated with BMS.<br>**Connector J3** through **J6** are interchangeable and may be used to connect to an HMI or VFD. |  |
| **J1** - CASLink/Slave<br>**J2** - CASLink/Slave<br>**J3** - HMI/VFD/Master | **J4** - HMI/VFD/Master<br>**J5** - HMI/VFD/Master<br>**J6** - HMI/VFD/Master |

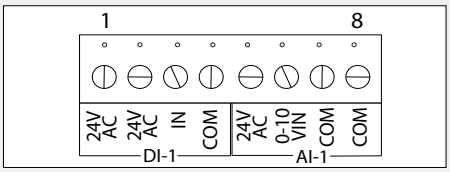
| | |
|---|---|
| **Connector J7** contains inputs and outputs for the Flame Safety Controller (FSC) |  |
| **Pin 1** - 24VAC Output to Pressure Switch Input (PSW) on FSC or Electric Heater (option)<br>**Pin 2** - 24VAC Output to Thermostat Input (TH/W) on FSC<br>**Pin 3** - 24VAC Input from IND on FSC<br>**Pin 4** - 24VAC Input from V1 on FSC<br>**Pin 5** - 24VAC Output to Main Gas Valve (Connected to J7-4)<br>**Pin 6** - 0-10VDC + Analog Output to Modulating Gas Valve<br>**Pin 7** - 0-10VDC - Output to Modulating Gas Valve<br>**Pin 8** - Modulating Gas Valve Shield<br>**Pin 9** - 24VAC Common to Main/Pilot Gas Valve | **Pin 10** - 24VAC Input from Vent Proving Switch (J7-1) / Electric Heat Dry Contact<br>**Pin 11** - 24VAC Output (L1) on FS<br>**Pin 12** - 24VAC Supply Power (R) on FSC<br>**Pin 13** - 24VAC Out to High Limit Switch<br>**Pin 14** - 24VAC Out to Vent Proving Switch<br>**Pin 15** - Detects 24VAC Presence from Roll Out Switch<br>**Pin 16** - Detects 24VAC Presence from High Limit Switch<br>**Pin 17** - 24VAC Out to Roll Out Switch<br>**Pin 18** - Valve Ground (V2) on FSC/High Efficiency (HE) Furnace Relay (RE-B) |

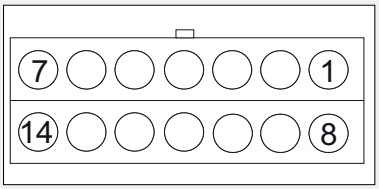
| **Connector J8** contains inputs and outputs for the Flame Safety Controller (FSC) |  |
|---|---|
| **Pin 1** - 24VAC Output to Pressure Switch Input (PSW) on FSC or Electric Heater (option)<br>**Pin 2** - 24VAC Output to Thermostat Input (TH/W) on FSC<br>**Pin 3** - Detects 24VAC Presence from IND on FSC<br>**Pin 4** - 24VAC Input from V1 on FSC<br>**Pin 5** - 24VAC Output to Main Gas Valve (Connected to J8-4)<br>**Pin 6** - 0-10VDC + Analog Output to Modulating Gas Valve<br>**Pin 7** - 0-10VDC - Output to Modulating Gas Valve<br>**Pin 8** - Modulating Gas Valve Shield<br>**Pin 9** - 24VAC Common to Main/Pilot Gas Valve | **Pin 10** - 24VAC Input from Vent Proving Switch (J8-1) / Electric Heat Dry Contact<br>**Pin 11** - 24VAC Output (L1) on FSC<br>**Pin 12** - 24VAC Supply Power (R) on FSC<br>**Pin 13** - 24VAC Output to High Limit Switch<br>**Pin 14** - 24VAC Output to Vent Proving Switch<br>**Pin 15** - Detects 24VAC Presence from Roll Out Switch<br>**Pin 16** - Detects 24VAC Presence from High Limit Switch<br>**Pin 17** - 24VAC Output to Roll Out Switch<br>**Pin 18** - Valve Ground (V2) on FSC/High Efficiency (HE) Furnace Relay (RE-B) |

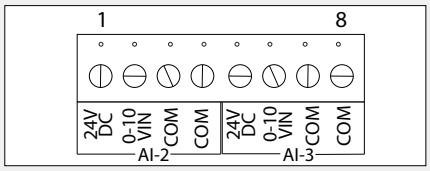
| **Connector J9** contains 120V AC connections |  |
|---|---|
| **Pin 1** - 120VAC Main Input<br>**Pin 2** - N/A<br>**Pin 3** - 120VAC Input from Fire Microswitch<br>**Pin 4** - 120VAC Output to Intake/Discharge Damper Actuator | **Pin 5** - 120VAC Input from Intake Damper End Switch<br>**Pin 6** - 120VAC Output to Drain Heater<br>**Pin 7** - 120VAC Output to Cabinet Heater<br>**Pin 8** - 120VAC Neutral |

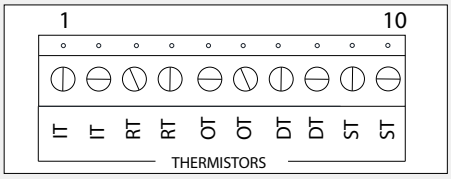
| **Connector J10** contains 120V AC connections |  |
|---|---|
| **Pin 1** - N/A<br>**Pin 2** - N/A<br>**Pin 3** - 120VAC Output to Hot Water Solenoid<br>**Pin 4** - 120VAC Output to Chilled Water Solenoid/ Crankcase Heater | **Pin 5** - 120VAC Input Supply Overload<br>**Pin 6** - 120VAC Output to Supply Starter/Purge Dry Relay<br>**Pin 7** - 120VAC Output to Exhaust Starter<br>**Pin 8** - 120VAC Neutral |

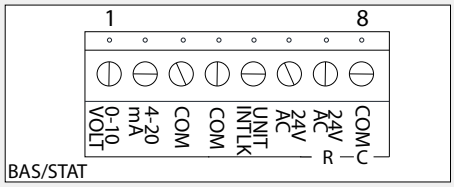
| | |
|---|---|
| **Connector J11** contains low voltage screw terminal connections |  |
| **Pin 1** - 24VAC Auxiliary Input/Purge Mode<br>**Pin 2** - 24VAC Auxiliary Input<br>**Pin 3** - 24VAC Auxiliary Input<br>**Pin 4** - 24VAC Call for Heat Input | **Pin 5** - 24VAC Call for Cooling Input<br>**Pin 6** - 24VAC Call for Blower Input<br>**Pin 7** - 24VAC Occupied Override Input<br>**Pin 8** - 24VAC Isolated Common |

| | |
|---|---|
| **Connector J12** contains low voltage screw terminal connections |  |
| **Pin 1** - 24VAC Output to Smoke Detector<br>**Pin 2** - 24VAC Output to Smoke Detector<br>**Pin 3** - 24VAC Digital Input from Smoke Detector<br>**Pin 4** - 24VAC Common to Smoke Detector | **Pin 5** - 24VAC Output to Air Quality Sensor<br>**Pin 6** - 0-10V Analog Input from Air Quality Sensor<br>**Pin 7** - 24VAC Common to Air Quality Sensor<br>**Pin 8** - 24VAC Common to Air Quality Sensor |

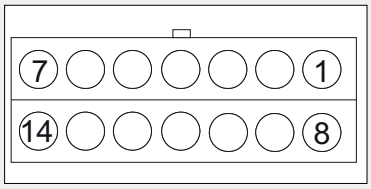
| | |
|---|---|
| **Connector J13** contains low voltage connections |  |
| **Pin 1** - N/A<br>**Pin 2** - PWM + Output for Supply ECM<br>**Pin 3** - 24VAC Output for Low Gas Pressure Switch<br>**Pin 4** - 24VAC Output for High Gas Pressure Switch<br>**Pin 5** - 24VAC Output for Clogged Filter Switch<br>**Pin 6** - 24VAC Output for Low Airflow<br>**Pin 7** - 24VAC Input for Board Power<br>**Pin 8** - N/A | **Pin 9** - N/A<br>**Pin 10** - 24VAC Input from Low Gas Pressure Switch<br>**Pin 11** - 24VAC Input from High Gas Pressure Switch<br>**Pin 12** - 24VAC Input from Clogged Filter Switch<br>**Pin 13** - 24VAC Input from Low Air Pressure Switch<br>**Pin 14** - 24VAC for Board Power |

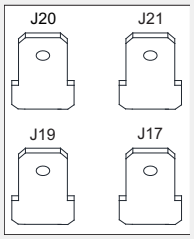
| | |
|---|---|
| **Connector J14** contains screw terminal connections |  |
| **Pin 1** - 24VDC Output to Intake RH<br>**Pin 2** - 0-10VDC Analog Input from Intake RH<br>**Pin 3** - 24VDC Common to Intake RH<br>**Pin 4** - 24VDC Common to Humidity Sensor | **Pin 5** - 24VDC Output to Space RH<br>**Pin 6** - 0-10VDC Analog Input from Space RH<br>**Pin 7** - 24VDC Common to Space RH<br>**Pin 8** - 24VDC Common to Humidity Sensor |

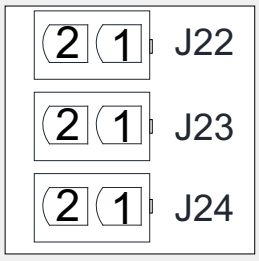
| | |
|---|---|
| **Connector J15** contains low voltage connections |  |
| **Pin 1** - Intake Temperature Thermistor Input<br>**Pin 2** - Intake Temperature Thermistor Input<br>**Pin 3** - Return Temperature Thermistor Input<br>**Pin 4** - Return Temperature Thermistor Input<br>**Pin 5** - Outdoor Temperature Thermistor Input | **Pin 6** - Outdoor Temperature Thermistor Input<br>**Pin 7** - Discharge Temperature Thermistor Input<br>**Pin 8** - Discharge Temperature Thermistor Input<br>**Pin 9** - Space Temperature Thermistor Input<br>**Pin 10** - Space Temperature Thermistor Input |

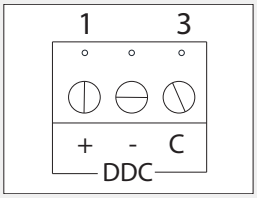
| | |
|---|---|
| **Connector J16** contains low voltage screw terminal connections |  |
| **Pin 1** - 0-10VDC Analog Input<br>**Pin 2** - 4-20 mA Analog Input<br>**Pin 3** - 24VAC Common<br>**Pin 4** - 24VAC Common | **Pin 5** - 24VAC Unit Interlock Input<br>**Pin 6** - 24VAC Output Stat tied to J12-7<br>**Pin 7** - 24VAC Output (R) tied to J12-6<br>**Pin 8** - 24VAC Common |

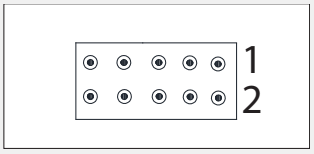
**NOTE:** Connector J17 is grouped with connectors J-19 through J-21

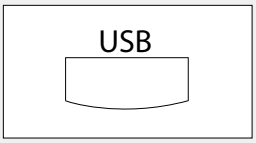
| | |
|---|---|
| **Connector J18** contains low voltage connections |  |
| **Pin 1** - 24VDC + Output for Spare<br>**Pin 2** - 0-10VDC Analog Output for Mixing Box Actuator<br>**Pin 3** - 0-10VDC Analog Output for Bypass Damper/ Powered Exhaust<br>**Pin 4** - 24VAC Output for DX Float Switch<br>**Pin 5** - 24VAC Output for Door Interlock<br>**Pin 6** - 24VAC Extreme Low Ambient Bypass Solenoid Output<br>**Pin 7** - 24VAC for Damper Actuator<br>**Pin 8** - 24VDC - Common for Spare | **Pin 9** - 0-10VDC Analog Output for Mixing Box Actuator<br>**Pin 10** - 0-10VDC Analog Output for Bypass Damper/Powered Exhaust<br>**Pin 11** - 24VAC Input from DX Float Switch<br>**Pin 12** - 24VAC Input from Door Interlock<br>**Pin 13** - 24VAC Extreme Low Ambient Bypass Solenoid Common<br>**Pin 14** - 24VAC for Damper Actuator |

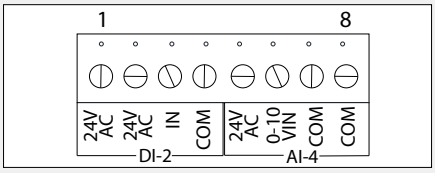
| | |
|---|---|
| **Connector J17** Output for Power Vent 1<br>**Connector J19** Output for Power Vent 2<br>**Connector J20** Neutral for Power Vent<br>**Connector J21** Neutral for Power Vent |  |
| **J17** - 120VAC Output for Power Vent 1<br>**J19** - 120VAC Output for Power Vent 2 | **J20** - 120VAC Neutral for Power Vents<br>**J21** - 120VAC Neutral for Power Vents |

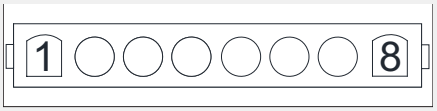
| | |
|---|---|
| **Connector J22** (Y1) N/A<br>**Connector J23** (Y2) Reversing Valve<br>**Connector J24** (Y3) N/A |  |
| **J22 Pin 1** - N/A<br>**J22 Pin 2** - N/A<br>**J23 Pin 1** - 24VAC Output to Reversing Valve 1 | **J23 Pin 2** - 24VAC Common to Reversing Valve 1<br>**J24 Pin 1** - N/A<br>**J24 Pin 2** - N/A |

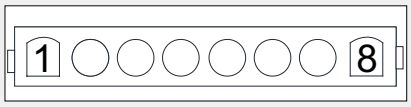
| | |
|---|---|
| **Connector J25** contains low voltage screw terminal connections for DDC Communications Isolated |  |
| **Pin 1** - RS-485 +<br>**Pin 2** - RS-485 - | **Pin 3** - RS-485 Common |

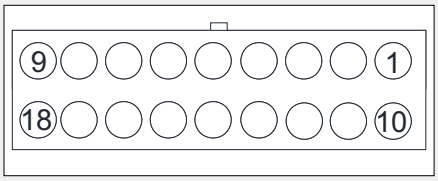
| | |
|---|---|
| **Connector J26** Programming Port |  |

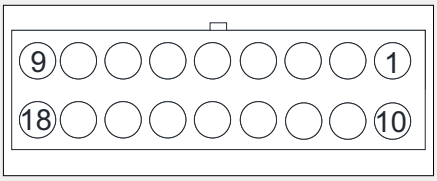
| | |
|---|---|
| **Connector J27** USB Programming Port |  |

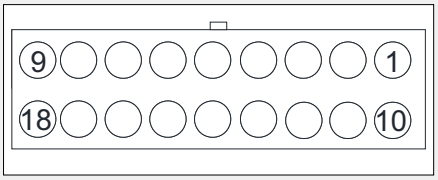
| | |
|---|---|
| **Connector J28** contains low voltage screw terminal connections |  |
| **Pin 1** - 24VAC Output<br>**Pin 2** - 24VAC Output<br>**Pin 3** - 24VAC Digital Input<br>**Pin 4** - 24VAC Common | **Pin 5** - 24VAC Output to Supply Fan<br>**Pin 6** - 0-10VDC Analog Input Supply Fan Speed<br>**Pin 7** - 24VAC Common to Supply Fan<br>**Pin 8** - 24VAC Common to Supply Fan |

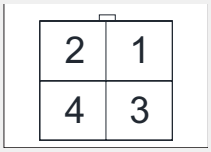
| | |
|---|---|
| **Connector J29** contains 120V AC connections |  |
| N/A | |

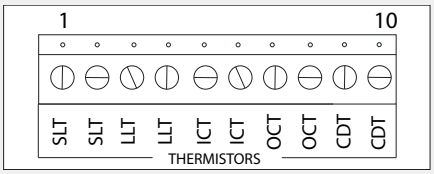
| **Connector J30** contains 120V AC connections |  |
|---|---|
| **Pin 1** through **Pin 7** - N/A | **Pin 8** - 120VAC Alarm Output |

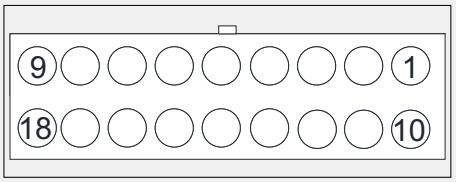
| **Connector J31** contains inputs and outputs for components |  |
|---|---|
| **Pin 1** - 24VDC + Output to Outdoor RH Sensor<br>**Pin 2** - 0-10VDC Analog Input from Outdoor RH Sensor<br>**Pin 3** - 24VDC/0-10VDC Common from Outdoor RH Sensor<br>**Pin 4** - 24VDC + Output to Inlet Gas Pressure Sensor<br>**Pin 5** - 0-10VDC Analog Input from Inlet Gas Pressure Sensor<br>**Pin 6** - 24VDC/0-10VDC Common from Inlet Gas Pressure Sensor<br>**Pin 7** - 24VDC + Output to Discharge RH Sensor<br>**Pin 8** - 0-10VDC Analog Input from Discharge RH Sensor<br>**Pin 9** - 24VDC/0-10VDC Common from Discharge RH Sensor | **Pin 10** - 24VDC + output to Return RH Sensor<br>**Pin 11** - 0-10VDC Analog Input from Return RH Sensor<br>**Pin 12** - 24VDC/0-10VDC Common from Return RH Sensor<br>**Pin 13** - 24VDC + output to Clogged Filter Pressure Sensor<br>**Pin 14** - 0-10VDC Analog Input from Clogged Filter Pressure Sensor<br>**Pin 15** - 24VDC/0-10VDC Common from Clogged Filter Pressure Sensor<br>**Pin 16** - 24VDC + Output for Analog or Static Pressure Control for Blower/Damper<br>**Pin 17** - 0-10VDC Analog Input for Analog or Static Pressure Control for Blower/Damper<br>**Pin 18** - 24VDC/0-10VDC Common for Analog or Static Pressure Control for Blower/Damper |

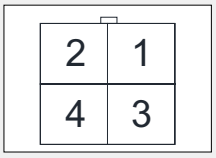
| **Connector J32** contains inputs and outputs for components |  |
|---|---|
| **Pin 1** - 24VAC Output for High Air Airflow Switch<br>**Pin 2** - PWM + Output for Exhaust/Power Vent ECM<br>**Pin 3** - 24VAC Output for Proof Of Closure / HE Furnace Float Switch<br>**Pin 4** - 24VDC + Output for Exhaust Current Sensor<br>**Pin 5** - 24VAC Output To CO Alarm<br>**Pin 6** - 0-24VDC + Analog Input from Flame Sensor<br>**Pin 7** - 24VDC Powered PWM to Modulating Gas Valve, Full Wave, 16 kHz<br>**Pin 8** - 0-10VDC Analog Output<br>**Pin 9** - 0-10VDC Analog Output for Electric Heat | **Pin 10** - 24VAC Input from High Airflow Switch<br>**Pin 11** - PWM - Output for Exhaust/Power Vent ECM<br>**Pin 12** - 24VAC Input from Proof of Closure / HE Furnace Float Switch<br>**Pin 13** - 4-20mA Input from Exhaust Current Sensor<br>**Pin 14** - 24VAC From CO Alarm<br>**Pin 15** - 24VDC Common From Flame Sensor<br>**Pin 16** - 24VDC Powered PWM to Modulating Gas Valve, Full Wave, 16 kHz<br>**Pin 17** - 0-10VDC Analog Output<br>**Pin 18** - 0-10VDC Analog Output for Electric heat |

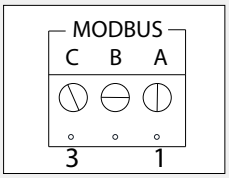
| **Connector J33** contains inputs and outputs for components |  |
|---|---|
| **Pin 1** - 24VDC + Output for Main Unit Current Sensor<br>**Pin 2** - 24VDC + Output for Cooling Current Sensor<br>**Pin 3** - PWM + Output for Condenser Fans 1<br>**Pin 4** - PWM + Output for Condenser Fans 2<br>**Pin 5** - PWM + Input for Spare 1<br>**Pin 6** - 24VDC + Pulse Input from Gas Meter<br>**Pin 7** - 24VDC + Pulse Input from Water Meter<br>**Pin 8** - 24VAC Output to Oil Solenoid<br>**Pin 9** - N/A | **Pin 10** - 4-20mA Input from Main Unit Current Sensor<br>**Pin 11** - 4-20mA Input from Cooling Current Sensor<br>**Pin 12** - PWM - Output for Condenser Fans 1<br>**Pin 13** - PWM - Output for Condenser Fans 2<br>**Pin 14** - PWM - Input for Spare 1<br>**Pin 15** - PWM - Pulse Input from Gas Meter<br>**Pin 16** - 24VDC - Pulse Input from Water Meter<br>**Pin 17** - 24VAC Common for Oil Solenoid<br>**Pin 18** - N/A |

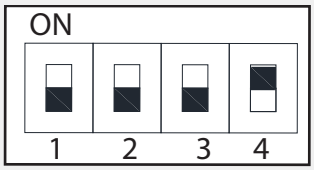
| **Connector J34** Stepper Motor (EEV) |  |
|---|---|
| **Pin 1** - Stepper Motor 1, 12V, Bipolar<br>**Pin 2** - Stepper Motor 1, 12V, Bipolar | **Pin 3** - Stepper Motor 1, 12V, Bipolar<br>**Pin 4** - Stepper Motor 1, 12V, Bipolar |

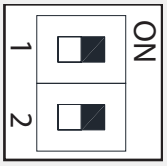
| **Connector J35** contains low voltage connections |  |
|---|---|
| **Pin 1** - Suction Line Thermistor Input<br>**Pin 2** - Suction Line Thermistor Input<br>**Pin 3** - Liquid Line Thermistor Input<br>**Pin 4** - Liquid Line Thermistor Input<br>**Pin 5** - Evap/Indoor Thermistor Input | **Pin 6** - Evap/Indoor Thermistor Input<br>**Pin 7** - Condenser/Outdoor Coil Thermistor Input<br>**Pin 8** - Condenser/Outdoor Coil Thermistor Input<br>**Pin 9** - Compressor Discharge Thermistor Input<br>**Pin 10** - Compressor Discharge Thermistor Input |

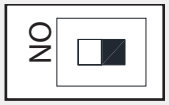
| **Connector J36** contains inputs and outputs for components |  |
|---|---|
| **Pin 1** - 24VAC Output for Low Pressure Switch<br>**Pin 2** - 24VAC Input for Low Pressure Switch<br>**Pin 3** - 24VAC Output for High Pressure Switch<br>**Pin 4** - 24VAC Input for Low Pressure Switch<br>**Pin 5** - 24VAC Output for High Temp Switch<br>**Pin 6** - 24VAC Input for Low Pressure Switch<br>**Pin 7** - 24VAC Output to Oil Sensor<br>**Pin 8** - 24VAC Common from Oil Sensor<br>**Pin 9** - 24VAC Input from Oil Sensor | **Pin 10** - 24VDC + output to Liquid Line Pressure Transducer<br>**Pin 11** - 0-10VDC Analog Input from Liquid Line Pressure Transducer<br>**Pin 12** - 24VDC/0-10VDC Common from Liquid Line Pressure Transducer<br>**Pin 13** - 24VDC + Output to Suction Line Pressure Transducer<br>**Pin 14** - 0-10VDC Analog Input from Suction Line Pressure Transducer<br>**Pin 15** - 24VDC/0-10VDC Common from Suction Line Pressure Transducer<br>**Pin 16** - 24VDC + output to Discharge Line Pressure Transducer<br>**Pin 17** - 0-10VDC Analog Input from Discharge Line Pressure Transducer<br>**Pin 18** - 24VDC/0-10VDC Common from Discharge Line Pressure Transducer |

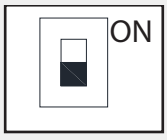
| **Connector J37** Stepper Motor (Reheat Valve) |  |
|---|---|
| **Pin 1** - Stepper Motor 2, 12V, Bipolar<br>**Pin 2** - Stepper Motor 2, 12V, Bipolar | **Pin 3** - Stepper Motor 2, 12V, Bipolar<br>**Pin 4** - Stepper Motor 2, 12V, Bipolar |

| | |
|---|---|
| **Connector J38** Modbus<br>J38 is used for Modbus communication with the compressor. Use terminal J25 for 3rd party Modbus control. |  |
| **Pin 1 (A)** - Modbus (-)<br>**Pin 2 (B)** - Modbus (+) | **Pin 3 (C)** - Modbus Ground |

| | |
|---|---|
| **Dip Switch S1** |  |
| Switch 1, 2, 3 always OFF. Switch 4 Always ON. If Switch 4 is OFF, BAS terminals disabled. | |

| | |
|---|---|
| **Dip Switch S2** |  |
| Programming - Service Only | |

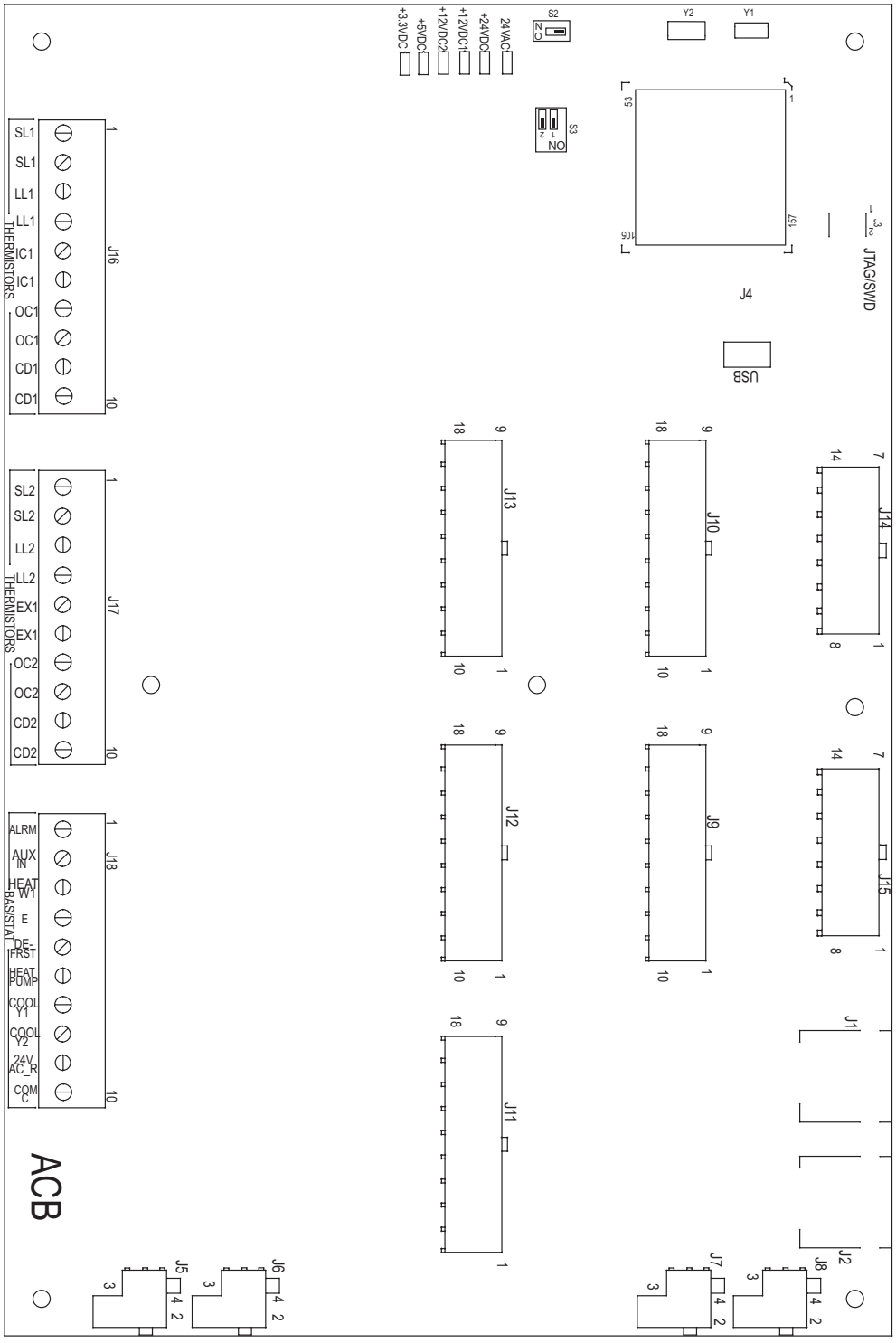
| | |
|---|---|
| **Dip Switch S3** |  |
| End of line termination | |

| | |
|---|---|
| **Dip Switch S4** |  |
| Programming - Service Only | |

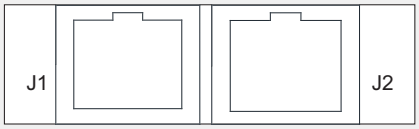
## ACB Connectors

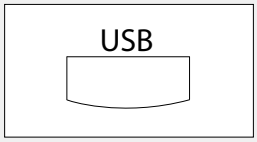
The Advanced Cooling Board (ACB) (**Figure 30**) is located in the main cabinet, refer to **Figure 31** for location. Circuit 1 Cooling inputs/outputs are located on the MUA Board. Circuit 2/3 Cooling inputs/outputs are located on the ACB.

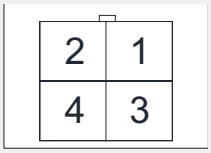
**Figure 30 - Advanced Cooling Board (ACB)**

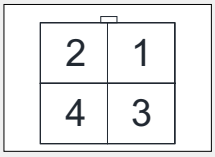


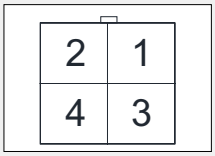
**NOTE: Some connections may not be used dependent on system configurations**

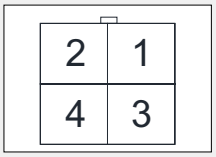
| | |
|---|---|
| RJ45 connectors<br>**Connector J1** and **J2** are associated with BMS.<br>**Connector J3** through **J6** are interchangeable and may be used to connect to an HMI or VFD. |  |
| **J1** - CASLink/Slave | **J2** - HMI/VFD/Master |

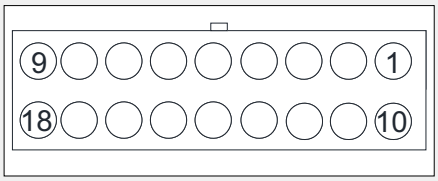
| | |
|---|---|
| **Connector J4** USB Programming Port |  |

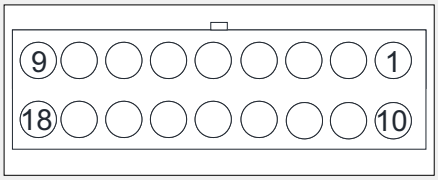
| | |
|---|---|
| **Connector J5** Stepper Motor (EEV 1)<br>(EEV 1 = Circuit 2) |  |
| **Pin 1** - Stepper Motor 1, 12V, Bipolar<br>**Pin 2** - Stepper Motor 1, 12V, Bipolar | **Pin 3** - Stepper Motor 1, 12V, Bipolar<br>**Pin 4** - Stepper Motor 1, 12V, Bipolar |

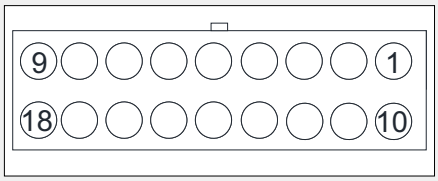
| | |
|---|---|
| **Connector J6** Stepper Motor (EEV 2)<br>(EEV 2 = Circuit 3) |  |
| **Pin 1** - Stepper Motor 2, 12V, Bipolar<br>**Pin 2** - Stepper Motor 2, 12V, Bipolar | **Pin 3** - Stepper Motor 2, 12V, Bipolar<br>**Pin 4** - Stepper Motor 2, 12V, Bipolar |

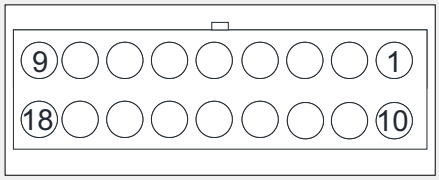
| | |
|---|---|
| **Connector J7** Stepper Motor (Reheat Valve 1)<br>(Reheat Valve 1 = Circuit 2) |  |
| **Pin 1** - Stepper Motor 1, 12V, Bipolar<br>**Pin 2** - Stepper Motor 1, 12V, Bipolar | **Pin 3** - Stepper Motor 1, 12V, Bipolar<br>**Pin 4** - Stepper Motor 1, 12V, Bipolar |

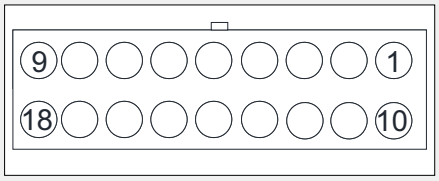
| **Connector J8** Stepper Motor (Reheat Valve 2)<br>(Reheat Valve 2 = Circuit 3) |  |
|---|---|
| **Pin 1** - Stepper Motor 2, 12V, Bipolar<br>**Pin 2** - Stepper Motor 2, 12V, Bipolar | **Pin 3** - Stepper Motor 2, 12V, Bipolar<br>**Pin 4** - Stepper Motor 2, 12V, Bipolar |

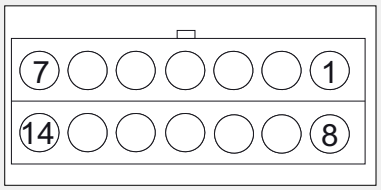
| **Connector J9** contains inputs and outputs for components |  |
|---|---|
| **Pin 1** - 24VDC + output to Discharge Line Pressure Transducer 1<br>**Pin 2** - 0-10VDC Analog Input from Discharge Line 1 Pressure Sensor<br>**Pin 3** - 24VDC/0-10VDC Common from Discharge Line 1 Pressure Sensor<br>**Pin 4** - 24VDC + output to Suction Line Pressure Transducer 1<br>**Pin 5** - 0-10VDC Analog Input from Suction Line 1 Pressure Sensor<br>**Pin 6** - 24VDC/0-10VDC Common from Suction Line 1 Pressure Sensor<br>**Pin 7** - 24VDC + output to Liquid Line Pressure Transducer 1<br>**Pin 8** - 0-10VDC Analog Input from Liquid Line 1 Pressure Sensor<br>**Pin 9** - 24VDC/0-10VDC Common from Liquid Line 1 Pressure Sensor | **Pin 10** - 24VAC constant output to High Pressure Switch Compressor 1<br>**Pin 11** - 24VAC Input for High Pressure Switch Compressor 1<br>**Pin 12** - 24VAC constant output to Low Pressure Switch Compressor 1<br>**Pin 13** - 24VAC Input for Low Pressure Switch Compressor 1<br>**Pin 14** - 24VAC constant output to Discharge Temp Compressor 1<br>**Pin 15** - 24VAC Input for High Discharge Temp Compressor 1<br>**Pin 16** - PWM + Output for Condensing Fan Group 1<br>**Pin 17** - PWM - Output for Condensing Fan Group 1<br>**Pin 18** - 24VAC Output Notification For Compressor 1 |

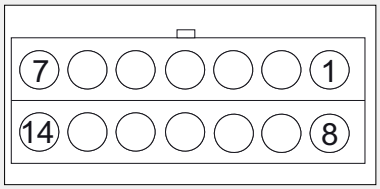
| **Connector J10** contains inputs and outputs for components |  |
|---|---|
| **Pin 1** - 24VDC + output to Discharge Line Pressure Transducer 2<br>**Pin 2** - 0-10VDC Analog Input from Discharge Line 2 Pressure Sensor<br>**Pin 3** - 24VDC/0-10VDC Common from Discharge Line 2 Pressure Sensor<br>**Pin 4** - 24VDC + output to Suction Line Pressure Transducer 2<br>**Pin 5** - 0-10VDC Analog Input from Suction Line 2 Pressure Sensor<br>**Pin 6** - 24VDC/0-10VDC Common from Suction Line 2 Pressure Sensor<br>**Pin 7** - 24VDC + output to Liquid Line Pressure Transducer 2<br>**Pin 8** - 0-10VDC Analog Input from Liquid Line 2 Pressure Sensor<br>**Pin 9** - 24VDC/0-10VDC Common from Liquid Line 2 Pressure Sensor | **Pin 10** - 24VAC constant output to High Pressure Switch Compressor 2<br>**Pin 11** - 24VAC Input for High Pressure Switch Compressor 2<br>**Pin 12** - 24VAC constant output to Low Pressure Switch Compressor 2<br>**Pin 13** - 24VAC Input for Low Pressure Switch Compressor 2<br>**Pin 14** - 24VAC constant output to Discharge Temp Compressor 2<br>**Pin 15** - 24VAC Input for High Discharge Temp Compressor 2<br>**Pin 16** - PWM + Output for Condensing Fan Group 2<br>**Pin 17** - PWM - Output for Condensing Fan Group 2<br>**Pin 18** - 24VAC Output Notification For Compressor 2 |

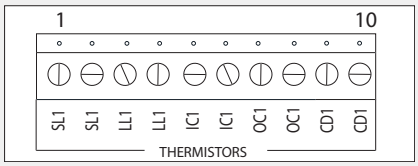
| **Connector J11** contains low voltage connections |  |
|---|---|
| **Pin 1** - 24VAC Input for Board Power<br>**Pin 2** - 24VAC Common for Board Power<br>**Pin 3** - 24VAC Output to Spare 1<br>**Pin 4** - 24VAC Common to Spare 1<br>**Pin 5** - PWM + Output for Spare 1<br>**Pin 6** - PWM - Output for Spare 1<br>**Pin 7** - 24VDC + Output for Evap RH Sensor<br>**Pin 8** - 0-10VDC Analog Input from Evap Coil RH Sensor<br>**Pin 9** - 24VDC/0-10VDC Common from Evap Coil RH Sensor | **Pin 10** - 24VDC + Output for ERV Exhaust RH Sensor<br>**Pin 11** - 0-10VDC Analog Input from ERV Exhaust Air RH Sensor<br>**Pin 12** - 24VDC/0-10VDC Common from ERV Exhaust Air RH Sensor<br>**Pin 13** - 24VDC + Output for Spare 2<br>**Pin 14** - 0-10VDC Analog Input for Spare 2<br>**Pin 15** - 24VDC/0-10VDC Common for Spare 2<br>**Pin 16** - 24VDC + Output for Spare 3<br>**Pin 17** - 0-10VDC Analog Input for Spare 3<br>**Pin 18** - 24VDC/0-10VDC Common for Spare 3 |

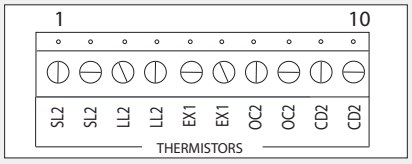
| | |
|---|---|
| **Connector J12** contains inputs and outputs for components |  |
| **Pin 1** - 24VAC Output to Compressor 1<br>**Pin 2** - 24VAC Output to Oil Solenoid 1<br>**Pin 3** - 24VAC Constant Output to Compressor 1 Overload<br>**Pin 4** - 24VAC Output to Reversing Valve 1<br>**Pin 5** - 24VDC + Output for Compressor 1 Current Sensor<br>**Pin 6** - 24VDC + Output for Condensing Fan 1 Current Sensor<br>**Pin 7** - 24VAC Input from Compressor 1 VFD<br>**Pin 8** - 24VAC Output for Oil Sensor Control Voltage 1 | **Pin 9** - 24VAC Input for Compressor 1 Phase Protection<br>**Pin 10** - 24VAC Common to Compressor 1<br>**Pin 11** - 24VAC Common to Oil Solenoid 1<br>**Pin 12** - 24VAC Input for Compressor 1 Overload<br>**Pin 13** - 24VAC Common to Reversing Valve 1<br>**Pin 14** - 4-20mA Input from Compressor 1 Current Sensor<br>**Pin 15** - 4-20mA Input from Condensing Fan 1 Current Sensor<br>**Pin 16** - 24VAC Output to Compressor 1 VFD<br>**Pin 17** - 24VAC Input for Oil Sensor 1<br>**Pin 18** - 24VAC Common for Oil Sensor 1 |

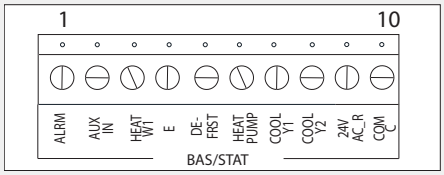
| | |
|---|---|
| **Connector J13** contains inputs and outputs for components |  |
| **Pin 1** - 24VAC Output to Compressor 2<br>**Pin 2** - 24VAC Output to Oil Solenoid 2<br>**Pin 3** - 24VAC Constant Output to Compressor 2 Overload<br>**Pin 4** - 24VAC Output to Reversing Valve 2<br>**Pin 5** - 24VDC + Output for Compressor 2 Current Sensor<br>**Pin 6** - 24VDC + Output for Condensing Fan 2 Current Sensor<br>**Pin 7** - 24VAC Input from Compressor 2 VFD<br>**Pin 8** - 24VAC Output for Oil Sensor Control Voltage 2 | **Pin 9** - 24VAC Input for Compressor 2 Phase Protection<br>**Pin 10** - 24VAC Common to Compressor 2<br>**Pin 11** - 24VAC Common to Oil Solenoid 2<br>**Pin 12** - 24VAC Input for Compressor 2 Overload<br>**Pin 13** - 24VAC Common to Reversing Valve 2<br>**Pin 14** - 4-20mA Input from Compressor 2 Current Sensor<br>**Pin 15** - 4-20mA Input from Condensing Fan 2 Current Sensor<br>**Pin 16** - 24VAC Output to Compressor 2 VFD<br>**Pin 17** - 24VAC Input for Oil Sensor 2<br>**Pin 18** - 24VAC Common for Oil Sensor 2 |

| | |
|---|---|
| **Connector J14** N/A |  |

| | |
|---|---|
| **Connector J15** N/A |  |

| | |
|---|---|
| **Connector J16** contains low voltage screw terminal connections |  |
| **Pin 1** - Suction Line Circuit 2 Temperature Input<br>**Pin 2** - Suction Line Circuit 2 Temperature Input<br>**Pin 3** - Liquid Line Circuit 2 Temperature Input<br>**Pin 4** - Liquid Line Circuit 2 Temperature Input<br>**Pin 5** - Evap/Indoor Coil 2 Temperature Input<br>**Pin 6** - Evap/Indoor Coil 2 Temperature Input | **Pin 7** - Condenser/Outdoor Coil 2 Thermistor Input<br>**Pin 8** - Condenser/Outdoor Coil 2 Thermistor Input<br>**Pin 9** - Compressor Discharge Line Circuit 2 Temperature Input<br>**Pin 10** - Compressor Discharge Line Circuit 2 Temperature Input |

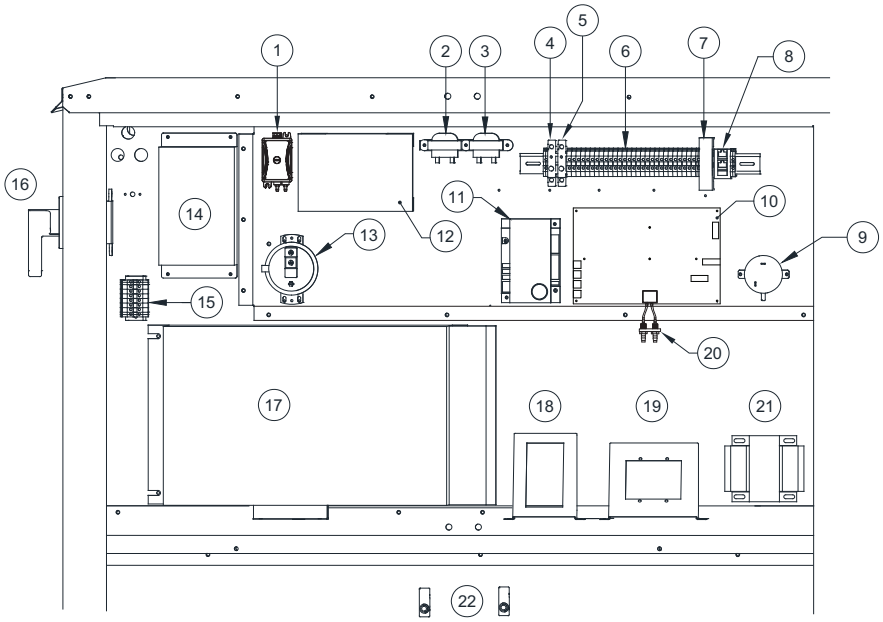
| | |
|---|---|
| **Connector J17** contains low voltage screw terminal connections |  |
| **Pin 1** - Suction Line Circuit 3 Temperature Input<br>**Pin 2** - Suction Line Circuit 3 Temperature Input<br>**Pin 3** - Liquid Line Circuit 3 Temperature Input<br>**Pin 4** - Liquid Line Circuit 3 Temperature Input<br>**Pin 5** - Evap/Indoor Coil 3 Temperature Input<br>**Pin 6** - Evap/Indoor Coil 3 Temperature Input | **Pin 7** - 2nd Suction Line Circuit 2 Temperature Input<br>**Pin 8** - 2nd Suction Line Circuit 2 Temperature Input<br>**Pin 9** - Compressor Discharge Line Circuit 3 Temperature Input<br>**Pin 10** - Compressor Discharge Line Circuit 3 Temperature Input |

| | |
|---|---|
| **Connector J18** contains low voltage connections |  |
| **Pin 1** - 24VAC Input for Alarm<br>**Pin 2** - 24VAC Input for AUX<br>**Pin 3** - 24VAC Call for Heat Stage 1 Input<br>**Pin 4** - 24VAC Call for Heat Stage 2/ Emergency Input<br>**Pin 5** - 24VAC Input for Defrost | **Pin 6** - 24VAC Input for Heat Pump Reversing Valve<br>**Pin 7** - 24VAC Input for Cooling Stage 1<br>**Pin 8** - 24VAC Input for Cooling Stage 2<br>**Pin 9** - 24VAC Constant Output (R)<br>**Pin 10** - 24VAC Common/ Isolated Common Via Dip Switch |

## Component Location

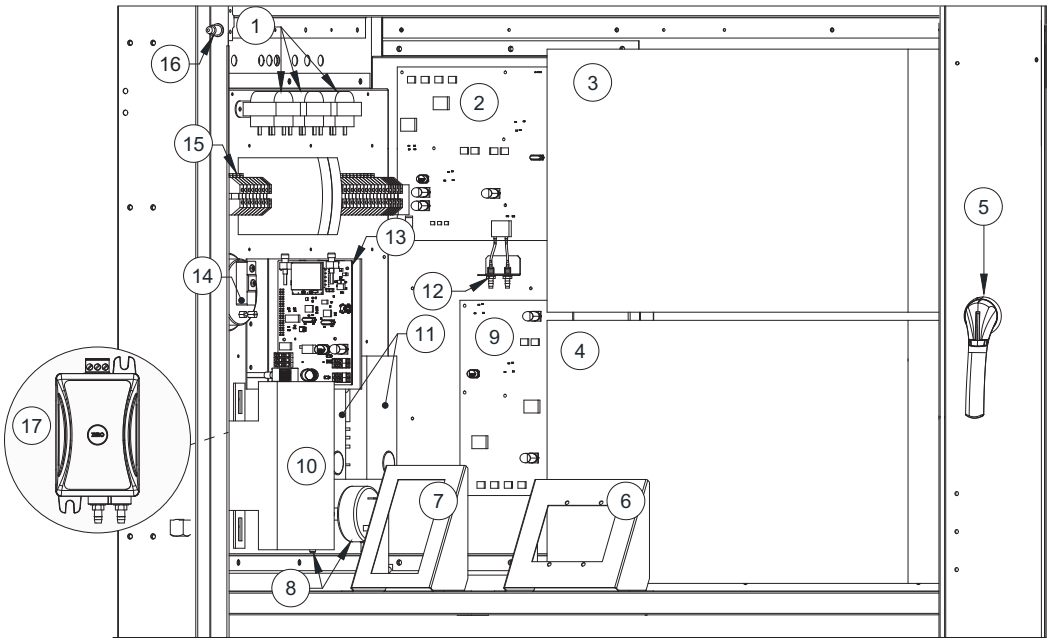
Use **Figure 31** through **Figure 38** for component locations. Units equipped with ERV, refer to **"Energy Recovery (Optional)" on page 116** for component descriptions and locations.

**Figure 31 - Typical Main Cabinet (Size 1-3)**




1. **Differential Pressure Transducer** – Monitors air pressure differential between two points. Used in different air control options.
2. **40VA 120V to 24V Transformer (TR-xx)** – Verify transformers on schematics, varies by application.
3. **20VA 120V to 24V Transformer (TR-xx)** – Verify transformers on schematics, varies by application.
4. **Convenience Outlet Circuit Breaker (CB-02)** – Protects transformer for convenience outlet from high current spikes.
5. **Circuit Breaker (CB-01)** – Protects electrical components from high current spikes.
6. **Terminal Strip** – Central location to terminate control wiring. Should be used for troubleshooting.
7. **24V DC Power Supply (PWS-01)** – Converts input voltage of **100-240 AC** to an output voltage of **24 DC**.
8. **RJ45 Converter** – Communication port for a Cat 5 cable that allows components to connect to other components.
9. **Induced Draft Air Sensor (PS-01)** – A safety device located near the draft inducer motor that will prevent operation of the furnace if correct venting air pressures are not detected.
10. **MUA Board** - Controls the **0-10V DC** signal to modulating furnace controls, modulating gas valve, and **24V AC** signals to staged furnace controls.
11. **Flame Safety Control (FSC-01)** – Initiates and monitors flame. Equipped with non-adjustable time settings for pre-purge, inter-purge, and post-purge of the exhaust flue and control cabinet.
12. **750V 230/460V to 120V Transformer** – Used for the convenience outlet. Voltage inputs 208/230/480.
13. **Clogged Filter Switch (PS-10)** – Senses whether the filters at the intake to the main supply motor are free of dirt and contaminant. Optional component.
14. **VFD Controller (VFD-01)** – Used to protect supply motor, and to control the speed of the motor to vary airflow across unit.
15. **Distribution Block** – Distributes power to condensing components.
16. **Disconnect Switch (SW-01)** – Controls all electrical power to the entire unit.
17. **Compressor Drive Frequency Converter (VFD-02)** – Operates the compressor.
18. **Compressor Local Control Panel (LCP)** – Used to navigate the compressor's VFD controls.
19. **HMI Panel** – MUA board interface. The 4 buttons are used to navigate through the menu screens.
20. **Air Flow Reducers** – Connection between on-board air flow sensor to probe mounted in the cabinet.
21. **Convenience Outlet Transformer (TR-09)** – 2000VA transformer used for the convenience outlet. Voltage inputs 208/230/480.
22. **Door Switches (DS-xx)** – These switches operate the LED lights inside the cabinet.

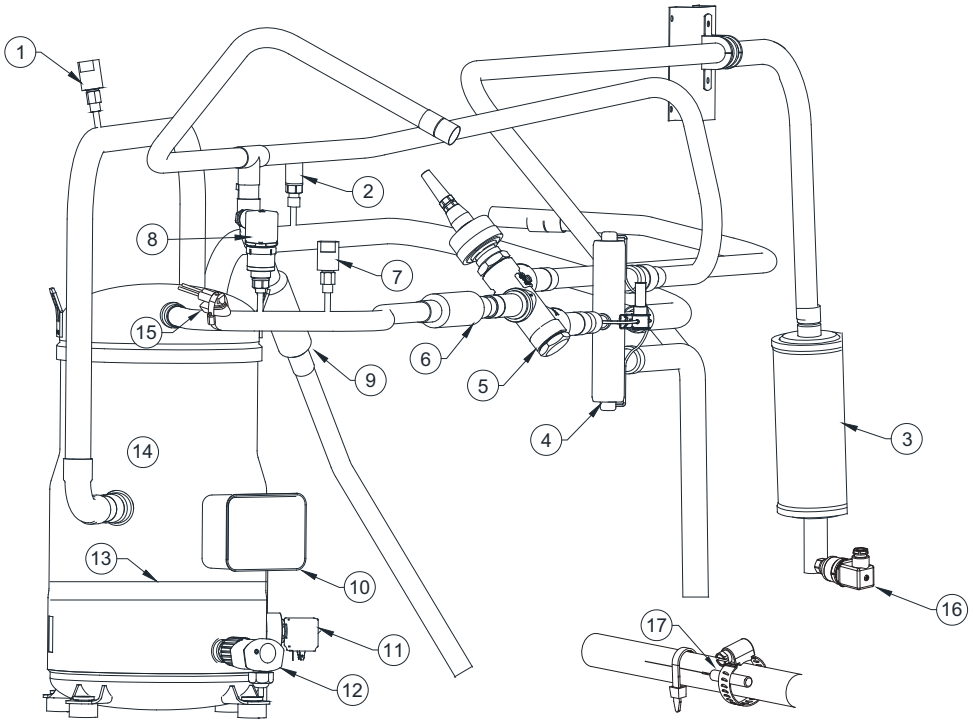
**Figure 32 - Typical Main Cabinet (Size 4)**




1. **Transformer (TR-xx)** – 40VA 120V to 24V/20VA 120V to 24V. Verify transformers on schematics, varies by application.
2. **Make-Up Air (MUA) Board** - Controls the **0-10V DC** signal to modulating furnace controls, modulating gas valve, and **24V AC** signals to staged furnace controls.
3. **Compressor Drive Frequency Converter (VFD-xx)** – Operates compressor 2. For 40/50T cooling units.
4. **Compressor Drive Frequency Converter (VFD-xx)** – Operates compressor 1.
5. **Disconnect Switch (SW-01)** – Controls all electrical power to the entire unit.
6. **HMI Panel** – MUA board interface. The 4 buttons are used to navigate through the menu screens.
7. **Compressor Local Control Panel (LCP)** – Used to navigate the compressor's VFD controls.
8. **Induced Draft Air Sensor (PS-xx)** – A safety device located near the draft inducer motor that will prevent operation of the furnace if correct venting air pressures are not detected. Quantity (1) for standard and high turndown furnace. Quantity (2) for 700/800mbh furnaces.
9. **Advanced Cooling Board (ACB)** – The ACB is used on 40/50T cooling units.
10. **750V 230/460V to 120V Transformer** – Used for controls. Voltage inputs 208/230/480.
11. **Flame Safety Control (FSC-xx)** – Initiates and monitors flame. Equipped with non-adjustable time settings for pre-purge, inter-purge, and post-purge of the exhaust flue and control cabinet. Quantity (1) sensor for standard and high turndown furnace. Quantity (2) for 700/800mbh furnaces.
12. **Air Flow Reducers** – Connection between on-board air flow sensor to probe mounted in the cabinet.
13. **SCADA Communication Module** – Communication module that relays product information to CASLink.
14. **Clogged Filter Switch (PS-10)** – Senses whether the filters at the intake to the main supply motor are free of dirt and contaminant. This is an optional component.
15. **Electrical Din Rail** - Contains the following electrical components:
    - **Convenience Outlet Circuit Breaker (CB-02)** – Protects transformer for convenience outlet from high current spikes. This is an optional component.
    - **Circuit Breaker (CB-01)** – Protects electrical components from high current spikes.
    - **Terminal Strip** – Central location to terminate control wiring. Should be used for field wiring.
    - **24V DC Power Supply (PWS-01)** – Converts input voltage of **100-240V AC** to an output voltage of **24V DC**.
    - **RJ45 Converter** – Communication port for a Cat 5 cable that allows components to connect to other components. This is an optional component.
16. **Door Switch (DS-xx)** – This switch operate the LED lights inside the cabinet.
17. **Differential Pressure Transducer** – Monitors the air pressure differential between two points. This transducer is used in different air control options. This is an optional component.

Not Shown: **VFD Controller (VFD-01)** – Used to protect supply motor, and to control the speed of the motor to vary airflow across unit. Located below main cabinet.

**Figure 33 - Typical Refrigerant Access Panel Heat Pump with Reheat shown**



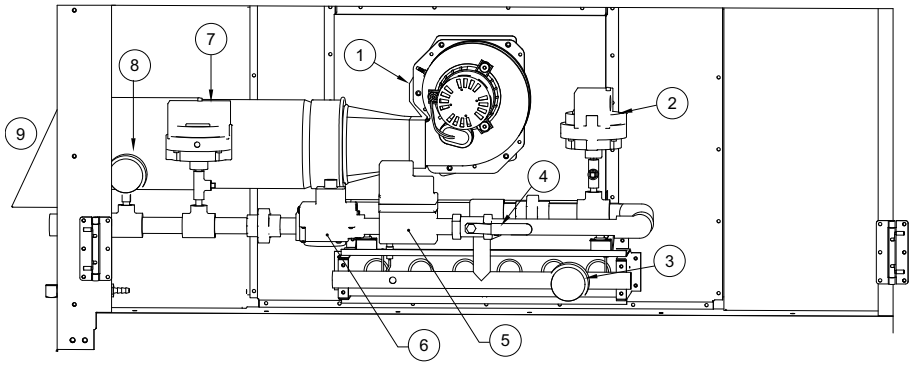

1. **Refrigerant Low Pressure Switch (SW-15)** – Detects refrigerant pressure on the low-pressure side of the system. If the pressure drops below the preset value, the compressor will shut down. This sensor has an automatic reset.
2. **Suction (Low) Line Pressure Sensor (PS-21)** – Transducer that monitors the low side of the refrigeration system.
3. **Filter/Drier** – Absorbs water and filters system contaminants.
4. **Reversing Valve (RV-01)** – A valve used for heat pump applications that changes the flow of refrigerant. By changing the flow of refrigerant, the heat pump cycle is changed from cooling to heating or heating to cooling.
5. **Hot Gas Reheat Valve(s)** – Valve(s) will modulate the supply of refrigerant to the outdoor (condensing) coil and to the reheat coil. Units with a single reheat valve, HG-01, will be a three-way valve. Units that use dual reheat valves, not shown, will have HG-01 in-line to the reheat coil inlet and HG-02 in-line to the outdoor (condensing) coil inlet.
6. **Discharge Check Valve** – Restricts liquid migration back to compressor during off cycles.
7. **Refrigerant High Pressure Switch (SW-16)** – If the pressure rises above the preset value, the compressor will shut down.
8. **Discharge (High) Pressure Transducer (PS-22)** – Transducer that monitors the high side of the refrigeration system.
9. **Reheat Coil Check Valve** – Restricts refrigerant flow to the reheat coil when reheat is not active.
10. **Compressor Power Termination** – Power connection from Compressor Drive Frequency Converter.
11. **Oil Return Solenoid Valve (OS-01)** – Allows oil to be distributed throughout the scroll set when activated. Not applicable to VZH-044/065 compressors.
12. **Oil Level Sensor (SEN-01)** – Monitors the oil level in the compressor. If the oil level is low, the unit will shut down.
13. **Crankcase Heater (HE-03)** – A heating cable used to boil off liquid refrigerant within the crank of the compressor.
14. **Compressor** – Circulates refrigerant throughout the system.
15. **Refrigerant High Temperature Switch (SW-18)** – This safety switch opens at dangerously high compressor discharge temperatures. For heat pump applications only.
16. **Liquid Line Pressure Sensor (PS-20)** – Pressure transducer that monitors the liquid line pressure in the refrigeration system.
17. **Suction/Discharge/Liquid Line Temperature Sensor** – A sensor mounted to copper piping. Refer to **"Suction Line Temperature (SLT) Sensors" on page 153**.

Not Shown**:**

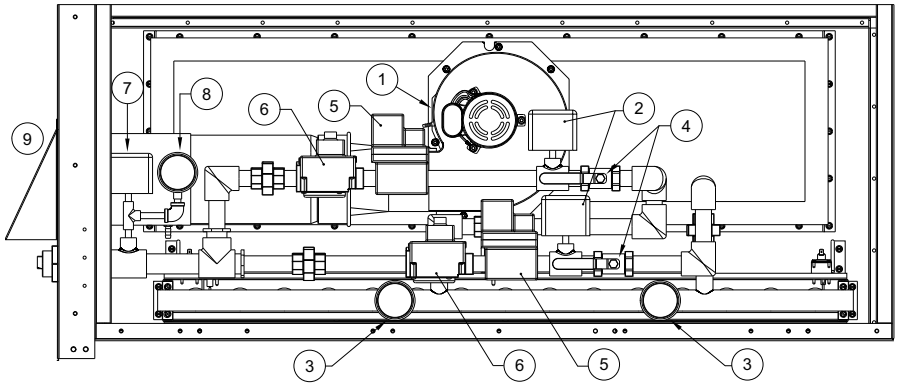
- **High-Pressure Port** – High-pressure gauge connection port.
- **Low-Pressure Port** – Low-pressure gauge connection port.
- **Accumulator** – Prevents liquid flooding back to the compressor. Used in heat pump and certain cooling applications.

## Figure 34 - Gas Furnace Cabinet

Typical Standard Gas Furnace



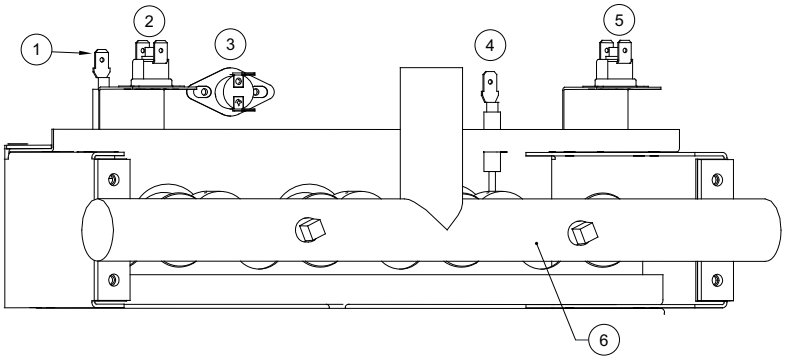

High Turndown Furnace Option



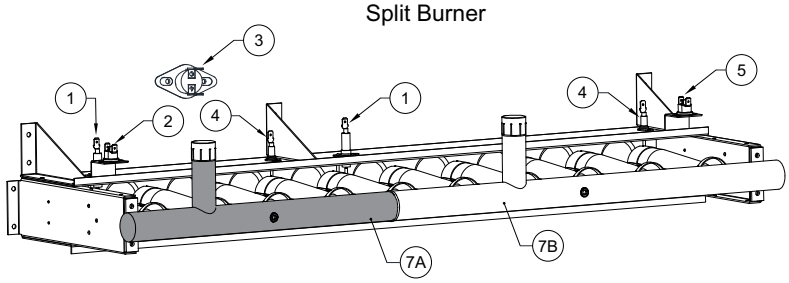

1. **Furnace Power Vent (PV-xx)** – An assembly used to exhaust flue gases.
2. **High-Pressure Gas Switch (PS-03)** – Monitors pressure and shuts down heating when pressures rise above the desired set point. This is an optional component.
3. **Manifold Gas Pressure Gauge (0-10” wc)** – Measures manifold gas pressure.
4. **Manual Gas Shut Off Valve** – Allows gas flow to burner. Shut off to leak test gas train.
5. **Modulating Gas Valve (VA-03)** – Controls the amount of gas to the furnace to meet desired discharge/space temperature.
6. **ON/OFF Gas Valve (VA-01)** – On/Off gas valve with built-in regulator and manual shut off switch.
7. **Low-Pressure Gas Switch (PS-04)** – Monitors pressure and shuts down heating when pressure drops below the desired set point. This is an optional component.
8. **Inlet Gas Pressure Gauge** (**0-35” wc)** – Measure inlet gas pressure.
9. For standard furnaces, a stainless steel type B vent will be used. For High Efficiency (HE) furnace, a PVC vent will be used. See **“Furnace Condensation Drain” on page 23**.

**Figure 35 - Typical Burner Cabinet**

Single Burner




Split Burner

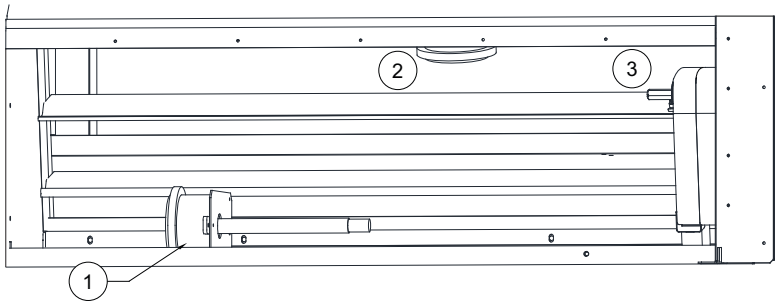



1. **Ignitor** – Powered by Flame Safety Control to initiate light-off.
2. **Rollout Switch 1 (SW-05)** – Normally closed temperature activated switch. Mounted on bracket at the firing tube. Senses flame roll-out in the event of a blocked tube, low airflow, or low gas pressure. If flame-rollout is present, the switch de-energizes heater circuit on the furnace. Must be manually reset by pressing the small button on top of the switch.
3. **Furnace High Temperature Switch (SW-04)** – Normally closed switch. De-energizes the heater circuit on the furnace if temperature exceeds mechanical set-point. Automatic recycling.
4. **Flame Rod (FR-01)** – Continuously senses for the presence of flame in heating mode after ignition has commenced. This sensor is wired to the Flame Safety Control (FSC-1).
5. **Rollout Switch 2 (SW-13)** – Normally closed temperature activated switch. Mounted on bracket at the firing tube. Senses flame roll-out in the event of a blocked tube, low airflow, or low gas pressure. If flame-rollout is present, the switch de-energizes heater circuit on the furnace. Must be manually reset by pressing the small button on top of the switch.
6. Single Burner Assembly – Capacity varies by unit size.
7. Split Furnace Assembly – Capacity varies by unit size. When the high turndown option is selected, a split furnace will be present.

   A. First Stage – Smallest of the two stages. The first stage can modulate for the highest turndown.

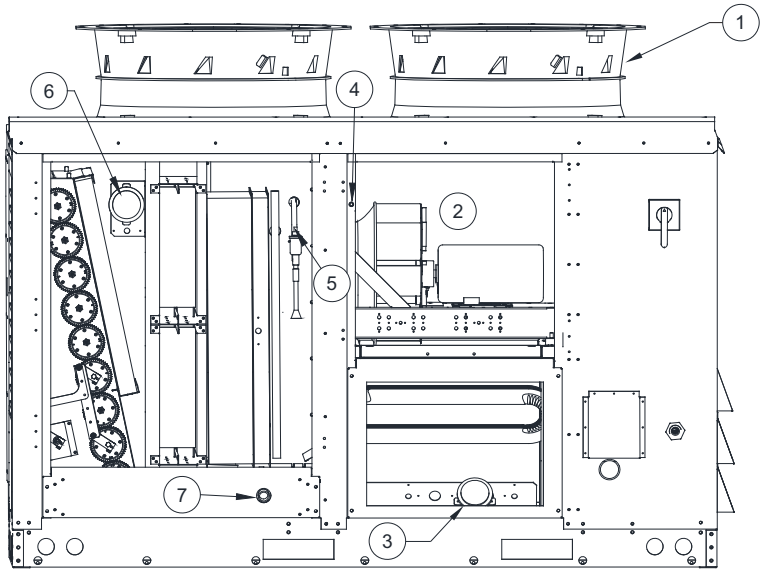
   B. Second Stage – When first stage is 100% operational, the second stage can modulate to meet the required heating capacity.

**Figure 36 - Typical Damper Access Panel**




1. **Return Temperature and/or Humidity Sensor (SN-xx)** – Monitors the return air temperature and/or humidity.
2. **Outdoor Temperature Sensor (SN-xx)** – Monitors the outdoor temperature. Located behind outside air intake louvers.
3. **Intake Damper Assembly Motor (MT-xx)** – Provides control of the outside/return air damper assembly.

**Figure 37 - Typical Blower and Air Intake Access Doors/Panel**




1. **Condensing Fan Motor (MT-xx)** – Pulls air across the outdoor coil.
2. **Supply Motor (MT-01)** – Located behind door. Main supply air motor.
3. **Discharge Temperature Sensor or Discharge Humidity/Temperature (SN-xx)** – Monitors discharge air temperature or humidity/temperature.
4. **Door Tamper Switch (SW-19)** – When the blower door is open, the switch will de-activate the supply motor.
5. **Electronic Expansion Valve (EEV-1)** – Controls the flow of refrigerant to maintain a desired superheat value.
6. **Intake Temperature or Intake Humidity/Temperature Sensor (SN-xx/HUM-xx)** – Monitors intake air humidity/temperature.
7. **Float Switch (SW-xx)** – Monitors the water level from condensation in the drain pan.

Not Shown: **Evap Coil Temperature Sensor (SN-xx)** – Monitors the dew point temperature of the air before the reheat coil.

## Optional Components

### AC Interlock

On units equipped with the optional AC interlock, **24V AC** power from a rooftop unit should be field wired to screw terminal J11-(5) on the MUA board. **24V AC** common from a rooftop unit should be field wired to terminal block J11-(8) on the MUA board. When these terminals are powered, heat will be locked out on the RTU.

### Burner Interlock

On units equipped with the optional burner interlock, **24V AC** power from a rooftop unit should be field wired to screw terminal J11-(4) on the MUA board. **24V AC** common from a rooftop unit should be field wired to terminal block J11-(8) on the MUA board. When these terminals are powered, cooling will be locked out on the RTU.

### Electric Cabinet Heater

Units can be shipped with an optional **120V** electric cabinet heater powered from the MUA board. There is a temperature sensor built onto the MUA board that will regulate when the cabinet heater activates.

### Communication Module

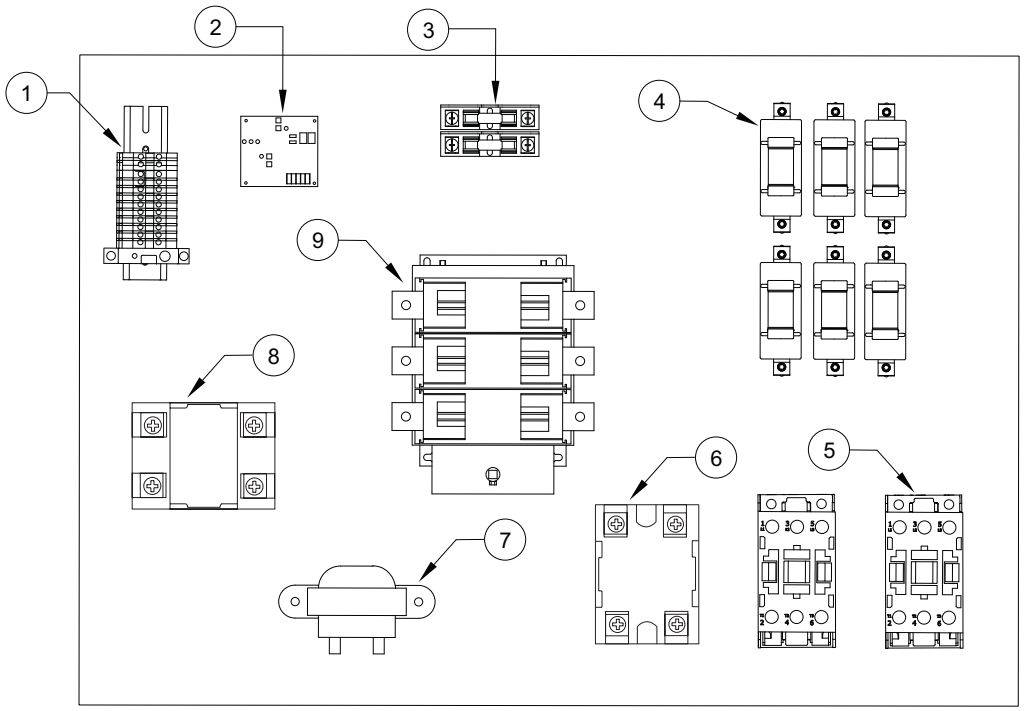
The Communication Module, PN: **SCADA**, is included in all CASlink equipped panels. It obtains operational data from various connected components. This communication wiring is either RS-485 shielded twisted pair wiring or RJ45 Cat 5 Ethernet wiring.

## Electric Heater Option

The electric coils on the heater are controlled using Silicon Controller Rectifier (SCR) controls. SCR is a time proportioning type controller that modulates the heater and supplies the exact amount of power to match the heat demand.

The three black wires from the electric heater will need to be field wired to the disconnect switch.

**Figure 38 - Electric Heater Option**




1. **Terminal Strip** – Central location to terminate control wiring. Should be used for troubleshooting.
2. **Stage Controller** – Controls multiple heating stages in a pre-determined sequence. Works in conjunction with a proportional thermostat (not shown). A sensor is mounted in the blower housing for discharge control. The set-point is mounted remotely for either space control or discharge control.
3. **Stage Fuses** - Protect the total load and/or individual heater stages.
4. **Mercury Contactor** – Provides power to the individual stages of the heater (optional for quieter operation).
5. **Coil Contactor** - Energizes coil when there is a signal from step controller.
6. **Magnetic Contactor** - Provides power to the individual stages of the heater.
7. **Transformer** - Supplies power to the control circuit. Supplied with a fuse.
8. **Solid State Relay (SSR)** - Proportionally controls the amount of power transmitted to the heating elements.
9. **Disconnect Switch** – Interrupts power to the electric coil.

## Compressor Information

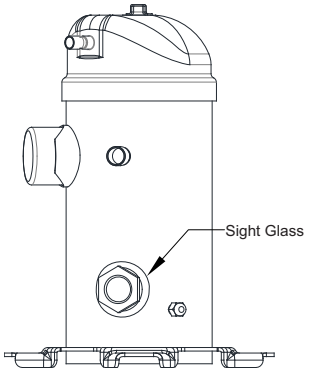
**Oil return management** – Insufficient lubrication can be the result of oil depositing itself in pipes and bends. Return management helps oil deposits to return to the crankcase by:

- Increasing velocity for short periods at regular time intervals.
- Providing adequate oil return when velocity is too low.

**Timed oil boost** – Returns oil from the system to the compressor for a defined time period. To set the oil boost configuration, go to **Factory Settings > Compressor Config > Oil Boost Time**. The user can set the time OFF or configure a time setting between 1-120 minutes. Default is set to 60 minutes. When the system is in an oil boost, the boost will last for 1 minute, and an “O” will be displayed on the HMI.

**Oil level** –When the compressor is running and in a stabilized condition, the oil level should be visible in the sight glass window, see **Figure 39**. The presence of small bubbles and foam indicates there could be a large concentration of refrigerant in the oil, or there may be liquid returning to the compressor.

**Figure 39 - Sight Glass**




### VZH 044/035/028

When the system has been running low on oil at a low RPM, less than 3000 RPM (100 Hz) for 19 minutes, the internal lubrication algorithm in the drive will accelerate the compressor. The compressor will accelerate to 4200 RPM (140 Hz) for 60 seconds. This will make sure there is sufficient lubrication of the compressor’s moving parts. When “Hands On” mode is selected, the oil return management will not be active, even if the parameter is set to be on. If the compressor does run below 3000 RPM (100 Hz) for 19 minutes, an error will occur, and the compressor will shut down. For 3-Ton units the minimum/maximum speed for the compressor is 900 RPM (30 Hz)/4200 RPM (140Hz). For 4-Ton units the minimum/ maximum speed for the compressor is 900 RPM (30 Hz)/4800 RPM (160Hz). For 5-tons and up, the minimum/maximum speed for the compressor is 900 RPM (30 Hz)/6000 RPM (200Hz).

**Oil level sensor** – This sensor is an optical sensor that monitors the compressor’s internal oil level. The sensor will send a signal to the VFD controller. A warning will be displayed on the HMI if a low oil level condition exists. If the oil level is low, the system will enter a secondary oil boost. If the oil level is still low after this boost cycle, the system will shut down and display a fault.

If the oil level is low, add oil as necessary when the compressor is idle. Use PVE oil from new containers. **DO NOT CONTAMINATE THE OIL**. Connect an oil hand pump to the Schrader valve connection on the compressor. Add oil until the level fills 50-75% of the sight glass after the unit has been off for at least 5 minutes.

### Compressor VZH 065

When the system has been running low on oil at a low RPM, less than 2400 RPM (80 Hz) for 19 minutes, the internal lubrication algorithm in the drive will accelerate the compressor. The compressor will accelerate to 3600 RPM (120 Hz) for 60 seconds. This will make sure there is sufficient lubrication of the compressor’s moving parts. When “Hands On” mode is selected, the oil return management will not be active, even if the parameter is set to be on. If the compressor does run below 2400 RPM (80 Hz) for 120 minutes, an error will occur, and the compressor will shut down. The minimum/maximum speed for the compressor is 1000 RPM (50Hz)/6600 RPM (330Hz).

If the oil level is low, add oil as necessary when the compressor is idle. Use PVE oil from new containers. **DO NOT CONTAMINATE THE OIL**. Connect an oil hand pump to the Schrader valve connection on the compressor. Add oil until the level fills 50-75% of the sight glass after the unit has been off for at least 5 minutes.

### Compressor VZH 088/117/170

When oil return management is enabled, the frequency converter performs an oil boost when the compressor is below 3000 RPM (100 Hz). The oil boost will happen every 60 minutes for 30 seconds when the compressor speed is below 3000 RPM (100 Hz). When “Hands On” mode is selected, the oil return management will not be active, even if the parameter is set to be on. The minimum/maximum speed for the compressor is 1500 RPM (50 Hz)/6000 RPM (200Hz).

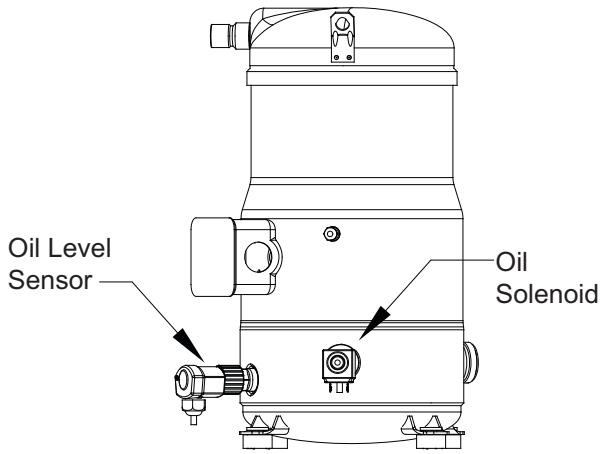
**Oil boost** – This function is controlled by the Variable Frequency Drive converter (VFD-02) to return oil from the system to the compressor when oil balance cannot be reached or maintained in a defined time period.

**Oil solenoid** – The MUA board controls the oil solenoid (**Figure 40**), which will then actuate the valve. This solenoid valve set up helps optimize the oil circulation and improves efficiency of the compressor at all running speeds. Control parameters are factory preset but are accessible on the parameter list as read-only values.

**Oil level sensor** – This sensor (**Figure 40**) is an optical sensor that monitors the compressor’s internal oil level. The sensor will send a signal to the VFD controller. A warning will be displayed on the HMI if a low oil level condition exists. If the oil level is low, the system will enter a secondary oil boost. If the oil level is still low after this boost cycle, the system will shut down and display a fault.

If the oil level is low, add oil as necessary when the compressor is idle. Use POE oil from new containers. **DO NOT CONTAMINATE THE OIL.** Connect an oil hand pump to the Schrader valve connection on the compressor. Carefully add oil until the oil level sensor is satisfied after the compressor has been off for at least 5 minutes. Repeat until the oil level sensor is satisfied for at least 30 minutes of unit operation.

**Figure 40 - Oil Level Sensor and Solenoid**



## Compressor Drive Information

Refer to **Figure 41** for CDS 803 controller interface. Refer to **Figure 42** for CDS302/303 controller interface.

### CDS803 Quick Menu Navigation

The parameter setting for the compressor drive is factory set and should not be adjusted unless specified by a service representative. If replacing the compressor drive, verify the settings match the compressor drive parameter settings. If settings need to be programmed, proceed with the following:

- Press “Menu” to enter the “Quick Menu.”
- Press [▼] to select “Compressor Function.”
- Press “OK” to enter parameter screen.
- Press “OK” to enter and edit the parameter. Use [▲] [▼] to adjust the parameter to the factory settings. Press “OK” to set parameter.
- Use the VFD schematics to locate the parameters that will need to be adjusted.

### CDS803 Main Menu Navigation

“Main Menu” is used for access to and programming of all parameters. The Main Menu parameters can be accessed readily by using the password. See VFD schematic for password.
For most Compressor Drive applications, it is not necessary to access the Main Menu parameters, but instead, the Quick Menu provides the simplest and quickest access to the typical required parameters.

The Main Menu accesses all parameters.

- Press [Menu] until indicator in display is placed above “Main Menu.”
- Press [▲] [▼] to browse through the parameter groups.
- Press “OK” to select a parameter group.
- Press [▲] [▼] to browse through the parameters in the specific group.
- Press “OK” to select the parameter.
- Press [▲] [▼] to set/change the parameter value.

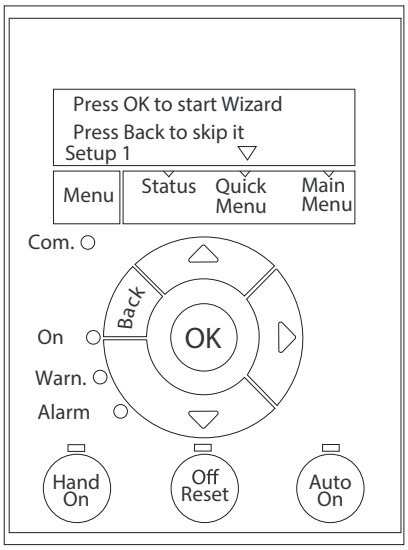
Press “Back” to go back one level.

**NOTE: Contact Factory Service Department if more information is needed.**

### CDS803 Reset

1. Power off the drive.
2. Press and hold “OK” and “Menu” buttons.
3. Apply power to the drive while holding the “OK” and “Menu” buttons.
4. Release the buttons after the VFD has been powered for 10 seconds.
5. Reprogram the VFD according to the factory schematics.

**Figure 41 - CDS 803 Interface Controller**



## CDS302/303 Quick Menu navigation

The parameter setting for the compressor drive is factory set and should not be adjusted unless specified by a service representative. If replacing the compressor drive, verify the settings match the compressor drive parameter settings. If settings need to be programmed, proceed with the following:

- Press ‘Quick Menus.’
- Press the down arrow to select ‘Compressor Functions.’
- Press ‘OK’ to enter the parameter screen.
- Use the arrow keypad to select parameters. Press ‘OK’ to enter the parameter screen.
- Press ‘OK’ to enter and edit the parameter. Use the arrows keypad to adjust the parameter to the factory settings. Press ‘OK’ to set parameter.
- Use the VFD schematics to locate the parameters that will need to be adjusted.

## CDS302/303 Main Menu

In the Main menu mode, the parameters are divided into groups. Use the navigation keys for selecting a parameter group.

After selecting a parameter group, select a parameter with the navigation keys. The middle section on the display shows the parameter number and name.

The procedure for changing data is the same in both the Quick menu and the Main menu mode.

Press “OK” to change the selected parameter. The procedure for changing data depends on whether the selected parameter represents a numerical data value or a text value.

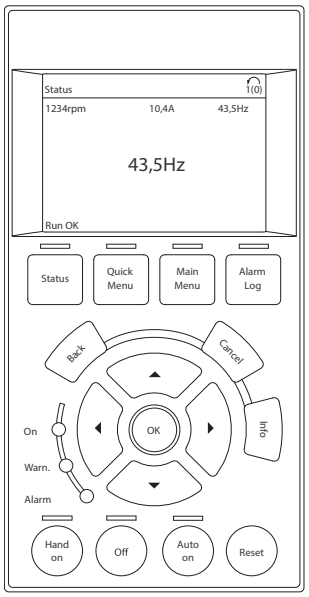
Some of the parameters cannot be changed from the LCP. These parameters are defined by the compressor choice made in 1-13 Compressor Selection. The parameters come up as “Read-only.”

**NOTE: Contact Factory Service Department if more information is needed.**

## CDS302/303 Reset

1. Power off the drive.
2. Press and hold “Status”, “Main Menu” and “OK” buttons.
3. Apply power to the drive while holding the “Status”, “Main Menu” and “OK” buttons.
4. Release the buttons after the VFD has been powered for 10 seconds.
5. Reprogram the VFD according to the factory schematics.

**Figure 42 - CDS 302/303 Interface Controller**

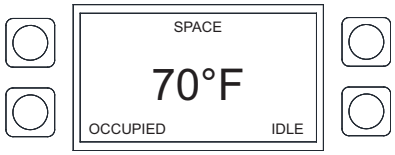


# OPERATION

## Accessing Menu Configurations

### General Overview

**Figure 43 - HMI Screen**



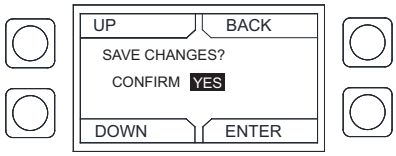

The HMI (Human Machine Interface) allows the user to change parameters and options. The user may use the unit HMI only to view operating information regarding sensors, temperatures, and pressures on the HMI screen (**Figure 43**).

There are four buttons to navigate through the HMI screens.

**NOTE: Buttons change functions during certain options and tests. Verify the screen and buttons throughout the menu display.**

When the HMI Home Screen is active, the Temp +/- buttons may be used to adjust basic temperature settings. Adjustments made are not permanent, and are based on Occupancy Configuration and Override Duration parameters in Factory Settings which are only accessible from the unit HMI.

**Figure 44 - Save Screen**




The user can access the Top Menu HMI configurations by pressing the top two buttons simultaneously. To exit this screen, simply press the ‘BACK’ button. When setting certain options or functions, pressing the ‘BACK’ button multiple times will bring up the save screen (**Figure 44**). The user may select ‘YES’ to save the changes, select ‘NO’ to return to factory settings, or select ‘CANCEL.’ When selecting ‘CANCEL,’ any changes made will not be saved, and the screen will return to the top menu.

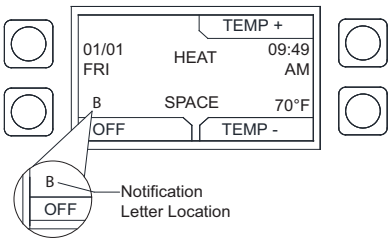
### Unit HMI Control Panel

The unit HMI menu system allows full access to every configurable parameter in the HMI. The parameters are factory configured to the specific application. Parameters may need to be modified to fine-tune automatic operation after the original setup. Parameters are locked out by a password and may only be accessed through contacting a service representative.

For information on the Space HMI, refer to **“Space HMI Control Panel” on page 73**.

## HMI Notification Letters

**Figure 45 - Notification Letters**



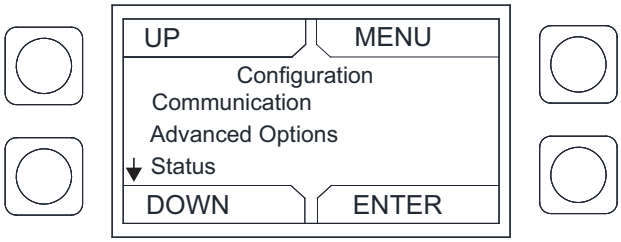

The HMI will display notification letters (**Figure 45**) when the unit is in a specific status.

- B = Blower Start or Blower Stop Delay Active
- C = Compressor Min On or Min Off Timer Active. Displayed when the unit loses a call for cooling or heating (heat pump) during the compressor’s “Min ON” or “Min OFF” time.
- E = Economizer Function
- O = Compressor Oil Boost
- T = Throttle Mode Active
- D = Dehumidification mode. Displayed when in dehumidification.
- Δ = Dynamic SP Applied.

## HMI Configuration Menu

To enter the configuration menu (**Figure 46**), press the bottom two buttons simultaneously on the HMI faceplate. In this menu screen, you may adjust Communication and Advanced Options, check Status, and About information.

**Figure 46 - Configuration Menu**




### Communication

Under the communication menu, the user may adjust the following settings:

- **Modbus Address** - Default is 55 for the first HMI. For every additional HMI, increase the address by one. For example, if a second HMI is used, the Modbus Address should be 56. For a third HMI, the Modbus Address should be 57.
- **Baud** - Do not adjust this setting. The baud rate address is 115200.
- **Parity** - Do not adjust this setting. The default setting should always be set to 'EVEN.'

### Advanced Options

Under advanced options, the user may adjust the following settings:

- **Contrast** - The user may adjust the setting from 0 to 10. Setting the contrast to 0 is the lowest setting available, and 10 is the highest contrast setting available. The factory default contrast setting is 5.
- **Audio Enable** - User may set the audio to off.
- **Dimming Enable** - Default is set to Off. If set to On, the 'HMI Dimming Timer' option will be available.
- **Set Time** - The user may adjust dimming setting from 10-60 seconds. The default time is 30 seconds.
- **RH Chip** - Relative Humidity sensor manufacturer. This setting is auto-detected. **DO NOT CHANGE SETTING**.
- **Temp Offse**t - Applies a temperature offset to the space HMI reading utilized by MUA Board. Must be set local to each space HMI. Range +/- 20°F. Calibrated individually from the manufacturer. User must consult with manufacturer before making adjustments.
- **RH Offset** - Applies a relative humidity offset to the space HMI reading utilized by MUA Board. Must be set local to each space HMI. Range +/- 30%. Calibrated individually from the manufacturer. User must consult with manufacturer before making adjustments.
- **PS Offset** - Applies a pressure offset to the space HMI reading utilized by MUA Board. Must be set local to each space HMI. Range +/- 200 mb. Calibrated individually from the manufacturer. User must consult with manufacturer before making adjustments.

### Status

User may monitor board temperature status, Uptime (how long the board has been active since last restart), HW RH (HMI hardware humidity sensor), HW Temp (HMI hardware temperature sensor).

### About

User may view SCADA HMI Software Version, Modbus Address (assigned to HMI), Baud (115200).

## Scheduling on Unit HMI

To set a schedule on the HMI (**Figure 47**), you must first enable scheduling on the unit HMI: **Factory Settings > Occupancy Config > Scheduling > On**

Set your sensor temperature set points for occupied and unoccupied schedules: **User Settings > Temp Set Points > (Varies)**

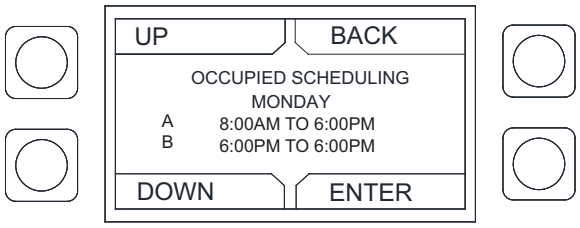
Once scheduling is enabled and the temperature set points are configured, you may enter your scheduled days and times: **User Settings > Scheduling**

Schedule A Default
- Monday - Friday 8:00AM to 6:00PM
- Saturday and Sunday Unocc

Schedule B Default
- Monday - Friday Unocc
- Saturday and Sunday Unocc

Schedule C Default
- Monday - Friday Unocc
- Saturday and Sunday Unocc

**Figure 47 - Scheduling Screen**




To adjust the settings, highlight the parameter and press **ENTER**.
- The first parameter to be highlighted will be the day. Press **UP** or **DOWN** to select the day an occupied time schedule is required.
- Press **ENTER** to continue to set a start time. Press **UP** or **DOWN** to set start time.
- Press **ENTER** to set an end time. Press **UP** or **DOWN** to set end time.

The system will run between these days, time, and desired temperature settings. When in the UNOCCUPIED setting, the system will run at the unoccupied temperature settings.

## Scheduling on Space HMI

When scheduling is enabled in Factory Settings, the space HMI will have scheduling available.

Set your Space/Discharge temperature set points for occupied and unoccupied schedules: **Space/Dischage Set Points > (Varies)**

Once scheduling is enabled and the temperature set points are configured, you may enter your scheduled days and times: **Scheduling**

Schedule A Default
- Monday - Friday 8:00AM to 6:00PM
- Saturday and Sunday Unocc

Schedule B Default
- Monday - Friday Unocc
- Saturday and Sunday Unocc

Schedule C Default
- Monday - Friday Unocc
- Saturday and Sunday Unocc

## Space HMI Control Panel

The space HMI(s) will be located in an area where the user may make comfort adjustments to the space. On units shipped with a space HMI, a Cat 5 cable will need to be run from J4, J5, or J6 (refer to schematics) on the main MUA Board to J2 on the HMI. If additional space HMIs have been added, they can be daisy-chained from the first HMI. In the event there is a slave MUA Board, HMIs can also be powered from J1 or J2 of the slave board. An end of line resistor should be added to the last HMI in the chain.

**NOTE: Some space HMIs may be CAS Wall Sensors, which function and look like HMIs but without a screen or buttons. To assign MODBUS Address, refer to Figure 48. The switches are on the back of the sensor.**

**Figure 48 - CAS Wall Sensor DIP Switches**

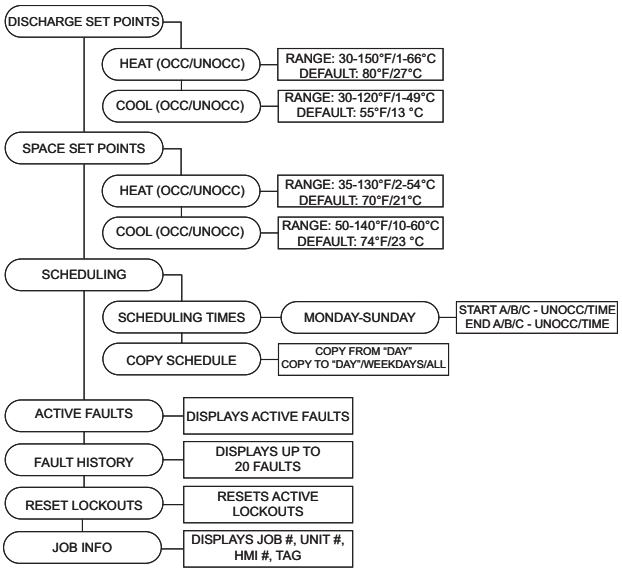



MODBUS Address = 56 MODBUS Address = 57 MODBUS Address = 58 MODBUS Address = 59

### Space HMI Menu Tree

The user can access the Space Top Menu HMI configurations by pressing the top two buttons simultaneously.

- **Discharge Set Points** - User adjustable SP for heating and cooling discharge tempering targets.
  - **Heat** - The unit will target this discharge temperature in heating mode. Tempering mode must be set to discharge or stat. Heating Type configuration must be set.
  - **Cool** - The unit will target this discharge temperature in cooling mode. Tempering mode must be set to discharge or stat. Cooling Type configuration must be set.
- **Space Set Points** - User adjustable SP for heat and cool space activation and tempering.
  - **Heat** - Heating will activate if the space temperature is below this value. The unit will target this space temperature after heating is active. “Activate Based On” must be set to Space, Both, or Either. Heating Type must be set to a heating configuration.
  - **Cool** - Cooling will activate if the space temperature is above this value. The unit will target this space temperature after cooling is active. “Activate Based On” must be set to Space, Both, or Either. Cooling Type must be set to a cooling configuration.
- **Scheduling** - Only active when the scheduling is set to On.
  - **Schedule Times** - Each day contains the option for three occupied time periods. If the time is set past 11:59 pm, it will display ‘UNOCC’.
  - **Copy Schedule** - This will allow the user to copy an existing schedule from one day of the week to individual days in the week, to Week Days, or All.
- **Active Faults** - Contains the current faults on the board.
- **Fault History** - Displays time-stamped history of the last 20 faults, most recent fault showing first.
- **Reset Lockouts** - Displayed when a lockout fault has occurred. Enter menu to reset fault(s).
- **Job Info** - Non-editable parameters. Displays Job #, Unit #, HMI #, Tag (HMI Name e.g, Office/Hallway/Break Room) entered at the factory.

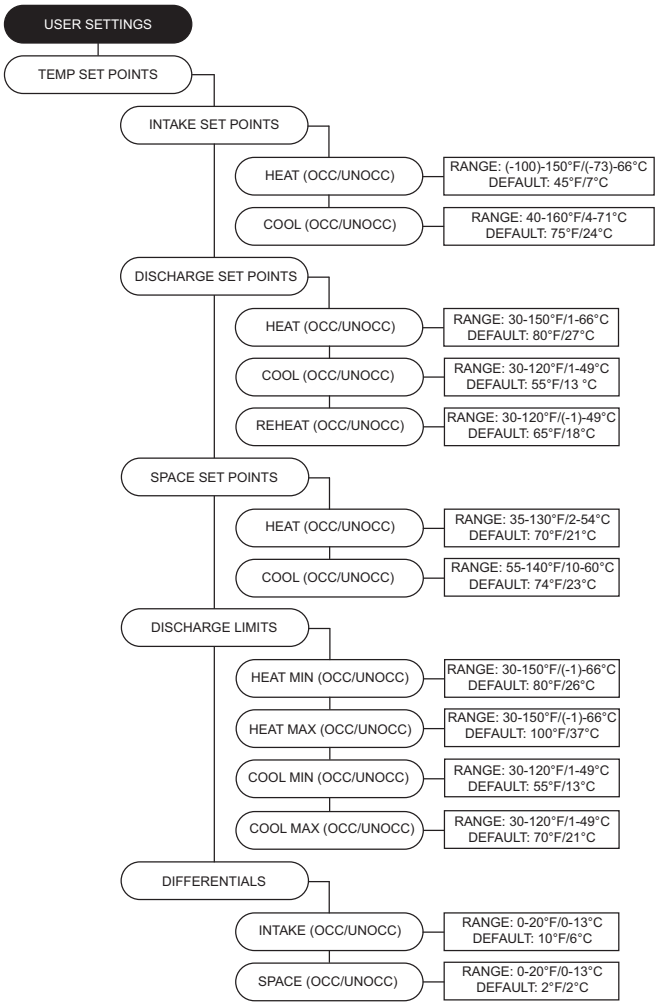


## Menu Descriptions

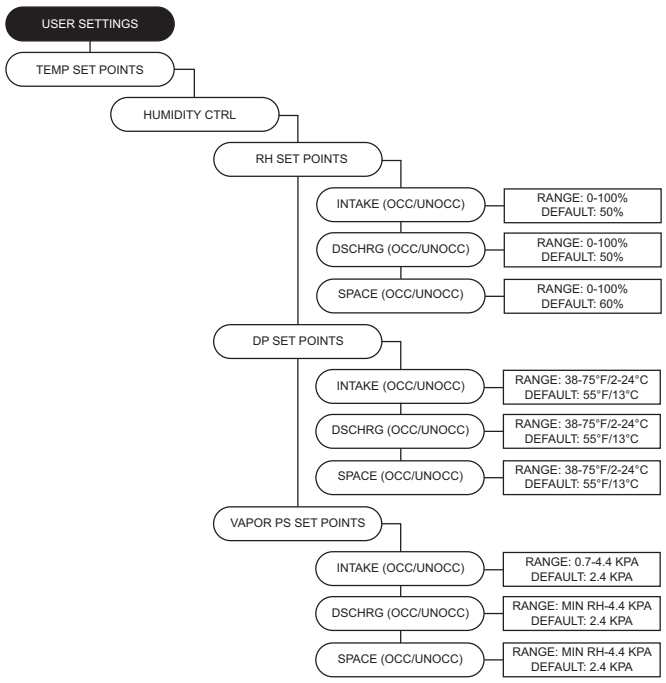
### USER SETTINGS

**Temp Set Points** - Some Set Points (SP) may not be available based on settings. If scheduling is enabled, there will be occupied (Occ) and Unoccupied (Unocc) values for each SP. The user will be allowed to check or adjust:

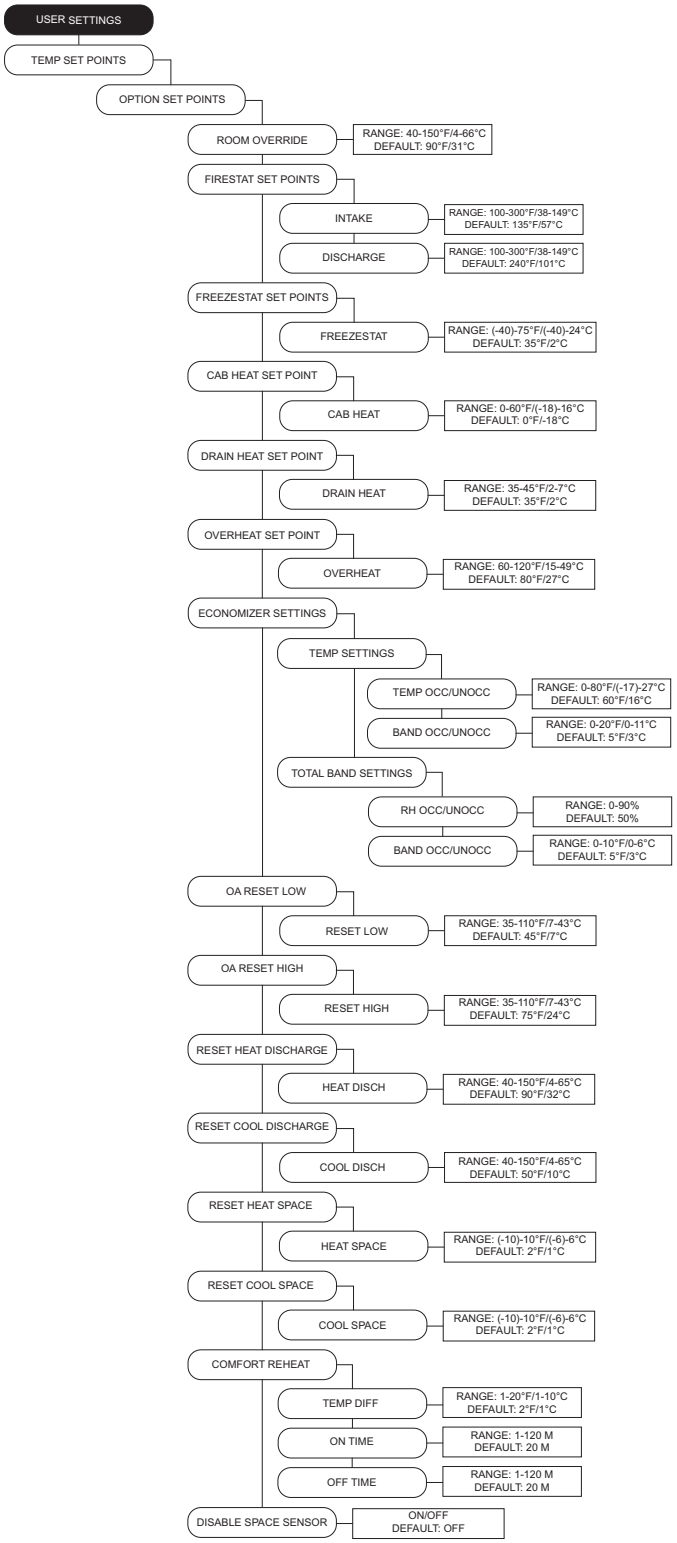
- **Intake Set Points** - User adjustable SP for heat, cool, and dehumidification activation based on intake conditions.
  - **Heat** - Heating will activate if the intake temperature is below this value. “Activate Based On” must be set to Intake, Both, Either, or Stat. Heating Type must be set to a heating configuration.
  - **Cool** - Cooling will activate if the intake temperature is above this value. “Activate Based On” must be set to Intake, Both, Either, or Stat. Cooling Type must be set to a cooling configuration.
- **Discharge Set Points** - User adjustable SP for heat, cool, and dehumidification discharge tempering targets.
  - **Heat** - The unit will target this discharge temperature in heating mode. Tempering mode must be set to discharge or stat. Heating Type must be set to a heating configuration.
  - **Cool** - The unit will target this discharge temperature in cooling mode. Tempering mode must be set to discharge or stat. Cooling Type must be set to a cooling configuration.
  - **Reheat** - Tempering mode must be set to stat.
- **Space Set Points** - User adjustable SP for heat and cool space activation and tempering.
  - **Heat** - Heating will activate if the space temperature is below this value. The unit will target this space temperature after heating is active. “Activate Based On” must be set to Space, Both, or Either. Heating Type must be set to a heating configuration.
  - **Cool** - Cooling will activate if the space temperature is above this value. The unit will target this space temperature after cooling is active. “Activate Based On” must be set to Space, Both, or Either. Cooling Type must be set to a cooling configuration.
- **Discharge Limits** - Adjustable SP for discharge limits when tempering is active.
  - **Min** - The minimum discharge temperature that the unit can target when heat, cool, or dehumidification is active. Minimum discharge temperature limit cannot be greater than maximum discharge heat/ cool SP.
  - **Max** - The maximum discharge temperature that the unit can target when heat, cool, or dehumidification is active. Maximum discharge temperature limit cannot be less than minimum discharge heat/ cool SP.
- **Differentials** - Adjustable intake/space differential SP.
  - **Intake** - Activate Based On must be set to Intake. Cool tempering mode set to Intake.
  - **Space** - Activate Based On must be set to Space. Cool tempering mode set to Space.



- **Humidity Ctrl** - Adjustable settings dependent on “Reheat Mode” selection.
  - **RH Set Points** - Relative Humidity SP
    - **Intake** - Dehumidification will activate if the intake RH is above this value. “Activate Based On” must be set to Intake, Both, Either, or Stat. Cooling Type must be set to a cooling configuration.
    - **Dschrg** - The unit will target this discharge RH when in dehumidification. Tempering mode must be set to discharge or stat. Cooling Type must be set to a cooling configuration.
    - **Space** - Dehumidification will activate if the space RH is above this value. The unit will target this space RH after cooling is active. “Activate Based On” must be set to Space, Both, or Either. Cooling Type must be set to a cooling configuration.
  - **DP Set Points** - Dew Point SP
    - **Intake** - Dehumidification will activate if the intake DP is above this value. “Activate Based On” must be set to Intake, Both, Either, or Stat. Cooling Type must be set to a cooling configuration.
    - **Dschrg** - The unit will target this discharge DP when in dehumidification. Tempering mode must be set to discharge or stat. Cooling Type must be set to a cooling configuration.
    - **Space** - Dehumidification will activate if the space DP is above this value. The unit will target this space DP after cooling is active. “Activate Based On” must be set to Space, Both, or Either. Cooling Type must be set to a cooling configuration.
  - **Vapor PS Set Points** - Vapor Pressure SP
    - **Intake** - Dehumidification will activate if the intake VPD is above this value. “Activate Based On” must be set to Intake, Both, Either, or Stat. Cooling Type must be set to a cooling configuration.
    - **Dschrg** - The unit will target this discharge VPD when in dehumidification. Tempering mode must be set to discharge or stat. Cooling Type must be set to a cooling configuration.
    - **Space** - Dehumidification will activate if the space VPD is above this value. The unit will target this space VPD after cooling is active. “Activate Based On” must be set to Space, Both, or Either. Cooling Type must be set to a cooling configuration.



- **Option Set Points** - Adjustable Set Points (SP) for options that are enabled to “ON” in Factory Settings.
  - **Room Override** - The discharge air temperature set-point that the unit will revert to when room override logic is active (see Factory Settings - Room Override for more information).
  - **Firestat Set Points** - Adjustable activations SP.
    - **Intake/Discharge** - If the intake/discharge temperature sensor goes above SP, the unit will shut down. Reset on HMI.
    - **Freezestat Set Point** - Adjustable activation SP. Must be 2 degrees less than Min Heat Discharge.
    - **Intake/Discharge** - If the discharge temp sensor goes below this SP, the unit will shut down. Reset on HMI.
  - **Cabinet Heat** - If equipped, cabinet heater will activate when the RTC temperature drops below SP.
  - **Drain Heat** - If equipped, drain heater will activate if OA temperature is below the SP.
  - **Overheat Set Point** - When in cooling or blower mode, if the discharge temperature exceeds SP, the blower/unit will shut down. Reset on HMI.
  - **Economizer Settings** - Activation SP for economizer (see Factory Settings - Economizer for more information).
    - **Temp Settings**
      - **Temp** - When OA drops below “Temp,” the economizer will activate.
      - **Band** - Damper’s position will be based on “Economizer Temp” SP minus the “Temp Band.” Damper will be fully open when OA temp is below Economizer Temp minus Temp Band.
    - **Total Band Settings** - Setting available when Economizer is set to Fixed Total or Diff Total.
      - **RH** - The damper will modulate when outside air dew point is less than “Temp” and “RH” SP.
      - **Band** - Damper’s position will be based on “Temp” and “RH” SP, minus the “Band.” Damper will be fully open when OA DP is below Economizer DP minus Temp Band DP.
  - **OA Reset Low** - When OA is below reset low SP, discharge heat will target “Reset Heat Discharge.”
  - **OA Reset High** - When OA is above the reset high SP, the discharge cool will target “Reset Cool Discharge.”
  - **Reset Cool Discharge/Space** - Temperature SP for “OA Reset High” functionality.
  - **Reset Heat Discharge/Space** - Temperature SP for “OA Reset Low” functionality.
  - **Comfort Reheat** - Activation SP and timers for comfort reheat logic (see Factory Settings - Comfort Reheat for more information). This menu will only populate if Comfort Reheat is configured.
    - **Temp Diff** - When reheat and “Temp Diff” are met, reheat should activate to meet discharge or space SP.
    - **On Time** - Delay time for comfort reheat activation.
    - **Off Time** - Delay time for comfort reheat deactivation.
    - **Disable Space Sensor** - When enabled On, the unit will temper based on discharge tempering if the space sensor is broken or missing.



**Scheduling** - This menu will only show when the scheduling option is set to On.

- **Schedule Times** - Each day contains the option for three occupied time periods. If the time is set past 11:59 pm, it will display 'UNOCC'.
- **Copy Schedule** - This will allow the user to copy an existing schedule from one day of the week to individual days in the week, to Week Days, or All.

**Fan Speed** - Blower speed setpoint. The range of this menu is limited by the min and max set points under factory settings. When the fan is set to VFD, the settings will be displayed in Hertz. When the fan is set to ECM, the PWM percentage will be displayed. If a VAV blower option is selected the logic may use the min/max speeds in factory settings and this setting may not be available. When occupied scheduling is set to On, occupied and unoccupied settings are available.

**Outdoor Air Setting** - Enabled when the outdoor air is set to percentage/voltage or scheduled control. Limited by min and max outdoor air percentages/voltages located in **Factory Settings > Unit Options > Outdoor Air Config > Outdoor Air Limits**. If a VAV damper option is selected the logic may use the min/max damper positions in factory settings and this setting may not be available.

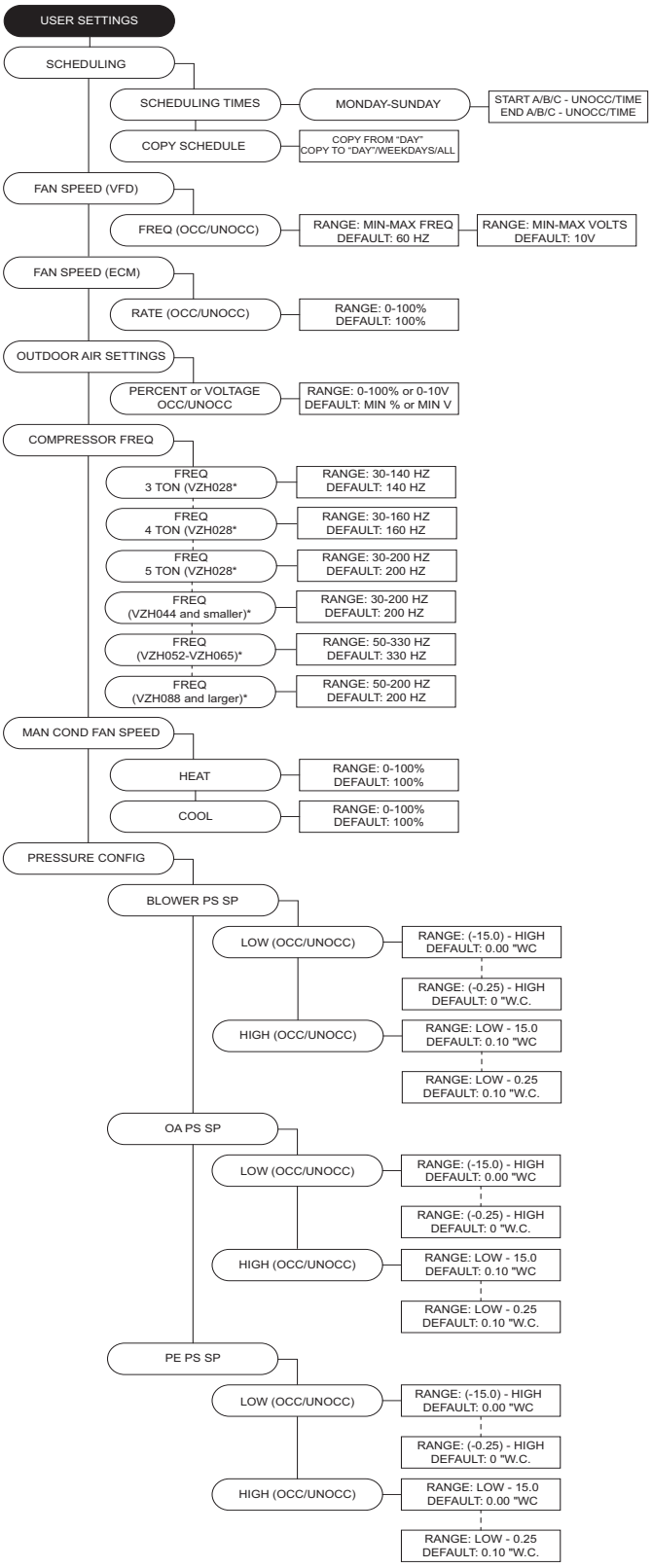
**Compressor Freq** - Menu is active when compressor is set to manual. For diagnostic or testing purposes, use the Test Menu in Service Settings. Verify compressor model (*).

**Man Cond Fan Speed** - Menu is active when cond fan mode is set to manual. For diagnostic or testing purposes, use the Test Menu in Service Settings

- **Heat** - Enabled when heat pump condensing fan mode is set to manual. Select the % the fans will operate at.
- **Cool** - Enabled when cooling condensing fan mode is set to manual, you may select the % the fans will operate at.

**Pressure Config** - Static pressure range SP. This menu will only populate if a pressure control option is configured.

- **Blower PS SP** - Adjustable blower pressure SP range.
- **OA PS SP** - Adjustable outdoor air pressure SP range.
- **PE PS SP** - Adjustable powered exhaust pressure SP range.

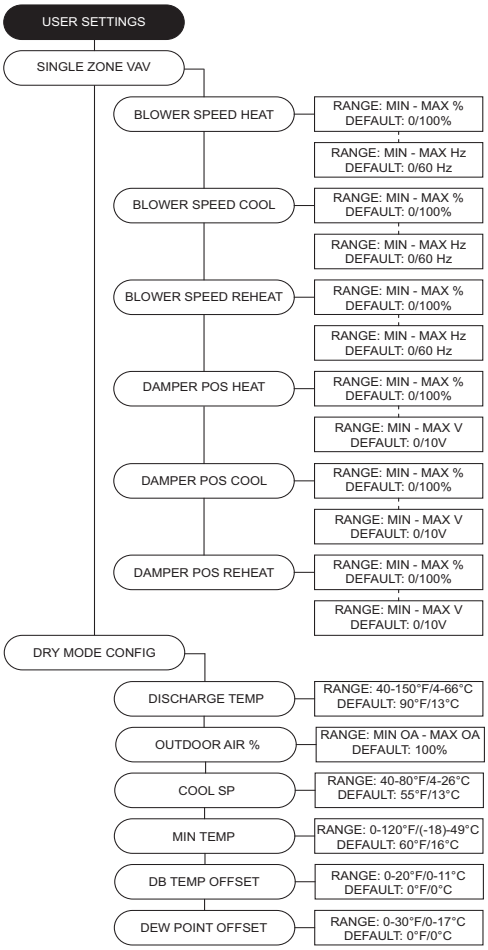


**Single Zone VAV** - Blower speed and damper position ranges for the single zone VAV logic (see Factory Settings - Single Zone VAV for more information). This menu will only populate if a Single Zone VAV option is configured.

- **Blower Speed Heat** - Min/Max range settings for blower speed in heating mode. Blower to modulate with the discharge temp. When normal logic is set (non-inverted): min discharge = min blower speed; max discharge = max blower speed. Scaled linearly between min/ max discharge to min/max blower speed.
- **Blower Speed Cool** - Min/Max range settings for blower speed in cooling mode. The blower will modulate with the discharge temp. When normal logic is set (non-inverted): min discharge = max blower speed; max discharge = min blower speed. Scaled linearly between min/max discharge to min/max blower speed.
- **Blower Speed Reheat** - Min/Max range settings for blower speed in dehumidification mode. The blower will modulate with the coil temp. When normal logic is set (non-inverted): min coil temp = max blower speed; max coil temp = min blower speed. Scaled linearly between min/max discharge to min/max blower speed.
- **Damper Pos Heat** - Min/Max range settings for damper position in heating mode. Damper to modulate with the discharge temp. When normal logic is set (non-inverted): min discharge = min damper position; max discharge = max damper position. Scaled linearly between min/ max discharge to min/max blower speed.
- **Damper Pos Cool** - Min/Max range settings for damper position in cooling mode. The damper will modulate with the discharge temp. When normal logic is set (non-inverted): min discharge = max damper position; max discharge = min damper position. Scaled linearly between min/max discharge to min/max damper position.
- **Damper Pos Reheat** - Min/Max range settings for damper position in dehumidification mode. The damper will modulate with the coil temp. When normal logic is set (non-inverted): min coil temp = max damper position; max coil temp = min damper position. Scaled linearly between min/ max discharge to min/max damper position.

**Dry Mode Config** - SP and limits used in dry mode logic (see Factory Settings - Dry Mode for more information). This menu will only populate if dry mode is configured.

- **Discharge Temp** - User defined discharge activation value.
- **Outdoor Air %** - User defined OA% activation value.
- **Cool SP** - User def ined cool SP activation value.
- **Min Temp** - User defined dry mode min temp activation value.
- **Dry Mode Hyst** - User defined dry mode hysteresis activation value.
- **DB Temp Offset** - User defined dry bulb offset activation value.
- **Dew Point Offset** - User defined dew point offset activation value.



**ERV Settings** - Energy Recovery Ventilator (ERV) settings. This menu will only populate if ERV is configured.

- **ERV Wheel Speed** - Adjustable ERV wheel speed when ERV wheel control is set to manual. This setting is typically hidden due to ERV wheel modulating automatically based on heating/cooling/dehumidification demand.
- **ERV Exhaust Fan** - Adjustable fan speed when ERV exhaust fan control is set to manual.
- **ERV Wheel Cleaning** - When ERV wheel cleaning is set to manual, this setting is used to activate the cleaning cycle.

**Dynamic SP Diff** - OA temperature differential required for dynamic SP change (see Factory Settings - Dynamic SP for more information).

**Dynamic SP Offset** - Amount the SP will change once the dynamic SP diff is met (see Factory Settings - Dynamic SP for more information).

**Dynamic Heat OA** - The outdoor air temperature at which dynamic SP heating logic activates (see Factory Settings - Dynamic SP for more information).

**Dynamic Cool OA** - The outdoor air temperature at which dynamic SP cooling logic activates (see Factory Settings - Dynamic SP for more information).

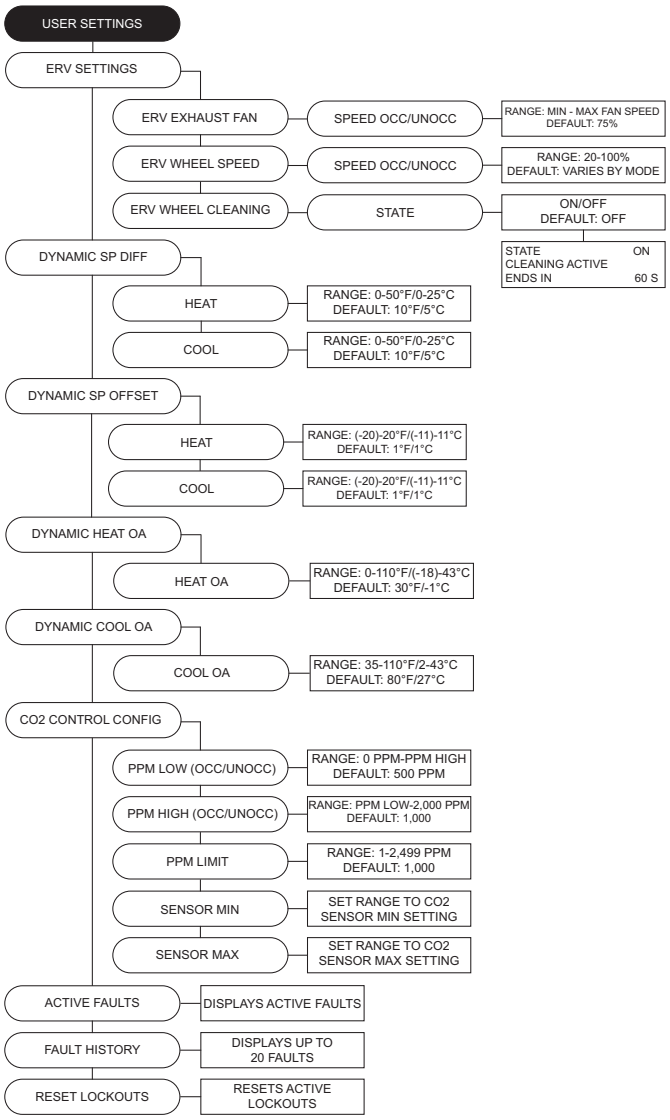
**CO2 Control Config** - CO2 Parts Per Million (PPM) SP and sensor settings. This menu will only populate if CO2 damper or blower controls are configured.

- **PPM Low/High** - CO2 PPM threshold SP for the space, used in CO2 Threshold & Override.
- **PPM Limit** - CO2 PPM threshold limit set point, used in CO2 Threshold & Override.
- **Sensor Min/Max** - Set minimum and maximum range setting for CO2 sensor.

**Active Faults** - Contains the current faults on the board.

**Fault History** - Displays time-stamped history of the last 20 faults, most recent fault showing first.

**Reset Lockouts** - Displayed when a lockout fault has occurred. Enter menu to reset fault(s).



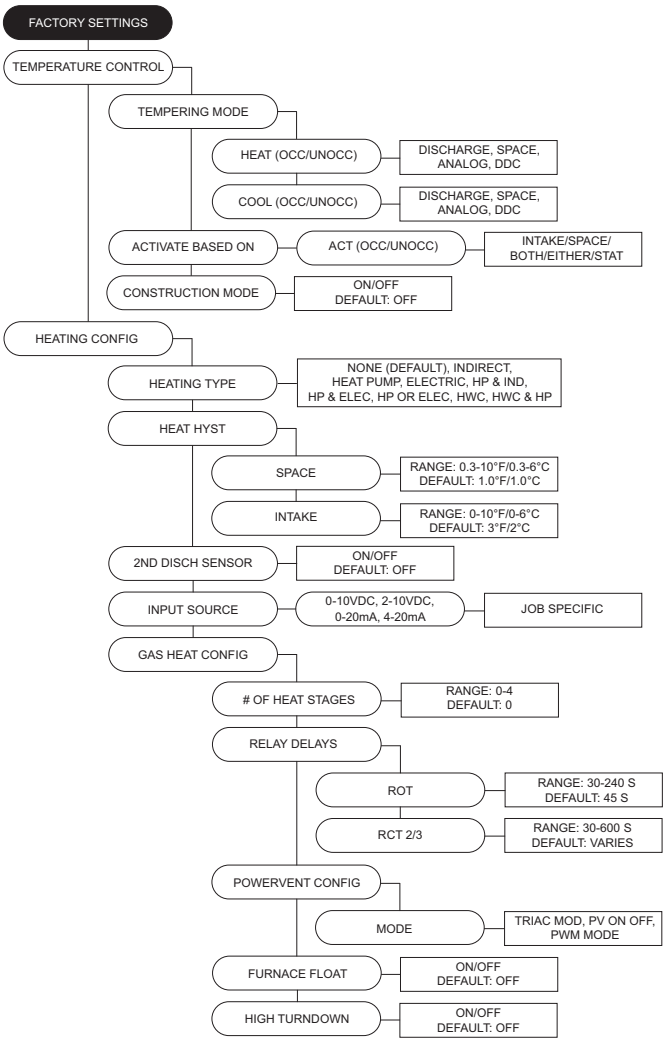
## FACTORY SETTINGS

**Temperature Control** - The MUA board monitors temperature control components.

- **Tempering Mode** - This setting dictates what conditions or inputs the unit will use to control heating, cooling, and dehumidification after they are active. Options for this setting are Discharge/ Space/Analog/Direct Digital Control (DDC). Refer to **"Sequence of Operation" on page 106**.
- **Activate Based On** - This setting dictates how the unit will activate heating, cooling, or dehumidification. Options for this setting are Intake/Space/Both/Either/ Stat (field installed thermostat). When set to Stat, the thermostat inputs and intake temperatures are monitored to activate heating/cooling.
- **Construction Mode** - Configurable option for units used while the space is actively under construction.

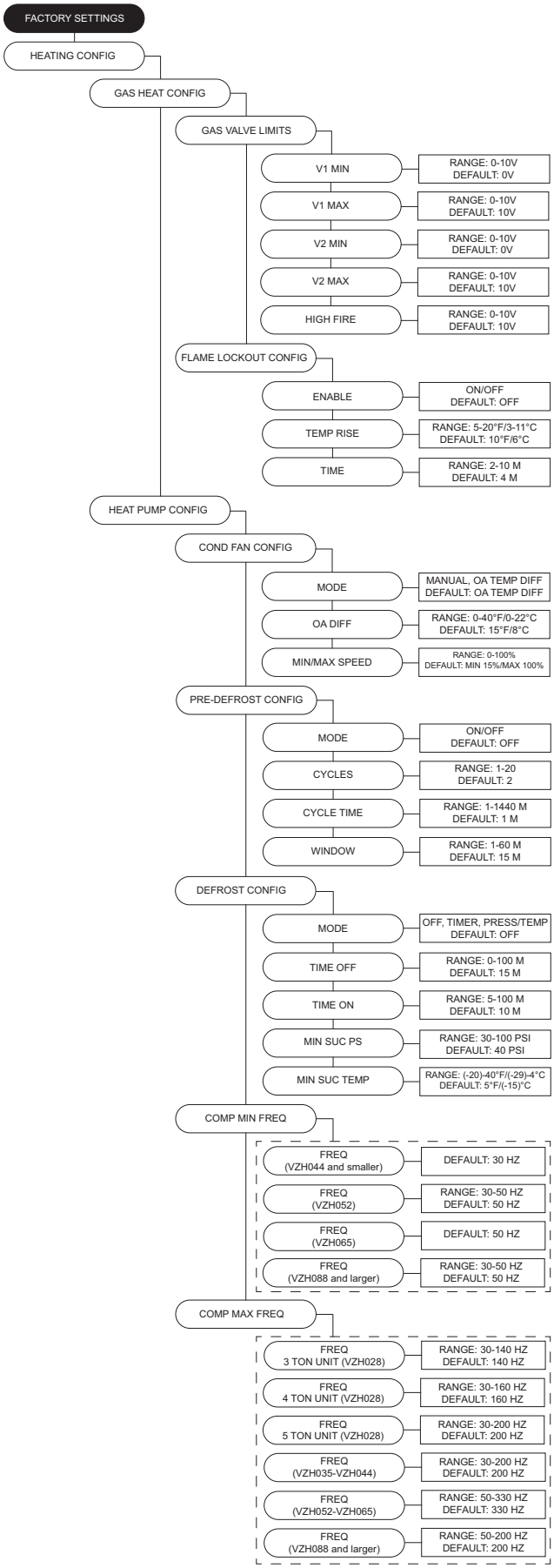
**Heating Config** - Configurable settings for the heating system.

- **Heating Type** - Select unit's heating type.
- **Heat Hyst**
  - **Space** - The space tempering sensor must go this amount of degrees above the set point before heating turns off.
  - **Intake** - The intake tempering sensor must go this amount of degrees above the set point before heating turns off.
- **2nd Disch Sensor** - When an additional thermistor is added, this feature is enabled to average the primary and secondary discharge air thermistors.
- **Input Source** - When heat tempering mode is set to "Analog", this setting is used to let the board know what signal (volts or milliamps) will be used to control the heat output.
- **Gas Heat Config**
  - **# of Heat Stages** - Default is set to '0' for units without gas heat. Select '1' for units equipped with gas heat. Select '2' for units equipped with gas heat and high turndown.
  - **Relay Delays**
    - **ROT** - This is the time after a furnace loses a call for heat before the furnace shuts down.
    - **RCT** - The Relay Close Time (RCT) is the time after a stage of heat receives a call for heat before the furnace starts up.
    - **Powervent Config** - The control signal output type that is used for the gas heat inducer.
    - **Furnace Float** - Monitors the water level from condensation in the heater drain line. Enable On if a float switch is installed. Required on high-efficiency furnaces.
    - **High Turndown** - Enable On for split burner manifold option.

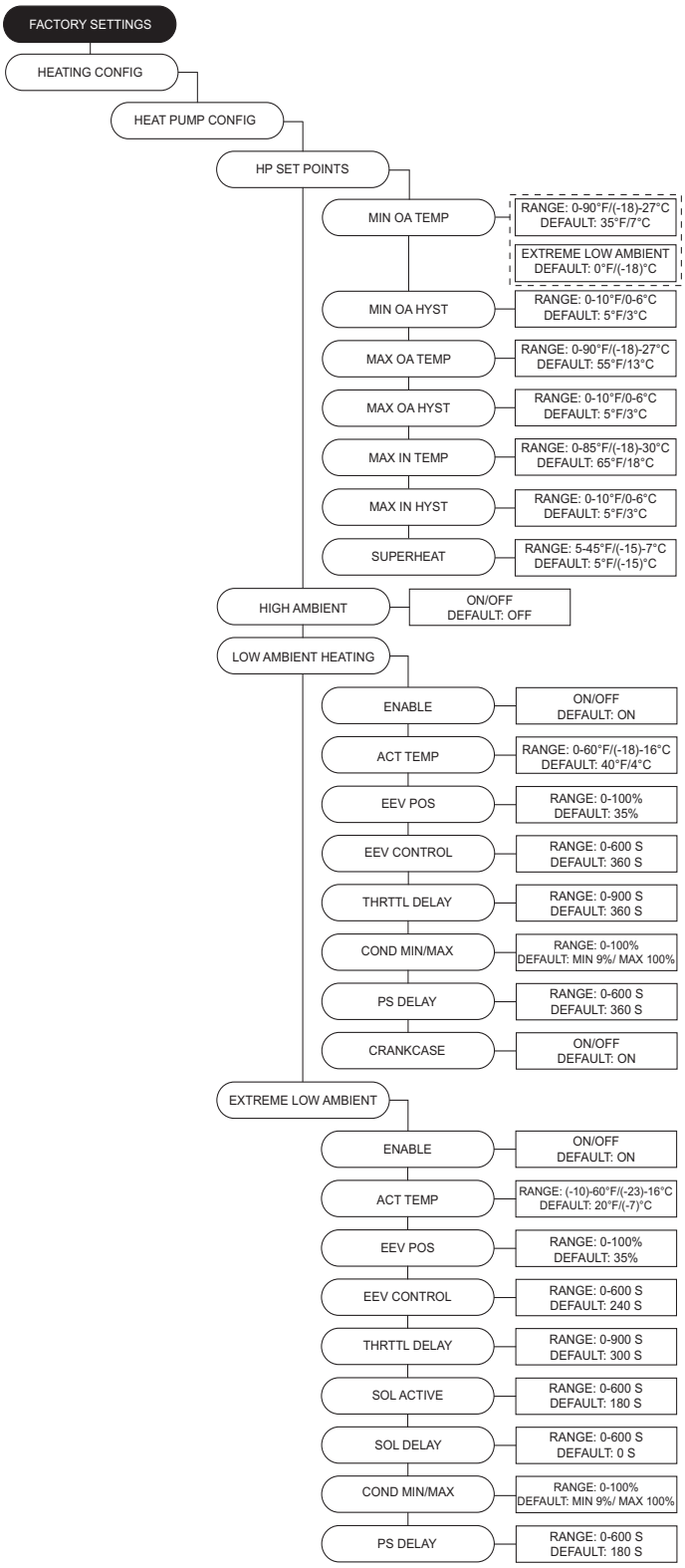


- **Gas Valve Limits**
  - **V1 Min/V2 Min** - Limits min voltage for modulating gas valve.
  - **V1 Max/V2 Max** - Limits max voltage for modulating gas valve.
  - **High Fire** - Limits high fire voltage.
- **Flame Lockout Config** - When enabled On, if the unit's temp rise does not exceed Flame Lockout Temp Rise SP after the duration of the Flame Lockout Timer, a flame lockout will occur.
  - **Temp Rise** - Temp rise limit.
  - **Time** - Amount of time before lockout occurs.

- **Heat Pump Config** - This menu only populates if the heating type is set to one of the options that utilizes heat pump.
  - **Cond Fan Config**
    - **Mode** - Used to select the condensing fan control method.
    - **OA Diff** - When OA Temp Diff is selected for the condensing fan mode, the fans modulate airflow to maintain the discharge saturation temperature at this differential to outdoor air temperature when in a heat pump call.
    - **Min Speed/Max Speed** - The minimum and maximum rate the condensing fans will operate.
  - **Pre-Defrost Config** - Option to energize a refrigerant solenoid to thaw the outdoor coil in a heat pump call before a defrost or backup heating cycle is started. This feature will only populate if extreme low ambient heat pump pre-defrost solenoid is installed and extreme low ambient heat pump is configured.
    - **Cycles** - Number of pre-defrost solenoid cycles before defrost mode is allowed to activate.
    - **Cycle Time** - Amount of time the pre-defrost solenoid is open during a cycle.
    - **Window** - Amount of time before the pre-defrost counter is reset.
  - **Defrost Config**
    - **Mode** - This allows for the unit to defrost the outdoor coil in the case of freezing coil conditions in a heat pump call. User may set defrost method to Off/Timer/PressTemp.
    - **Time Off** - If the timer option is selected, the time off default is 15 minutes.
    - **Time On** - Minutes between defrost cycles if in timer or PressTemp mode.
    - **Min Suc PS** - The minimum suction pressure limit to activate a defrost. This setting will only populate if Defrost Mode is set to PressTemp.
    - **Min Suc Temp** - The minimum suction line temperature to activate a defrost. This setting will only populate if Defrost Mode is set to PressTemp.
  - **Comp Min/Comp Max Freq** - Limits the run speed of the compressor.



- **HP Set Points**
  - **Min OA Temp** - The heat pump will shut off when the OA temp drops below this SP.
  - **Min OA Hyst** - The heat pump will not be allowed to reactivate until OA temp is above Min OA Temp SP plus the hysteresis SP.
  - **Max OA Temp** - The heat pump will shut off when the OA temp rises above this SP.
  - **Max OA Hyst** - The heat pump will not be allowed to reactivate until OA temp is below Max OA Temp SP minus the hysteresis SP.
  - **Max IN Temp** - The heat pump will shut off when the IA temp rises above this SP.
  - **Max IN Hyst** - The heat pump will not be allowed to reactivate until Intake temp is below Max IN Temp SP minus the hysteresis SP.
  - **Superheat** - Target superheat setpoint that the EEV tries to maintain in heat pump mode. Superheat is used to determine the state the refrigerant is in as it leaves the evaporator coil.
- **High Ambient** - Option optimizes heat pump operation when outside temperatures increase to avoid high head pressures from the compressor.
- **Low Ambient Heating** - When enabled, adjustable parameters and logic to improve low ambient heat pump (LA HP) performance down to 0°F ambient.
  - **Act Temp** - LA HP logic will activate when OA temp is below SP.
  - **EEV Pos** - Sets min position for EEV during LA HP start-up for the duration of the EEV control timer.
  - **EEV Control** - Minimum duration setting for EEV position at LA HP start-up.
  - **Thrttl Delay** - Prevents compressor from throttling on low pressure for duration of this timer during LA HP start-up.
  - **Cond Min/Cond Max** - The minimum and maximum rate the condensing fans will operate during LA HP operation.
  - **PS Delay** - Low pressure faults are delayed for the duration of this timer during LA HP start-up.
  - **Crankcase** - When enabled on, and LA HP logic is active, the crankcase heater is active during
- **Extreme Low Ambient** - When enabled, adjustable parameters and logic to improve heat pump performance down to -10°F ambient. Extreme low ambient heat pump (ELA HP) solenoid must be present to enable this feature.
  - **Act Temp** - Extreme low ambient heat pump (ELA HP) logic will activate when OA temp is below SP.
  - **EEV Pos** - Sets min position for EEV during ELA HP start-up for the duration of the EEV control timer.
  - **EEV Control** - Minimum duration setting for EEV position at ELA HP start-up.
  - **Thrttl Delay** - Prevents compressor from throttling on low pressure for the duration of this timer during ELA HP start-up.
  - **Sol Active** - A timer for the bypass solenoid to boost suction pressure on ELA HP start-up.
  - **Sol Delay** - A delay timer before bypass solenoid opens after ELA HP start-up.
  - **Cond Min/Cond Max** - Minimum and maximum rate the condensing fans will operate during ELA HP operation.
  - **PS Delay** - Low pressure faults are delayed for the duration of this timer during ELA HP start-up.

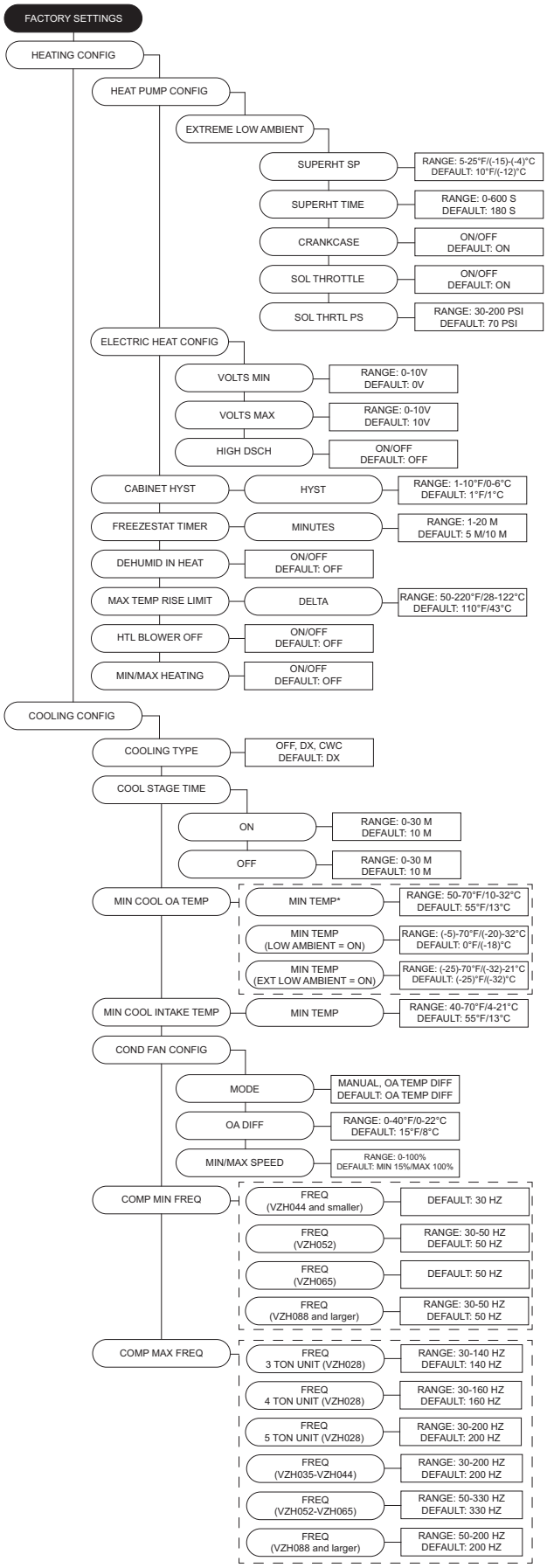


- **Superht SP** - Start-up target superheat during ELA HP start-up.
- **Superht Time** - The timer for the modified superheat target during ELA HP start-up
- **Crankcase** - When enabled on, and ELA HP is active, the crankcase heater will operate when the compressor is on.
- **Sol Throttle** - When enabled, the ELA HP solenoid will open when the compressor is throttling speed.
- **Sol Thrtl Ps** - The suction pressure where the ELA HP solenoid closes after opening for throttling.

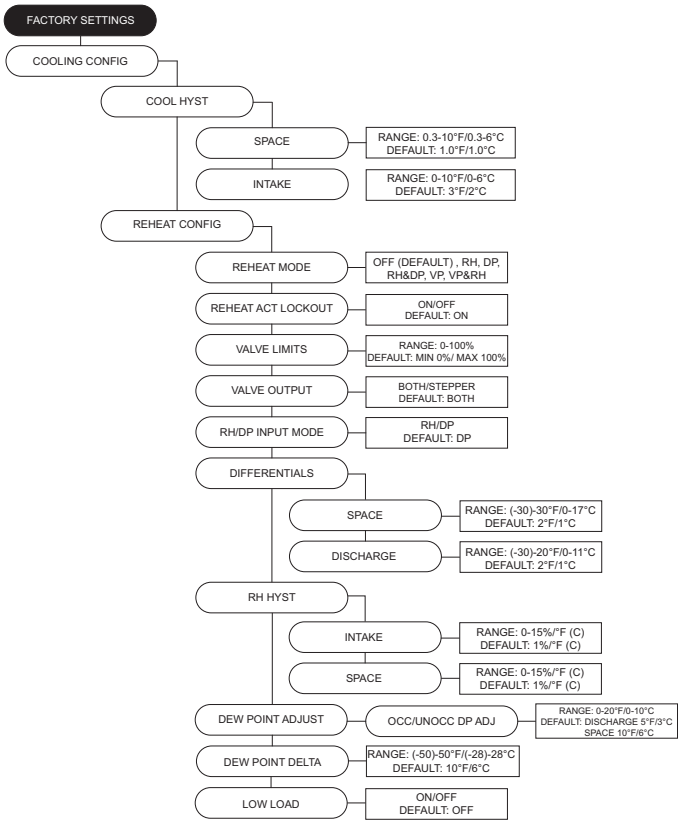
- **Electric Heat Config** - This menu only populates if the heating type is set to one of the options that utilizes an electric heat insert.
  - **Volts Min** - Limits min voltage for electric inserts.
  - **Volts Max** - Limits max voltage for electric inserts.
  - **High Disch** - Enabled On, the max discharge limit is 150°F. Enabled Off, the max discharge limit is 90°F.
- **Cabinet Hyst** - The outdoor air temp must reach this many degrees above the activation set point for the cabinet heater to turn off.
- **Freezestat Timer** - The discharge temp must stay below the freezestat set point for this amount of time before the unit will lock-out on freeze stat.
- **Dehumid In Heat** - When enabled On, dehumidification can activate during heating. Menu will only populate if the reheat mode is not set to an option with RH in the name.
- **Max Temp Rise Limit** - Limits maximum temp rise of the configured heating system.
- **HTL Blower Off** - The blower will shut off when the high temperature limit trips.
- **Min/Max Heating** - When enabled On, high fire and low fire test heating settings are adjustable.

**Cooling Config** - Cooling configuration settings.

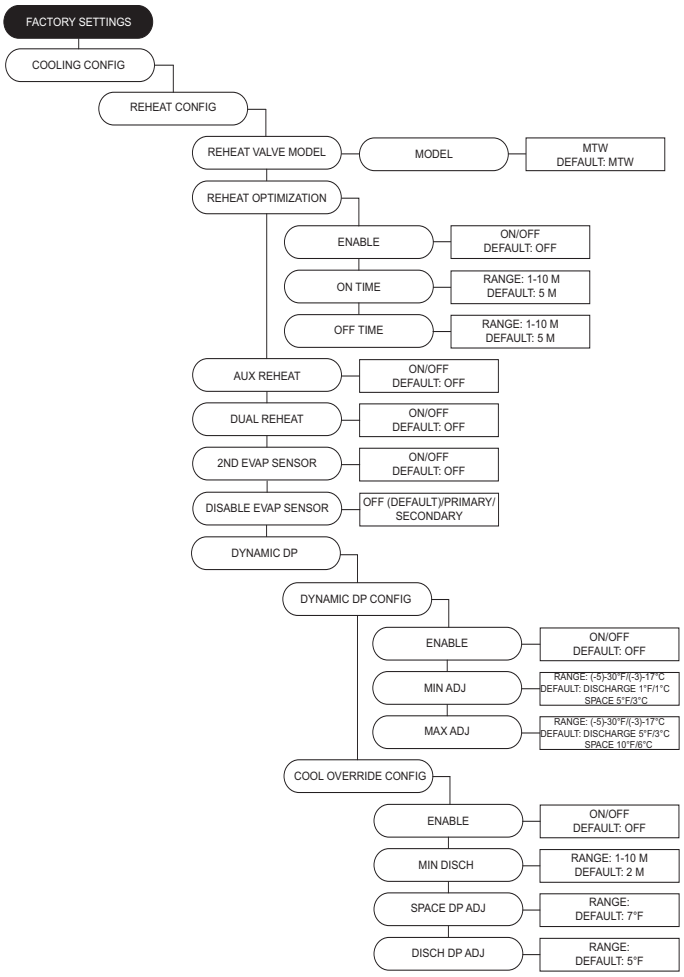
- **Cooling Type** - Select unit's cooling type.
- **Cool Stage Time** - Timer for cooling stages.
  - **On** - Timer for cooling stage to run.
  - **Off** - Timer for cooling stage to turn off.
- **Min Cool (OA) Temp** - The compressor will not activate when outdoor air temperature is below this set point.
- **Min Cool Intake Temp** - The compressor will not activate when intake temperature is below this set point.
- **Cond Fan Config**
  - **Mode** - Used to select the condensing fan control method.
  - **OA Diff** - When OA Temp Diff is selected for the condensing fan mode, the fans modulate airflow to maintain the discharge saturation temperature at this differential to outdoor air temperature when in a heat pump call.
  - **Min Speed/Max Speed** - The minimum and maximum rate the condensing fans will operate.
- **Comp Min/Comp Max Freq** - Limits the run speed of the compressor.



- **Cool Hyst**
  - **Intake** - Tempering sensor (intake) must be this setting of degrees below the set point before cooling turns off.
  - **Space** - Tempering sensor (space) must be this setting of degrees below the set point before cooling turns off.
- **Reheat Config**
  - **Reheat Mode** - When RH/DP is selected, software will monitor both dew point and relative humidity for reheat activation. When only DP is selected, software will monitor dew point for reheat activation. When only RH is selected, software will monitor relative humidity for reheat activation. When only VP is selected, software will monitor vapor pressure for reheat activation. When VP&RH is selected, software will monitor both vapor pressure and relative humidity for reheat activation. When Off is selected, reheat will not be active.
  - **Reheat Act Lockout** - When Enabled On, prevents dehumidification calls from cycling the unit.
  - **Valve Limits** - Min and max settings for reheat valve position.
  - **Valve Output** - The output signal type for the reheat valve.
  - **RH/DP Input Mode** - When reheat mode is set to RH/DP, the user may select between DP or RH.
  - **Differentials**
    - **Space** - Reheat will activate if the cooling mode is set to SPACE, the inside coil temperature and the desired reheat set point is less than the intake dew point minus the space differential.
    - **Discharge** - Reheat will activate if the cooling mode is set to “Discharge”, the inside coil temperature and the desired reheat set point is less than the intake dew point minus the discharge differential.
  - **RH Hyst**
    - **Intake** - The Intake RH/DP must go below the intake RH/DP set point plus intake reheat hyst before reheat turns off.
    - **Space** - The space RH/DP must go below the intake RH/DP set point plus intake reheat hyst before reheat turns off.
  - **Dew Point Adjust** - Settings for dew point adjust. This value determines what dew point the unit will cool to before reheating occurs. If the reheat dew point adjust is set to 5°F, and the reheat set points’ dew point is set to 50°F, the unit will cool the air to 45°F before reheating when in a dehumidification call.
  - **Dew Point Delta** - If the cooling mode is set to SPACE, reheat can activate if the intake DP is greater than the space DP SP minus the DP Delta. If the cooling mode is set to DISCHARGE, reheat can activate if the intake DP is greater than the discharge DP SP minus the DP Delta.
  - **Low Load** - Enabled On, if the unit is only dehumidifying and heating shuts cooling down, the unit should not try to dehumidify again until there is a call for cooling from temp activation. Enabled Off, if the unit is only dehumidifying and heating shuts cooling down, the unit can try to dehumidify again.

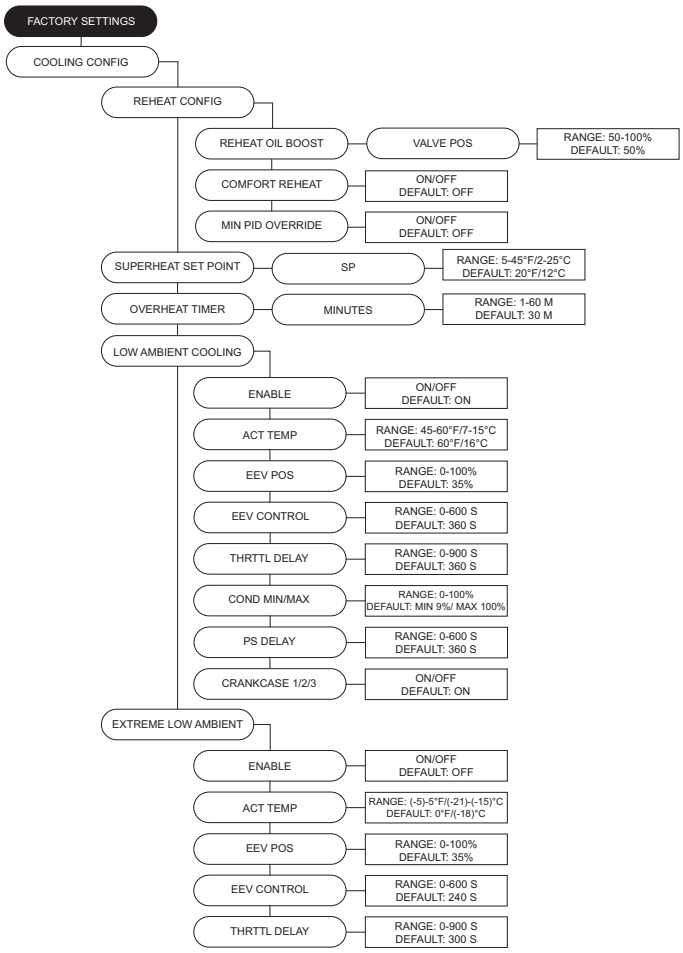


- **Reheat Valve Model** - Valve model selection.
- **Reheat Optimization** - Enabled On, the user may adjust optimization On/Off Timers.
  - **On Time** - Increase condensing fan differential when reheat PID is at 100% for On Time setting and outdoor temp is below 76°F.
  - **Off Time** - Decrease condensing fan differential when reheat PID is at 0% for Off Time setting and outdoor temp is above 77°F.
- **Aux Reheat** - Activates auxiliary heat source (gas or electric) when the unit needs more reheat capacity. Timers will control the staging of the auxiliary reheat source.
  - **On Time** - The time hot gas reheat (HGRH) PID needs to be at 100% before it is shut off and aux reheat is utilized instead. If dual reheat is enabled, this is the time that HGRH reheat PID needs to be at 100% before it is locked at 100% and the aux reheat source is utilized in addition to HGRH.
  - **Off Time** - The time aux reheat PID needs to be at 0% before aux reheat can turn off. If dual reheat is enabled, this is the time that aux reheat PID needs to be at 0% before it is locked in the lowest capacity heat and HGRH is unlocked from 100% and starts to modulate.
  - **Stage Time** - Only used for Dual Reheat. The time both aux reheat and HGR PIDs need to be at 0% before turning off the aux reheat source and restarting normal HGRH operation.
- **Dual Reheat** - Allows hot gas reheat and auxiliary heat to operate at the same time.
- **2nd Evap Sensor** - When active, the evap temperature will be averaged between the two sensors.
- **Disable Evap Sensor** - Will not factor in the selected evap sensor into th evap sensor's reading.
- **Dynamic DP**
  - **Dynamic DP Config** - When enabled On, adjusts target evaporator temperature based on demand instead of discharging a fixed DP.
    - **Min Adj/Max Adj** - Minimum and maximum DP adjustment range. If the min adj is set to 5°F and the max adj is set to 10F, and the reheat set points' dew point is set to 50°F, the unit will be able to target a coil temperature in the range of 40F to 45F before reheating when in a dehumidification call.
  - **Cool Override Config** - When enabled On, if the unit senses a high sensible heat ratio and the space overheats in a dehumidification call, cooling will override dehumidification.
    - **Min Disch** - Timer before the unit will go to cool override functionality.
    - **Space DP Adj** - Fixed space dew point adjustment that the unit reverts to when cool override is active.
    - **Disch DP Adj** - Fixed discharge dew point adjustment that the unit reverts to when cool override is active.



- **Reheat Oil Boost** - When an oil boost is active, the reheat valve will move to this set position.
- **Comfort Reheat** - When enabled, the reheat valve can be used/opened in a standard cooling call to achieve target discharge conditions. To activate, system must be in cooling (not dehumidification) at low compressor speed and system cannot achieve the Cool Discharge Stp – Comfort Reheat Temp Diff (discharge tempering) or the Max Cool Discharge – Comfort Reheat Temp Diff (space tempering).
- **Min PID Override** - In a cooling call when condenser fans are off, lock out hot gas reheat.

- **Superheat Set Point** - Monitors what state the refrigerant is in as it leaves the evaporator coil.
- **Overheat Timer** - The discharge temperature must not exceed the set point for 30 minutes (default), or the unit will shut down. When in cooling or blower only, the unit will wait for the “Comp Min Off Time” for the compressor, then re-attempt to cool again. If the overheat stat fails again, everything will shut down and display the fault “Overheat Stat Failure.”
- **Low Ambient Cooling** - When enabled, adjustable parameters and logic to improve low ambient cooling/dehumidification (LA) performance down to 0°F ambient.
  - **Act Temp** - Low ambient logic will activate when OA temp is below SP.
  - **EEV Pos** - Sets min position for EEV during LA start-up for the duration of the EEV control timer.
  - **EEV Control** - Minimum duration setting for EEV position at LA start-up.
  - **Thrttl Delay** - Prevents the compressor from throttling on low pressure for the duration of this timer during LA start-up
  - **Cond Min/Max** - The minimum and maximum rate the condensing fans will operate at low ambient conditions.
  - **PS Delay** - Low pressure faults are delayed for the duration of this timer during LA start-up.
  - **Crankcase 1/2/3** - Option for crankcase heater to turn on when the compressor is running. Crankcase heater 1 active connector J10-4 on MUA board. Crankcase heater 2 active connector J9-18 on Advanced Cool Board (ACB). Crankcase heater 3 active connector J10-18 on ACB.
- **Extreme Low Ambient** - When enabled, adjustable parameters and logic to improve cooling/dehumidification performance down to -20°F ambient. Extreme low ambient (ELA) solenoid must be present to enable this feature.
  - **Act Temp** - Extreme low ambient (ELA) logic will activate when OA temp is below SP.
  - **EEV Pos** - Sets min position for EEV during ELA start-up for the duration of the EEV control timer.
  - **EEV Control** - Minimum duration setting for EEV position at ELA start-up.
  - **Thrttl Delay** - Prevents the compressor from throttling on low pressure for the duration of this timer during ELA start-up.

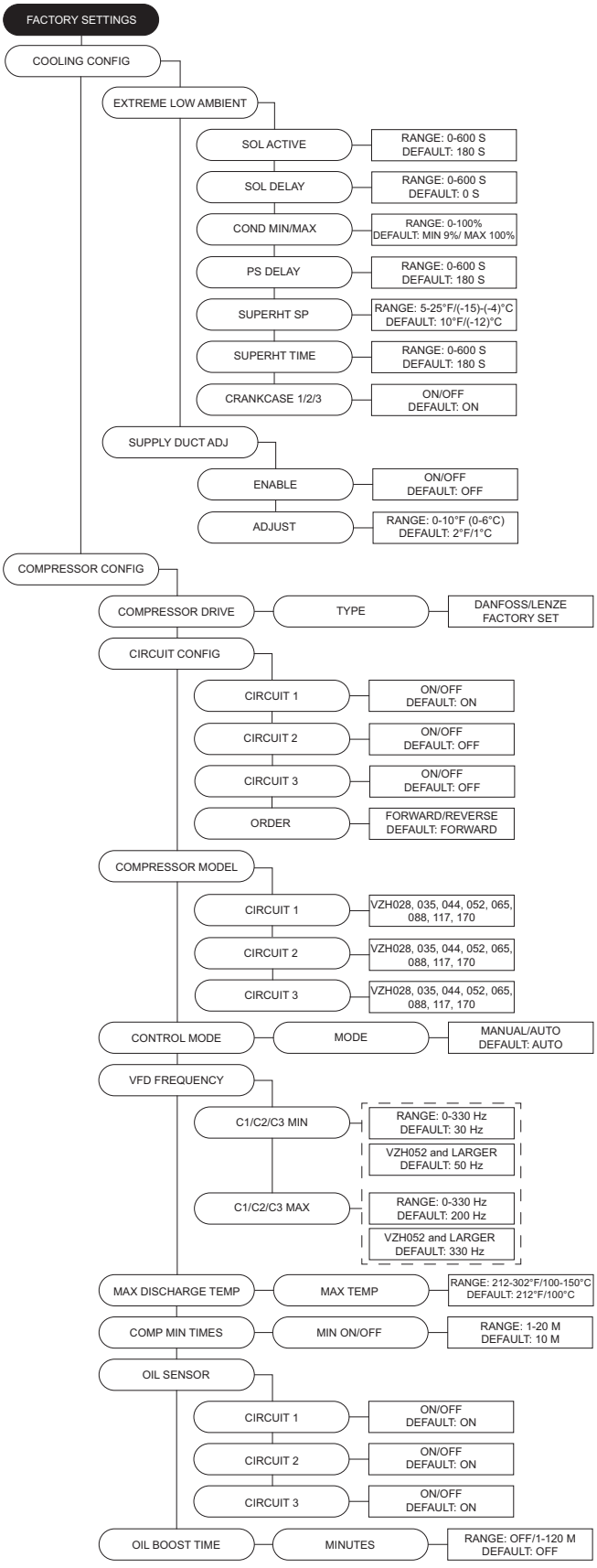


- **Sol Active** - A timer for the bypass solenoid to boost suction pressure on ELA start-up.
- **Sol Delay** - A delay timer before bypass solenoid opens after ELA start-up.
- **Cond Min/Max** - The minimum and maximum rate the condensing fans will operate during ELA operation.
- **PS Delay** - Low pressure faults are delayed for the duration of this timer during ELA start-up.
- **Superht SP** - Start-up target superheat during ELA start-up.
- **Superht Time** - The timer for the modified superheat target during ELA start-up
- **Crankcase 1/2/3** - Option for crankcase heater to turn on when the compressor is running. Crankcase heater 1 active connector J10-4 on MUA board. Crankcase heater 2 active connector J9-18 on Advanced Cool Board (ACB). Crankcase heater 3 active connector J10-18 on ACB.

- **Supply Duct Adj** - Discharge temperature offset is used to ensure there is no condensation on uninsulated supply duct(s).
  - **Adjust** - The minimum offset the discharge temperature will be above space dew point.

**Compressor Config** - Adjustments for compressor settings.

- **Compressor Drive** - Setting for compressor manufacturer.
- **Circuit Config** - Settings for compressor circuits.
  - **Circuit 1/2/3** - On/Off setting for available circuits.
  - **Order** - Setting for circuit staging operation. Forward = 1, 2, 3. Reverse = 3, 2, 1.
- **Compressor Model** - Compressor model selection.
- **Control Mode** - Allows the user to turn the compressor between manual or auto control.
- **VFD Frequency** - Scaling adjustment for the compressor and compressor drive.
  - **C1/C2/C3 Min** - Defines the minimum speed range of the compressor for cooling/dehumidification mode. Must be set equal to the compressor VFD minimum speed.
  - **C1/C2/C3 Max** - Defines the maximum speed range of the compressor for cooling/dehumidification mode. Must be set equal to the compressor VFD maximum speed.
- **Max Discharge Temp** - Limits discharge temperature out of the compressor.
- **Comp Min Times**
  - **Min On** - Minimum amount of time the compressor stays on.
  - **Min Off** - Minimum amount of time the compressor stays off after being active.
- **Oil Sensor** - Settings for oil sensor circuits.
- **Stage 1/2/3:** Enable/disable the oil sensor monitoring. This feature must be enabled if an oil sensor is present.
- **Oil Boost Time** - Timed compressor boost time option.



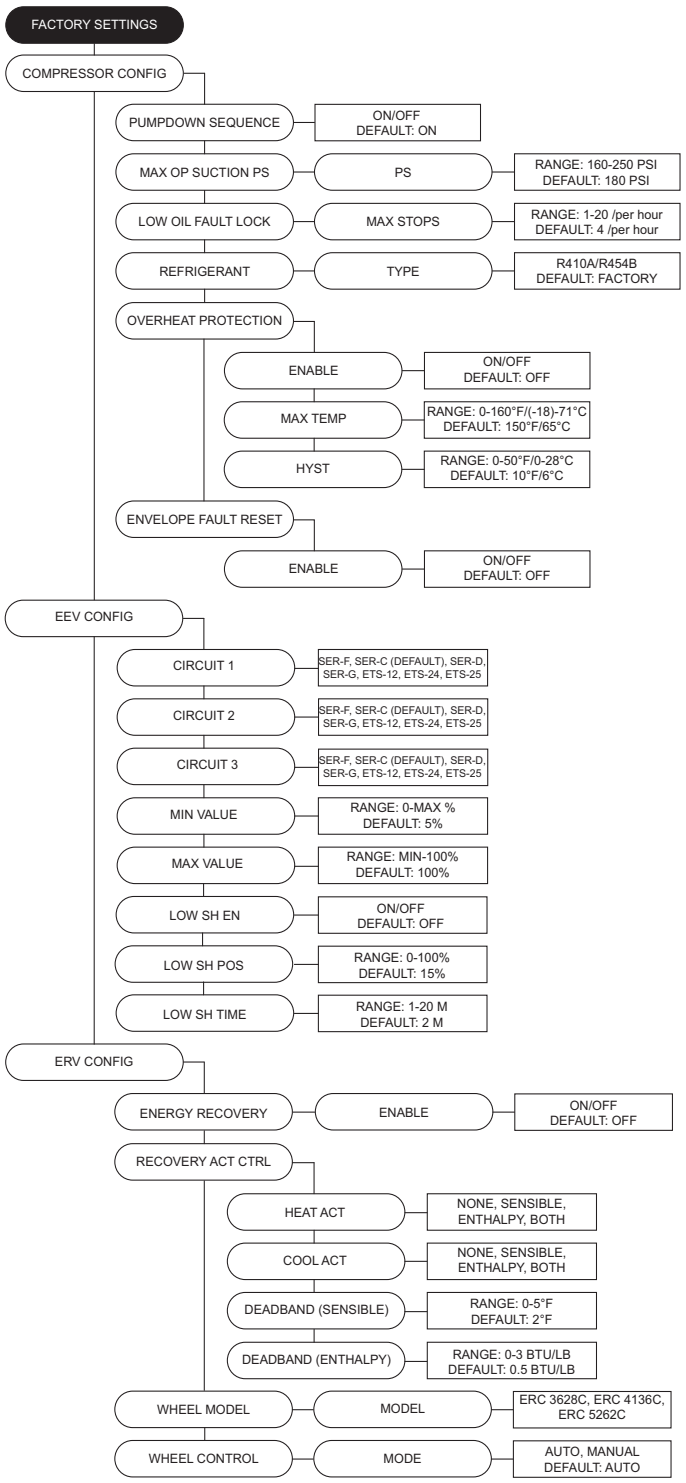
- **Pumpdown Sequence** - Compressor soft stop and liquid migration protection to store most of the refrigerant in the outdoor coil during an off cycle. Before the pumpdown sequence begins, an oil boost will run to return oil back to the compressor before shutting down.
- **Max OP Suction PS** - When suction pressure is above setting, the EEV will close to 0% to drop suction pressure within the envelope range.
- **Low Oil Fault Lock** - If oil is repeatedly lost but regained, the system will lock out. Clear the lockout on the HMI.
- **Refrigerant** - Select the type of refrigerant used in the system.
- **Overheat Protection** - When enabled, protects VFD heat sink from locking out unit.
  - **Max Temp** - When the VFD heat sink rises above set point, cooling will start.
  - **Hyst** - Temperature hysteresis value the unit will stop cooling.
- **Envelope Fault Reset** - Allows one automatic retry when an envelope fault occurs.

**EEV Config** - Allows user to set Electronic Expansion Valve (EEV) model and adjust EEV position values.

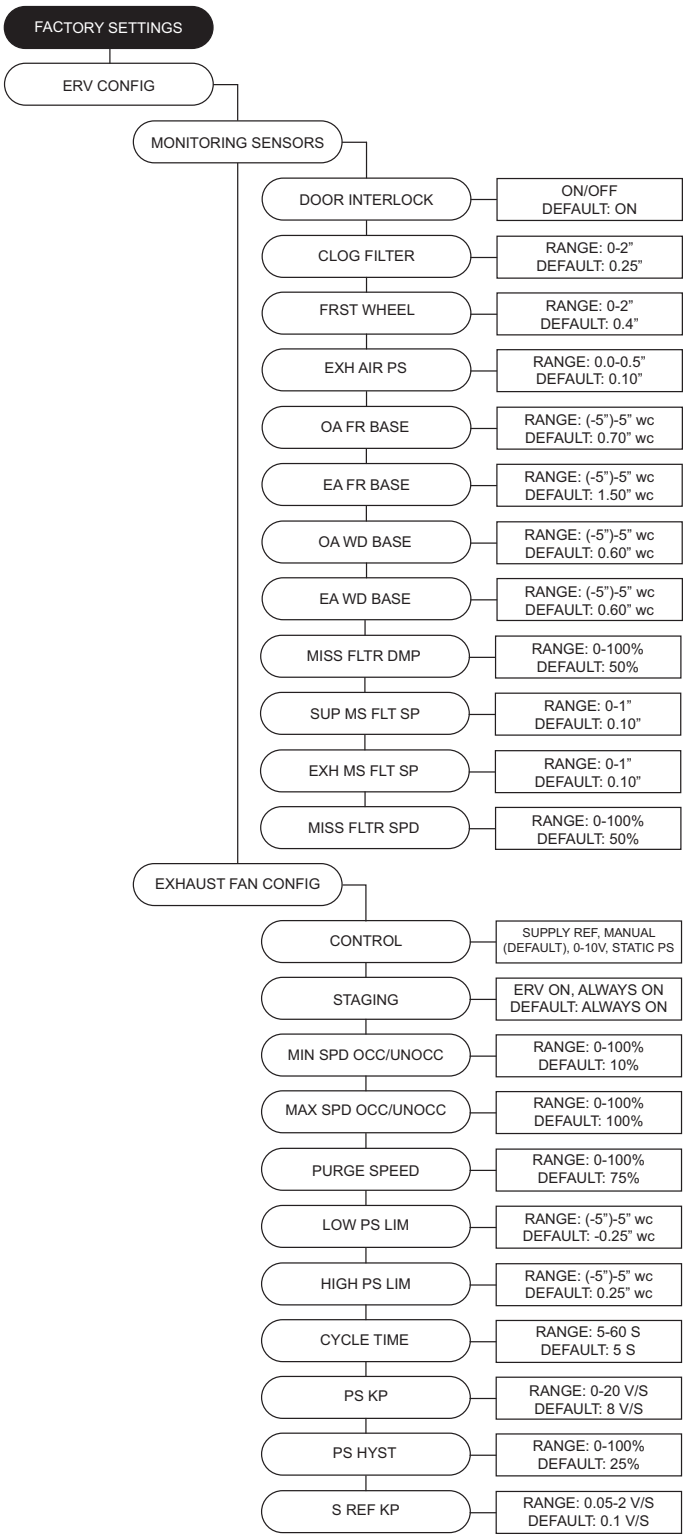
- **Circuit 1/2/3** - Selectable range of EEV models.
- **Min Value** - Adjustable minimum position between 0% to max setpoint.
- **Max Value** - Adjustable maximum position between min set point and 100%.
- **Low SH Enabled** - Enable/Disable for a feature to limit the EEV min position during start-up when low ambient logic is not active
- **Low SH Position** - Minimum EEV position setting for Low SH feature Will show up if Low SH is enabled.
- **Low SH Time** - Minimum EEV position timer for Low SH feature. Will show up if Low SH is enabled.

**ERV Config** - If the Energy Recovery Ventilator (ERV) option is enabled, ERV settings and parameters will be visible.

- **Energy Recovery** - On/Off selection. If the energy recovery option is set to ON, menus will be available to adjust various energy recovery settings.
- **Recovery Act Control** - Selectable control type and dead band for ERV operation.
  - **Heat Act** - Heating activation method for ERV. Determines if the unit will use sensible, enthalpy or both for ERV tempering activation.
  - **Cool Act** - Cooling activation method for ERV. Determines if the unit will use sensible, enthalpy or both for ERV tempering activation.
  - **Deadband (Sensible)** - A temperature deadband that must be satisfied in order for ERV tempering to activate.
  - **Deadband (Enthalpy)** - An enthalpy deadband that must be satisfied in order for ERV tempering to activate.
- **Wheel Model** - Setting to determine the ERV wheel size. This must be correct for the wheel speed to modulate correctly.
- **Wheel Control** - Auto or manual control settings.



- **Monitoring Sensors** - Values that are associated with the operation of the ERV. Sensor pressure values monitor how much dirt and debris are collected on the filters and wheel.
  - **Door Interlock** - When enabled, a “Door Interlock” fault will display when the blower door is open during normal operation. This is only enabled if the door interlock is wired to the control board.
  - **Clog Filter** - Setpoint adjustment for ERV filter monitoring A fault will display when differential pressure is out of range.
  - **Frst Wheel** - Setpoint adjustment for frosted wheel monitoring. A fault will display when differential pressure is out of range.
  - **Exh Air PS** - Setpoint adjustment for airflow proving. A fault will display when differential pressure is out of range.
  - **OA FR Base** - Calibration value for clogged filter and wheel functionality.
  - **EA FR Base** - Calibration value for clogged filter and wheel functionality.
  - **OA WD Base** - Calibration value for clogged filter and wheel functionality.
  - **EA WD Base** - Calibration value for clogged filter and wheel functionality.
  - **Miss FIter Dmp** - Outdoor air damper opening value. A fault will display when damper is out of range.
  - **Sup MS FIt SP** - Supply missing filter setpoint.
  - **Miss FItr Spd** - Missing filter pressure setpoint. A fault will display when differential pressure is less than set value.
- **Exhaust Fan Config** - ERV exhaust blower settings.
  - **Control** - Selectable control type for exhaust blower.
  - **Staging** - Selectable activation modes for exhaust blower. Only available with certain modes.
  - **Min Speed Occ/Unocc** - Adjustable range between 0% to Max Speed set point. When occupied setting are enabled, two set points will be available.
  - **Max Speed Occ/Unocc** - Adjustable range between Min Speed set point to 100%. When occupied setting are enabled, two set points will be available.
  - **Purge Speed** - Fixed speed that the exhaust fan will operate when purge is activated.
  - **Low PS Lim** - Low pressure limit setting for building differential pressure.
  - **High PS Lim** - High pressure limit setting for building differential pressure.
  - **Cycle Time** - Cycle time is the time between two consecutive readings.
  - **PS KP** - Proportionally constant value for static pressure measured in V/sec.
  - **PS Hyst** - Building pressure must go above or below hysteresis value for fan adjust accordingly.
  - **S REF KP** - Proportionally constant value for supply fan pressure measured in V/sec. Only displayed when Exhaust Fan Control is set to supply reference.



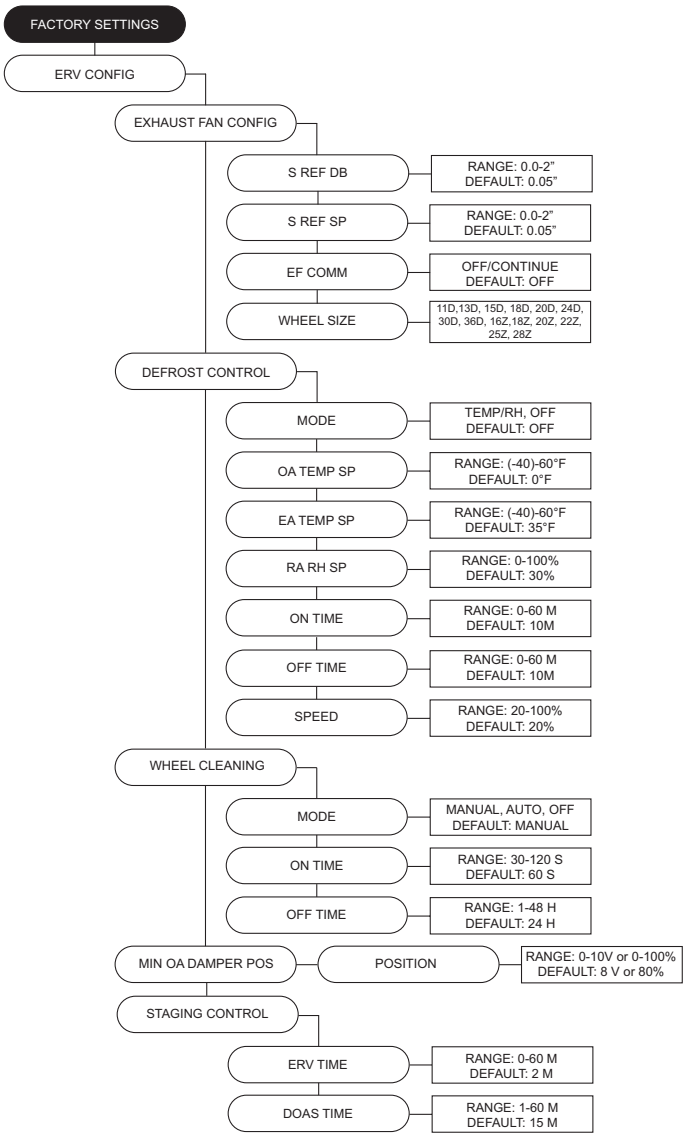
- **S REF DB** - Defines the limits the unit will adjust to keep supply fan reference. Only displayed when Exhaust Fan Control is set to supply reference.
- **S REF SP** - If the pressure difference between the supply and exhaust is greater/less than this set point, the MUA board will attempt to adjust the output voltage until it matches the supply reference set point.
- **EF Comm** - ERV communication loss, dictates functionality of exhaust fan when communication is lost between exhaust fan and ERV.
- **Wheel Size** - Direct drive wheel size selection. The wheel size selection will be utilized for CFM monitoring. Dual blower models will have a '2' assigned after the wheel size model number.

• **Defrost Control** - Optional monitoring and wheel control that will keep frost from forming, or melt the frost if it has formed.
- **Mode** - Selectable activation type for frost control.
- **OA Temp SP** - If Temp/RH defrost is selected, the outside air temp must be below set point for the ERV to enter defrost mode.
- **EA Temp SP** - If Temp/RH defrost is selected, the exhaust air temp must be below set point for the ERV to enter defrost mode.
- **RA RH SP** - If Temp/RH defrost is selected, the return air RH must be above set point for the ERV to enter defrost mode.
- **On Time** - Set time in which the enthalpy wheel spins at the defrost wheel speed setting.
- **Off Time** - Set time the ERV cannot activate into a defrost cycle after a cycle has completed.
- **Speed** - Adjustable speed which the user may set the enthalpy wheel speed during defrost cycle.

• **Wheel Cleaning** - Wheel cleaning settings.
- **Mode** - Selectable activation modes for wheel cleaning cycle.
- **On Time** - Amount of time the cleaning cycle is on when activated. This is only applicable if the wheel clean mode is set to automatic.
- **Off Time** - Amount of time that if the ERV is continuously off will activate a cleaning cycle. This is only applicable if the wheel clean mode is set to automatic.

• **Min OA Damper Pos** - Adjustable set point to dictate when the ERV can activate. The damper must be open more than this setpoint in order for the ERV to activate tempering.

• **Staging Control** - Adjustable time value that corresponds to the staging of the ERV and Roof Top Unit (RTU).
- **ERV Time** - Timer that determines how long the host unit must be at minimum capacity before it stages off and only ERV is used for tempering.
- **DOAS Time** - Timer that determines how long the ERV must be at maximum capacity before the host unit stages on.

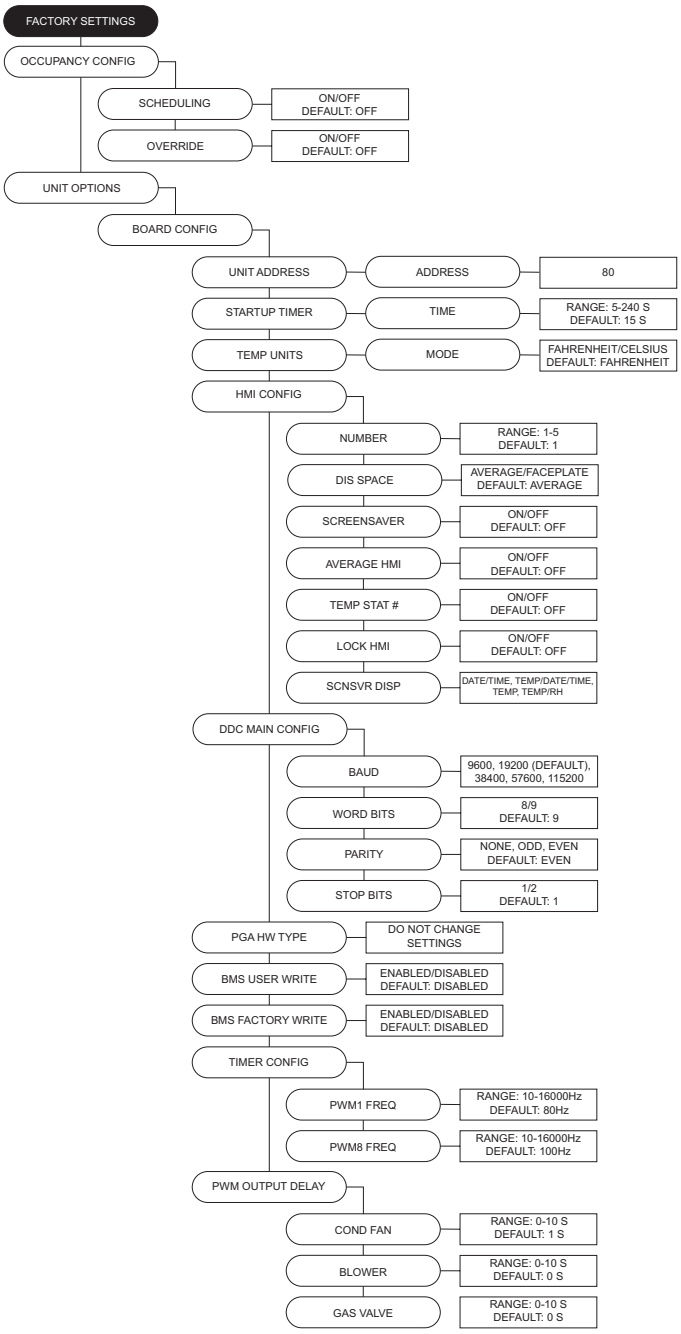


**Occupancy Config**

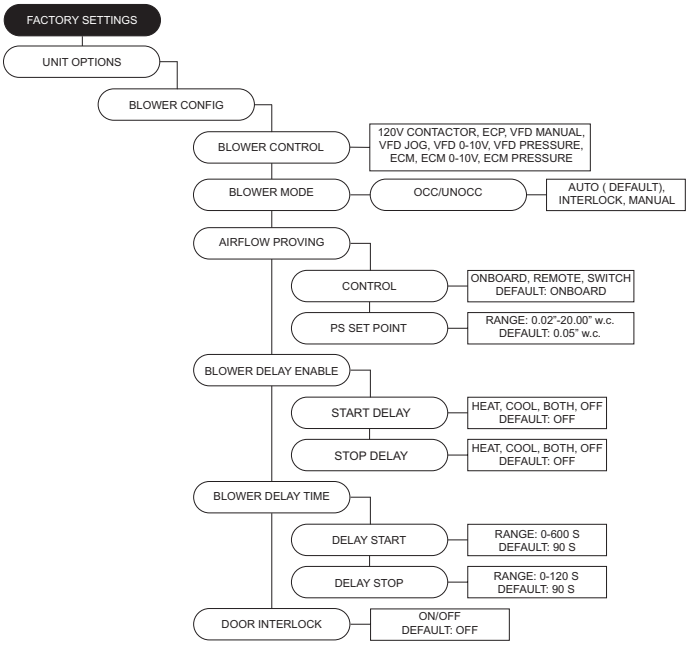
- **Scheduling** - This menu is where scheduling may be turned On or Off.
- **Override** - Allows the user to override the current occupied settings.

Unit Options

- **Board Config**
  - **Unit Address** - Modbus address of the MUA board.
  - **Startup Timer** - Time upon power-up where the board will sit idle.
  - **Temp Units** - Allows the user to set temperature units. Changing between the two will reset all set points. The board will reset as well.
  - **HMI Config**
    - **Number** - The number of HMIs connected to the MUA board. Must always be at least one.
    - **Dis Space** - Select display space temperature option. Faceplate will display the room's current temperature. Average will display an average of all faceplates, excluding HMI in the unit, and all wired space sensor readings.
    - **Screensaver** - If set to Off, the home screen will not time out to the screensaver.
    - **Average HMI** - If there are multiple space HMIs connected, this menu allows you to select which will be included in the space temperature and relative humidity averaging. If a thermistor or relative humidity sensor is connected into the ST screw terminals, it will automatically be averaged into any HMIs included.
    - **Temp Stat #** - On/Off option to turn on temperature averaging for wired HMI thermistors.
    - **Lock HMI** - If the option is set to On, a password (9999) will be required; when screen saver option enabled or any buttons are not pressed for 5 minutes.
    - **Scnsvr Disp** - User may select date, time, and/or temperature/RH to display on the HMI when screensaver is active.
  - **DDC Main Config** - **Network settings should not be changed if the unit is equipped with BACNET**.
    - **Baud** - The baud rate of the Modbus communications.
    - **Word Bits** - The amount of data bits over Modbus communications.
    - **Parity** - Selection for Modbus communications.
    - **Stop Bits** - Selection for Modbus communications.
  - **PGA HW Type** - (DO NOT CHANGE SETTINGS)
  - **BMS User Write** - Allows BMS writing to user settings.
  - **BMS Factory Write** - Allows BMS writing to factory settings.
  - **Timer Config** - (DO NOT CHANGE SETTINGS)
  - **PWM Output Delay** - Delays PWM output for Condensing Fans, Blower, and Gas Valve for smooth modulation.
    - **Cond Fan** - Time setting.
    - **Blower** - Time setting.
    - **Gas Valve** - Time setting.



- **Blower Config**
  - **Blower Control**
    - **120V Contactor** - 120V output on the MUA board to energize the coil of a contactor.
    - **ECP** - This option should be selected when the supply fan VFD is wired to a hood control package control board via CAT5 cable.
    - **VFD Manual** - HMI selectable VFD frequency.
    - **VFD Jog** - For use with VFD using photohelic control. Uses the aux pins to control the VFD. Powering “Aux 1” will speed the fan up, powering “Aux 2” will slow the fan down. When neither “Aux 1” nor “Aux 2” are powered, the VFD will hold current speed.
    - **VFD 0-10V** - For use when an external 0-10V signal is being provided to control the speed of the VFD.
    - **VFD Pressure** - For use when the VFD is controlling speed based on space or duct pressure.
    - **ECM (Electronically Controlled Motor)** – HMI selectable supply fan rate.
    - **ECM 0-10V** - For use when an external 0-10V signal is being provided to modulate the ECM supply output between min and max speed.
    - **ECM Pressure** - For use when the ECM is controlling speed based on space or duct pressure.
  - **Blower Mode**:
    - If the “Occupied Scheduling” is set to On, the menu screen for the blower mode will allow you to choose ON/AUTO/OFF for Occupied or Unoccupied.
    - If the “Occupied Scheduling” is set to Off, the menu screen for the blower mode will allow you to choose MANUAL/AUTO/OFF.
    - In blower AUTO mode, the blower will only run when it gets a call for heating/cooling.
    - In blower ON mode, the blower will run as long as the fan button is enabled regardless of whether the unit is heating/cooling.
    - In blower OFF mode, powering the unit interlock pin will cause the blower to run.
  - **Airflow Proving** - Unit may be set to prove by an external airflow switch, remote 0-10 V input signal, or from the onboard switch (connector J39).
    - **Control** - Onboard, remote, or switch.
    - **PS Set Point** - PS Set Point should be 0.05” w.c. below the lowest static pressure reading that is observed.
  - **Blower Delay Enable** - User may set the blower start/ stop delay to Off/Both/Cool/Heat.
  - **Blower Delay Time** - A time setting delay for the start or stop of the supply blower before/after selected tempering starts/stops.
  - **Door Interlock** - When enabled, a “Door Interlock” fault will display when the blower door is open during normal operation.



- **Fan Proving Config** - Proving for fan operation.
  - **Proving** - When enabled, a fault detected will display when not operating.
  - **Retry** - When enabled, the unit will try to automatically reset upon airflow proving failure. After a second failed attempt, a manual reset will be required.
  - **# Contactors** - Number of exhaust fan contactors.
  - **Exh Fan** - If exhaust contactor fails proving, while “Exh Fan” is set to On, all fans shut down. When “Exh Fan” is set to Alarm Only, only post proving faults but allow fans to keep running.
- **DD Wheel Size** - Selection for wheel size and settings.
  - **Size** - This selection is utilized for CFM monitoring. Dual blower models will have a ‘2’ assigned after the wheel size model number.
  - **K2 Factor** - Used for supply CFM calculations.
- **Blower Presets** - User may set blower preset option On/Off.
- **Occ/Unocc Fan Presets** - After the blower has started, energizing the auxiliary pins will drive the blower to a preset occupied value.
  - Fan Preset Default: 1 = 0Hz, 2 = 40Hz, 3 = 50Hz, 4 = 60Hz, 5 = 0Hz, 6 = 0Hz, 7 = 0Hz.
- **Occ/Unocc PWM Presets** - After the blower has started, energizing the auxiliary pins will drive the blower to a preset occupied value.
  - PWM Preset Default: 1 = 0%, 2 = 80%, 3 = 100%, 4 = 100%, 5 = 0%, 6 = 0%, 7 = 0%.
- **VFD Direction** - Sends a command to the VFD to run in forward or reverse.
- **VFD Freq Limits** - Min to Max settings for fan speed.
- **VFD Current Limit** - This limits the max current to the VFD.
- **PWM Rate Limits** - Min to Max settings for fan speed using ECM.
- **Constant CFM** - When enabled On, blower will modulate to maintain constant CFM.
  - **Max Step** - Modulation adjustment; EC motors = %, VFD = Hertz (HZ).

- **Pressure Config**
  - **Sensor Range** - Menu is available when any blower pressure or mixing box pressure option is selected. This sets the pressure range for the transducers that are wired to the board – possible transducer ranges are +/-15”w.c. or +/-.25”w.c. PS1 is wired to the J31 connector and PS2 is wired to the J16 connector.
  - **Static PS KP** - Proportionally constant value for static pressure measured in V/sec.
  - **Cycle Time** - Cycle time is the time between two consecutive readings.
  - **Static PS Hysteresis** - This is the hysteresis band used for the static pressure set point (SP).
  - **PS Control Types** - Used to assign PS1 or PS2 to exhaust, blower, or damper control. PS1 is the transducer wired to J31 and PS2 is the transducer wired to J16.

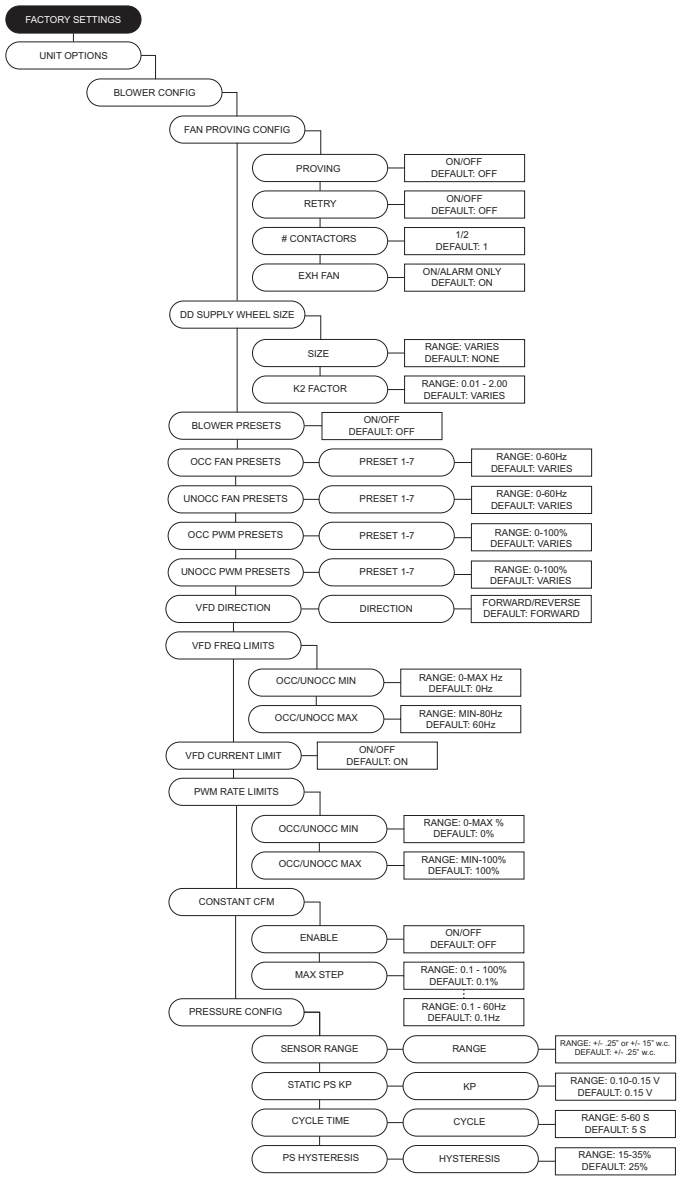


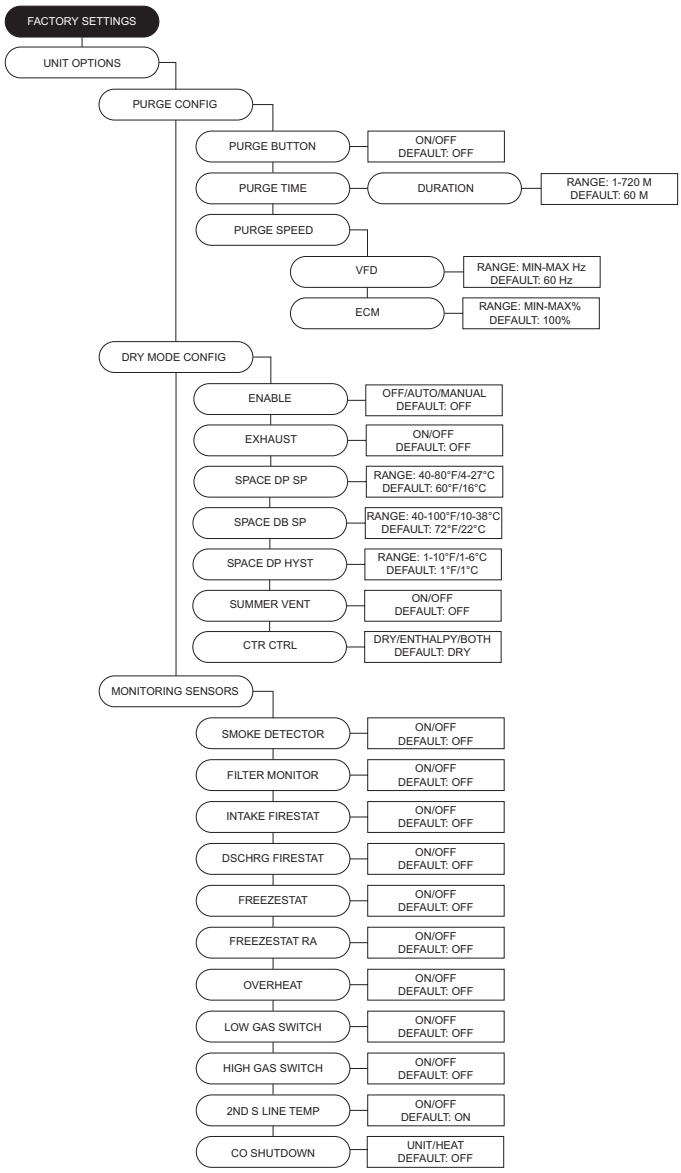

Table 16 outlines the aux pins on Connector J11 for preset settings associated with fan speed and damper position found in Factory Settings > Unit Options.

**NOTE: When dehumidification is enabled (Aux 1), fan or damper preset speeds will not work.**

**Table 16 - Aux Presets**

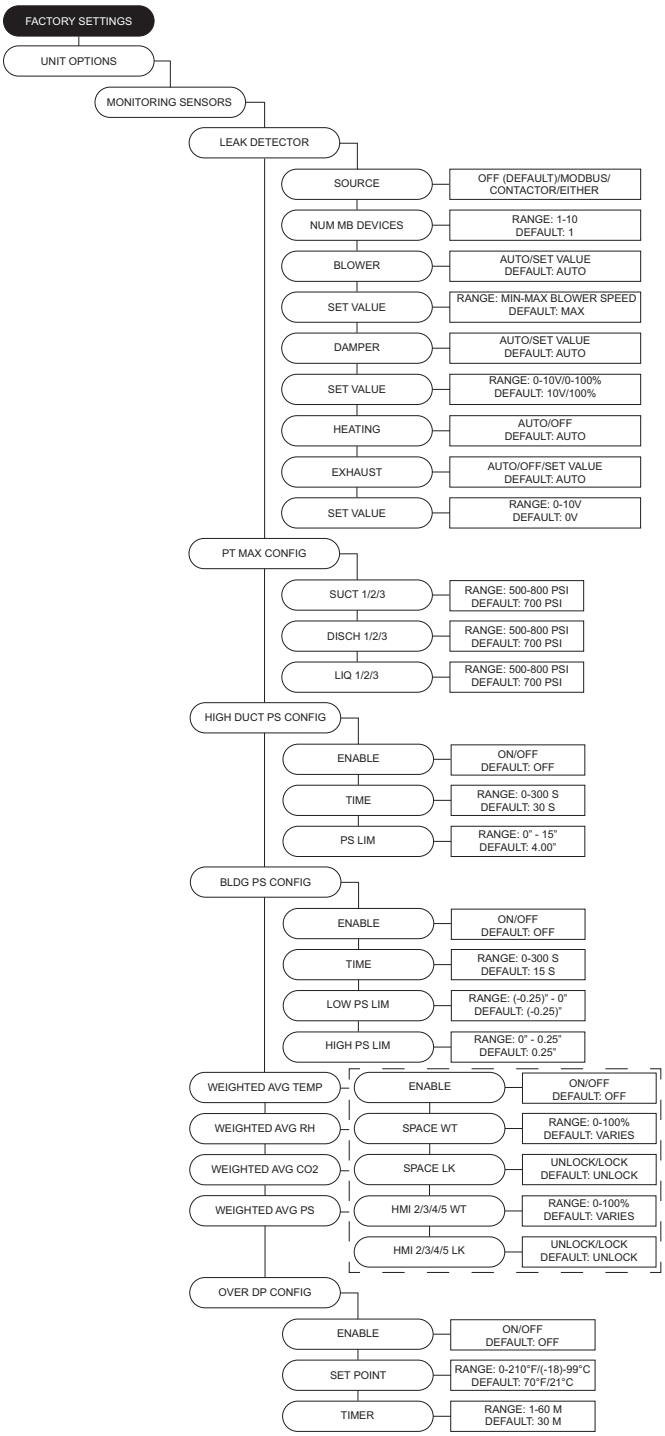
| Presets | Aux 1 | Aux 2 | Aux 3 |
|---|---|---|---|
| Normal Operation (Selected Blower Mode | | | |
| Fan Speed/Damper Position 1 | X | | |
| Fan Speed/Damper Position 2 | | X | |
| Fan Speed/Damper Position 3 | X | X | |
| Fan Speed/Damper Position 4 | | | X |
| Fan Speed/Damper Position 5 | X | | X |
| Fan Speed/Damper Position 6 | | X | X |
| Fan Speed/Damper Position 7 | X | X | X |

- **Purge Config**
  - **Purge Button** - When enabled On, a purge button will be displayed on the HMI. When the purge button is pressed, the damper will open to max outdoor air and turn on the exhaust contactor.
  - **Purge Time** - Amount of time that the unit will run purge process if the user does not stop the purge manually.
  - **Purge Speed** - Adjustable between VFD Min and Max frequency. This is the speed the blower will run during the purge cycle. ECM Purge Speed – Adjustable between PWM Min and Max frequency.
- **Dry Mode Config** - When this option is enabled, dry mode will activate when indoor conditions are above DP setpoint and outdoor conditions are more favorable than indoor conditions. Dry mode will force the damper to 100% OA and energize an exhaust contactor if one is configured.
  - **Exhaust** - Enables/disables exhaust contactor during dry mode.
  - **Space DP SP** - Dew point threshold for automatic dry mode activation.
  - **Space DB SP** - Dry bulb threshold for automatic dry mode activation.
  - **Space DP Hyst** - Hysteresis value applied to dew point setting.
  - **Summer Vent** – When enabled, dry mode activated on a dry bulb temperature instead of DP.
  - **CTR CTRL** - J29-7 will energize per the selected option.
- **Monitoring Sensors** - This menu enables optional components from the factory or when field installed.
  - **Smoke Detector** - Enables for smoke detection.
  - **Filter Mon** - The option may be set to Off, Contacts or Sensor (J31-14). When set to Contacts or Sensor, if the input is active, a fault will be displayed on the HMI.
  - **Intake Firestat** - When enabled, if the intake sensor is above the intake firestat set point, the unit will shut down immediately. Reset manually on HMI.
  - **Discharge Firestat** - When enabled, if the discharge sensor is above the discharge firestat set point, the unit will shut down immediately. Reset manually on HMI.
  - **Freezestat** - When enabled, if the freezestat sensor trips, the unit will shut down immediately. Reset manually on HMI.
  - **Freezestat RA** - When enabled and the freezestat trips, the unit will go to full return air.
  - **Overheat** - When enabled, if the overheat stat fails again, the unit will shut down and display “Overheat Stat Failure.” Reset manually on HMI.
  - **Low Gas Switch** - When enabled, if incoming gas pressure drops below threshold, heating will shut down.
  - **High Gas Switch** - When enabled, if incoming gas pressure rises above threshold, heating will shut down.
  - **2nd S Line Temp** - When enabled, a second suction line sensor will be used for redundancy.
  - **CO Shutdown** - When enabled, if J12-6 reaches 10V, shut down the unit (blower, heating, and cooling).

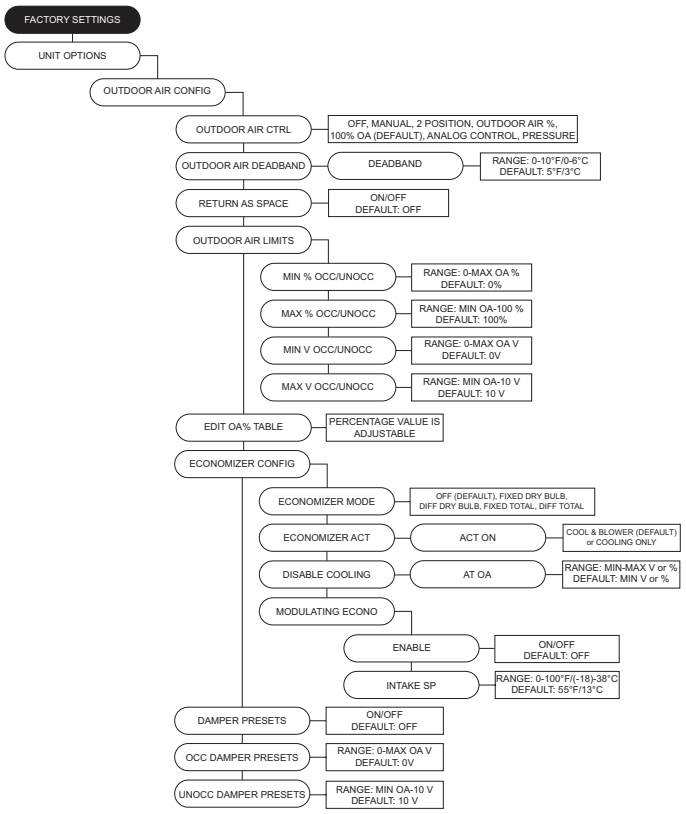


- **Leak Detector** - Enables A2L sensor.
  - **Source** - Off = no leak detection present, Contactor = 24V DC input, Modbus = Modbus Communication, Either = Contactor or Modbus.
  - **Num MB Devices** - Number of leak detectors communicating via Modbus.
  - **Blower** - When Auto is selected, the blower will run at normal design speed. When Set Value is selected, the blower will run at the set value.
  - **Set Value** - Speed the blower will operate at when a leak is detected.
  - **Damper** - When Auto is selected, the damper will open to normal operating setting. When Set Value is selected, the damper will open to the set value.
  - **Set Value** - Position the damper will open at when a leak is detected.
  - **Heating** - When Auto is selected, heating will run at normal operation. When Off, heating will immediately shut off and not operate if a leak is detected.
  - **Exhaust** - When Auto is selected, powered exhaust will run at normal operation. When Off, powered exhaust will immediately shut off and not operate if a leak is detected.
  - **Set Value** - Speed the power exhaust will operate at when a leak is detected.
- **PT Max Config** - Select pressure range for suction line, discharge line, or liquid line sensors.
- **High Duct PS Config** - When enabled, if duct pressure is greater than the set point for longer than the set time, heating/cooling will shut down. A fault will be displayed on the HMI.
  - **Time** - Setting for how long the unit can be outside of its pressure range.
  - **PS Lim**- Duct pressure alarm set point.
- **Bldg PS Config** - Enabled On, if the building pressure is lower/greater than the set point for longer than the set time, heating/cooling will shut down. A fault will be displayed on the HMI.
  - **Time** - Setting for how long the unit can be outside of its pressure range.
  - **Low PS Lim** - Low pressure alarm set point.
  - **High PS Lim** - High pressure alarm set point.
- **Weighted Avg Temp** - Averages Temperature
- **Weighted Avg RH** - Averages Relative Humidity
- **Weighted Avg CO2** - Averages CO2
- **Weighted Avg PS** - Averages Pressure

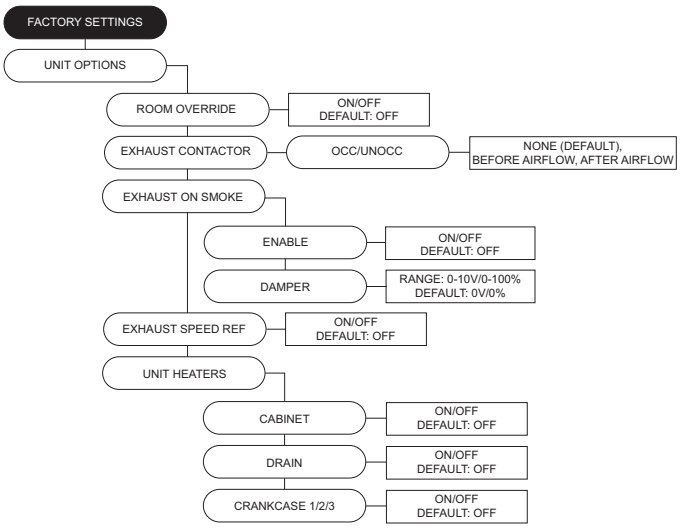
  When Weighted settings are enabled On, weight (WT) and lock (LK) adjustments are active. Use WT to assign Space priority monitoring. Use LK when you want specific WT assignments on certain HMIs.
- **Over DP Config** - When enabled, if discharge DP is greater than over dewpoint set point for the set time, shut down the unit.
  - **Set Point** - Max discharge dew point allowed.
  - **Timer** - Time allowed for DP set point overshoot before unit shutdown.



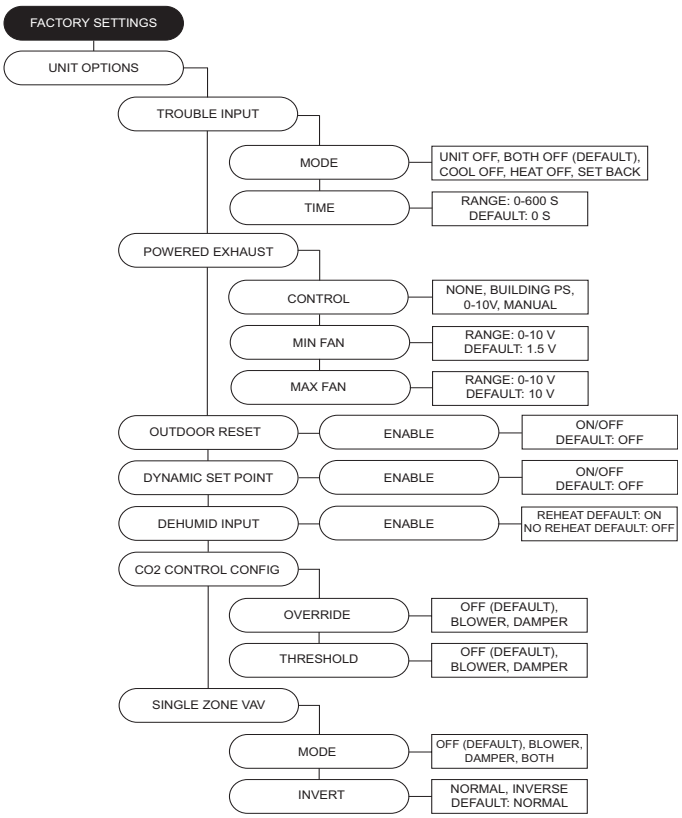
- **Outdoor Air Config**
  - **Outdoor Air Control** - Off, Manual, 2 Position, Outdoor Air %, Analog Control, Pressure, 100% OA.
  - **Outdoor Air Deadband** - If the temperature difference between the outdoor and return sensor is less than or equal to this set point, the MUA board will not attempt to adjust the output voltage until it matches the outdoor air percentage set point. This setting only takes effect when either outdoor air % or schedule is selected.
  - **Return As Space** - Enabled On, unit will utilize the return air temperature and humidity sensor as the space reading.
  - **Outdoor Air Limits** - Min/Max settings for mixing box. % or Volt values based on mixing box selection.
    - **Min/Max Outdoor Air %** - Min/Max allowed outdoor air percentage.
    - **Min/Max Outdoor Air** - Min/Max allowed outdoor air voltage range.
  - **Edit OA% Table** - User may edit values in 1/2 volt increments (0-10V). Volt value corresponds to % value.
  - **Economizer Config** - Refer to **"Economizer" on page 112**.
    - **Economizer Mode** - Off, Fixed Dry Bulb, Diff (Differential) Dry Bulb, Fixed Enthalpy, Diff Enthalpy.
    - **Economizer Act** - Option to set the economizer to activate on cooling only, or cooling and blower.
    - **Disable Cooling** - When the economizer is using an outside air % greater than this setting, mechanical cooling will be disabled.
    - **Modulating Econo** - Mixing box will modulate to meet Modulating Econo > Intake SP.
      - **Intake SP** - Unit will modulate to meet Intake SP.
  - **Damper Presets** - Option to set damper preset voltage option On or Off. Refer to **Table 16 on page 93** for Aux Presets.
  - **Damper Preset Volts** - Adjustable damper speeds.
  - **Occ Damper Presets** - Adjustable occupied damper speeds.
  - **Unocc Damper Presets** - Adjustable unoccupied damper speeds.



- **Room Override** - When enabled On, the unit uses Room Override SP rather than Discharge SP. Use this setting when heat tempering mode = Discharge and “Activate Based On” = Either. If the space is calling for heat, it will use the Room Override SP instead of Discharge SP to heat the space.
- **Exhaust Contactor** - Option to assign a contactor for an interlocked exhaust fan. There is an occupied and unoccupied setting for this.
  - **None**
  - **Before Airflow**: Exhaust fan will start before the airflow proving switch has been activated.
  - **After Airflow**: Exhaust fan will start after the airflow proving switch has proved there is airflow.
- **Exhaust On Smoke** - Input that when enabled, if it receives a 120V signal from a fire system, will shut down the supply fan, enable the exhaust contactor, and drive damper position to exhaust on smoke damper setting.
  - **Damper** - When Outdoor Air Control is set to manual = Volts. When Outdoor Air Control is not set to manual = Percentage. If powered exhaust on fire is enabled, powered exhaust on fire will override the damper position setting.
- **Exhaust Speed Ref** - When enabled On, the exhaust speed will match supply blower VFD.
- **Unit Heaters** - On/Off selection for heater options.
  - **Cabinet** - Heater will activate based on User Settings > Temp Set Points > Cab Heat Set Point
  - **Drain** - Heater will activate based on User Settings > Temp Set Points > Drain Heat Set Point
  - **Crankcase** - Heater will activate based on Factory Settings:
    - Heating Config > Heat Pump Config > Low Ambient Heating/Extreme Low Ambient
    - Cooling Config > Low Ambient Cooling/Extreme Low Ambient



- **Trouble Input** - If connector J28 pin 3 receives 24 volts, the unit will act based on one of the following settings:
  - **Mode**
    - **Unit Off** - Shuts down blower (heating/cooling will also shutdown). Bypass any timers.
    - **Both Off** - Turn off/lockout heating and cooling. Bypass min timers.
    - **Heat Off** - Turns off/lockout heating.
    - **Cool Off** - Turns off/lockout cooling. Bypass min timers.
    - **Set Back** - Forces unit to unoccupied state.
  - **Time** - Turn off/lockout delayed based on time setting.
- **Powered Exhaust**
  - **Control** - Operates on Building PS, 0-10V (external field wiring), or Manual (0-10V board output specified in “User Settings” to exhaust blower).
  - **Min/Max Fan Speed** - The powered exhaust should never go below min speed or above max speed.
- **Outdoor Reset** - Access to setting option On/Off. Scenarios for Outdoor Reset functionality:
  - Discharge Heat Tempering: If outside air is below OA Reset Low set point, heat will discharge to Reset Heat Discharge setting.
  - Space Heat Tempering: If outside air is below OA Reset Low set point, space set point will adjust to Reset Heat Space setting.
- **Dynamic Set Point** - Dynamic functionality will adjust the heating and cooling setpoints based on outside air temperature. When heating: If the measured outside air temperature is below the Dynamic Heat OA set point minus the differential set point, the space or discharge set point will increase by offset. When cooling: If the measured outside air temperature is above the Dynamic Cool OA set point plus the differential set point, the space or discharge set point will decrease by offset.
- **Dehumid Input** - Option associated with units that contain reheat. Set to Off when the unit does not contain reheat, set to On when unit contains reheat.
- **CO2 Control Config** - Monitors CO2 and will adjust blower speed/damper position based on CO2 set point.
  - **Override** - The unit will try to maintain space CO2 Parts Per Million (PPM) levels based on adjustable min/max threshold set points. The unit will modulate the blower/ damper linearly between corresponding set points. **NOTE: If CO2 PPM measurement exceeds the limit set point, unit will provide a ‘CO2 Override’ fault.**
  - **Threshold** - CO2 PPM maximum threshold set points for the space. When the space CO2 PPM reading exceeds the threshold setting, the blower/damper will go to their max setting.
- **Single Zone VAV** - When enabled the blower, damper, or both (depending on settings), will modulate linearly between min and max discharge.
  - **Invert** - In normal operation the blower/damper will go to max speed or position when the heating/cooling/dehumidification capacity is at the max. In inverse operation, the blower/damper will go to max speed or position when the heating/cooling/dehumidification capacity is at the min.



- **Virtual Space Input**
  - **Temp** - Utilizes a virtual space temp reading through the BMS instead of the hard-wired space temp sensor.
  - **RH** - Utilizes a virtual space relative humidity reading through the BMS instead of the hard-wired space relative humidity sensor.
  - **Input Timer** - Utilizes wired sensor if Virtual signal goes stale for timer duration.
- **Pool Room** - Enable this option for pool room applications.
  - **Dew Point** - When above the dew point setpoint (SP), the blower will modulate to the pool room's blower speed setting.
  - **DP Hyst** - Hysteresis value is applied to dew point SP.
  - **Speed** - Blower speed adjustment for high dew point pool rooms.
- **Unit Performance** - Adjustable points for monitoring. For service settings, go to Service > Unit Performance.
  - **CFM** - Design CFM.
  - **Min/Max Duct SP** - Design duct static pressure.
  - **Min/Max Building SP** - Design building static pressure.
  - **Mtr Eff** - Motor Efficiency.
  - **BHP** - Brake Horsepower.
  - **D Freq** - Design Frequency.
  - **D ECM** - Design Percentage.

**Occpd Ovrd (Occupancy Override) Duration** - Length of override timer. If override is active, it can be manually stopped by pressing the end override button on the HMI. The default setting is 1 hour but can be adjusted up to 16 hours.

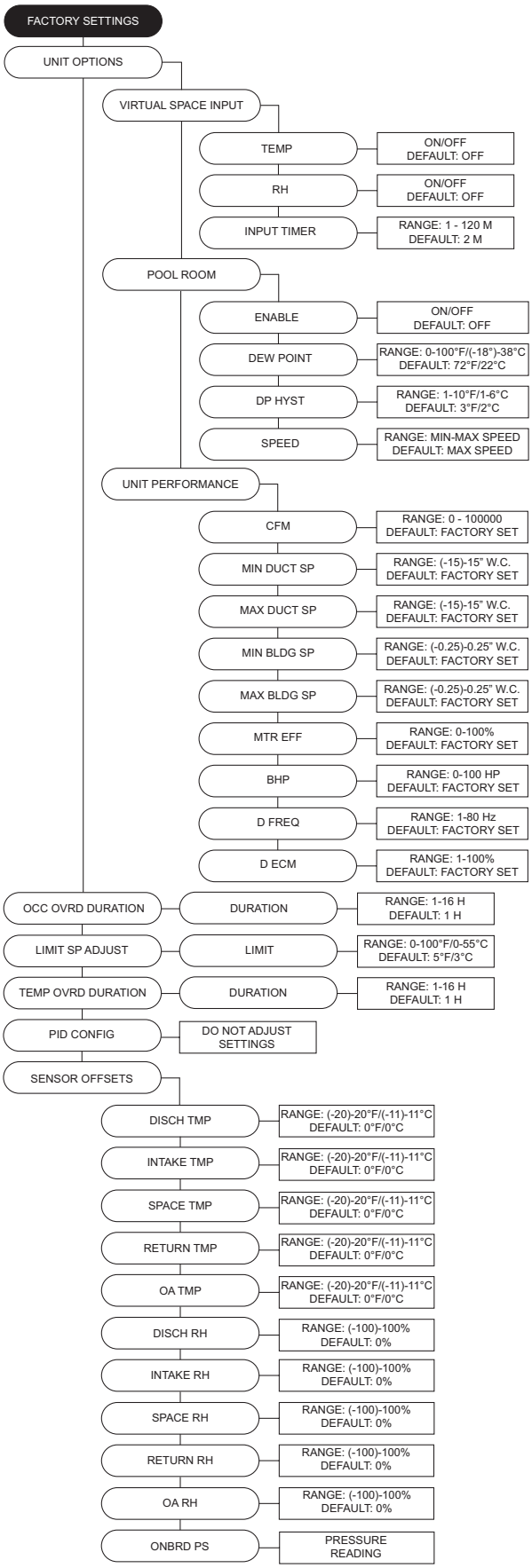
**Limit SP Adjust** - This allows the user to change the current temperature set point through the home screen. The adjustment range can be 0-100 degrees. Default range max is 5F. When the set point is set to 0F, the adjustment buttons (+/-) will not be visible.

**Temp Ovrd Duration** - Length of temperature override timer.

**PID Config** - Protected Parameters (DO NOT CHANGE THESE PARAMETERS)

**Sensor Offsets:** Offsets for temperature, and humidity. These offsets only impact the display and do not impact the value that the logic uses for control. Use when actual readings measured are different from what is being displayed.

- **Disch Tmp/RH** - Displays offset for discharge temperature/ humidity.
- **Intake Tmp/RH** - Displays offset for intake temperature/ humidity.
- **Space Tmp/RH** - Displays offset for space temperature/ humidity.
- **Return Tmp/RH** - Displays offset for return temperature/ humidity.
- **OA Tmp/RH** - Displays offset for outdoor air temperature/ humidity.
- **Onbrd PS** - Displays onboard pressure sensor information. Non-configurable setting.



**SERVICE SETTINGS**

**Job Info** - Non-editable parameters. Displays Job #, Unit #, HMI #, Tag (HMI Name e.g, Office/Hallway/Break Room) entered at the factory.

**Temperatures** - Display monitoring for temperature values.

**RH Values** - Current RH value readings per HMI.

**CO2 Values** - Current CO2 value readings per HMI.

**Pressure Values** - Current Pressure readings per HMI.

**Open/Closed Status** - View open/closed status of all inputs.

**Variable Values** - Monitor all of the variable input and output values.

**Blower VFD Status** - Live parameter feedback from the supply VFD.

**Comp VFD Status** - Live parameter feedback from the compressor VFD.

**Refridge Diag 1** - This allows the user to monitor refrigerant components, pressures, and temperatures for circuit 1.

**Refridge Diag 2** - This allows the user to monitor refrigerant components, pressures, and temperatures for circuit 2.

**Refridge Diag 3** - This allows the user to monitor refrigerant components, pressures, and temperatures for circuit 3.

**Outdoor Air Values** - Displays the high/low airflow limits, and calculated actual outdoor air percentage.

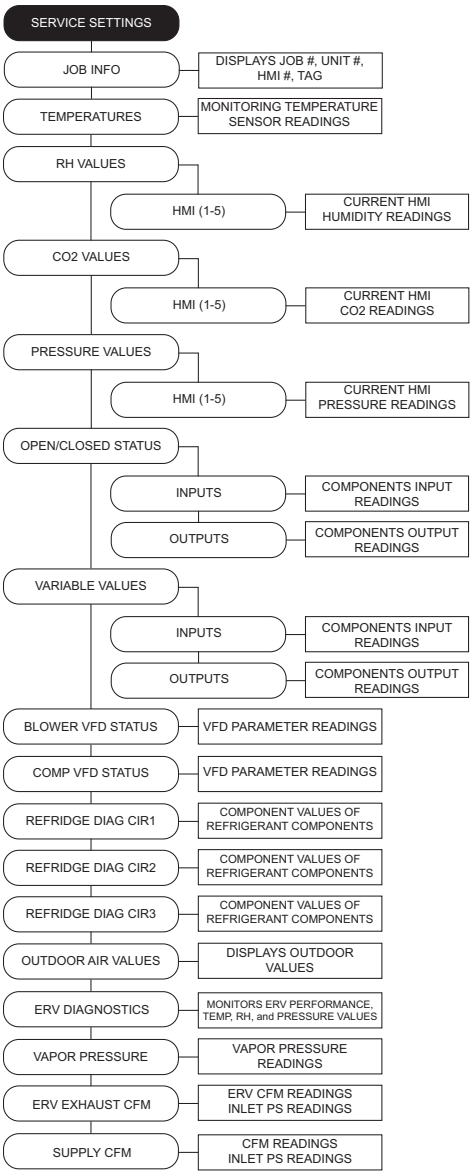
**ERV Diagnostics** - Displays ERV performance and diagnostic values.

- **Current Performance** - Displays ERV state, ERV wheel speed, exhaust fan speed, and wheel differential pressure.
- **Temp and RH** - Displays temperature and RH values for every quadrant. Also calculates enthalpy at every point.
- **ERV Pressure** - Real time values for monitoring ERV pressure parameters. Stores based values for pressure faults. These values can be adjusted manually or through the ERV calibration process.

**Vapor Pressure** - Displays vapor pressure readings.

**ERV Exhaust CFM** - Displays measured ERV CFM readings. This readout is only valid for units with direct-drive wheels.

**Supply CFM** - Displays measured CFM readings. This readout is only valid for units with direct-drive wheels.

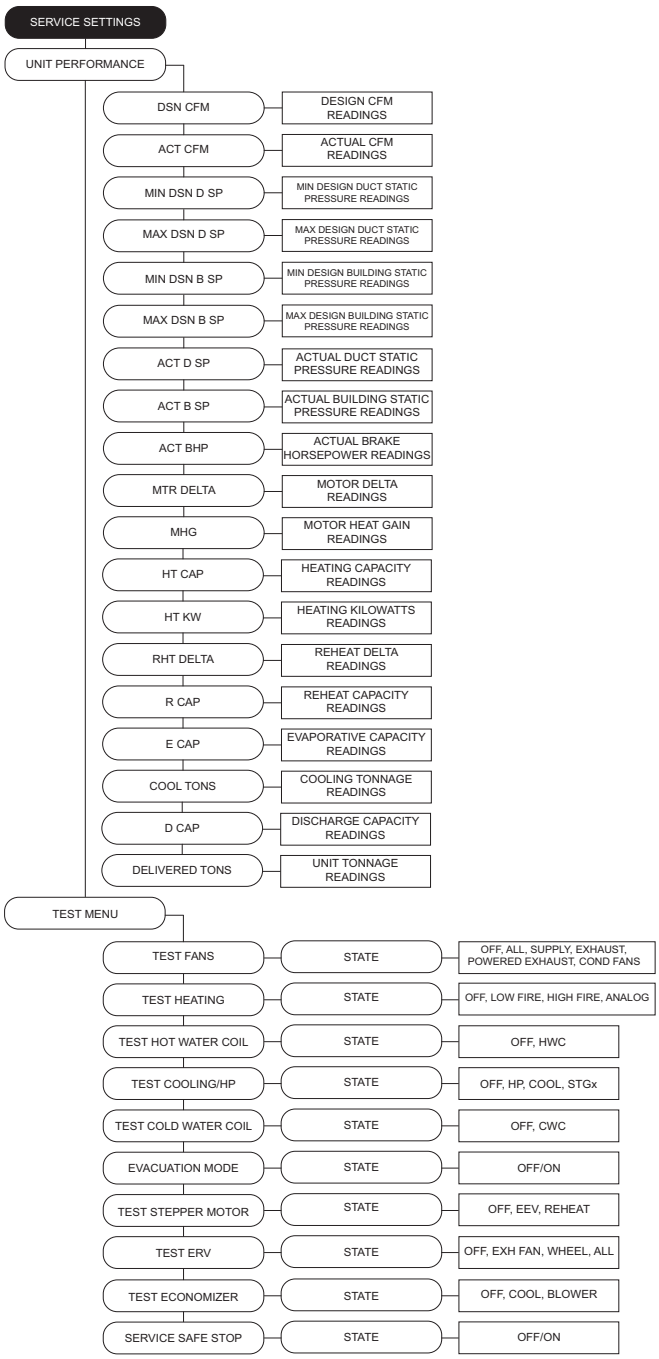


**Unit Performance**- Compares **Unit Options > Unit Performance** to current unit's operational values.

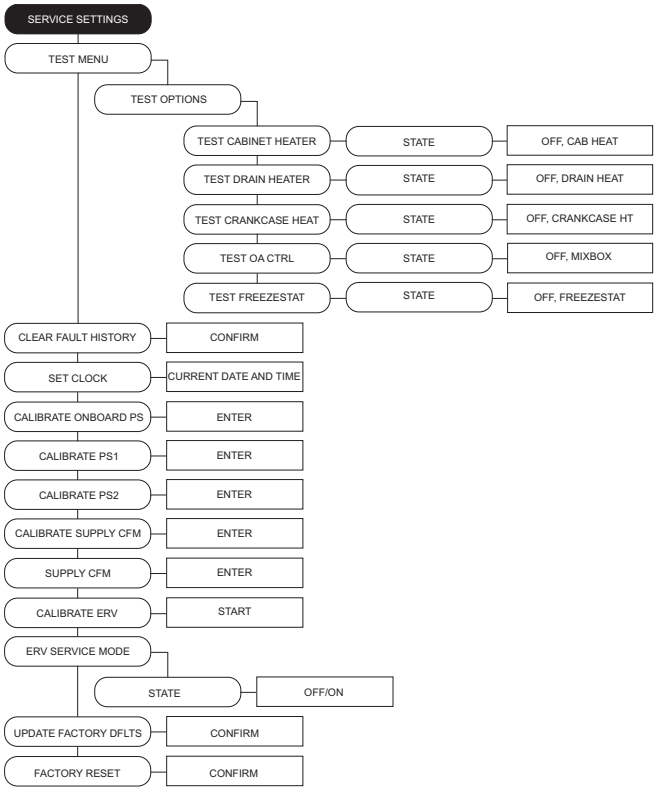
- **Dsn CFM** - Design CFM. Job specific unit CFM.
- **Act CFM** - Actual CFM. Current unit CFM reading.
- **Min/Max Dsn D SP** - Design duct static pressure. Job specific external static pressure.
- **Min/Max Dsn B SP** - Design building static pressure. Job specific external static pressure.
- **Act D SP** - Actual duct static pressure. Current external static pressure.
- **Act B SP** - Actual building static pressure. Current external static pressure.
- **Act BHP** - Actual Brake Horsepower.
- **Mtr Delta** - Motor Delta. Temperature rise caused by motor heat.
- **MHG** - Motor Heat Gain. BTU rise caused by motor heat.
- **HT Cap** - Heating capacity output in MBH.
- **HT KW** - Heating output in kilowatts.
- **Rht Delta** - Reheat Delta.
- **R Cap** - Reheat Capacity.
- **E Cap** - Evaporative Capacity.
- **Cool Tons** - Cooling Tonnage.
- **D Cap** - Discharge Capacity.
- **Delivered Tons** - Unit delivered tonnage.

**Test Menu**

- **Test Fans** - Test operation of unit's fans.
- **Test Heating** - Contains high fire, low fire, and analog monitoring parameters and adjustments for testing.
  - The analog test simulates a voltage input from a BMS system. The test begins at 0 volts.
  - Allows blower and damper modulation.
  - Pressing up/down modulates input.
- **Test Hot Water Coil** - Contains hot water coil parameters and adjustments for testing.
- **Test Cooling/HP** - Contains Heat Pump, Cooling, Stage "X" monitoring parameters and adjustments for testing.
  - Allows blower and damper modulation.
  - Pressing up/down modulates input.
  - Stage selections allows the user to monitor Subcool for Max, Target, and Min readings.
  - Leak detection will simulate a leak in the system, unit will go into leak detection mode.
  - When in the STGx selection, user may test subcool. Test Subcool menu must be set to On. CIRx Subcool Details will be available for monitoring.
- **Test Cold Water Coil** - Contains cold water coil parameters and adjustments for testing.
- **Evacuation Mode** - Only to be used when working on the cooling system. All refrigeration valves in the circuit will be open during evacuation.
- **Test Stepper Motor** - Displays valve position when testing EEV or Reheat valves.
- **Test ERV** - Manually adjustable values when testing ERV Exhaust Fan, Wheel, or All.
- **Test Economizer** - Manually adjustable values when testing in Cool or Blower.
- **Service Safe Stop** - Unit shutdown with pumpdown off.



- **Test Options**
  - **Test Cabinet Heater** - Beginning this test will activate the cabinet heater on.
  - **Test Drain Heater** - Beginning this test will activate the drain heater on.
  - **Test Crankcase Heater** - Beginning this test will activate the crankcase heater on.
  - **Test OA Ctrl** - Beginning this test will create an output to the outdoor air control. The test will begin at 0 volts. Pressing up/down modulates the output.
  - **Test Freezestat** - Test menu will allow user access to adjust set points to verify freezestat operation in various types of ambient conditions.




**Clear Fault History** - This will clear the entire fault history. If there is an active fault when cleared, that fault will show up until it is fixed.

**Set Clock** - Set day and time.

**Calibrate Onboard PS** - Calibrates onboard pressure sensor. Must disconnect all pressure tubes before calibration.

**Calibrate PS1** - Calibrates static pressure sensor input at connector J31 pin 17. Must disconnect all pressure tubes before calibration.

**Calibrate PS2** - Calibrates static pressure sensor input at connector J16 pin 1. Must disconnect all pressure tubes before calibration.

**Calibrate Supply CFM** - Calibrates pressure differential in the venturi to calculate approximate fan CFM. Must disconnect all pressure tubes before calibration.

**Supply CFM** - Calibrates pressure differential in the venturi to calculate approximate fan CFM. Must disconnect all pressure tubes prior to calibration.

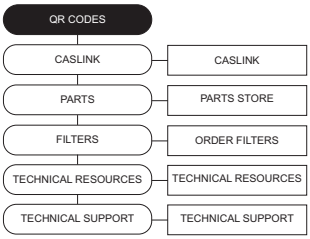
**Calibrate ERV** - Calibrates pressure differentials across all filters and energy wheel.

**ERV Service Mode** - Allows user to control damper, supply, and exhaust fans.

**Update Factory Defaults** - This allows the original factory default settings to be overridden. When confirming the updated settings, these settings will now be used when “Factory Reset” is needed.

**Factory Reset** - Resets board to factory commissioned settings.

## QR Codes




**CASLink** - Provides access to CASLink webpage. The user will need an account to log in to see informations.

**Parts** - Provides access to the online parts store for parts available for product groups on the job number.

**Filters** - Provides access to the online parts store for available filters for product groups on the job number.

**Technical Resources** - Provides access to the online resources page for technical documentation.

**Technical Support** - Provides access to the service page for Technical Support.

# UNIT OPERATION

**WARNING: Gloves and safety glasses must be worn when servicing refrigeration equipment.**

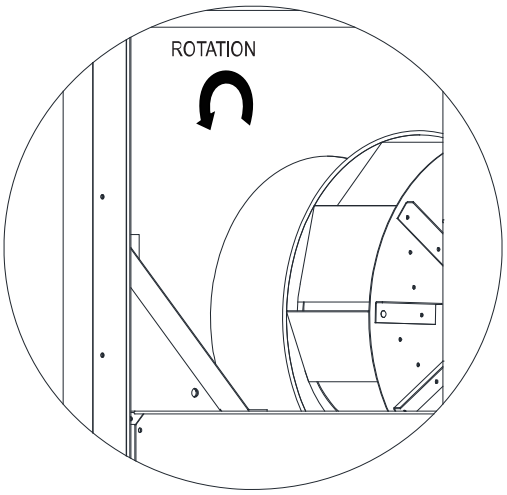
Before starting or operating the unit, verify all fasteners are secure and tight. In particular, check the set screw in the wheel hub. Verify power and gas are **OFF** to the unit. Before connecting the unit to power, turn the fan wheel by hand to verify it is not striking the inlet, or there are any obstructions. Re-center, if necessary.

Special Tools Required for start-up: AC Voltage Meter, Standard Hand Tools, Differential Pressure Gauge, Thermometer, Tachometer, Amperage Meter, Refrigeration Gauge Set

## Start-Up Procedure

1. Check all electrical connections are secure and tight.
2. Inspect the condition of the intake damper and damper linkage, if applicable.
3. Inspect the air-stream for obstructions. Install necessary filters.
4. Verify all drains are connected and routed in the proper positions. For high-efficiency furnaces, verify the condensate drain is connected. Refer to **“Furnace Condensation Drain” on page 23**.
5. Compare the supplied **motor voltage** with the fan’s nameplate voltage. If this does not match, correct the problem.
6. Check the rotation of the wheel motor. Verify the wheel is moving in the direction of the directional arrow (**Figure 49**). Incorrect rotation will result in poor air performance, motor overloading, and possible damage to the motor. If the motor rotation is incorrect, adjust using the HMI panel. Go to: **Factory Settings > Unit Options > Blower Config > Supply VFD Direction > Forward**.
7. When the fan is started, observe the operation and check for any unusual noises.
8. Connect a refrigerant gauge set to the system. Refer to **“Monitoring the A/C System” on page 125**. Verify the high side and low side pressure readings are equal at the initial connection.
9. Monitor the surface temperature with a thermometer.
10. Start and run the unit for approximately 20 minutes.
11. Monitor the manifold gauge, surface temperature, subcool, and superheat readings:
    - Refer to **Table 20 on page 120** to convert the pressure gauge readings to temperature.
    - The subcool reading should be approximately **10-20°F**.
    - The superheat reading should be approximately **20°F**.

**Figure 49 - Direction of Rotation**



## Start-Up Procedure Heating

### Furnace Start-Up Summary

1. Open the field-installed manual gas shut-off valve and ensure the On/Off gas control valve knob is set to 'On.'
2. Check inlets to all firing tubes on the furnace and ensure that they are all clear of foreign debris. Verify that the tubes line up properly with each nozzle of the gas manifold.
3. Start the unit and check the gas supply pressure at the inlet gas gauge, this gauge is upstream of all electronic gas valves. The inlet pressure should be **7 in. - 14 in. wc on natural gas or 11 in. - 14 in. wc on propane gas**. If the inlet pressure is too high, install an additional pressure regulator external to the unit.
4. Verify DIP switches are set correctly on the modulating valve (**Figure 50**). Factory setting for DIP switches is Off. Refer to **Table 17** for DIP switch settings.
5. A final gas leak check shall be performed to verify the gas-tightness of the heater's components and piping under normal operating conditions.
6. At any point during high/low fire burner adjustment, check the characteristics of the flames in every firing tube of the furnace. Non-existence of flame or a lazy flame can be caused by no gas pressure, low gas pressure, a dirty nozzle orifice, or clogged section of exhaust flue.
7. When testing has completed, replace all caps and covers removed during the adjustment procedure.

**Table 17 - Modulating Valve Dip Switch Settings**

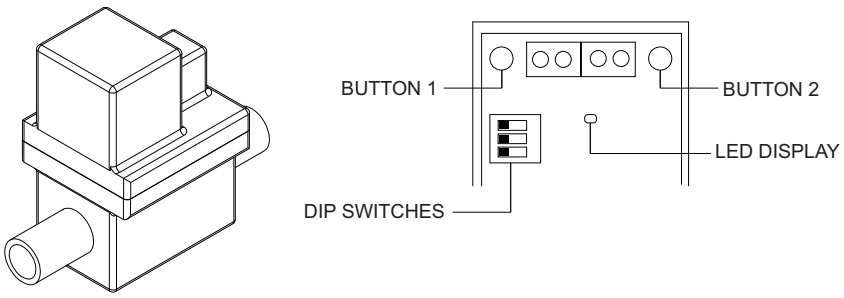
| Control Signal | SW1 Signal | SW2 Offset | SW3 Characteristic |
|---|---|---|---|
| 0-10 V | OFF | OFF | OFF |
| 2-10 V | OFF | ON | OFF |
| 0-2 mA | ON | OFF | OFF |
| 4-20 mA | ON | ON | OFF |

## High Fire Burner Adjustment

1. Set the unit into high fire mode. This is achieved by configuring high fire by going into the HMI's configuration, refer to **"Accessing Menu Configurations" on page 70**. Go to: **Service > Test Heating > State > High Fire**.
2. Verify the furnace(s) are lighting off properly, the manifold gas pressure should be adjusted to jobsite conditions. The gas pressure regulator (integral to the On/Off gas control valve, refer to **Figure 26**) is adjusted at the factory for average gas conditions. The gas supplied to the furnace must be in accordance with the input rating on the rating plate. Once the gas pressure is verified, continue to step 3.
3. If the unit is set up for analog control, continue with high fire using the method above or send the unit a constant 10V DC or 20mA signal. Refer to **Table 17**.
   - Remove the cover on the modulating valve (**Figure 50**). Read the manifold gas pressure gauge (0-10 in. wc) located directly on the gas manifold. The pressure should read **3.5 in. wc** for natural gas / **10 in. wc** for propane. If the pressure is incorrect, adjust the pressure.
   - To adjust the pressure, press button #1 until the LED lights solid red. Release the button. The valve is now in high fire setting mode.
   - Buttons #1 and #2 are used to set high fire setting. Press once to step or hold to auto step.
4. If the proper (**in. wc**) gas pressure cannot be achieved by adjusting the modulating gas valve, and it has been verified that the inlet gas pressure is within the acceptable range of **7 - 14 in. wc on natural gas and 11 - 14 in. wc on propane gas**, adjust the regulator on the On/Off gas control valve. Use a screwdriver to **turn the inner adjustment screw clockwise to increase the gas pressure, refer to "Gas Conversion Instruction" on page 35.**
5. Save the high fire setting by simultaneously holding down buttons #1 and #2 until the blinking LED turns off.

**IMPORTANT: WHENEVER HIGH FIRE IS ADJUSTED ON THE REGULATOR OR MODULATING VALVE, LOWFIRE MUST BE ADJUSTED OR RE-VERIFIED.**

**Figure 50 - Modulating Valve and Controls**




## Low-Fire Burner Adjustment

1. Lock the unit into low fire mode. This is achieved by configuring low fire by going into the HMI's configuration, go to: **Service > Test Menu > Test Heating > State > Low Fire**.
2. Press and hold button #2 on the modulating valve until the LED light blinks red. Release the button. The valve is now in low fire setting mode.
3. Press button #1 to increase flow or press button #2 to decrease flow.
   - The desired pressure reading for natural gas is **0.15 in. wc** If this cannot be obtained, set the low fire pressure as low as possible.
   - The pressure reading for propane gas should be **0.75 in. wc**
4. Save the low fire setting by simultaneously holding down buttons #1 and #2 until the blinking LED turns off.

## Final Start-Up Procedure

1. With the air and burner systems in full operation and all ductwork attached, measure the system airflow.
2. Once the proper airflow is achieved, measure and record the fan speed with a reliable tachometer. **Caution - Excessive speed will result in motor overloading or bearing failure**. **Do not set fan RPMs higher than specified in the maximum RPM chart**.
3. Measure and record the **voltage** and **amperage** to the motor and compare with the motor nameplate to determine if the motor is operating under safe load condition.
4. Check for any obstructions, tools, or hardware that may cause damage when unit is in full operation.
5. Make sure all access panels are in place and secure.

## Sequence of Operation

### Operation Summary - Gas Heating

When there is a call for heat, the main blower is turned “On” and the airflow switch is proven.

- The Flame Safety Controller (FSC-1) sends 120V AC power to the line input of the power vent blower.
- The Power vent blower is controlled by pin J17 on the control board. This varies a signal to the powervent blower motor to initiate a 1 min pre-purge at high speed.
- 24V AC signal runs through the safety circuit (Power Vent Airflow Switch/High Temperature Limit/Flame Roll-out Switch) and into FSC-1.
- FSC-1 initiates Trial for Ignition by sending a signal to the spark igniter to light the furnace and 24V AC power to the On/Off gas valve. This opens the On/Off gas valve and the modulating valve.
- Flame is sensed by FSC-1’s remote flame sensor at the firing tube of furnace.
- HMI’s 17-second high-fire off-delay time sequence runs out, and a variable voltage is sent to the power vent blower motor.
- The control board continues to modulate the heat output of the unit by adjusting the 0-10V DC signal to the modulating gas valve.

**NOTE: If a high turndown furnace is present, this sequence occurs with FSC-2 if the call for heat dictates a need for a second furnace.**

There are different options for controlling the temperature output of these units. These include Discharge Temperature Control, Space Temperature Control, Analog Control, and Direct Digital Control (DDC). In all cases, the MUA board controls the amount of gas to the burner based on the signal from the temperature control components. When the modulating gas valve is all the way open, achieving the maximum BTUs and temperature rise of the unit, the unit is in high fire.

**Discharge Control**: When used in discharge control, the MUA board receives a call to heat from the intake sensor, the MUA board will modulate the discharge temperature until it hits the desired set point. The user can choose whether discharge heating is activated based on intake temperature, space temperature, either, both, or stat.

**Space Control**: When the space control option has been selected, there may be an HMI (that contains an internal temperature sensor) or a space thermistor. The user can choose whether the space heating is activated based on intake temperature, space temperature, either, both or stat.

**Scan for DDC Application Guide**

**Analog Control/Direct Digital Control (DDC)**: A 0-10V DC or 0-20mA signal is sent to the MUA board from the building control system to regulate the heating output of the unit. Refer to **DDC Application Guide** for more information.

### Modulating Gas System

The Modulating Gas System consists of an Intake Temp Sensor, a Discharge Temp Sensor, a Space Temp Sensor (only on space temperature control options), and modulating gas valve(s). The intake air sensor, the space sensor, or a combination of the two can be used to give a call for heat signal to the MUA board.

The MUA board uses a PID loop and checks the difference between the temperature sensor readings in order to modulate the heat appropriately.

- For kitchen MUA heating applications, intake air set point should be set at 45°F, whereas the discharge set point should be set at 55°F. The defaults may be adjusted per field conditions.
- For all other applications, the set point should be set appropriately based on end-user preferences and on-site conditions.

### High Temperature Limit

One of the backup safety devices is the high-temperature limit lockout. This temperature sensor measures the temperature inside the unit, downstream of the burner. If the factory-set temperature of °F is exceeded, it will signal the FSC to turn off the burner. This requires a manual reset of the high-temperature limit. Refer to **“Resetting Unit” on page 165**.

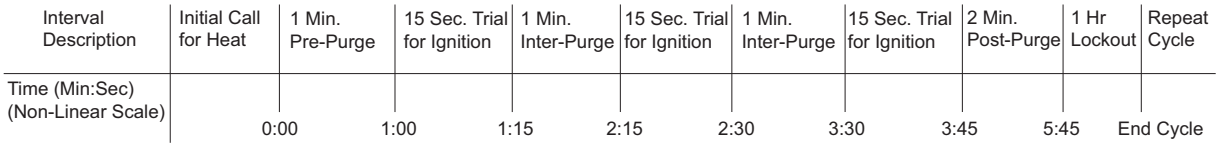
## Flame Safety Control (FSC)

The Flame Safety Control (FSC) is present ***only*** to monitor the flame, **NOT** to control temperature.

The FSC uses a sensor mounted at the intake of the upper-most firing tube of the furnace to sense the existence of a flame. The FSC controls the opening of the solenoid gas valve, and the operation of the spark igniter to initiate a flame upon start-up. When there is a call for heat, the LED on the FSC is energized, indicating that the unit has power. Then, there is a one-minute pre-purge. The power vent blower on the furnace is sent to high speed to exhaust any gas in the Heat-exchanger/Control Cabinet that may be present before trial for ignition. As soon as the pre-purge has initiated, the FSC checks that airflow is sensed by the power vent airflow switch and that the High Limit and Roll-out switches are not tripped.

Upon successful sensing of induced power vent airflow, continuity of temperature limit, and roll-out switches, the FSC initiates a **15-second** ignition sequence. During this ignition sequence (**Figure 51**), the FSC opens the On/Off gas valve and allows gas to pass through to the gas manifold. At the same moment, the spark igniter begins to spark, causing the electrode on the burner to ignite the gas. This results in a flame at the lowest firing tube of the furnace. This immediately ignites the flow of gas in each succeeding firing tube moving vertically until the entire furnace is lit. When the sensor detects the flame at the intake of the uppermost firing tube, the FSC continues to power the On/Off gas valve until there is a loss of flame presence. This is the normal operating mode.

**Figure 51 - Ignition Sequence**




## Modulating Stage Sequence

The modulating stage operates differently than other On/Off staged furnaces. Instead of being “On” or “Off,” the gas flow to this furnace is modulated up and down to account for varying calls for heat during the unit’s operating period. In addition, the speed of its power vent blower is varied as the gas flow changes to maintain constant combustion efficiency over the entire firing range.

The modulating furnace power vent blower is controlled by an on-board speed controller, located on the MUA control board. Voltage to the motor is based on a **0-10V DC** signal. The output voltage (True RMS) to the motor varies non-linearly between **120V AC** @ **10V DC** for high fire and **86.5V AC** @ **0V DC** for low fire.

## MUA Board and High Fire Start

The MUA board compares a difference between two sensor values and set points; or compares a **0-10V DC** or **0-20 mA** signal from an analog control to the modulating furnace. The signal is linearized such that input voltage is directly proportional to amount of gas being delivered to the modulating valve.

To ensure proper light-off in all conditions, the MUA board contains software that forces the modulating furnace to light at high-fire when that furnace’s main gas valve is first opened. There is a built-in timer that allows it to send a constant **10V DC** signal to the modulating gas valve, and power vent blower speed controller. This will force the furnace into high-fire for a period of **17-seconds** after the initial spark is sent by the FSC. After this forced high-fire light-off period has expired, the modulating furnace’s power vent blower and modulating gas valve will receive a modulating signal from the MUA board.

## Re-Circulating Control Options

The ratio of outdoor to indoor air in the discharge supply air can be adjusted through the MUA board output. The board will output a **0-10V DC** signal to command the position of the damper. There are several options for controlling the position of this damper. Use the HMI panel to change options:
**Factory Settings > Unit Options > Outdoor Air Config> Outdoor Air Ctrl**

## Powered Exhaust

The powered exhaust fan is located by the intake damper assembly and is designed to prevent the building from over pressurizing. When there is excessive static in the building's return ductwork, the powered exhaust fan will assist exhausting air directly outdoors to balance the building's internal pressure. The powered exhaust fan will actuate depending on the outdoor air configuration's settings and supply fan activation.

## Outdoor Air Configuration

When Outdoor Air % or Schedule is selected, "Outdoor Air Deadband" will be active. This setting checks the delta T between outdoor and return air. If the difference between these two temperatures is less than or equal to the dead band setting (default setting is 5 degrees), the MUA board will not alter its output to the damper assembly.

**Off** - Outdoor air control from the control board will not output a signal. May be used when damper is controlled by a photohelic gauge or a Building Management System (BMS).

**Manual** - The fresh air dampers can be manually controlled from the HMI panel corresponding to a 0-10V DC output signal from the control board. This output voltage signal can be manually adjusted. This will allow the user to manually set the dampers to match the building ventilation requirements.

**2 Position** - The fresh air dampers can be controlled by a two-position switch (a field-supplied switching device) to select closed position or 100% open. The control board sends out a constant 10V DC signal to the actuator. The field supplied switch will break or make the signal from the control board to the outdoor air damper. When the switch is used to disconnect power (open the circuit), or if a power failure occurs, or if the control board is shut-off, the return air damper will open by spring return. If using a two-position switch, connect in series to the control board at connection A+ and D+.

**Outdoor Air %** - The dampers can be controlled from the HMI to position the dampers from 0% to 100% fresh air. The MUA board utilizes an internal algorithm to alter its 0-10V output to the damper assembly to maintain an exact outdoor air percentage.

**100% OA** - If this damper control is chosen, anytime the blower is running, the damper will be fully open. The board logic will send 10 volts to open the damper. When there is no call for the blower, the board logic will send 0 volts to close the damper.

**Analog Control -** When this is set to ON, the damper will modulate linearly between the min and max OA voltage for both occupied and unoccupied modes.

**Pressure Control** - Damper position will modulate to maintain building pressure. Building pressure below the set point will increase the amount of outdoor air supplied to increase pressure.

**NOTE: When Scheduling is enabled, separate occupied and unoccupied set points will be available for outdoor air control settings.**

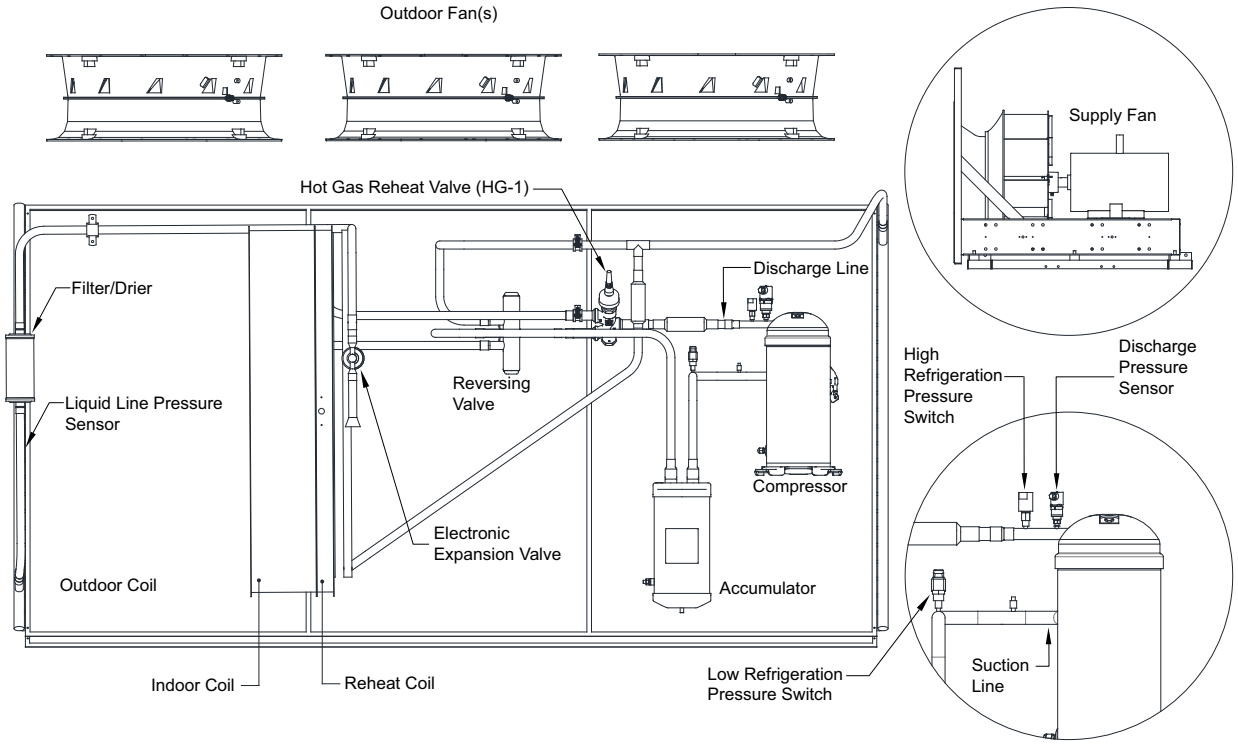
## Programmable Thermostat

The programmable thermostat can be set off the discharge sensor set point. This allows the unit to modulate for the programmed space set point. An example would be, if the discharge set point is set for 65°F, and the space calls for heat/cooling cycle, the unit will modulate to meet the discharge set point.

The thermostat can also work off blower mode. This setting will look at the intake air temperature. The unit will modulate to avoid bringing in too hot or too cold of air into the space.

## Heating, Cooling, Defrost, and Reheat

**Figure 52 - Heat Pump with Reheat Option**




**NOTE: Figure 52 is one example of many configurations offered.**

Air velocity should be maintained between 200 and 550 fpm through the indoor coil.

**Heating cycle (heat pump)**

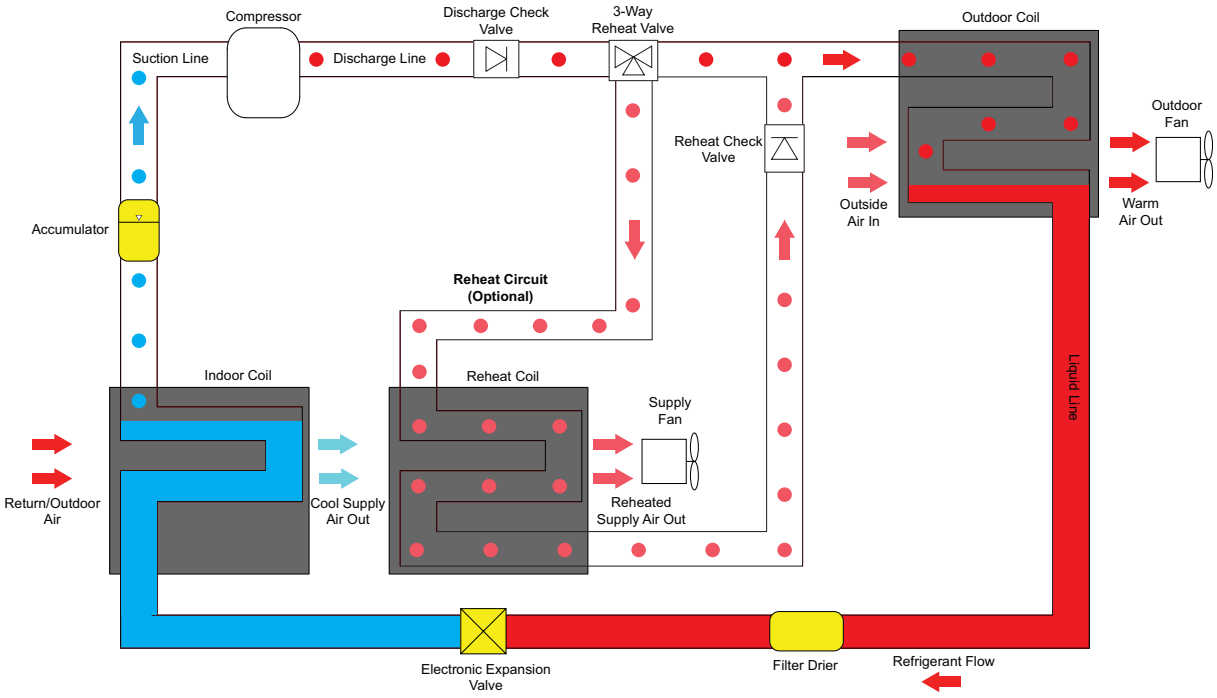
- In heating mode, the outdoor coil acts as the evaporator coil. When the thermostat calls for a heating sequence, the reversing valve is automatically powered. The compressor and outdoor fan start. The heating system is now in operation. Once the thermostat is satisfied, the system will shut down.
- The compressor pumps out high pressure refrigerant vapor. The vapor leaves the compressor, and then through the energized reversing valve.
- The refrigerant then flows through the indoor coil. Supply air removes heat from the refrigerant vapor, warming the indoor air and heating the building. When enough heat is removed, the vapor condenses into a high pressure liquid. The liquid temperature is slightly warmer than indoor air temperature. The liquid refrigerant then passes through an Electronic Expansion Valve (EEV), reducing its pressure and temperature, then passes through a filter/drier. The filter/drier adsorbs water and filters system contaminants.
- As the cool, low pressure liquid refrigerant enters the outdoor coil, it expands and absorbs heat from the outdoor air passing over the finned surface. Heat from the outdoor air causes the low pressure liquid to evaporate into a cool vapor.
- The cold refrigerant vapor passes through the outdoor vapor line to the reversing valve. The reversing valve directs refrigerant into the accumulator. The accumulator holds a liquid refrigerant and oil mixture, and controls flow back to the compressor. The liquid refrigerant and oil mixture are metered back to the compressor through a small orifice near the bottom of the accumulator.
- The refrigerant vapor passes through the suction line to the intake of the compressor. The cycle then repeats.

### Cooling cycle

**Figure 53** is a basic representation of the cooling cycle.

- When the cooling sequence is initiated, the compressor and outdoor fan start. The cooling system is now in operation. Once the thermostat is satisfied, the system will shut down.
- The compressor pumps out high pressure refrigerant vapor (discharge line). The vapor leaves the compressor. If the unit is a heat pump, the vapor will pass through the de-energized reversing valve.
- The vapor flows through the discharge line to the outdoor coil. Air from the outdoor fan removes heat from the refrigerant vapor. When enough heat is removed, the vapor condenses into a high pressure liquid. The liquid temperature is slightly warmer than ambient air temperature. This warm, high pressure liquid leaves the outdoor coil and flows through the copper refrigerant line. The liquid passes through a filter/drier. The filter/drier adsorbs water and filters system contaminants.
- At the end of the line, the refrigerant passes through an Electronic Expansion Valve (EEV), reducing its pressure and temperature.
- As the liquid, under reduced pressure, enters the indoor coil, it expands and absorbs heat from the indoor air passing over the finned surface. Heat from the indoor air, causes the low pressure liquid to evaporate, and cools the indoor air. The refrigerant is now a cool vapor.
- Refrigerant vapor passes through the insulated vapor line. If the unit is a heat pump, a reversing valve will direct refrigerant into the accumulator. The accumulator controls liquid refrigerant and refrigerant oil flow back to the compressor. Refrigerant vapor passes through the suction line to the compressor. The cycle then repeats.

**Figure 53 - Cooling Cycle**



**Defrost cycle (heat pump)**

- In heating mode, the outdoor (condensing) coil acts as the evaporator coil. Moisture from the outside air condenses on the outside coil, and normally runs off. During the colder part of the heating season, this moisture freezes. This frozen moisture blocks air movement through the coil. A defrost cycle needs to be run to remove the frost.
- The defrost control detects the buildup of ice on the outdoor coil. The reversing valve will direct hot gas from the compressor to the outdoor coil. This starts the defrost process.
- The outdoor fan stops to prevent cold air from being passed onto the outdoor coil while hot refrigerant is in the outdoor coil.
- When the defrost control has detected the ice has melted, the defrost mode will end. The reversing valve shifts to the heating position. Hot refrigerant gas is then sent to the indoor coil. The outdoor fan operates, and the unit is now in normal heating mode.

**Reheat cycle (cooling only)**

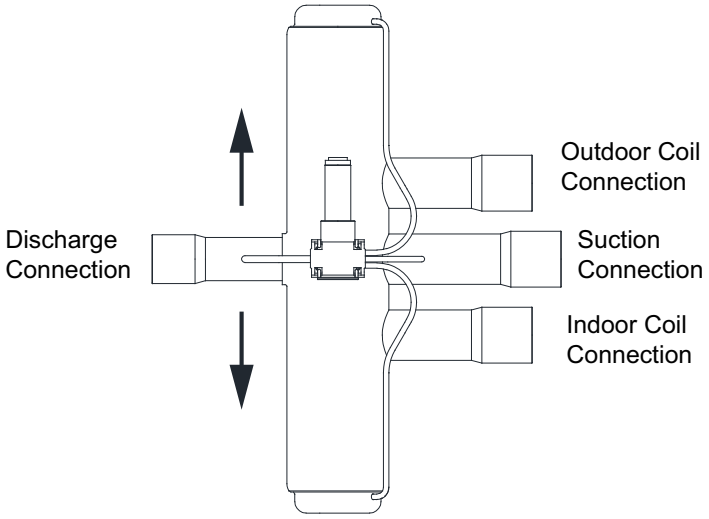
- During the reheat cycle, a portion of the hot gas from the compressor enters the reheat coil and then is fed into the discharge line to the outdoor coil.
- The air is cooled and dehumidified as it flows across the indoor coil. It is then reheated by the reheat coil to lower the relative humidity.

**Reversing valve for heating/cooling (heat pump)**

When the unit is set up to run as a heat pump, the reversing valve is activated before the compressor starts. The reversing valve will de-energize if there is a call for cooling. Refer to **Figure 54** for details.

- When the internal valve is de-energized (down), the unit will be in cooling mode.
- When the internal valve is energized (up), the unit will be in heating mode.

**Figure 54 - Reversing Valve**



## Economizer

Economizer type sets the type of economizer logic that will be used. This feature will control the economizer using a **0-10V DC** signal output on the MUA board. The table below shows option selections and definitions.

Use the HMI to select Economizer type. Go to **Factory Settings > Unit Options > Outdoor Air Config > Economizer**.

**Table 18 - Economizer Options**

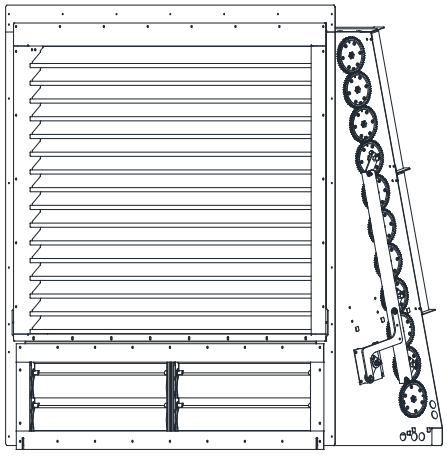
| Option | Definition |
|---|---|
| Fixed Dry Bulb | The economizer will modulate open if the outdoor air temperature is less than the economizer temperature set point. The modulation occurs from the current damper position to fully open over a specific temperature range (determined by the economizer temperature band value). |
| Differential Dry Bulb | The economizer will modulate open if the outdoor air temperature is less than the return air temperature. The modulation occurs from the current damper position to fully open over a specific temperature range (determined by the economizer temperature band value). |
| Fixed Total | The economizer will modulate open from the current position if the outdoor air dew point temperature is less than the economizer dew point set point, and the outdoor dry bulb temperature is less than the economizer temperature set point. The dew point set point is calculated using the economizer temperature and humidity set points. The modulation occurs from the current damper position to fully open over a specific dew point temperature band. |
| Differential Total | The economizer will modulate open from the current position if the outdoor air wet bulb temperature is less than the economizer dew point set point, and the outdoor dry bulb temperature is less than the economizer temperature set point. If the return dew point is less than the dew point set point, the unit will use the return dew point as the beginning of the modulation band. The modulation occurs from the current damper position to fully open over a specific dew point temperature band. |

### Disable Cooling

This allows the user to set the Outdoor Air (OA) percentage through the damper assembly (**Figure 55**) when mechanical cooling is disabled.

Refer to **“Psychrometric Chart” on page 113** for economizer operation and logic.

**Figure 55 - Damper Assembly**

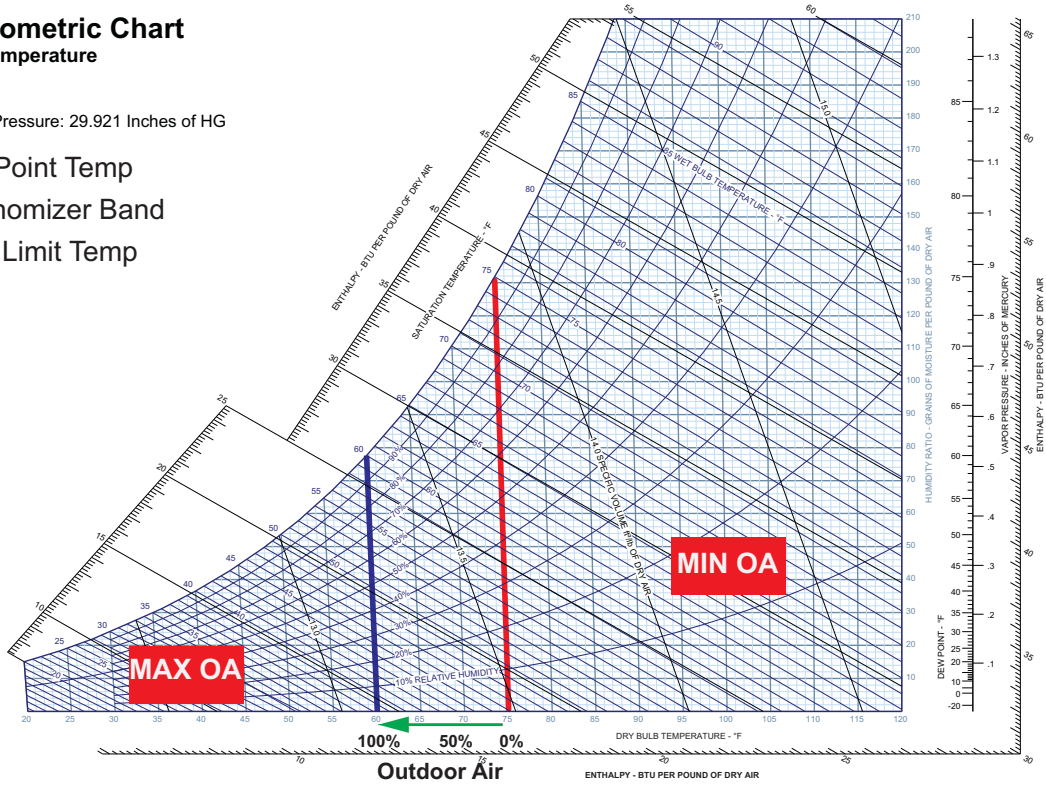


# Psychrometric Chart

## Fixed Dry Bulb Economizer

**Psychrometric Chart**
**Normal Temperature**
I-P Units
**Sea Level**
Barometric Pressure: 29.921 Inches of HG

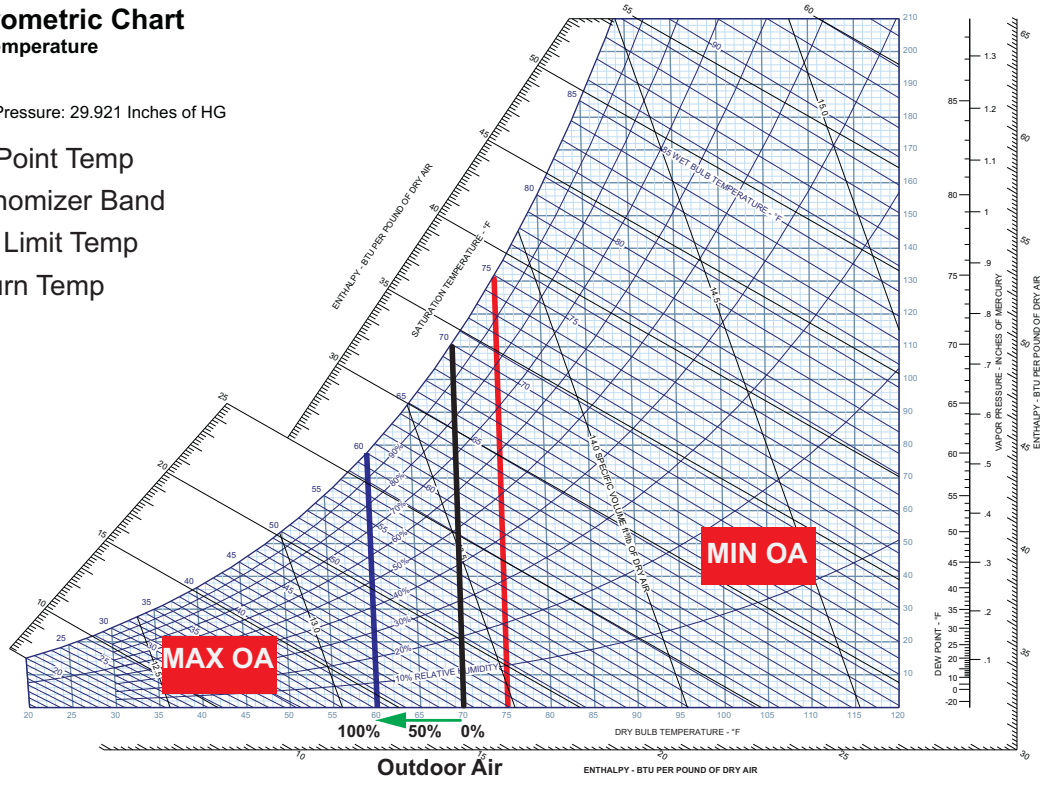
- Set Point Temp
- Economizer Band
- Low Limit Temp




## Differential Dry Bulb Economizer

**Psychrometric Chart**
**Normal Temperature**
I-P Units
**Sea Level**
Barometric Pressure: 29.921 Inches of HG

- Set Point Temp
- Economizer Band
- Low Limit Temp
- Return Temp

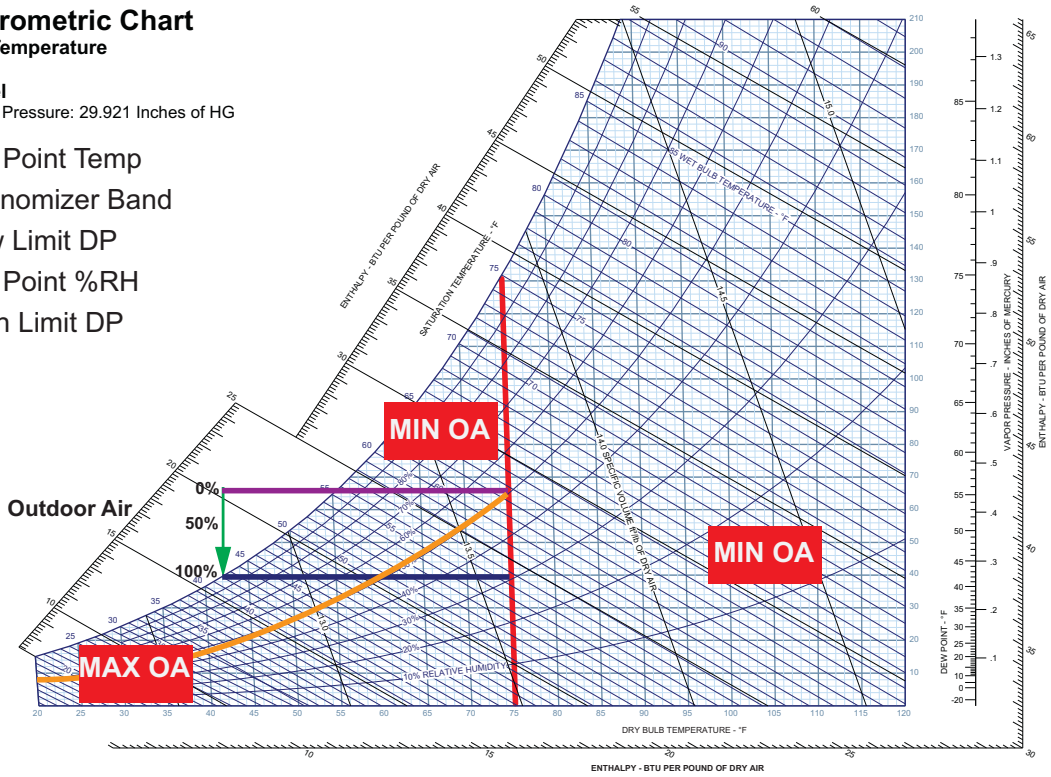


## Fixed Total Economizer

### Psychrometric Chart

**Normal Temperature**
I-P Units
**Sea Level**
Barometric Pressure: 29.921 Inches of HG

- Set Point Temp
- Economizer Band
- Low Limit DP
- Set Point %RH
- High Limit DP

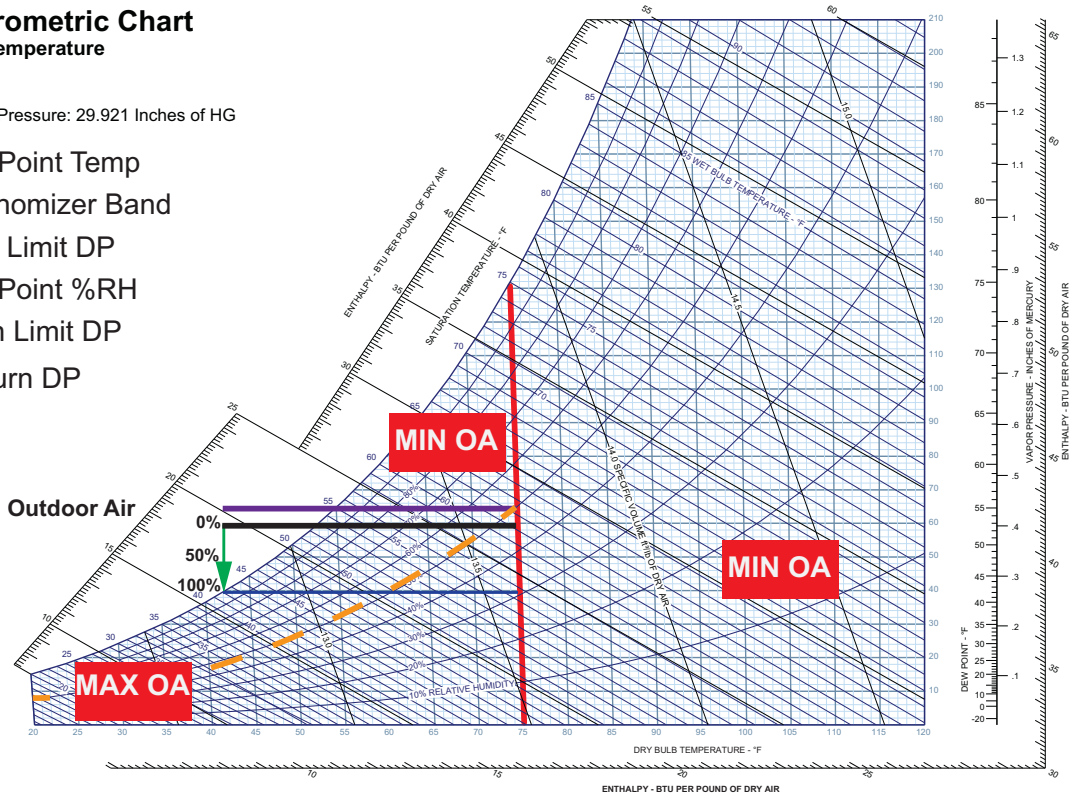



## Differential Total Economizer

### Psychrometric Chart

**Normal Temperature**
I-P Units
**Sea Level**
Barometric Pressure: 29.921 Inches of HG

- Set Point Temp
- Economizer Band
- Low Limit DP
- Set Point %RH
- High Limit DP
- Return DP



## Hydronic Heating/Cooling (Optional)

The Hydronic Heating Coil is located below the blower with field-piped connections in the bottom of the electrical cabinet. The Inlet and Outlet are both labeled accordingly, and there are factory installed ball valves and drains for maintenance.

The Chilled Water Coil is located upstream of the blower with field-piped connections located in the chilled water compartment. The Inlet and Outlet are both labeled accordingly.

Refer to **Figure 56** for Hot Water and Chilled Water connection locations.

It is important to prevent the water from freezing to protect the coil and pipes from cracking. If the cooling circuit is not in use during winter, the water can be drained from the coil and the piping. There are drains located at the bottom of each coil and vents located at the top of each coil. Drains are also located near the ball valves. Glycol can also be used in the water to lower the freezing point. Refer to **Table 19** for glycol percentage to freezing point.

**Figure 56 - Hydronic Connections**

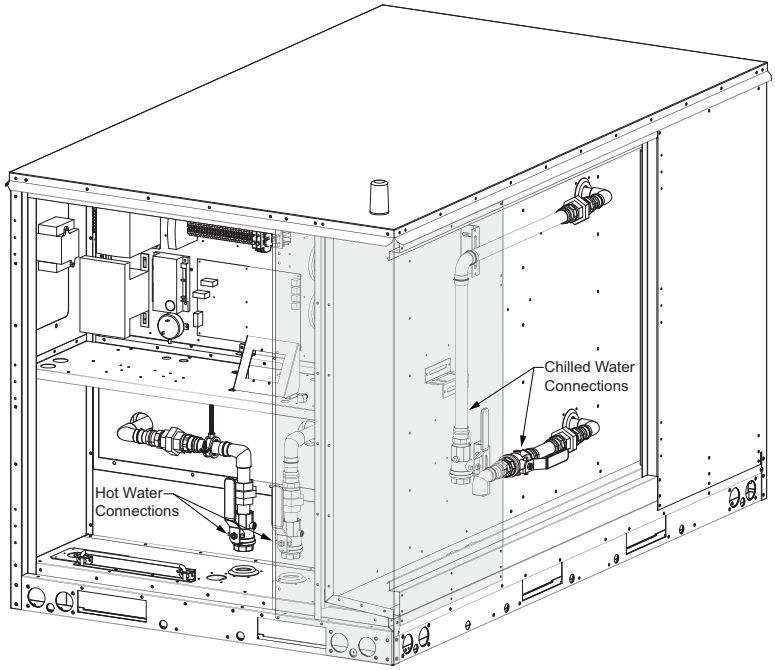



**Table 19 - Glycol Percentage vs. Freezing Point**

| % Ethylene Glycol by Volume | Freezing Point Temperature (°F) |
|---|---|
| 0 | 32 |
| 10 | 25 |
| 20 | 16 |
| 30 | 3 |
| 40 | -13 |
| 50 | -34 |
| 60 | -55 |

| % Propylene Glycol by Volume | Freezing Point Temperature (°F) |
|---|---|
| 0 | 32 |
| 10 | 26 |
| 20 | 19 |
| 30 | 8 |
| 40 | -7 |
| 50 | -28 |
| 60 | -60 |

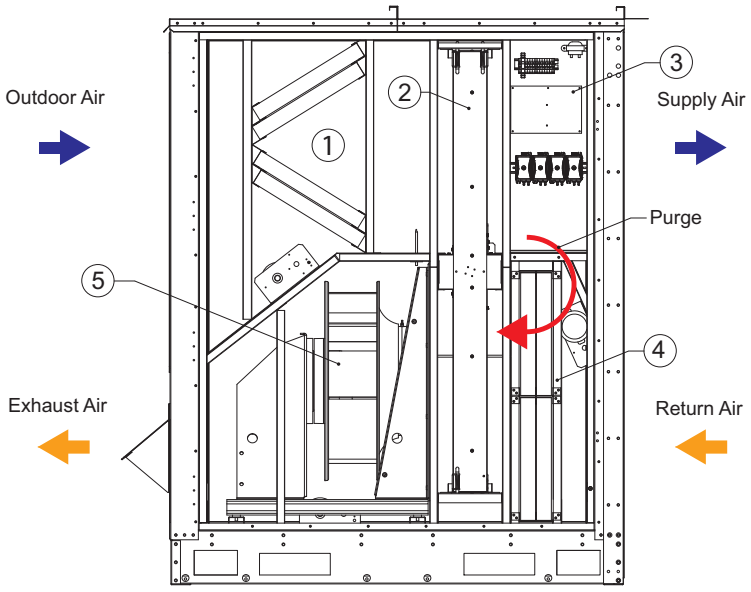
## Energy Recovery (Optional)

The Energy Recovery (Enthalpy) Wheel is assembled and installed from the factory. Minimal maintenance will provide years of trouble-free service.

If the unit is equipped with the optional enthalpy wheel, energy recovery is provided by pulling outside air across half of the wheel and moving exhaust air across the other half. Latent heat and sensible heat are moved from the hotter and moist exhaust air to the colder and dry outside air during winter conditions. Latent heat and sensible heat are transferred from the hotter and moist outside air to the cooler and dry exhaust air during summer conditions. Enthalpy control comprises of starting and stopping the exhaust fan, modulating the speed of the exhaust fan, starting and stopping the enthalpy wheel, and optionally controlling the speed of the enthalpy wheel. If required by outdoor air conditions, the outdoor damper is controlled in the normal manner. **Figure 57** provides details for components associated with the enthalpy wheel.

**Figure 57 - Energy Recovery Wheel Overview**

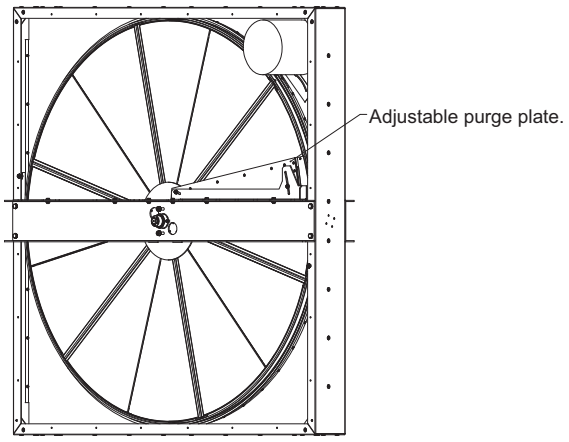
1. Outdoor Air Filtration
2. Energy Wheel
3. ERV Controls
4. Return/Exhaust Filtration
5. ECM Exhaust Fan




## Purge and Pressurization

Pressurization is critical to minimize crossover from exhaust to supply and to allow the purge to operate properly. Move the adjustable purge plate (**Figure 58**) up to increase purge and minimize crossover.

**Figure 58 - Purge Details**



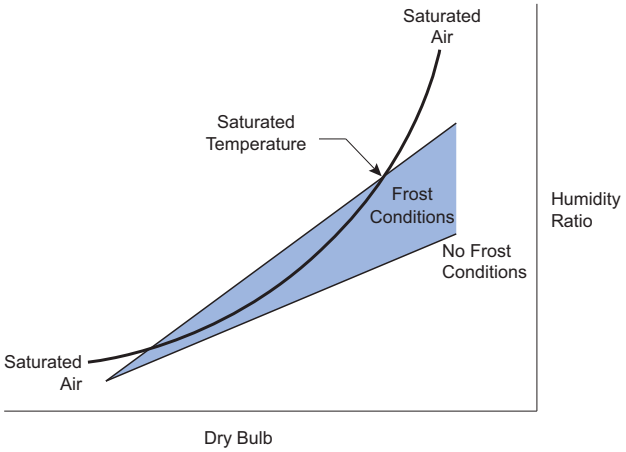
### Drive Motor

The enthalpy wheel comes standard with a variable speed drive motor, which is pre-wired to turn in the proper direction. The motor can adjust speed to lower the enthalpy's wheel capacity during frosting conditions. This lowered capacity allows the wheel to recover energy still while preventing frosting. During non-frosting conditions, the modulation of the wheel allows enhanced capacity control of wheel for greater turn-down and more precise discharge control.

### Frost Protection (Optional)

**Figure 59** illustrates frost prevention conditions. During extremely cold winter conditions, the wheel can frost overdue to the moisture content of the return/exhaust air. A frozen wheel will increase static pressure and reduce efficiency of the wheel. If the wheel fully freezes, the host unit can be starved of supply air. To avoid this situation, the recovery wheel comes standard with a variable speed motor that modulates down during frosting conditions.

**Figure 59 - Frost Prevention Psychrometric Chart**




### Variable Speed Frost Prevention

When there is a threat of frost on the enthalpy wheel, the wheel is slowed down so that less enthalpy transfer occurs, and frosting of the wheel is avoided. Frosting can occur on the enthalpy wheel when the exhaust air leaving the wheel is saturated. This condition occurs when the energy transfer and saturated air lines intersect on a psychrometric chart, and it does not occur when these two lines do not intersect.

## Energy Recovery Exhaust Hoods

Units with the optional energy recovery module have an exhaust hood. Each hood is factory installed over the barometric relief, allowing the unit to function in adverse weather without the risk of water/debris infiltration.

## Exhaust Fan

Unit utilizes an integral ECM exhaust fan that features various control modes to optimize energy transfer and ensure proper air movement. Exhaust cabinet features barometric relief that seals when the exhaust fan is not powered. This will allow for return air to be utilized when the ERV is off.

## Slide-Out Wheel

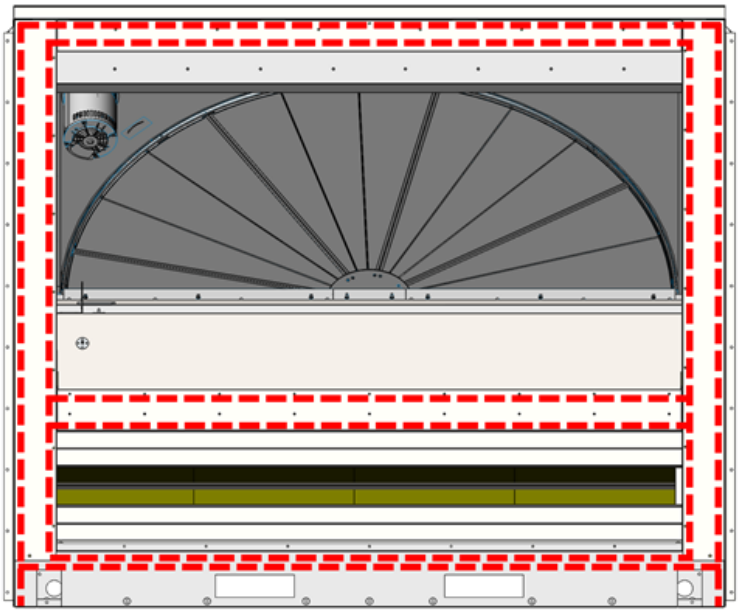
The wheel can be pulled out to facilitate cleaning and servicing. Power wires for the wheel will need to be unfastened from the lid of the module to allow the full range of motion necessary to service the wheel.

## Field Installation of Large ERVs

Due to their larger size, all size 4 ERVs are shipped loose and must be mounted and wired in the field. This section and **Figure 60** through **Figure 63 on page 119** cover the install and wiring process for large ERVs. These larger ERVs will have hardware bags and gasket rolls placed inside before shipping. Such units should have the gasket applied to the mating side as shown in **Figure 60**.

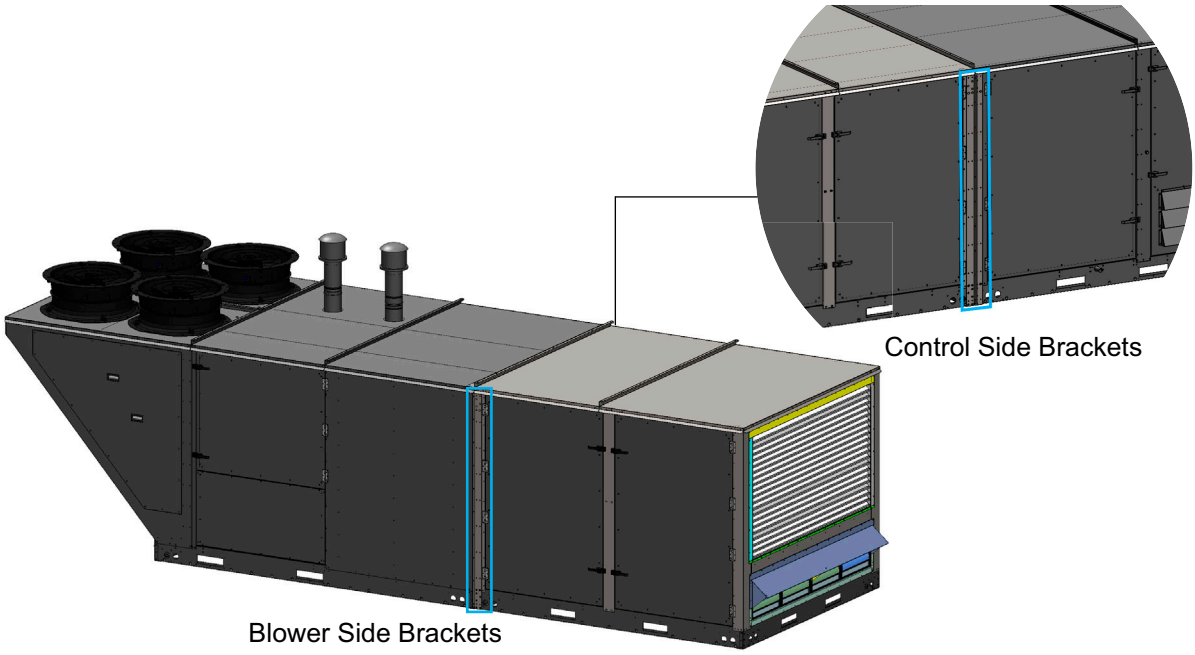
If the unit is not gasketed already, add gasketing to the marked lines on the mounting side of the ERV before installation (**Figure 60**). Ensure that any joints between gasket strips are silicone to guarantee water cannot travel between the strips.

**Figure 60 - ERV Gasket Outline**



Next, align the ERV with the RTU unit. Ensure that the marked brackets (**Figure 61**) are aligned and pushed as close together as possible.

**Figure 61 - ERV Mating Profile**

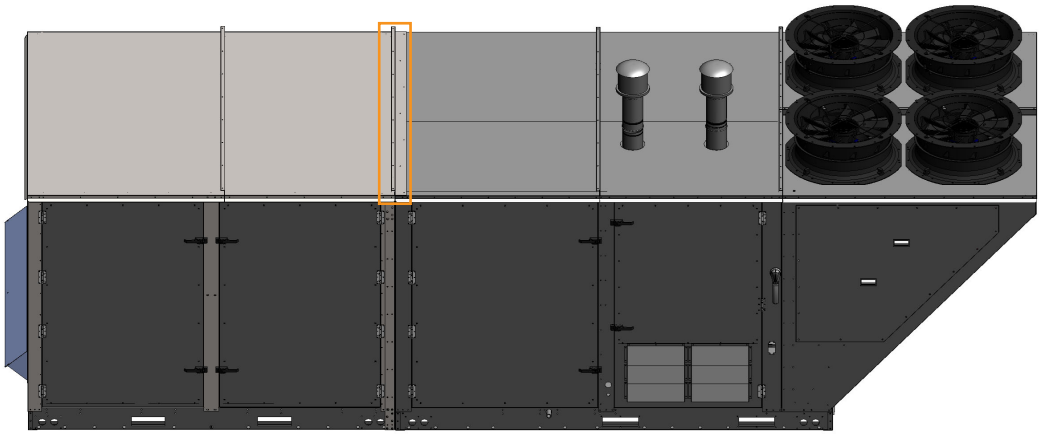


After the units are positioned correctly, push the bolts through the aligned holes on the side mounting brackets and hand tighten the nuts on the other side. **BOTH SIDES MUST HAVE THE BOLTS INTALLED AND HAND TIGHTENED.**

Working around the unit (from side to side), uniformly tighten the bolts to bring the modules together. Ensure the gasket between the two mating surfaces are compressed. **FAILURE TO DO SO CAN RESULT IN POOR SEALING AND WARPED METAL ON THE UNIT.**

Once the ERV has been mounted tight against the RTU, place the top mating bracket over the exposed raised flange on the ERV lid (**Figure 62**). Liberally apply silicone to all points of contact between the mating bracket and lids. Rivet the mating bracket to the raised flange of the ERV lid. Use 1-1/2” (max) rubber-washer self-tapping screws to attach to the lid of the RTU.

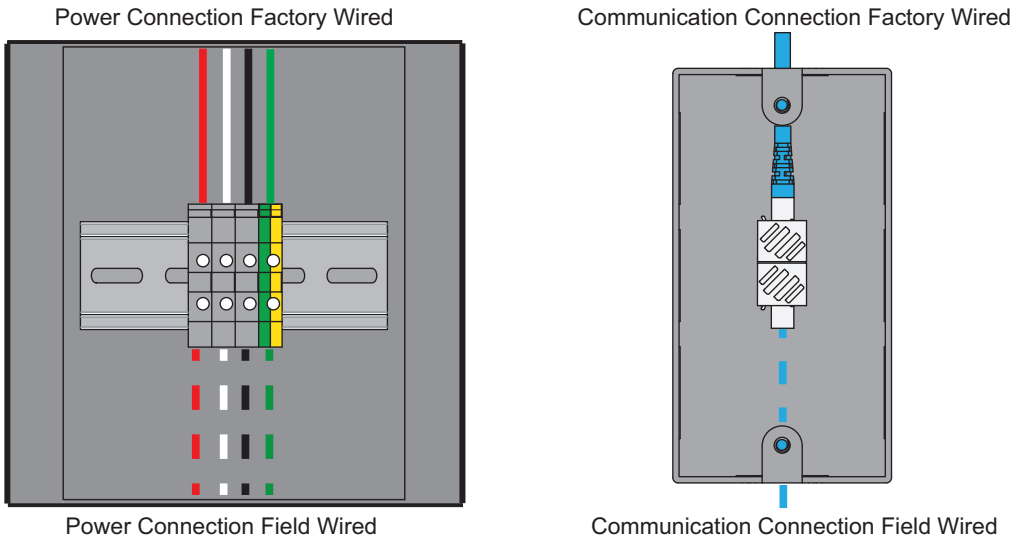
**Figure 62 - ERV Top Lid**



With the ERV fully attached, the power and communication wires must be connected (**Figure 63**). **MAKE SURE THE UNIT HAS NO POWER TO ITS MAIN DISCONNECT BEFORE CONTINUING**.

The ERV will have junction boxes in the lower right of the module relative to the control panel. The largest junction box will have a set of terminal blocks for incoming power. Two cable bundles that require field wiring will be spooled and stored in the return opening of the RTU. The larger junction box will have terminal blocks for incoming power for the ERV module. The smaller junction box will have a CAT5 cable with a coupler. Connect the supplied CAT5 cable from the RTU to the coupler. With this done, restore power to the RTU and verify the ERV powers up and can communicate with the main board in the RTU unit.

**Figure 63 - ERV Electrical Connections**



## Superheat and Subcooling

### Superheat

When determining superheat (vapor pressure), use **Table 20** to convert the low side pressure gauge (suction line) to the appropriate temperature. Subtract the converted temperature from the suction line surface temperature. There should be approximately a **20°F** difference. Superheat monitors what state the refrigerant is when it leaves the evaporator coil. High superheat indicates the refrigerant has picked up more heat than designed. Low superheat indicates the refrigerant has not picked up enough heat and can cause flooding in the compressor. If superheat is incorrect, verify subcool first before making changes to the system.

**Table 20 - R454B Pressure Temperature**

| Temperature (°F) | Liquid Pressure (PSIG) | Vapor Pressure (PSIG) | Temperature (°F) | Liquid Pressure (PSIG) | Vapor Pressure (PSIG) |
|---|---|---|---|---|---|
| -40 | 9.5 | 8.4 | 70 | 190.5 | 183.1 |
| -35 | 12.7 | 11.4 | 75 | 206.5 | 198.7 |
| -30 | 16.2 | 14.8 | 80 | 223.4 | 215.2 |
| -25 | 20.1 | 18.5 | 85 | 241.2 | 232.6 |
| -20 | 24.3 | 22.6 | 90 | 260.1 | 251.0 |
| -15 | 28.9 | 27.0 | 95 | 279.9 | 270.4 |
| -10 | 33.9 | 31.8 | 100 | 300.8 | 290.9 |
| -5 | 39.4 | 37.0 | 105 | 322.8 | 312.5 |
| 0 | 45.3 | 42.7 | 110 | 345.9 | 335.2 |
| 5 | 51.7 | 48.8 | 115 | 370.2 | 359.1 |
| 10 | 58.5 | 55.4 | 120 | 395.7 | 384.3 |
| 15 | 66.0 | 62.6 | 125 | 422.4 | 410.8 |
| 20 | 73.9 | 70.3 | 130 | 450.5 | 438.7 |
| 25 | 82.5 | 78.5 | 135 | 479.9 | 468.0 |
| 30 | 91.7 | 87.4 | 140 | 510.7 | 498.8 |
| 35 | 101.5 | 96.9 | 145 | 543.0 | 531.3 |
| 40 | 112.0 | 107.0 | 150 | 576.8 | 565.4 |
| 45 | 123.1 | 117.8 | 155 | 612.3 | 601.4 |
| 50 | 135.0 | 129.3 | 160 | 649.3 | 639.3 |
| 55 | 147.7 | 141.6 | 165 | 688.2 | 679.7 |
| 60 | 161.1 | 154.6 | 170 | 728.9 | 723.1 |
| 65 | 175.4 | 168.5 | | | |

### Subcool

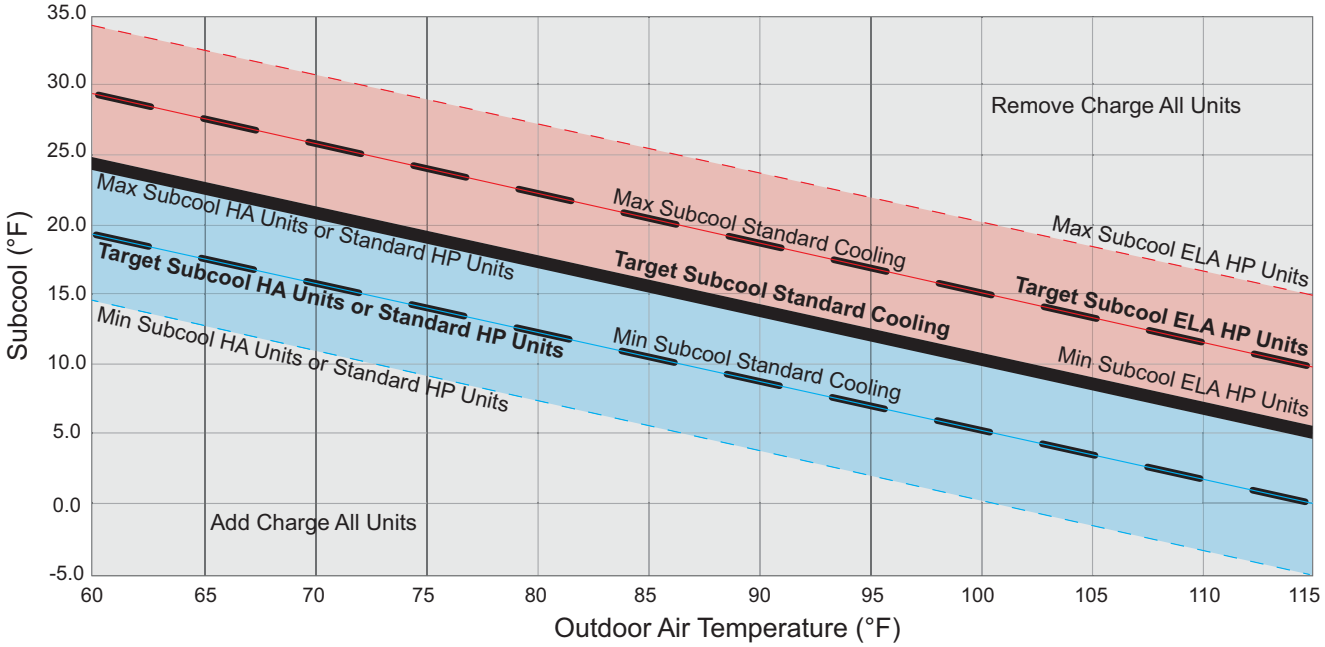
Subcooling (liquid pressure) monitors what state the refrigerant is in when it leaves the condensing coil. High subcooling means the condenser is flooded with liquid refrigerant, stacked on the EEV. Low subcooling means the condenser is starving and operating less efficiently. The subcool measurement represents how much the refrigerant in the condenser is cooled past the saturation point. When determining subcool, convert the high side pressure gauge (condensing coil liquid line) to the appropriate temperature in **Table 20**. Subtract the liquid line surface temperature from the converted temperature. The proper amount of subcool is dependent on the outdoor air temperature. Refer to **“Monitoring Subcool” on page 121**.

## Monitoring Subcool

- To monitor subcool, enable “Test Subcool” under **Service Settings > Test Menu > Test Cooling/HP > STGx**.
  - Measure subcool with condensing fans set to target **110°F** discharge condensing temp under STGx.
  - If the discharge condensing temp is greater than 110°F, but condensing fans are at 100% speed, subcool measurements are still accurate.
  - Subcool readings with sub 110°F discharge condensing temperatures are not valid. Subcool readings should not be taken when ambient temps are below °60F.
- Subcool tests should be ran with the reheat valve closed. The blower and OA damper set to the same speed and position that the unit will be operating at.
- If the superheat is high and the subcool is low under normal operating conditions, the system may be low on charge. Determine the cause of low refrigerant and repair as necessary. Refer to **“Charging System Low on Refrigerant” on page 129**.
- If the superheat is low and the subcool is high under normal operating conditions, the system may be over-charged. Refer to **“Recovering Refrigerant from the System” on page 126**.
- If the superheat is high and the subcool is high under normal operating conditions, there could be a blockage in the coil, or line set.
- Refer to **Figure 64** when targeting subcool values.
  - Standard Cooling should target the solid line labeled **“Target Subcool Standard Cooling.”**
  - High Ambient Heat Pump, High Ambient Cooling, and Standard Heat pump should target the dashed line labeled **“Target Subcool HA Units or Standard HP Units.”**
  - Extreme Low Ambient Heat Pump should target the dashed line labeled **“Target Subcool ELA HP Units.”**
- Subcool tolerance is always +/- 5°F from the target subcool line for that unit.
- Example 1 through Example 3 are for an outdoor air temperature of 85°F.
  - Example 1: Standard Cooling Subcool target = 15°F. Minimum is 10°F/Maximum is 20°F.
  - Example 2: HA and Standard HP Units Subcool target = 10°F. Minimum is 5°F/Maximum is 15°F.
  - Example 3: ELA HP Subcool target = 20°F. Minimum is 15°F/Maximum is 25°F.
- To increase subcooling, add refrigerant charge. To decrease subcooling, remove refrigerant charge.

**NOTE: Do not add or remove refrigerant based on the impulse to achieve a subjective subcooling value. Ambient temperatures may affect subcooling.**

**Figure 64 - Outdoor Air Temperature vs. Subcool**



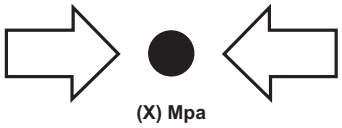
# SERVICE INFORMATION

**Requirements for Servicing Units**

**Qualifications for personnel working on, performing maintenance, service, and repair operations that include breaking into the refrigeration circuit, opening of sealed components, and opening of ventilate enclosures.**

- Leak Detector System Installed. Unit must be powered except for service.
- Refrigerant sensors may only be replaced with manufacturer approved sensors. Once replaced, the new sensor should be tested for proper functionality.
- Technicians must be certified by an EPA-approved training and certification program to service any HVAC equipment, regardless of the refrigerant.
- Technicians working on the equipment should not have any sources of ignition that may lead to fire or an explosion. All possible ignition sources including cigarette smoking should be kept sufficiently away from the unit.
- All maintenance staff and others working in the local area should be instructed on the nature of the work being carried out. Work in confined spaces should be avoided.
- The area surrounding the refrigeration circuit should be checked with a leak detector prior to work to ensure the technician is aware of any leaks. Ensure that the leak detection equipment being used is suitable for use with R-454B refrigerant, i.e. non-sparking, adequately sealed or intrinsically safe.
- Under no circumstances shall no sources of ignition be used in the searching for or detection of refrigeration leaks. A halide torch (or any other detector using a naked flame) shall not be used. The following leak detection methods are deemed acceptable for all refrigerant systems.
  - Electronic leak detectors may be used to detect refrigerant leaks but, in the case of R454B, the sensitivity may not be adequate, or may need re-calibration (detection equipment shall be calibrated in a refrigerant free area). Ensure that the detector is not a potential source of ignition and is suitable for R454B. Leak detection equipment shall be set to a percentage of the LFL of R454B and shall be calibrated to 25% maximum.
  - Leak detection fluids are also suitable for use but the use of detergents containing chlorine shall be avoided as the chlorine may react to the refrigerant and corrode the copper pipe work. Examples of fluid leak detectors include; bubble method or florescent method agents.
- If a leak is suspected, all naked flames shall be removed/extinguished.
- Ensure the area is in the open or that it is adequately ventilated before breaking into the system or conducting any hot work. A degree of ventilation shall continue during the period that the work is carried out. The ventilation should safely disperse any released refrigerant and preferably expel it externally into the atmosphere.
- The appropriate dry powder or CO2 fire extinguisher should be on hand before any brazing or cutting is conducted on the refrigeration circuit.
- Before brazing or cutting into the refrigeration circuit, all refrigerant must be evacuated from the circuit. Place the unit into Evacuation mode on the HMI and use the appropriate equipment to recover all refrigerant from the circuit. The circuit should be continuously purged with an inert gas to ensure all refrigerant has been removed. All service port Schrader cores should be removed before cutting or brazing the circuit.
- The refrigerant charge shall be recovered into the correct recovery cylinders if venting is not allowed by Local and National Codes.
- The outlet for the vacuum pump shall not be close to any potential ignition sources, any ventilation shall be available.

- The following checks shall be applied to installations using R454B refrigerant.
  - The actual REFRIGERANT CHARGE is in accordance with the room size within the refrigerant containing parts are installed.
  - The ventilation machinery and outlets are operating adequately and are not obstructed.
  - Marking to the equipment continues to be visible and legible. Markings and signs that are illegible shall be corrected.
- In addition to conventional charging procedures, the following requirements shall be followed:
  - Ensure the contamination of different refrigerants does not occur when using charging equipment. Hoses or lines shall be as short as possible to minimize the amount of refrigerant contained in them.
  - Cylinders shall be kept in the appropriate position according to the instructions.
  - Ensure that the refrigeration system is earthed before charging the system with refrigerant.
  - Label the system when charging is complete (if not already).
  - Extreme care shall be taken not to overfill the refrigeration system.

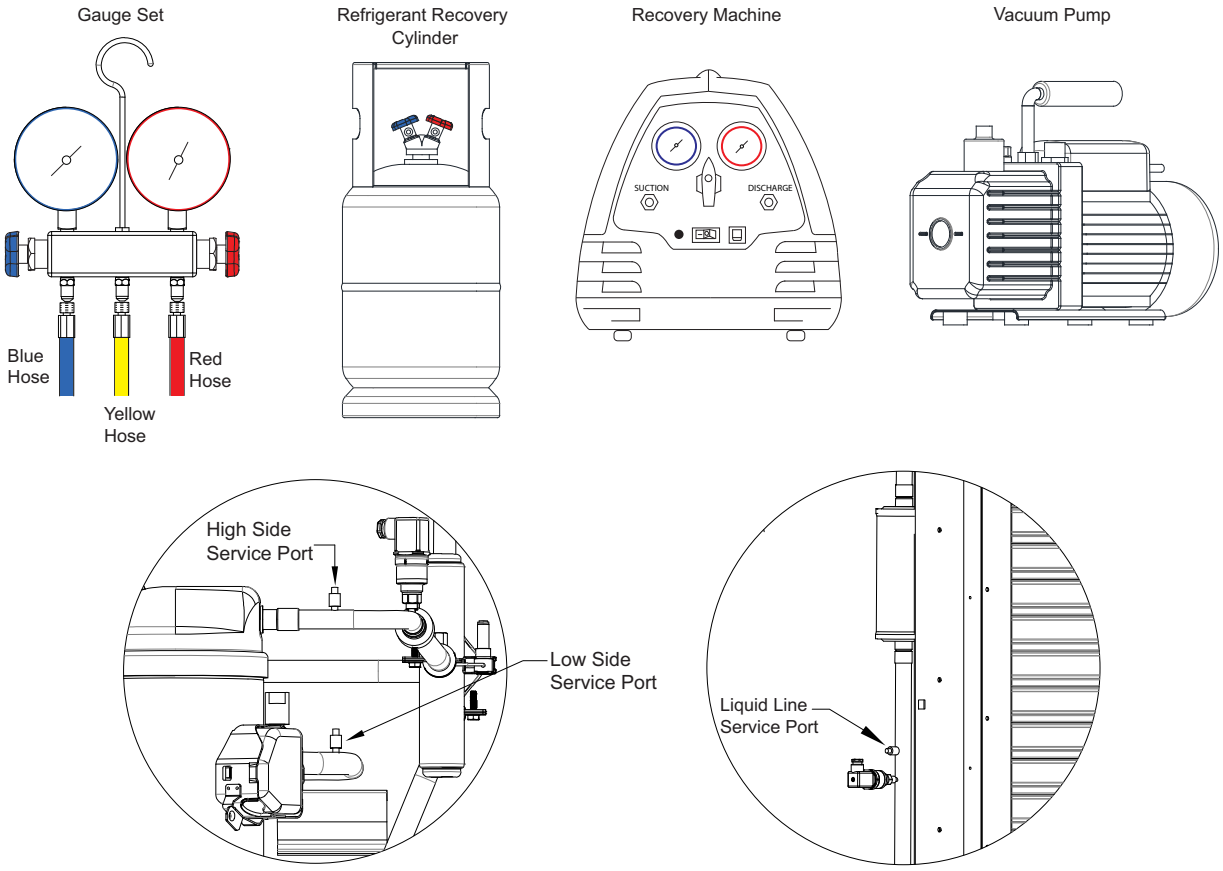
| Symbols | | |
|---|---|---|
|  **Warning: Flammable Materials** |  **Warning: Low Burning Velocity Materials** |   **Pressure** |

## Basic Service

**NOTE: Always wear gloves and eye protection when working with refrigerant.**

**NOTE: Purge lines before connecting to service ports.**

**Figure 65 - Refrigeration Service Tools and Service Port Locations**



## Monitoring the A/C System

**NOTE: Do not add or remove refrigerant based on the impulse to achieve a subjective subcooling value. Refer to "Superheat and Subcooling" on page 120 for more information.**

### Monitoring with HMI

The HMI can monitor the A/C temperature and pressure readings through the service function menu. Enter HMI menu function by pressing the top two buttons simultaneously. Navigate to **Service > Inputs > Refridge Diag**.

The Refridge Diag menu will display the following:

- **Discharge Pressure (DSCHRG PS)**
- **Discharge Saturated Temperature (DCH SAT TMP)**
- **Suction Pressure (SUCTION PS)**
- **Suction Saturation Temperature (SUC SAT TMP)**
- **Suction Line Temp (SUC LIN TMP)**
- **Superheat Temperature**
- **EEV Position Percentage**
- **Compressor Hertz**
- **PWM Rate Percentage**
- **Oil Voltage - Yes/No**

### Monitoring with Gauge Set

1. Close the high side hand valve (red) and low side hand valve (blue).
2. Connect vacuum rated manifold service hoses, refer to **Figure 65 on page 124**.
   - Red service hose to the high side service port.
   - Blue service hose to the low side service port.
   - Verify the yellow service hose is capped when not connected to a refrigerant tank, recovery tank, or vacuum pump.
3. Connect a standard pressure gauge set to the liquid line service port located on the outdoor coil, see **Figure 65**.
4. Start the system.
5. If the service hoses have a manual turn valve, open the valve. Monitor the following:
   - The low side and high side gauges.
   - The superheat reading should be 20°F.
6. Refer to **page 121** to determine subcool. Compressor must be running at 100%, and condenser fan temperature must be 110°F.
   **NOTE: subcool readings will vary based on ambient and condensing fan temperatures**.
7. Determining the readings:
   - If the readings are correct, close the gauge set and shut down the system. Disconnect the gauge set, refer to **"Removing Manifold Gauge Set" on page 129**.
   - If the readings are incorrect, follow the **"System Troubleshooting Chart" on page 130** to locate and repair the problem.

## Recovering Refrigerant from the System

Before carrying out this procedure, it is essential that the technician is completely familiar with the equipment and all its detail. It is recommended good practice that all refrigerants are recovered safely. Before recovering the refrigerant, an oil and refrigerant sample shall be taken in case an analysis is required prior to reuse of recovered refrigerant.

- Become familiar with the equipment and its operation.
- Isolate the system electrically.
- Ensure that mechanical handling equipment is available, if required, for handling refrigerant cylinders. Personal Protective Equipment (PPE) must be available and used properly. The recovery process should be supervised at all times by a competent person. All recovery equipment and cylinders must conform to the appropriate standards.
- Use the pump down sequence on the HMI to pump down the refrigeration system.
- If a vacuum is not possible, make a manifold so that the refrigerant can be removed from various parts of the system.
- Make sure the cylinder is situated on the scales before recovery takes place.
- Start the recovery machine and operate in accordance with instructions.
- Do not overfill cylinders (no more than 80% volume liquid charge).
- Do not exceed the maximum working pressure of the cylinder, even temporarily.
- When the cylinders have been filled correctly and the process completed, make sure the cylinders and the equipment are removed from site promptly and all isolation valves on the equipment are closed off.
- Recovered refrigerant shall not be charged into another refrigeration system unless it has been cleaned and checked.

1. Connect vacuum rated manifold service hoses, refer to **Figure 65 on page 124**:
   - Red service hose to the high side service port.
   - Blue service hose to the low side service port.
   - Connect the yellow service hose to the inlet port of the recovery machine.
   - Connect a hose from the discharge port of the recovery machine to the recovery tank.
2. Purge all hoses of non-condensables before starting the system.
3. Place the system in ‘Evacuation Mode’. Enter HMI menu function by pressing the top two buttons simultaneously. Navigate to **Service > Test Menu > Evacuation Mode > Enable**.
4. When the system is in ‘Evacuation mode’, the EEV and reheat valve (if applicable) will open and allow full access to the system via the high and low side service ports. Ensure the compressor does not run by pressing ‘OFF/Reset’ on the compressor VFD HMI.
5. Open the connected valve on the recovery tank.
6. Turn the recovery unit on. Open the low side and high side hand valves.
7. Monitor the gauge set until all refrigerant has been recovered and the system is under a proper vacuum.

**IMPORTANT!: Units should NOT be dye tested for leaks on the refrigerant system as it will void compressor warranty.**

## Nitrogen Purging

Whenever brazing will be performed in the system, flowing nitrogen through the system is required. This should be done when unsweating connections or brazing new components in the system. Remove Schrader core from the inlet and outlet path for full flow and minimize back-pressure. This step is critical to prevent oxidation and protect the system from contaminants.

## Pressure Testing

Anytime repairs are made, use dry nitrogen to verify there are no leaks in the system. Connect the dry nitrogen tank to the high and low service ports, ensuring the entire system will be pressurized. Pressurize the system to 350-400 PSI. Use soap bubbles or another liquid leak solvent to check for leaks. Check the system for approximately 15 minutes. For instructions on how to evacuate the system, refer to **"Evacuating the System"**.

- If there are leaks, evacuate the nitrogen from the system. Repair as necessary.
- If there are no leaks, evacuate the nitrogen from the system.

## Evacuating the System

1. Connect vacuum rated manifold service hoses, refer to **Figure 65 on page 124**:
   • Red service hose to the high side service port.
   • Blue service hose to the low side service port.
   • Connect the yellow service hose to the vacuum pump.
2. Connect a micron gauge to the liquid line service port located on the outdoor coil, refer to **Figure 65**.
3. Place the system in 'Evacuation Mode'. Enter HMI menu function by pressing the top two buttons simultaneously. Navigate to **Service > Test Menu > Evacuation Mode > Enable**.
4. When the system is in 'Evacuation mode', the EEV and reheat valve (if applicable) will open and allow full access to the system via the high and low side service ports. Ensure the compressor does not run by pressing 'OFF/Reset' on the compressor VFD HMI.
5. Open the high side hand valve (red) and low side hand valve (blue). Start the vacuum pump.
6. Pump the system down until the micron gauge reads 500 microns.
7. Close off the valve to the vacuum pump. Turn the pump off.
8. Monitor the micron gauge for twenty minutes. Make sure it does not rise above 1000 microns.
   - If the reading goes above 1000 microns in less than twenty minutes, there is a leak or moisture in the system. Determine the issue and repair.
   - If the reading stays below 1000 microns, close all valves on the manifold gauge set.
9. Charge the system, refer to **"Charging an Empty System" on page 128**.

**NOTE: To prevent trapping liquid refrigerant in the manifold gauge set, make sure the gauge set is brought to suction pressure before disconnecting.**

## Charging an Empty System

1. Connect the manifold service hoses, refer to **Figure 65 on page 124**:
   - Red service hose to the liquid side service port.
   - Connect the yellow service hose to refrigerant source.
2. Connect a temperature clamp near the liquid line service port located on the outdoor coil, refer to **Figure 65**.
3. Place the system in 'Evacuation Mode'. Enter HMI menu function by pressing the top two buttons simultaneously. Go to **Service > Test Menu > Evacuation Mode > Enable**.
4. When the system is in 'Evacuation mode', the EEV and reheat valve (if applicable) will open and allow full access to the system via the high side, low side, and liquid line service ports.
5. Ensure the compressor does not run by pressing 'OFF/Reset' on the compressor VFD HMI.
6. Open the valve on the refrigerant source.
7. Open the high side hand valve (red) on the manifold set.

**NOTE: Unit should be charged with liquid refrigerant.**

8. Once the unit has at least 50% of the charge from the unit label, close the valve on the refrigerant source and the high side hand valve (red) on the manifold set. Abort 'Evacuation Mode.'
9. Remove red service hose from the liquid line service port.
10. Connect blue service hose to the low side service port. Verify the yellow service hose is connected to the manifold and refrigerant source.
11. Open the valve on the refrigerant source.
12. Check the compressor's oil level before starting unit. Refer to **"Compressor Information" on page 66** for compressor models and oil type information.
13. Verify the unit is in an idle state (it should not be in cooling, heating, reheat, or blower only modes).
    - Occupied scheduling must be disabled. **Go to Factory Settings > Occupancy Config > Scheduling > Off**.
    - Turn on the cooling system through the service test menu. Go to **Service > Test Menu > Test Cool/HP > Select unit's cooling type**.
    - Set the compressor to run at maximum speed and verify reheat voltage is set to 0V.
    - The blower will be off and the damper will be closed when in an idle state. Adjust the components as needed.
    - Adjust condensing fans so that the condensing coil maintains a 110°F liquid saturation temperature.
14. To prevent damage to the compressor, do not open the hand valve all the way. Crack open the low side hand valve (blue) on the manifold set.
15. Continue charging the system until the following conditions are met:
    - Refer to **Table 20 on page 120** and **Figure 63 on page 121** to determine subcool.
    - Compressor must be running at 100%, and condenser fan temperature must be 110°F.

**NOTE: Subcool readings will vary based on ambient and condensing fan temperatures**.

    - The superheat reading should be 20°F.
    - To monitor subcool, go to **Service > Test Menu > Test Cooling/HP > State > Cool > Cond Mode > Auto**.
    - Monitor the readings in the test menu screen.
16. Close the low side hand valve (blue). Monitor the gauge set, and determine if the system is operating properly.

**NOTE: Once the unit is back to full operation, verify any altered settings (i.e. Scheduling) are changed back to their last set configuration.**

## Charging System Low on Refrigerant

**NOTE: Do not add or remove refrigerant based on the impulse to achieve a subjective subcooling value. Refer to "Superheat and Subcooling" on page 120 for more information.**

1. To add refrigerant with system running, open the low side hand valve (blue).
2. Start the unit. Verify the unit is in an idle state (it should not be in cooling, heating, reheat, or blower only modes). Occupied scheduling must be disabled.
3. Navigate to **Service > Test Menu > State > Cool/HP** to activate system test. Once the test is active, you may monitor and adjust settings.
   - Set the compressor to run at maximum speed.
   - Adjust condensing fans, and monitor the condensing coil maintains a 110°F temperature.
   - Verify reheat voltage is set to 0V.
4. Monitor the system until the following conditions are met:
   - Refer to **Table 20 on page 120** and **Figure 63 on page 121** to determine subcool.
   - Compressor must be running at 100%, and condenser fan temperature must be 110°F.

**NOTE: Subcool readings will vary based on ambient and condensing fan temperatures**.

   - The superheat reading should be 20°F.
   - To monitor subcool, set Cond Mode to Auto. Navigate to **Service > Test Menu > Test Cooling/HP > State > Cool > Cond Mode > Auto**.
   - Monitor the readings through the test menu screen.
5. Check compressor oil level after a repair. Refer to **"Compressor Information" on page 66** for compressor models and oil type information.

## Removing Manifold Gauge Set

1. Make sure the hand valves are closed.
2. Make sure the refrigerant source is closed / the vacuum pump is not running.
3. Disconnect all hoses from the service valve ports.
4. Install the service port caps. Tighten by hand.

# TROUBLESHOOTING

The following tables and information list possible causes and corrective actions for possible problems. Review this section prior to consulting technical support.

## System Troubleshooting Chart

| Problem | Potential Cause | Corrective Action |
|---|---|---|
| Unit will not start | Power failure | Check voltage to the unit. |
| | | Check the disconnect switch. |
| | | Check the circuit breaker. |
| | | Check the hot, neutral, and ground wiring. |
| Unit On - HMI Off | Power Issue | Check connector J13 is properly connected. |
| | | Check wiring from HMI to connector J13. |
| | | Verify the circuit breaker (CB-01) is On. |
| System operates continuously - poor cooling/heating (heat pump mode) | Shortage of refrigerant | Test for leaks. Add refrigerant. |
| | Restricted discharge line | Repair or replace as required. |
| | Dirty or clogged filters | Inspect filters. Clean or replace. |
| | Dirty indoor coil | Inspect coil. Clean the coil, refer to **“Coil Cleaning Procedure” on page 163**. |
| | Low airflow across indoor coil | Check blower speed, duct static pressure, filters. |
| | Compressor | Verify compressor modulates between Min to Max frequency. |
| | Electronic Expansion Valve (EEV) | Verify EEV position is 0% when not in heating or cooling under Refridge Diag. See **“Monitoring the A/C System” on page 125.** |
| | | Check the correct EEV is installed. |
| | | Refer to **“Electronic Expansion Valve (EEV-1)” on page 159**. |
| System operates – blows cold air in heat pump mode | Compressor | Verify compressor modulates between Min to Max frequency. |
| | Incorrect refrigerant | Refer to **“Superheat and Subcooling” on page 120** to check parameters. |
| | Non-condensable in system | Recover the charge, evacuate the system. Recharge the system. Refer to **“Basic Service” on page 124**. |
| | Faulty reversing valve | Test reversing valve. |
| | Defrost control | Test defrost control. |
| System operates - blows cold air in gas heat mode | Gas supply issue | Refer to **“Furnace Troubleshooting Chart” on page 147**. |
| | Faulty gas train components. | |
| System runs – blows cold air in electric heat mode | Improper wiring | Check electrical wiring. |
| | Electric disconnect switch | Check electric heater disconnect switch |
| | Fuse in electric heater panel | Check fuses, replace is required. |
| | Airflow Switch | Check airflow switch and tubing at the MUA board. |

## HMI Fault Codes

| Problem | Potential Cause | Corrective Action |
|---|---|---|
| Fire | A 120V AC signal was detected on the Fire input (terminal F). | Possible fire present. |
| | | Check for voltage on terminal F. There should be no voltage. |
| | | Verify connector J9 is secure. Pin 3 and 8 must be fully inserted. |
| | | Check wiring. Repair broken or loose wiring connections. |
| | | Replace fire detector if not operational. |
| Fire/Smoke (optional) | A signal was detected on the Smoke Detector input. | Check for voltage on terminal SD3. |
| | | Verify the smoke detector is set up properly. Reset if required. |
| | | Check wiring. Repair broken or loose wiring connections. |
| | | Replace smoke detector if not operational. |
| Supply Ovld (optional) | The motor overload has tripped. | Check motor for debris. |
| | | Check contactor/motor wiring connections. |
| | | Verify motor rotation is correct. |
| Exhaust Ovld (optional) | | Verify P108 is set properly. Check schematics for correct settings. |
| Master ROM CRC | CRC detected corruption of the unit's software. | Contact technical support. |
| Aux ROM CRC | | |
| Flame Lockout | The Flame Safety Control (FSC) verifies that airflow is sensed by the airflow sensor | Faulty flame rod. |
| | | Use the HMI to reset. |
| | | Faulty FSC. Verify FSC operation. |
| Intake Firestat (optional) | The intake firestat temperature has exceeded its set point. | Possible fire present. |
| | | Check accuracy of sensor readings. |
| Discharge Firestat (optional) | The discharge firestat temperature has exceeded its set point. | Verify high/low fire setting, refer to **page 105**. |
| | | Use the HMI to reset. |
| Freezestat (Optional) | The air-side discharge thermistor reported a value below the freezestat setpoint for the duration of the freezestat timer when in fan only or heat state. | Check accuracy of intake/discharge temperature sensor readings. |
| | | Verify operation of reversing valve and heat pump. |
| | | Use the HMI to reset. |
| Overheat Stat (Optional) | The air-side discharge thermistor reported a value above the overheat setpoint for the duration of the overheat timer. | Check accuracy of intake/discharge temperature sensor readings. |
| | | Verify cooling performance and refrigerant charge. |
| | | Use the HMI to reset. |

| Problem | Potential Cause | Corrective Action |
|---|---|---|
| High Gas PS (optional) | The normally closed switch is open. The 24V AC input signal is no longer present at connector J13-pin 11. | If option is off, turn on in HMI. |
| | | Verify incoming gas pressure. |
| | | Check wiring. Repair broken or loose wiring connections. |
| | | Verify high/low fire setting, refer to **page 105**. |
| | | Refer to **"High Gas Pressure Switch (PS-03)" on page 154** on High Gas Pressure Switch. |
| Low Gas PS (optional) | The normally closed switch is open. The 24V AC input signal is no longer present at connector J13-pin 10. | If option is off, turn on in HMI. |
| | | Verify incoming gas pressure. |
| | | Check wiring. Repair broken or loose wiring connections. |
| | | Verify high/low fire setting, refer to **page 105**. |
| | | Refer to **"Low Gas Pressure Switch (PS-04)" on page 154**. |
| CO Alarm | The detected CO level is above the sensor limit. | Check for proper exhaust ventilation. |
| | | Check wiring. Repair broken or loose wiring connections. |
| | | Faulty CO detector, replace CO detector. |
| DX Float | The control board is receiving a signal from the evap drain pan float switch; indicating that the switch tripped because the drain pan filled with water. | Verify float switch is not stuck in tripped position. |
| | | Make sure the pan drain is clear and water is draining. |
| | | Check wiring. Repair broken or loose wiring connections. |
| | | Replace float switch if not operational. |
| Furnace Float | The control board is receiving a signal from the furnace condensation float switch; indicating that the high efficiency furnace was not draining. | Refer to **"Furnace Condensation Drain" on page 23** to check the float. |
| | | Verify pipe connections are not clogged. |
| | | Verify the pipes are draining. |
| | | Check wiring. Repair broken or loose wiring connections. |
| | | Replace float switch if not operational. |
| Supply VFD Comm | A communication error between the blower VFD and MUA board was detected. | Verify supply VFD settings; P102 (min freq), P103 (max freq) on supply VFD match min/max blower freq in factory settings. |
| | | Verify P410 on supply VFD is set to 21. |
| | | Check CAT5 with a tester. |
| Door Interlock | No signal to control board from the door switch(es). | Verify door switches are wired properly, if required. |
| ERV Door Interlock | | Check door interlock settings in HMI. |
| | | Check doors for obstructions/alignment issues. |
| | | Check ERV door interlock settings. Go to **Factory Settings > ERV Config > Monitoring Sensors > Door Interlock**. |

| Problem | Potential Cause | Corrective Action |
|---|---|---|
| DX VFD Comm | A communication error between the compressor VFD and MUA board was detected. | Check twisted shielded pair wiring. |
| | | Verify compressor VFD parameters match schematics. |
| Aux Board MB Comm | A communication error between an auxiliary Modbus device and the MUA board was detected. | Check CAT5 wiring between MUA board and auxiliary board. |
| | | Verify DIP switches are in the correct position for all control boards. |
| Supply Air Low | The onboard pressure reading was below the air proving setpoint; indicating low airflow. | Verify supply fan operation, refer to **"Start-Up Procedure" on page 103**. |
| | | Check damper operation. |
| | | Check airflow switch and tubing at the MUA board. |
| Clgd Fltr Mtnce (optional) | The clogged filter input is active, indicating the pressure differential across the air filters was above the switch's field-adjustable setpoint. | Clean or replace filters. |
| | | Refer to **"Clogged Filter Switch (PS-10)" on page 149**. |
| Intake Stat Missing<br>Dschrg Stat Missing<br>Space Stat Missing<br>OA Stat Missing<br>Return Stat Missing<br>Suction Line Missing<br>Indoor Coil Missing<br>2nd Dschrg Stat Missing<br>DX Dschrg Missing | The thermistor input is reading an excessively low temperature (high resistance/ open circuit). | Check for faulty wiring, refer to **"Temperature Sensor" on page 152**. |
| | | Install and wire sensor. |
| Intake Stat Broken<br>Dschrg Stat Broken<br>Space Stat Broken<br>OA Stat Broken<br>Return Stat Broken<br>Suction Line Broken<br>Indoor Coil Broken<br>2nd Dschrg Stat Broken<br>DX Dschrg Broken | The thermistor input is reading an excessively high temperature (low resistance/ short circuit). | Check for faulty wiring, refer to **"Temperature Sensor" on page 152**. |
| | | Install and wire sensor. |
| Space HMI Missing | One of the HMIs in the system is not connected properly, or one of the settings is not properly set. | Verify that the "# of HMIs" is set correctly. |
| | | Verify there is no damage to the HMI(s). |
| | | Check for loose or damaged wiring to HMI(s). |
| | | If space temperature is being utilized, make sure "HMI Averaging" is set to 'On' for all space HMIs. |

| Problem | Potential Cause | Corrective Action |
|---|---|---|
| RTC Temp Invalid | Real-Time Clock (RTC) temperature sensor located on MUA board. | Verify there is no damage to the MUA board or the wiring to the MUA board. |
| Aux RTC Temp Invalid | | Contact technical support. |
| HMI 1 Temp Invalid<br>HMI 2 Temp Invalid<br>HMI 3 Temp Invalid<br>HMI 4 Temp Invalid<br>HMI 5 Temp Invalid | The unit HMI is unable to read temperature. | Verify control board dip switches match schematics. |
| | | Verify HMI CAT5 cable. |
| | | Verify the amount of HMIs is properly set. Go to **Factory Settings >Unit Options > Board Config > HMI Config > Number** |
| | | Verify Modbus Address for the HMI. Refer to **page 71**. |
| Stat Pressure Low | The space or duct pressure is below the limit configured in User Settings, which disables the unit. | Verify the space or duct pressure transducer wiring |
| | | Verify the space or duct pressure reading to a manometer |
| | | Verify the low pressure limit in **User Settings**. |
| Stat Pressure High | The space or duct pressure is above the limit configured in User Settings, which disables the unit. | Verify the space or duct pressure transducer wiring |
| | | Verify the space or duct pressure reading to a manometer |
| | | Verify the low pressure limit in **User Settings**. |
| FSC1 High Temp<br>FSC2 High Temp | The high limit switch is tripped (open circuit). | Verify max discharge set point. |
| | | Verify airflow. |
| | | Verify accuracy of discharge temperature senor. |
| | | Verify furnace modulation. Refer to high/low fire settings, refer to **page 105**. |
| FSC1 Rollout<br>FSC2 Rollout | One or more flame rollout switch is tripped (open circuit). Rollout switches require manual reset. | Check wiring to the switches. |
| | | Verify furnace modulation. Refer to high/low fire settings, refer to **page 105**. |
| | | Check for a blocked tube, low airflow, or low gas pressure. |
| | | Manually reset by pressing the small button on top of the switch. |
| FSC1 Vent Proving<br>FSC2 Vent Proving | The vent proving switch is not proving airflow (open circuit). | Inspect vent tubing. Check for damage or obstructions. |
| | | Check bleed hole in proving switch. |
| | | Check inducer motor wiring. |
| | | Verify the inducer starts. Go to **Service > Test Menu > Test Heating**. |
| | | Verify there is at least 0.35" of pressure measured from the tube to atmosphere when the inducer is running |
| | | Refer to **“Vent Proving Switch (PS-01)” on page 155**. |

| Problem | Potential Cause | Corrective Action |
|---|---|---|
| Low Refridge PS (Circuit 1/2/3) | The low pressure (suction pressure) switch tripped. Suction pressure dropped below 25psi. The switch auto resets when pressure rises above 39psi. Fault must be reset using reset lockouts after the switch is reset. | Check low pressure switch wiring. |
| | | Verify coils are not restricting airflow. |
| | | Verify air filters are not restricting airflow. |
| | | Verify supply airflow. |
| | | Review cooling and dehumidification set-points. Verify they are not causing the coil to freeze. |
| | | Perform cooling test and verify refrigerant charge. Refer to **"Monitoring the A/C System" on page 125**. |
| High Refridge PS (Circuit 1/2/3) | The high pressure (discharge pressure) switch tripped, above 610psi. The switch requires manual reset when pressure drops below 480 PSI. Fault must be reset using reset lockouts after switch resets. | Check high pressure switch wiring. |
| | | Verify coils are not restricting airflow. |
| | | Perform condenser fan test to make sure all fans are operational and modulate. |
| | | Perform cooling test and verify refrigerant charge. Refer to **"Monitoring the A/C System" on page 125**. |
| Refrdg Dschrg Temp (Circuit 1/2/3) - Heat Pump Only | The refrigerant discharge line temperature switch has detected high temperature (heat pump sensor only). | Verify refrigerant high pressure switch operation. Reset if the switch is tripped. |
| | | Verify coils are not restricting airflow. |
| | | Verify air filters are not restricting airflow. |
| | | Perform condenser fan test to make sure all fans are operational and modulate. |
| | | Perform cooling test and verify refrigerant charge. Refer to **"Monitoring the A/C System" on page 125**. |
| Oil Low (Circuit 1/2/3) | The Oil Level Sensor (OLS) reported no oil. For information on oil management, refer to **"Compressor Information" on page 66**. | Check OLS installation/wiring. |
| | | Check OLS operation, refer to **"Oil Level Sensor (Sen-x)" on page 155**. |
| | | Perform cooling test and verify refrigerant charge. Refer to **"Monitoring the A/C System" on page 125**. |
| | | For units equipped with an oil solenoid, check installation/wiring. |
| | | Verify oil level at sight glass after compressor has run for 5 min and also after comp has been off for 5 min. |
| | | Monitor OLS reading for extended period while comp is at max speed to confirm oil level. |
| | | Use the HMI to reset. |

| Problem | Potential Cause | Corrective Action |
|---|---|---|
| Env Cond Temp High (Circuit 1/2/3)<br><br>Env Cond Temp Low (Circuit 1/2/3)<br><br>Env Evap Temp High (Circuit 1/2/3)<br><br>Env Evap Temp Low (Circuit 1/2/3) | The discharge line pressure sensor is reporting higher than expected discharge pressure for current operating conditions.<br><br>The discharge line pressure sensor is reporting lower than expected discharge pressure for current operating conditions.<br><br>The suction line pressure sensor is reporting higher than expected suction pressure for current operating conditions.<br><br>The suction line pressure sensor is reporting lower than expected suction pressure for current operating conditions. | Verify discharge sensor operation.<br>Verify coils are not restricting airflow.<br>Verify air filters are not restricting airflow.<br>Verify supply airflow.<br>Perform condenser fan test to make sure all fans are operational and modulate.<br>Perform cooling tests and verify refrigerant charge. Refer to **"Monitoring the A/C System" on page 125**. |
| Env Angle | The indoor and outdoor coil operating temperatures (suction and discharge saturation temperatures) are out of range. | Verify suction and discharge pressure transducer readings are accurate.<br>Verify coils are not restricting airflow.<br>Verify air filters are not restricting airflow.<br>Verify supply airflow.<br>Perform condenser fan test to make sure all fans are operational and modulate.<br>Perform cooling tests and verify refrigerant charge. Refer to **"Monitoring the A/C System" on page 125**. |
| Max Head Pressure (Circuit 1/2/3) | The max head pressure for the compressor is too high. | Verify discharge pressure transducer readings to gauge.<br>Verify coils are not restricting airflow.<br>Verify air filters are not restricting airflow.<br>Verify supply airflow.<br>Perform condenser fan test to make sure all fans are operational and modulate.<br>Perform cooling tests and verify refrigerant charge. Refer to **"Monitoring the A/C System" on page 125**. |
| EEV Temp | The suction line thermistor is reading high temperatures while in a cooling call. | Verify suction line thermistor wiring.<br>Verify suction line thermistor reading. Refer to **"Temperature Sensor" on page 152**. |
| Suction PS (Circuit 1/2/3) | The suction transducer is reading low pressure | Verify suction and discharge pressure transducer readings are accurate.<br>Verify coils are not restricting airflow.<br>Verify air filters are not restricting airflow.<br>Verify supply airflow.<br>Perform condenser fan test to make sure all fans are operational and modulate.<br>Perform cooling tests and verify refrigerant charge. Refer to **"Monitoring the A/C System" on page 125**. |

| Problem | Potential Cause | Corrective Action |
|---|---|---|
| SLT Fault | Suction Line Temperature has surpassed 110°F for greater than 10 minutes and the EEV is at 100%. | Verify suction line thermistor wiring. |
| | | Check sensor mounting location. Refer to **page 61**. |
| SLT Diff (Circuit 1/2/3) | Second suction line thermistor reading is 15 degrees apart from each other. One or more sensor's are drifting. | Verify suction line thermistor wiring. |
| | | Check sensor mounting location. Refer to **page 61**. |
| Electric Heater Fault | Voltage input is lost while the electric heater is active. | Verify electric heat wiring. |
| | | Verify 24V AC is present on terminal I. |
| | | Check electric heater wiring to board connector J7 pin 10. |
| | | Check incoming power at the heater disconnect. |
| | | Check that the fuses are not blown and there is voltage to the line and load side of the main transformer in electric heater. |
| | | Check the manual and auto reset limit switches to make sure they are not tripped. |
| Space RH<br>Intake RH<br>Discharge RH<br>Return RH<br>Exhaust RH<br>Outside RH | The relative humidity sensor(s) is not reading correctly. | Verify sensor wiring to the schematic. |
| | | For sensors with DIP switches, verify DIP switch settings are correct. |
| | | Compare sensor readings to a psychrometer. |
| | | Refer to **"Humidity/Temperature Sensors" on page 151**. |
| Comp VFD Not Auto | The compressor VFD is not in Auto mode. | Place the compressor VFD to Auto mode. |
| HMI MB Comm 1<br>HMI MB Comm 2<br>HMI MB Comm 3<br>HMI MB Comm 4<br>HMI MB Comm 5 | Modbus Communication Error. | Verify control board dip switches match schematics. |
| | | Verify HMI CAT5 cable. |
| | | Verify the amount of HMIs is properly set. Go to **Factory Settings > Unit Options > Board Config > HMI Config > Number** |
| | | Verify Modbus Address for the HMI. Refer to **page 71**. |
| Power Card Temp<br>Ctrl Card Temp | The VFD power or control card is overheating (above 175F). | Check compressor twisted shielded pair wiring. |
| | | Compare VFD parameters to schematics. |
| | | Check line/load wiring. |
| | | Factory reset and program the drive. For CDS 803, refer to **page 68**. |
| | | Factory reset and program the drive. For CDS 302/303, refer to **page 69**. |
| | | Enable Compressor VFD Overheat protection if fault occurs when system is idle. |

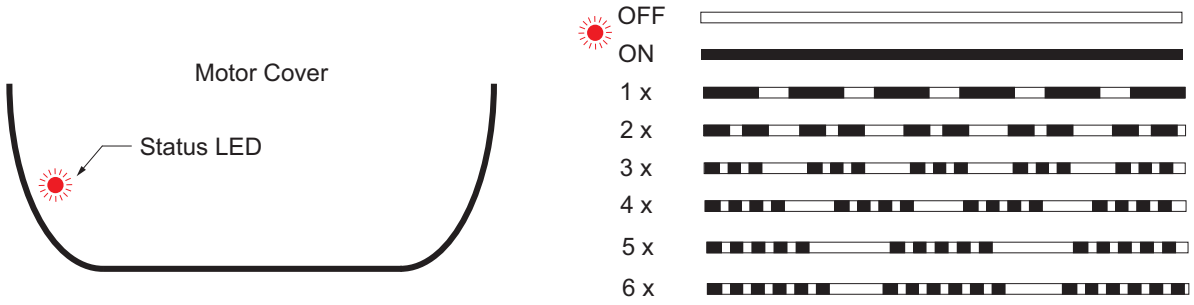
| Problem | Potential Cause | Corrective Action |
|---|---|---|
| Earth Fault | The VFD senses there is current from the output phases to earth. | Check for shorts to ground between compressor and VFD. |
| | | Disconnect wiring at compressor and meg compressor leg to ground. |
| | | Disconnect wiring at compressor and measure resistance leg to leg. |
| | | Reconnect wiring at compressor and disconnect wiring at load of compressor VFD. Meg test compressor through the wiring. |
| Ctrl Word Timeout | There is no communication to the VFD. | Check compressor twisted shielded pair wiring. |
| | | Compare VFD parameters to schematics. |
| CO2 Shutdown<br>CO2 Override<br>CO2 Threshold | The CO2 PPM is above the limit setpoint. | Verify CO2 sensor wiring. |
| | | Verify CO2 sensor PPM reading. |
| | | Verify CO2 sensor setpoints. |
| ERV Exh Clog Filter<br>ERV Exh Fltrs Mtnce<br>ERV Sup Fltrs Mtnce<br>ERV Fltr Mtnce | Dirty or clogged filters/Advanced Cool Board (ACB) tubing. | Inspect filters. Clean or replace filters. |
| | | Inspect airflow tubing at the ACB. Clean or replace tubing. |
| | | Recalibrate filters. Go to **Service > Calibrate ERV**. |
| ERV Deadband Fail | No temperature differential across the wheel. | Inspect ERV motor belt. Replace belt if broken/worn. |
| | | Clean ERV wheel if needed. |
| | | Make sure wheel turns freely. Correct any obstructions. |
| | | Inspect ERV motor for failure. |
| ERV Exhaust Air Proving | No pressure differential detected across the exhaust air stream wheel section. | Inspect airflow tubing at the ACB. Clean or replace tubing. |
| | | Verify ERV Wheel Side Panels are in place if applicable (Size 3 & 4 ERV) |
| | | Verify the exhaust blower is operating. |
| ERV Exhaust RH | Exhaust RH Sensor reading 0% RH | Verify RH sensor dip switches are correctly set. |
| | | Inspect exhaust RH sensor for signs of failure. |
| ERV Supply Missing Filter | Low or zero differential across the supply filter rack. | Verify filters are installed properly. |
| ERV Exhaust Missing Filter | Low or zero differential across the exhaust filter rack. | |
| ACB ERV Comm | ACB and MUA board miscommunication. | Check Cat 5 communication between the ACB and MUA board. Confirm ACB board is powered and MUA board is correctly programmed. |
| Contactor1 Proving<br>Contactor2 Proving | Exhaust fan proving is enabled and the current transducer dry contact is open for fan #1 or fan #2. | Verify wiring to current switch. |
| | | Check exhaust fan wiring. |

| Problem | Potential Cause | Corrective Action |
|---|---|---|
| Space Temp Disabled | The disable space temperature feature is active. The unit sensed a space temperature out of range and automatically reverted to discharge temperature control. | Check the space temp disable option in **User Settings.** |
| Damper Fault | Damper not responding. | Check dampers for proper operation and movement.<br>Check wiring and connections.<br>Check for motor failures.<br>Check HMI settings.<br>Check for damage temperature sensors. |
| Damper Closed | Damper stuck closed. | |
| Excess OA | Damper stuck open. | |
| No Economizer | The unit is not economizing. | |
| Economizer Fault | Improper economizing. | |

## Condensing Fan Blink Codes

The condensing fan is equipped with an LED indicator light for troubleshooting. Count the LED's blinks, refer to **Figure 66**, then compare to LED Code.

**Figure 66 - Status LED**




| LED Code | Potential Cause | Corrective Action |
|---|---|---|
| OFF | No voltage supply | Unit switches OFF and automatically ON when the voltage has been restored.<br>**Check voltage supply.** |
| ON | Normal operation without fault. | No action required. |
| 1 x | **No enable = OFF**<br>Terminals "D1" - "24 V" (Digital In 1) not bridged. | Switch OFF by external contact (see digital input). |
| 2 x | **Temperature management active**<br>The device has integrated active temperature management to protect the device from damage caused by excessively high interior temperatures. | In case of a temperature increase above the predetermined limits the modulation is linearly reduced. With a drop in temperature the modulation rises again linear.<br>**Check installation of the device and cooling of the motor.** |
| 3 x | **Error rotor position**<br>Determination of the rotor position has failed. | After 8 starting tests, an error message is displayed.<br>**Check whether the motor can rotate freely (without line voltage).** |
| 4 x | **Line failure** (only for 3 ~ types)<br>The device is provided with a built-in phase-monitoring function for the mains supply. In the event of a mains interruption (failure of a fuse or mains phase) the unit switches off after a delay (approx. 200 ms). Only functioning with an adequate load for the controller. | Following a shutoff, a startup attempt is made after approximately 15 seconds, if the voltage supply is high enough. This keeps occurring until all 3 supply phases are available again.<br>**Check power supply.** |
| 5 x | **Motor blocked**<br>If no speed > 0 is measured for a specific time window with commutation, the error "Motor blocked" is triggered. | Device switches off, renewed attempt to start after about 2.5 sec. Final shutoff, when fourth starting test fails.<br>**It is then necessary to have a reset by disconnecting the line voltage. Check if motor is freely rotatable.** |
| 6 x | **Failure power module**<br>Short circuit to earth or short circuit of the motor winding. | EC-Controller switches off, renewed attempt to start after about 70 sec. see code 9.<br>Final shutoff, if - following a second starting test – a second fault detection is detected within a period of 75 seconds.<br>**It is then necessary to have a reset by disconnecting the line voltage.** |

| LED Code | Potential Cause | Corrective Action |
|---|---|---|
| 7 x | **DC-link undervoltage**<br>If the DC-link voltage drops below a specified limit the device will switch off. | If the DC-link voltage rises above the limit within 75 seconds, then the controller will attempt to start. Should the DC-link voltage stay for more than 75 seconds below the limit, the device will switch off with a fault message. |
| 8 x | **DC- link overvoltage**<br>If the DC-link voltage increases above a specified limit, the motor will switch off.<br>Reason for excessively high input voltage or alternator motor operation. | If the DC-link voltage drops below the limit within 75 seconds, then the controller will attempt to start. Should the DC-link voltage stay above the limit for more than 75 seconds, the device will switch off with a fault message. |
| 9 x | **Cooling down period power module**<br>Cooling down period power module for approx. 70 sec. Final shutoff after 2 cooling-off intervals see code 6. | Power module cooling down period for approx. 70 sec. Final shutoff after 2 cooling-off intervals see code 6. |
| 10 x | **Communication fault**<br>If the communication watchdog is active, it signals that MODBUS communication is interrupted. | Response dependent on set watchdog mode (see MODBUS communication description).<br>**Check MODBUS communication.** |
| 11 x | **Error motor start**<br>If a starting command is given (enable available and Setpoint > 0) and the motor does not start to turn in the correct direction within 5 minutes, then an error message will appear. | If it is possible to start the motor in the target direction of rotation after the error message, the error message will disappear. Should a voltage interruption occur in the meantime, the time taken up to the switch off will begin again.<br>**Check whether the motor can rotate freely (without line voltage).**<br>**Check if the fan is driven in reverse direction by an air stream (see behavior in rotation by air current in reverse direction).** |
| 12 x | **Line voltage too low**<br>If the line voltage drops below a specified limit the device will switch off. | If the line voltage rises above a specified limit within 75 seconds, then the controller will attempt to start.<br>Should the line voltage stay below the specified limit for more than 75 seconds, the device will switch off with an error message. |
| 13 x | **Line voltage too high**<br>Cause to high input voltage<br>If the line voltage increases above a specified limit, the motor will switch off. | If the line voltage drops below the specified limit within 75 seconds, then the controller will attempt to start.<br>Should the line voltage stay above the specified limit for more than 75 seconds, the device will switch off with an error message. |
| 14 x | **Error peak current**<br>If the motor current increases above the specified limit (even in a short time-frame) the device will switch-off. | After a switch off the controller waits for 5 seconds then the controller attempt a start. Arises within 60 sec. in series 5 further disconnections a final switch off with fault indication follows.<br>Should no further switch off be exceeded in 60 sec. the counter will be reset. |
| 17 x | **Temperature alarm**<br>Excess of the max. permissible inside temperature. | Controller switches off motor. Automatic restarting after cooling down.<br>**Check installation of the device and cooling of the controller.** |
| 18 x | **System error**<br>Device has detected a system error. Only limited operation, or no operation at all, is possible. | The error is displayed immediately. The motor is switched off depending on the system error.<br>**Reset by disconnecting the voltage supply. If the error message persists, repair by the manufacturer is necessary.** |

| LED Code | Potential Cause | Corrective Action |
|---|---|---|
| 20 x | **a) Vibration values**<br>If the vibration velocity rises above the specified limits, an error message is issued. | The error is displayed after the set time. The device continues to operate unchanged.<br>**Check the impeller for damage, contamination, or ice formation.** |
| | **b) Lifetime**<br>If the remaining service determined life falls below the defined limit, an error message is issued. | The error is displayed immediately. The device continues to operate unchanged.<br>**After consultation with the manufacturer, perform maintenance.** |
| 21 x | **Error PFC-Control (only for version with 3 ~ PFC)**<br>Fault in PFC unit | With the factory settings, the motor continues to operate unchanged. If a motor shutdown is desired in response to a PFC failure, the parameter settings can be changed. |
| ∞ x | **Internal communication error**<br>Internal communication failure | Fault indication<br>**If error message persists, repair by the manufacturer is necessary.** |
| 1 x — 2 x | **MODBUS Recovery function**<br>A failure in the MODBUS communication has been detected, e.g. incorrect communication parameters (baud rate, parity), wiring error. | The motor can be accessed in recovery mode using the following parameters: Address 254, 19200Baud / 8E1<br>**Check the bus wiring and communication parameters.** |

## Compressor Drive VFD Troubleshooting Chart

| Problem | Potential Cause | Corrective Action |
|---|---|---|
| Earth Fault | There is current from the output phases to ground (earth) in the cables, or the motor. | Check the cables from the converter to the compressor. |
| | | Check for continuity from the compressor terminals to ground. There should be no continuity. |
| Control Word Timeout | There is no communication to the frequency converter. Only active if setting 8-04 is NOT set to [0] OFF. | Verify wiring, and connections are correct. |
| | | Check cable connections to the converter. |
| | | Increase the Control Word Timeout time setting 8-03. |
| | | Check the communication components. |
| Over Current | This fault can be caused by shock loading, or quick acceleration with high inertia load. | Make sure the unit is OFF. Verify the motor shaft can be turned. |
| | | Check the motor size matches the frequency converter. |
| | | Check parameters 1-20 to 1-25 for correct setup. |
| Torque Limit | The torque has exceeded the value in setting 4-16 or 4-17. | Check for excessive current draw on the motor. |
| | | If the motor torque limit is exceeded during ramp-up, extend ramp up time. |
| | | If the generator torque limit is exceeded during ramp down, extend ramp downtime. |
| | | If torque limit occurs while running, increase the torque limit. Verify the system operation can operate safely at a higher torque. |
| Inverter Overload | The converter is about to cut out because of an overload. The thermal protection issues a warning at 98% and an alarm at 100%. This converter cannot be reset until the counter is at 90%. | Compare current output from LCP to the converter's rated current. |
| | | Compare the output shown from the LCP with measured motor current. |
| | | Verify the drive load on the LCP. Monitor the value. The counter will increase when running above the continuous current rating. The counter will decrease when running below the continuous current rating. |
| DC Under Volt | If the intermediate circuit voltage drops below the under-voltage limit, the frequency converter checks if a **24V DC** backup supply is connected. If no **24V DC** backup supply is connected, the converter trips after a fixed time delay. The time delay varies with unit size. | Check that the supply voltage matches the frequency converter voltage. |
| | | Perform input voltage test. |
| DC Over Volt | If the intermediate circuit voltage exceeds the limit, the converter trips after a time. | Connect a brake resistor. |
| | | Extend the ramp time. |
| | | Change the ramp type. |
| | | Activate the functions in 2-10 Brake Function. |
| | | Increase 14-26 Trip Delay at Inverter Fault. |
| | | If the alarm/warning occurs during a power sag, the solution is to use kinetic back-up (14-10 Mains Failure). |
| Short Circuit | There is short-circuiting in the motor or motor wiring. | Remove power to the frequency converter and repair the short circuit. |

| Problem | Potential Cause | Corrective Action |
|---|---|---|
| Mains Phase Loss | A phase is missing on the supply side, or the mains voltage imbalance is too high. This message also appears for a fault in the input rectifier on the frequency converter. Options are programmed at parameter 14-12. | Check the supply voltage and supply currents to the frequency converter. |
| | | Refer to **"Compressor Drive Input/Output (VFD-02)" on page 151**. |
| U Phase Loss | The "U" output terminal signal is lost. | Refer to **"Compressor Drive Input/Output (VFD-02)" on page 151**. |
| V Phase Loss | The "V" output terminal signal is lost. | |
| W Phase Loss | The "W" output terminal signal is lost. | |
| 24V Supply Low | The **24V DC** is measured on the control card. The external **24V DC** backup power supply maybe overloaded. | Check wiring. |
| | | Check backup supply. |
| Mains Fail | This warning/alarm is only active if the supply voltage to the frequency converter is lost and parameter 14-10 is NOT set to [0] No Function. | Check the fuses to the frequency converter and mains power supply to the unit. |
| Safe Stop | Loss of the **24V DC** signal on terminal 37 has caused the filter to trip. | Apply **24V DC** to terminal 37 and reset the filter. |
| Start Fail | The speed has not been able to exceed parameter 1-77 during start within the allowed time. | Motor may be locked. |
| Speed Limit | When the speed is not within the specified range in parameters 4-11 and 4-13, the converter shows a warning. When the speed is below the specified limit in parameter 1-86 (except when starting or stopping), the frequency converter will trip. | This alarm is reset automatically, and the compressor restarts automatically. |
| Current Limit | The current is higher than the value in 4-18 Current Limit. Ensure that the motor data in parameters 1-20 to 1-25 are set correctly. Possibly increase the current limit. Be sure that the system can operate safely at a higher limit. | Make sure that motor data in parameters 1-20 to 1-25 are set correctly. |
| | | Possibly increase the current limit. Be sure that the system can operate safely at a higher limit. |

## Compressor Troubleshooting Chart

| Problem | Potential Cause | Corrective Action |
|---|---|---|
| Compressor will not start | Shorted or broken wires | Use a multi-meter to check the compressor wiring harness for an open or short circuit. |
| | Locked rotor | Check continuity of the compressor. Replace if failed. |
| | Low voltage | Test voltage. |
| | Internal failure | If no other failure is present, there is an internal failure. Replace the compressor. |
| Compressor runs intermittently | Shorted or broken wires | Check the compressor wiring harness for an open or short circuit. |
| | Loose connections | Secure connections. |
| | Shorted or grounded compressor | Check for continuity from the compressor terminals to ground. There should be no continuity. |
| | Overcharge of refrigerant | Recover part of the refrigerant. |
| | Dirty outdoor coil | Clean the outdoor coil. |
| | Incorrect thermostat location | Relocate thermostat. |
| | Electronic Expansion Valve (EEV) | Verify the correct expansion valve is installed. |
| | Hot Gas Reheat Valve | Refer to **“Hot Gas Reheat Valve (HG-1/HG-2)” on page 159**. |
| | Faulty reversing valve | Test reversing valve. |
| | Defrost control | Test defrost control. |
| Compressor cycles on overload | Shortage of refrigerant | Test for leak. Recharge. |
| | Restricted discharge line | Repair or replace as needed. |
| | Non-condensables in system | Recover the charge, evacuate the system. Recharge the system. |
| | Recirculation of condensing air | Remove airflow obstruction. |
| | Electronic Expansion Valve (EEV) | Make sure the expansion valve is operating properly. |
| Compressor making abnormal noise | Overcharge of refrigerant | Recover part of the refrigerant. |
| | Loose hardware | Tighten the mounting bolts. |
| | Internal failure | If no other failure is present, replace the compressor. |
| | Liquid in compressor head | Check **“Superheat and Subcooling” on page 120** and EEV position. |
| Low suction pressure | Low charge | Check **“Superheat and Subcooling” on page 120**. |
| | Restricted discharge line, drier, or reversing valve | Repair as needed. |
| Compressor oil issues | Low oil | If sight glass is available, check oil level. Add oil. |
| | | If there is an oil level sensor. Refer to **“Oil Level Sensor (Sen-x)” on page 155**. |
| | Imbalance of refrigerant | Check **“Superheat and Subcooling” on page 120**. |
| | Compressor running too slow for a long period of time | Adjust compressor speed. |

## Airflow Troubleshooting Chart

| Problem | Potential Cause | Corrective Action |
|---|---|---|
| Fan Inoperative | Blown fuse/Open circuit breaker | Replace fuse or reset circuit breaker and check amps. |
| | Disconnect switch in “Off” position | Turn to “On” position. |
| | Door switch | Verify door is closed properly. |
| | | Check door switch wiring and switch. |
| | Motor wired incorrectly | Check motor wiring to wiring diagram located on fan motor. |
| | Motor starter overloaded | Reset starter and check amps. |
| | HMI set to “Blower Off” | Set HMI to “Blower On.” |
| Motor Overload | Fan rotating in the wrong direction | Verify fan is rotating in the direction shown on rotation label. |
| | Fan speed is too high | Reduce fan RPM. |
| | Motor wired incorrectly | Check motor wiring to wiring diagram located on fan motor. |
| | | Check the fan wiring. |
| | | Check fan rotation using the HMI. |
| | Overload in starter set too low | Set overload to motor FLA value. |
| | Motor HP too low | Determine if HP is sufficient for job. |
| | Duct static pressure lower than design | Reduce fan RPM. |
| Insufficient Airflow | Fan rotating in the wrong direction | Verify fan is rotating in the direction shown on rotation label. |
| | | Check the fan wiring. |
| | | Check fan rotation using the HMI. |
| | Poor outlet conditions | There should be a straight clear duct at the outlet. |
| | Intake damper not fully open | Inspect damper linkage and replace damper motor if needed. |
| | Duct static pressure higher than design | Improve ductwork to eliminate or reduce duct losses. |
| | Fan speed too low | Increase fan RPM. Do not overload motor. |
| | Indoor coil dirty or frozen | Clean Indoor Coil and filters. |
| | Supply grills or registers closed | Open and adjust. |
| | Dirty or clogged filters | Clean and/or replace. |
| Excessive Airflow | Fan speed to high | Reduce fan RPM. |
| | Filters not installed | Install filters. |
| | Duct static pressure lower than design | Reduce fan RPM. |
| Excessive Vibration and Noise | Fan speed is too high | Reduce fan RPM. |
| | Damaged or unbalanced wheel | Replace wheel. |
| | Fan is operating in the unstable region of the fan curve | Refer to performance curve for fan. |
| | Bearings need lubrication or replacement | Lubricate or replace. |

## Furnace Troubleshooting Chart

| Problem | Potential Cause | Corrective Action |
|---|---|---|
| Furnace Does Not Light/Stay Lit | Main gas is off | Open main gas valve. |
| | Shut off valve closed | Open shut off valve. |
| | ON/OFF gas valve is off | Turn ON/OFF gas valve on. |
| | Gas pressure out of range | Adjust to proper gas pressure. |
| | Air in gas line | Purge gas line. |
| | Dirt in burner orifices | Clean orifices with compressed air. |
| | Spark igniter rod out of position | Relocate spark igniter rod to proper area. |
| | No spark at igniter | Refer to **"Flame Safety Control (FSC-01)" on page 157**. |
| | Defective flame safety controller | |
| | Excessive drafts | Re-direct draft away from unit. |
| | Safety device has cut power | Check limits. |
| | | Check airflow switch and tubing at the MUA board. |
| | Dirty flame sensor | Clean flame sensor. |
| | Defective flame sensor | Change heating set-points to call for heat. |
| | Defective valve | Refer to **"Gas Valves" on page 156**. |
| | Loose gas valve wiring | |
| | Thermostat not calling for heat | Change heating set-points to call for heat. |
| | Unit cycling on high limit | Check gas pressure. Increase airflow through furnace, if required. |
| Not Enough Heat | Main gas pressure too low | Increase main gas pressure – do not exceed **14 in. wc** inlet pressure. |
| | Unit locked into low fire | Check wiring or modulating valve settings. Refer to **"Furnace Start-Up Summary" on page 104**. |
| | Too much airflow | Decrease airflow if possible. |
| | Furnace undersized | Check design conditions. |
| | Gas controls not wired properly | Refer to **"Gas Valves" on page 156**. |
| | Thermostat setting too low | Increase thermostat setting. |
| | Thermostat malfunction | Check thermostat. |
| Too Much Heat | Defective modulating gas valve | Check/replace modulating valve. |
| | Thermostat setting too high | Decrease thermostat setting. |
| | Unit locked into high fire | Check modulation valve settings. Refer to **"Furnace Start-Up Summary" on page 104**. |
| | Thermostat wired incorrectly | Check thermostat wiring. |
| | Too much primary air | Reduce primary air. |
| | Manifold pressure set too high | Reduce manifold pressure. |
| Lifting Flames or Flashback | Dirty orifice | Check and clean orifice. |
| | Orifice too large | Check orifice size. |
| | Insufficient primary air | Increase primary air. |
| Yellow Tipping Flames | Misaligned orifice | Check manifold alignment. |
| | Insufficient primary air | Increase primary air. |
| | Orifice too large | Check orifice size. |
| Floating Flames or Flame Rollout | Manifold pressure too high | Decrease manifold pressure. |
| | Blocked vent | Check venting system. |
| | Misaligned orifice | Check manifold alignment. |

## Component Check/Testing

Where electrical components are being changed, they shall be fit for the purpose and to the correct specification. At all times the manufacturer's maintenance and service guidelines shall be followed.

Initial safety checks shall include:

- That capacitors are discharged: this shall be done in a safe manor to avoid possibility of sparking.
- That no live electrical components and wiring are exposed while charging, recovering or purging the system.
- That there is a continuity of earth bonding.

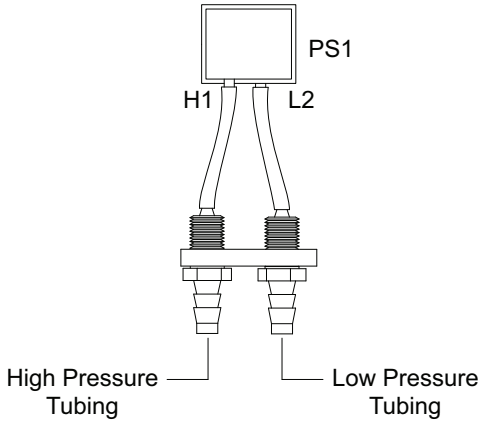
Any broken or malfunctioning sealed electrical components or intrinsically safe components shall be replaced.

Check that cabling will not be subject to wear, corrosion, excessive pressure, vibration, sharp edges, or any other adverse environmental effects. The check shall also take into account the effects of aging or continual vibration from sources such as compressors or fans.

### On-board Airflow Sensor

1. Verify the tubing to the on-board sensor is connected. Confirm there are no kinks, cracks, or damage to the tubing. Replace tubing if needed.
2. With the unit ON, set the blower to "Manual" through the HMI. Go to **Factory Settings > Unit Options > Blower Config > Blower Control > Manual**.
3. Use the HMI to modulate the blower speed to achieve system's minimum design CFM. Go to **User Settings > Fan Speed** to adjust blower frequency or percentage.
4. Monitor the static pressure on the HMI through the service menu for at least one minute. Go to **Service > Variable Values > Inputs > Onbd PS**.
5. Record the lowest pressure reading in **"START-UP AND MAINTENANCE DOCUMENTATION" on page 167**.

**Figure 67 - Board Airflow Sensor**



**Clogged Filter Switch (PS-10)**

1. The vent tube should be connected to the low side port (**Figure 68**). A fault will occur when the switch senses a negative pressure.
2. If the “Clogged Filters” fault is active:
   - Check the filters. If the filters are clogged or damaged, replace as needed. Check for any other obstructions in the unit.
   - Verify the electrical connections are secure and tight. Verify vent tube is not pinched or damaged.
   - When the unit is powered ON:
     - There should be **24-28V AC** at connector J13 pin 5 to ground. If the voltage reading is incorrect, check the wiring harness and voltage at the circuit board.
     - There should be **0V AC** at connector J13 pin 12 to ground. If there is voltage at pin 12, check the adjustment of the switch.

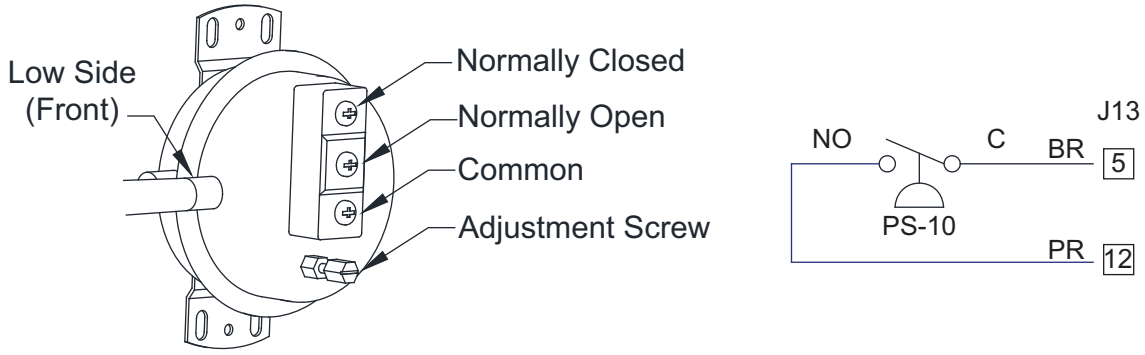
**Clogged Filter Switch Field Adjustment**

Follow these steps if performing a part replacement, or to calibrate the switch.

- Install the switch. Install the vent tube on the low side port.
- Install the electrical connections. Power the unit ON. Set dampers to 100% open for outdoor air. Monitor the HMI screen.
- Use a screwdriver to turn the adjustment screw clockwise until it is completely seated in the switch. Use material suitable to block 50-75% of the intake from the outside of the unit.

Turn the adjustment screw counter-clockwise in one turn increments (waiting 3 seconds per adjustment) until the “Clogged Filters” fault is active. Turn the adjustment screw a 1/4 to 1/2 turn clockwise until the fault is no longer active.

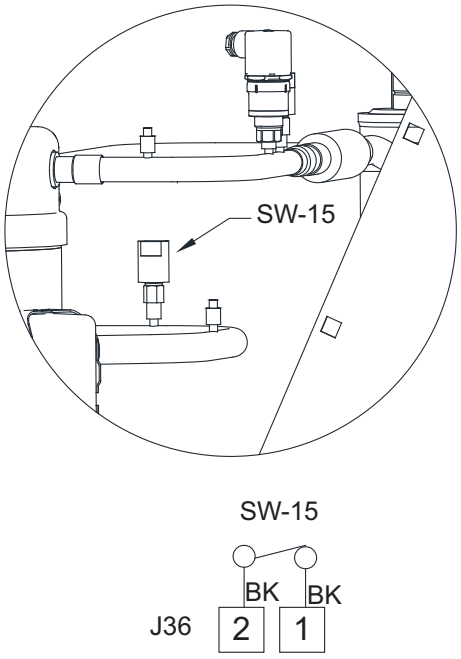
**Figure 68 - Clogged Filter Switch**



### Low Refrigeration Pressure Switch (SW-15)

**Figure 69 - Low Refrigeration Pressure Switch**

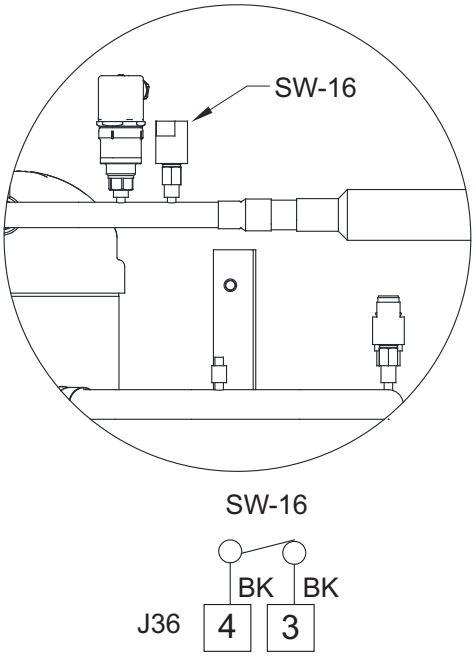
1. For the low pressure switch (**Figure 69**), insert a back probe tool at connector J36 pin 1 and pin 2. Power the unit ON. Check for voltage at the following pins:
   - J36 pin 1 to ground. There should be **24-28V AC**.
   - J36 pin 2 to ground. There should be **24-28V AC**.
     - If the voltage is incorrect, continue to step 2.
     - If the voltage is correct, the system may need to be charged. Refer to **"Monitoring the A/C System" on page 125**.
2. Check the electrical circuit. Power the unit OFF. Check for continuity in the wiring harness.
   - J36 pin 1 to pin 2. There should be continuity.
   - J36 pin 1 to ground. There should be no continuity.
   - J36 pin 2 to ground. There should be no continuity.
     - If any of the continuity readings are incorrect, verify the wiring is not damaged. If no damage is found, replace the low pressure switch.
     - If all of the continuity readings are correct, there may be an issue with transformer.




### High Refrigeration Pressure Switch (SW-16)

**Figure 70 - High Refrigeration Pressure Switch**

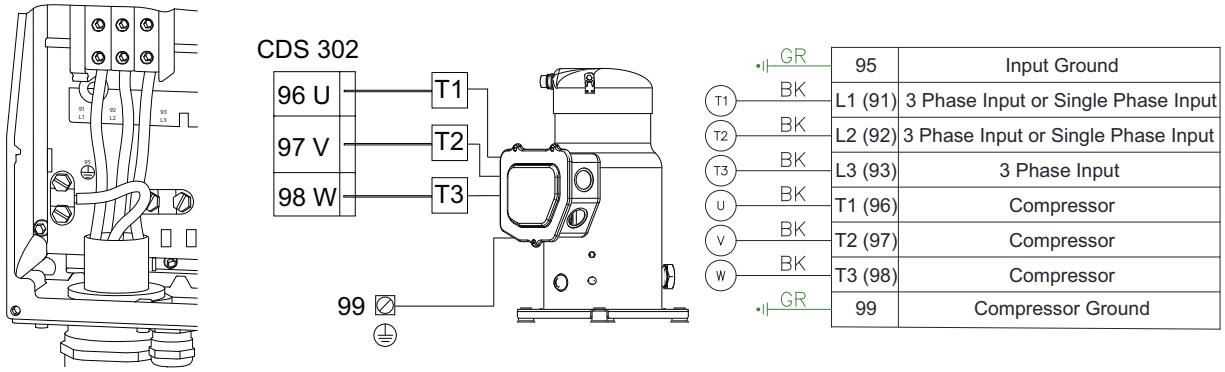
1. If a high pressure switch (**Figure 70**) failure occurred, manually reset the switch.
2. For the high pressure switch, insert a back probe tool at connector J36 pin 3 and pin 4. Power the unit ON. Check for voltage at the following pins:
   - J36 pin 3 to ground. There should be **24-28V AC**.
   - J36 pin 4 to ground. There should be **24-28V AC**.
     - If the voltage is incorrect, continue to step 3.
     - If the voltage is correct, the system maybe overcharged. Refer to **"Monitoring the A/C System" on page 125**.
3. Check the electrical circuit. Power the unit OFF. Check for continuity in the wiring harness.
   - J36 pin 3 to pin 4. There should be continuity.
   - J36 pin 3 to ground. There should be no continuity.
   - J36 pin 4 to ground. There should be no continuity.
     - If any of the continuity readings are incorrect, verify the wiring is not damaged. If no damage is found, replace the high pressure switch.
     - If all of the continuity readings are correct, there may be an issue with transformer.



**Compressor Drive Input/Output (VFD-02)**

1. Power the unit OFF. Verify there is no damage to the wiring. Make sure all connections are secure and connected. Verify wiring connections to the schematic. Refer to **Figure 71** for details.
2. Verify the unit is OFF. Check for open or short circuits in the wiring harness.
3. Power the unit ON. Check for voltage at the following terminals:
   - Terminal L1 to ground. Verify reading to nameplate voltage.
   - Terminal L2 to ground. Verify reading to nameplate voltage.
   - Terminal L3 to ground. Verify reading to nameplate voltage.
   - Terminal T1/U to ground. Voltage will vary with compressor speed.
   - Terminal T2/V to ground. Voltage will vary with compressor speed.
   - Terminal T3/W to ground. Voltage will vary with compressor speed.

**Figure 71 - Compressor Drive**




| | |
|---|---|
| 95 | Input Ground |
| L1 (91) | 3 Phase Input or Single Phase Input |
| L2 (92) | 3 Phase Input or Single Phase Input |
| L3 (93) | 3 Phase Input |
| T1 (96) | Compressor |
| T2 (97) | Compressor |
| T3 (98) | Compressor |
| 99 | Compressor Ground |

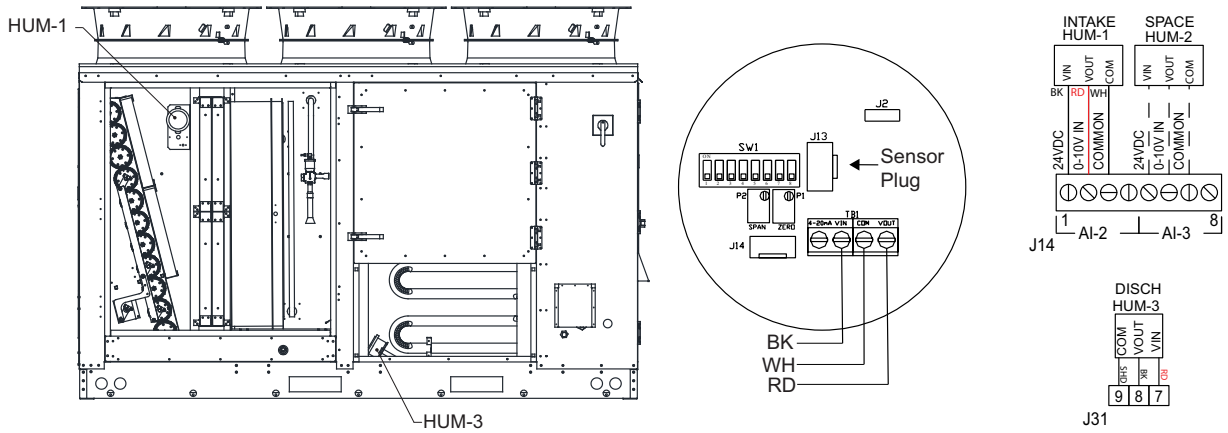
**Humidity Temperature Sensor**

**Intake (HUM-1)/Space (HUM-2)/Discharge (HUM-3)**

**Refer to Figure 72 for component locations. Check the following:**

1. Verify the wiring is connected properly to the terminal block.
2. Verify the DIP switches are set properly. Make sure switch 7 and 8 are ON.
3. Check the wiring is connected properly at the switch.
4. Make sure all the connections are clean, and that there is no condensation on the RH sensor circuit board.

**Figure 72 - Humidity/Temperature Sensors**



**Temperature Sensor**

**Intake (SN-01)/Return (SN-02)/Outdoor (SN-03)/Discharge (SN-04)/Space (HUM-2)**

Refer to **Figure 73** component locations. Check the following:

1. Make sure the unit is OFF.
2. Make sure the wires are connected properly.
3. Measure the resistance of the temperature sensor. Use the temperature/ohm chart to determine your readings.

Connector J15 Sensor Connections:

- SN-01 – J15 pin 1 to pin 2
- SN-02 – J15 pin 3 to pin 4
- SN-03 – J15 pin 5 to pin 6
- SN-04 – J15 pin 7 to pin 8
- SN-05 – J15 pin 9 to pin 10
- HUM-2 – J15 pin 9 to pin 10

Connector J35 Sensor Connections:

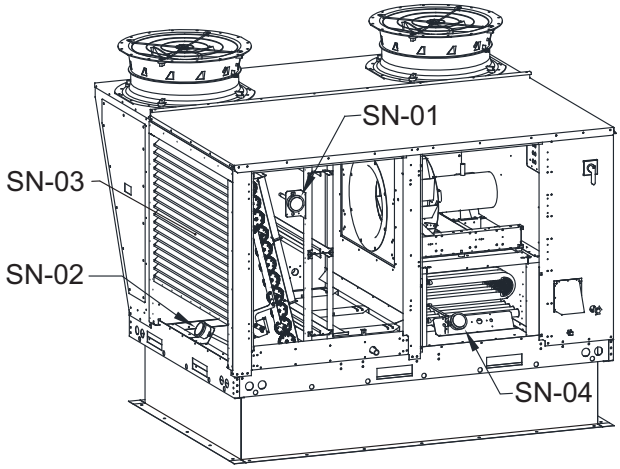
- SN-06 – J35 pin 1 to pin 2
- SN-07 – J35 pin 3 to pin 4
- SN-08 – J35 pin 5 to pin 6
- SN-09 – J35 pin 7 to pin 8
- SN-10 – J35 pin 9 to pin 10

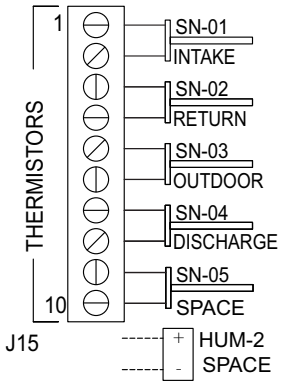
- If there is **0 ohms**, the sensor or wires are shorted.
- If there is **infinite (OL) ohms**, the sensor or wires are open.

If the sensor or wiring has failed, replace the sensor.

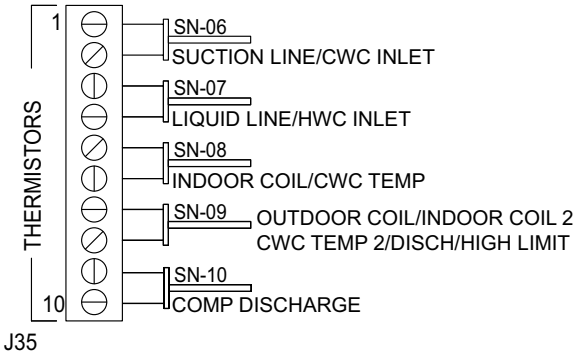
**NOTE: SN-03 is located behind the damper assembly.**

**Figure 73 - Temperature Sensors**




| Temperature | Ohm 10k |
|---|---|
| -20 | 165k |
| -10 | 117k |
| 0 | 85k |
| 10 | 62k |
| 20 | 46k |
| 30 | 34k |
| 40 | 26k |
| 50 | 19k |
| 60 | 15k |
| 70 | 11k |
| 80 | 9k |
| 90 | 7k |
| 100 | 5k |

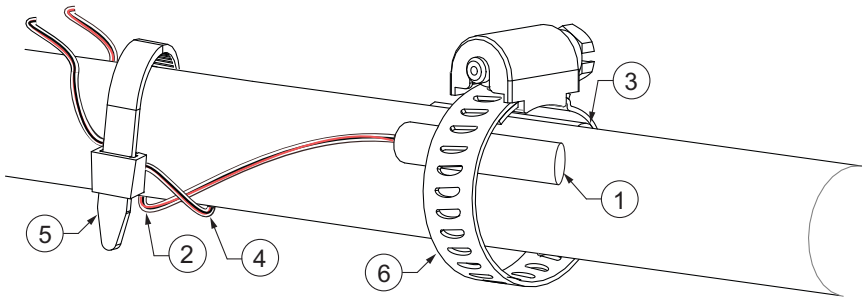


### Suction Line Temperature (SLT) Sensors

1. When installing or replacing a Suction Line Temperature (SLT) sensor, mount the sensor at the 10 and 2 o'clock position (**Figure 74**). The sensor is located by the Low Side Pressure Transducer.
2. Use a stainless steel hose clamp to secure the sensor.
3. Route the cables around the suction line to create a drip loop. Make sure the cables cross underneath the pipe.
4. Zip tie the cables to the copper pipe to secure the drip leg. Refer to **Figure 74. Keep the drip loop between the zip tie and the sensor.**
5. Wrap cork insulation tape around the sensor. Do not cover the area where the wires enter the probe to prevent trapping moisture.
6. Verify wiring is secured to the MUA Board for the Suction Line Temperature Sensor #1. If the sensor is being replaced, crimp ferrules onto the wire ends.
7. If a second temperature sensor is installed, this will be connected to the HMI in the electrical cabinet. Crimp ferrules onto the wire ends.
8. Connect wiring to connector J5 (**Figure 75**).

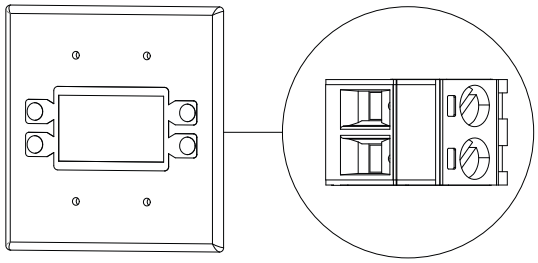
**DO NOT COVER SENSOR WIRES WITH CORK INSULATION TAPE.**

**Figure 74 - Installing Sensors to Copper Pipe**




1. SLT Sensor #1
2. Drip loop for Sensor #1
3. SLT Sensor #2
4. Drip loop for Sensor #2
5. Zip Tie
6. Stainless Steel Hose Clamp

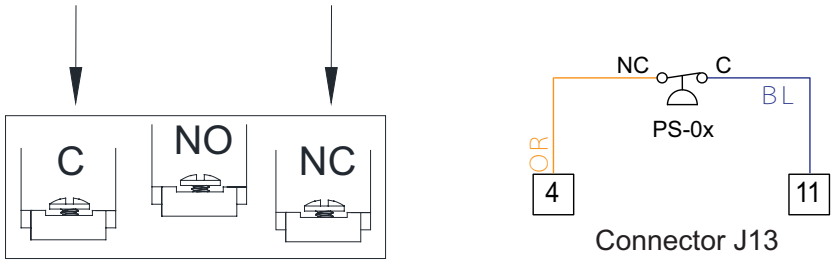
**Figure 75 - Second SLT Connection**



**High Gas Pressure Switch (PS-03)**

1. Turn the unit ON. Reset the lever on the switch. Gas pressure must be lower in the chamber for the reset latch to be set properly. Verify the high gas pressure switch is set to **12 in. w.c.**
2. Remove the cover. Make sure the wiring is set up for Normally Closed (N.C.) contact (**Figure 76**).
3. Verify the ON/OFF gas valve, and modulating valve is set properly. Refer to **"Start-Up Procedure Heating" on page 104**.
4. Check for voltage:
   - Back probe connector J13 pin 4 to ground. There should be **24-28V AC**.
   - Back probe connector J13 pin 11 to ground. There should be **24-28V AC**.
     - If the voltage reading is incorrect, check the wiring for an open or short circuit. If the wiring is correct, the switch has failed. Replace the switch.
     - If the voltage reading is correct, and the switch reset corrected the fault, there may have been an intermittent fault.

**Figure 76 - High Gas Pressure Switch**



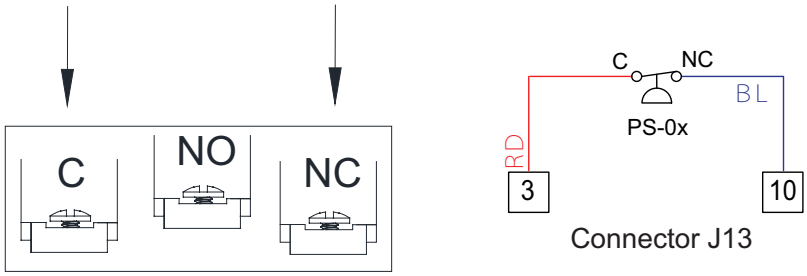

**Low Gas Pressure Switch (PS-04)**

1. Turn the unit ON. Verify the inlet pressure gauge is reading the correct pressure.
   - Natural gas - **7 in. w.c. – 14 in. w.c**.
   - Propane - **11 in. w.c. – 14 in. w.c.**

**NOTE: If the reading is incorrect, contact the gas supply company**.

2. Reset the lever on the switch. Gas pressure must be higher in the chamber for the reset latch to be set properly. If the reset did not work, continue with the next step.
3. Remove the cover. Make sure the wiring is set up for Normally Closed (N.C.) contact (**Figure 77**).
4. Check for voltage:
   - Back probe connector J13 pin 3 to ground. There should be **24-28V AC**.
   - Back probe connector J13 pin 10 to ground. There should be **24-28V AC**.
     - If the voltage reading is incorrect, check the wiring for an open or short circuit. If the wiring is correct, the switch has failed. Replace the switch.
     - If the voltage reading is correct, and the switch reset corrected the fault, there may have been an intermittent fault.

**Figure 77 - Low Gas Pressure Switch**

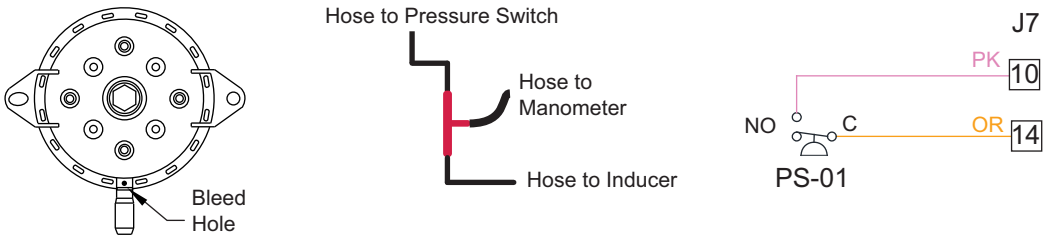


### Vent Proving Switch (PS-01)

1. Verify wiring is connected properly.
2. Check that the vent tubing is routed correctly. Make sure the tube is not pinched or clogged.
3. Verify the bleed hole is not clogged (**Figure 78**). The bleed hole reduces condensation build-up in the switch and tubing.
4. Make sure the unit is OFF. Check the switch. Remove electrical connections. Check for continuity between pin "C" to pin "NO". There should be no continuity.
   - If there is continuity, the switch has failed. Replace the switch.
   - If there is no continuity, re-connect the electrical connections. Continue to the next step.
5. Connect a manometer between the pressure switch and hose. Turn the unit ON. Monitor the manometer. Verify the value (**w.c.**) on the switch is correct.
   - If the reading is below the value, there is an issue with the vacuum. Refer to **"HMI Fault Codes" on page 131** for more information.
   - If the reading is above the value, continue to the next step.
6. With the unit ON. Check for voltage:

- Back probe connector J7 pin 14 to ground. There should be **24-28V AC**.
- Back probe connector J7 pin 10 to ground. There should be **24-28V AC**.
  - If the voltage reading is incorrect, check the wiring for an open or short circuit. If the wiring check is correct, the switch has failed. Replace the switch.
  - If the voltage reading is correct, there may have been an intermittent fault.

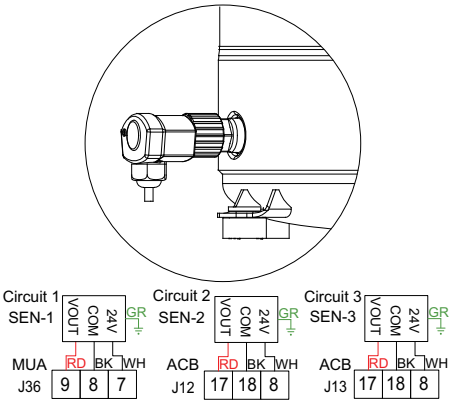
**Figure 78 - Vent Proving Switch**




### Oil Level Sensor (Sen-x)

Refer to **"Compressor Information" on page 66** for more information on oil level sensor (**Figure 79**).

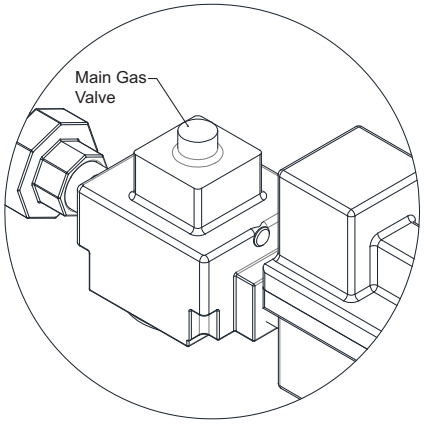
**Figure 79 - Oil Level Sensor**




1. Verify the compressor is not running. Remove the oil level sensor from the compressor.
2. Turn the unit ON. Verify the compressor is OFF by pressing OFF on the LCP panel.
3. Go to Service > Open/Closed Status > Inputs > Oil Sensor: The status should be NC.
   - If the OLS diagnostic tool (120Z0560) is available, insert tool over the optical sensor. The status should change to NO.
   - If the OLS diagnostic tool (120Z0560) is not available, place a light source tightly over the optical sensor. The status should change to NO.
4. Verify checks:
   - If the reading does not change, replace the sensor.
   - If the reading changes (sensor is good), and an oil boost does not clear fault, check for low oil or leaks in the system.

### Main (On/Off) Gas Valve (VA-01)

**Figure 80 - Main Gas Valve**

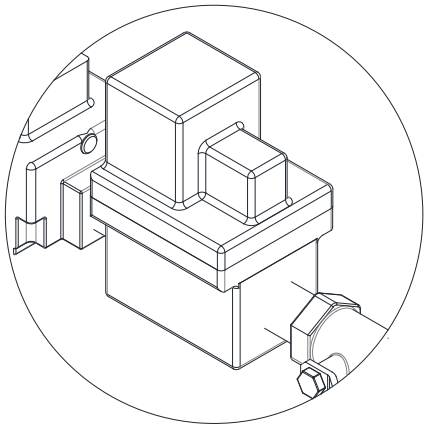


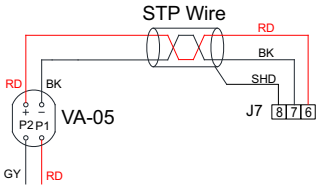

The main gas valve (**Figure 80**) is located in the burner cabinet. Units that use 500MBH and larger furnaces are equipped with two shut-off valves internal to a single body.

1. Make sure the wiring is connected properly.
2. Make sure the gas valve is ON.
3. Turn the unit ON. Check for voltage. Check for voltage across the pins on the gas valve. There should be **24-28V AC**.
   - If the voltage reading is incorrect, check the wiring for an open or short circuit.
   - If the voltage reading is correct, the gas valve may be faulty.

### Modulating Gas Valve (VA-05)

**Figure 81 - Modulating Gas Valve**






The modulating gas valve (**Figure 81**) is located in the main burner cabinet.

1. Make sure the wiring is connected properly. Check the wiring using a multi-meter for open or short circuits.
   - Terminal 1 – Signal (**+**) to J7 pin 6
   - Terminal 2 – Signal (**-**) to J7 pin 7
   - Terminal 3 – Power **24V DC** (**+**) to H4
   - Terminal 4 – Power (**-**) to N4
     - If any damaged wiring is found, repair or replace.
     - If any open or short circuits are found, repair or replace.
     - If any wiring is connected incorrectly, correct the wiring.

**NOTE: The wiring connection is polarity sensitive.**

2. Make sure the DIP switches are all in the OFF position (factory setting). This will set the valve to receive a **0-10V DC** signal. If the unit is set up for an analog control system, refer to **Table 17**.
3. Make sure the valve has been adjusted properly. Refer to **“Start-Up Procedure Heating” on page 104**.
4. If the unit has been running, restart the unit. Check for voltage:
   - Connector J7 pin 6 to ground. There should be **10V DC**. The voltage reading will drop after the unit has been running.
   - Check for voltage between H4 to N4 on the terminal block. There should be **24-28V AC**. This voltage reading will be constant.
     - If the voltage reading is incorrect, check voltage to the IBT control board.
     - If the voltage reading is correct, there may be an issue with the modulating valve.

**Flame Safety Control (FSC-01)**

The FSC is located in the main control cabinet.

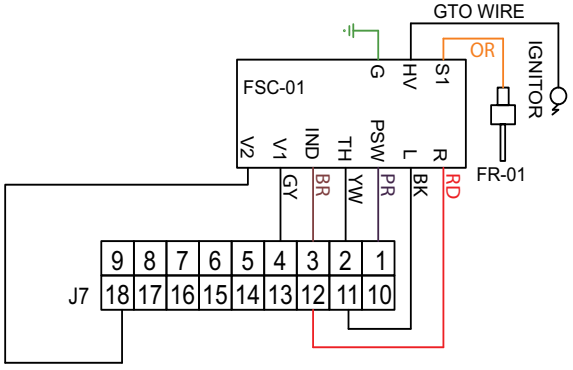
1. Verify wiring and connections are properly connected (**Figure 82**).
2. Turn the unit ON. Use the HMI to set the unit in test mode.
   - Service > Test Menu > Test Heating > Run Low Fire Test > Stages All
   - Refer to **"Flame Safety Control (FSC)" on page 107** for operation of sequence.

Determine the symptom below:

| Symptom | Action |
|---|---|
| Control does not start | • Check wiring.<br>• Check for a **24V AC** transformer failure.<br>• Check circuit breaker.<br>• Check LED light. |
| Thermostat ON – no spark | • Check wiring to thermostat input (TH).<br>• Faulty thermostat.<br>• Check LED light. |
| Blower ON – no Trial For Ignition (TFI) after purge delay | • Check wiring.<br>• Check for flame fault.<br>• Air flow fault, check tubes and connections to MUA Board airflow switch.<br>• Check connection at PSW terminal.<br>• Faulty control (Check voltage between L1 and IND. There should be **24V AC**). |
| Valve ON – no spark during TFI | • Check wiring.<br>• Shorted ignitor electrode.<br>• Check cable to ignitor. |
| Spark ON – valve OFF | • Check wiring.<br>• Valve coil open.<br>• Check voltage at V1. |
| Flame during TFI – no flame sensed after TFI | • Check flame rod position.<br>• Check cable to flame rod.<br>• Poor ground connection at burner.<br>• Poor flame. |

3. Turn the unit ON. If the LED is blinking, verify the fault:
   - Steady ON = Internal controller failure
   - 1 flash = Airflow fault. 2 flashes = Flame without call for heat. 3 flashes = Ignition lock out

**Figure 82 - FSC Wiring**



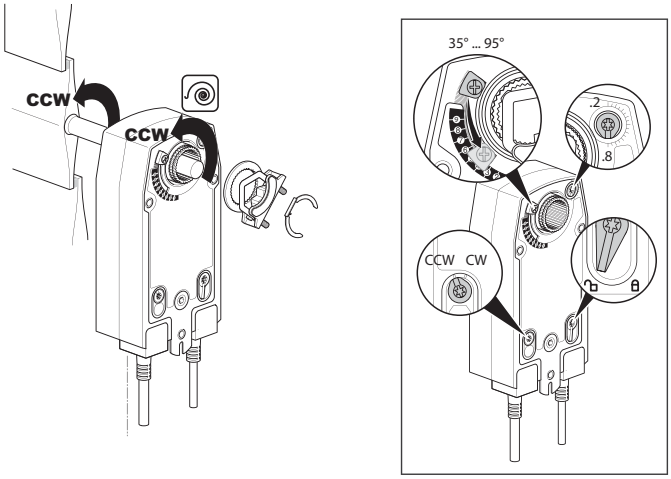
**Intake Damper Motor Assembly (MT-06)**

1. Verify the wiring is correct.
2. Check the wiring for open or short circuits.
3. Verify the positive signal from J18 pin 2 is connected to the assembly at pin 3.
4. Verify the negative signal from J18 pin 9 is connected to the assembly at pin 1.
5. Test the damper rotation. Turn the unit ON. Use the HMI to monitor the movement of the damper.
   - User Settings > Outdoor Air Voltage > 10V (default).
   - Adjust the voltage setting and monitor the damper movement.
     - If the damper movement and voltage reading are correct, test is complete.
     - If the damper movement and voltage reading are incorrect, continue to the next step.
6. Check transformer voltages.
     - If there is an issue with the transformer or wiring, repair or replace.
     - If the transformer check is good, check for mechanical failures.

**Field installation/adjustment**

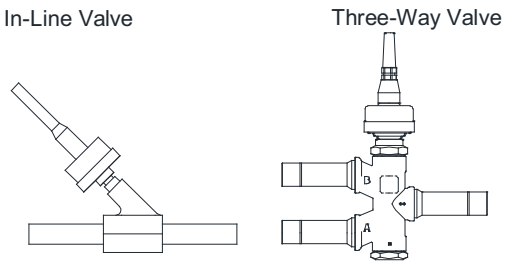
1. Rotate the damper shaft to its fail-safe position (closed). Mount the actuator with the counterclockwise “CCW” out. Refer to **Figure 83**.
2. If the universal clamp is not on the correct side of the actuator, move it to the correct side.
3. Slide the actuator onto the shaft. Position the clamp so that the pointer of the tab is at the top of the rotation.
4. Lock the clamp to the actuator using the retaining clip.
5. Tighten the nuts on the V-bolt. Torque to **6-8 ft-lb**.
6. Secure to strap.
7. Make sure the rotation is set correctly. Y = 0 set to CCW.
8. Test the spring return damper rotation.
   - You can use the crank handle to test manually.
   - Turn the unit ON. Use the HMI to monitor the movement of the damper.
   - Service > Test Menu > Test Misc > Outdoor Air
   - Adjust the voltage setting and monitor the damper movement. **0V – Outdoor air dampers closed**; **10V – Outdoor air dampers open**.
     - If the damper operates properly, the installation is correct.
     - If the damper operates incorrectly, adjust as required. If adjustment cannot be made, check the wiring is correct. Verify to the unit’s wiring schematics.

**Figure 83 - Intake Damper Motor Assembly**



### Hot Gas Reheat Valve (HG-1/HG-2)

**Figure 84 - Hot Gas Reheat**

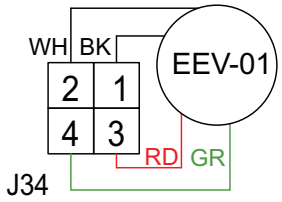



Units with a single reheat valve, HG-1 will be a three-way valve. Units that use dual reheat valves will have HG-1 in-line to the reheat coil inlet and HG-2 in-line to the outdoor (condensing) coil inlet. Refer to **Figure 84** for valve differences.

Power the unit OFF. Verify there is no damage to the wiring. Check the wiring connections to the MUA board connector, verify wiring connections to the schematic. Make sure all connections are secure and connected.

### Electronic Expansion Valve (EEV-1)

**Figure 85 - EEV Wiring Reference**




The Electronic Expansion Valve (EEV-1) wiring (**Figure 85**) is connected to the MUA Board.

1. Power the unit OFF. Verify there is no damage to the wiring. Make sure all connections are secure and connected.
2. Use a multi-meter to measure the resistance in the electronic expansion valve harness from:
   - The black wire to white wire. There should be **90-100 ohms**.
   - The red wire to green wire. There should be **90-100 ohms**.
   - The white wire to ground. There should be infinite resistance (open circuit).
   - The black wire to ground. There should be infinite resistance (open circuit).
   - The red wire to ground. There should be infinite resistance (open circuit).
   - The green wire to ground. There should be infinite resistance (open circuit).
     - If the readings are incorrect, there may be an issue with the electronic expansion valve. Replace EEV if necessary.
     - If the readings are correct and there are no issues with the electronic expansion valve, there may be an issue with the superheat controller.

**Power Vent (MT-02)**

1. If the power vent motor is not operating properly, power the unit OFF.
2. Verify there is no damage to the vent proving switch or vent tube.
3. Verify there is no damage to the wiring, motor or capacitor. Make sure all connections are secure and connected. Verify wiring connections to the schematic. If damage is found, replace the damaged component(s).
4. Check the motor's electrical circuit.

**For standard furnaces (Figure 86):**

Disconnect the wiring connections from pin J17 and pin J21. Power the unit ON. Check for voltage from pin J17 to pin J21 on the board. There should be **115-120V AC.**

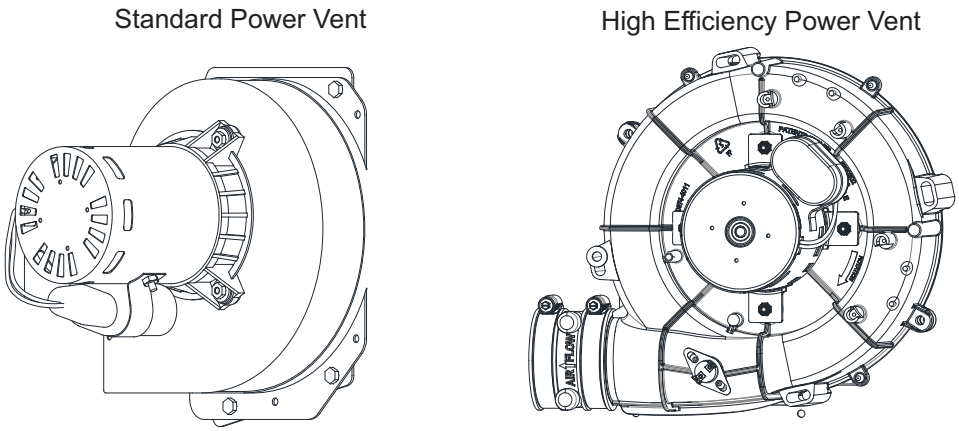
- If the voltage reading is incorrect, verify there is **120V AC** to the circuit board.
- If the voltage reading is correct, check the motor's capacitor. If the capacitor is OK, there may be an issue with the power vent motor.

**For 400HE (High Efficiency) Furnaces (Figure 86):**

1. Power the unit OFF. Check the ground circuit on the five pin connector. Check the ground circuit on the three pin connector. If there is an issue with the ground circuit, repair the circuit. If there is not an issue with the ground circuit, power the unit ON.
2. With the unit powered ON, check for **24V DC** between the (**+**) and (**-**) terminals. If the voltage reading is incorrect, check the **24V DC** power supply.
3. Check the PWM signal from the **EC+** to ground. The voltage reading should vary. If the voltage reading is incorrect, verify connections to the circuit board.
4. Check for **120V AC** between the **H** and **N** terminals. If the voltage reading is incorrect, check the circuit breaker and the main transformer (TR-01).
5. Check the **24V AC** HE Furnace Relay (RE-B). When the relay is actuated, check the following:

- Black wire terminal to ground. There should be **120V AC**.
- Red wire terminal to ground. The voltage will vary.
  - If the voltage reading is incorrect, the relay may have failed.
  - If the voltage reading and all other checks are within specifications, there may be an issue with the power vent motor.

**Figure 86 - Power Vent Motor**



# MAINTENANCE

**WARNING: DO NOT ATTEMPT MAINTENANCE ON THIS EQUIPMENT UNTIL THE ELECTRICAL SUPPLY HAS BEEN COMPLETELY DISCONNECTED AND THE MAIN GAS SUPPLY VALVE HAS BEEN TURNED OFF.**

To guarantee trouble-free operation of this unit, the manufacturer suggests following these guidelines. Most problems associated with failures are directly related to poor service and maintenance.

Record any maintenance or service performed on this unit in the documentation section located at the end of this manual.

## General Maintenance

- Fan inlet and approaches to ventilator and coils should be kept clean and free from any obstruction. Clean both the indoor and outdoor coils regularly to maintain unit efficiency.
- Motors are normally permanently lubricated. Check bearings periodically. If they have grease fittings, lubricate each season. Use caution when lubricating bearings, wipe the fittings clean, the unit should be rotated by hand while lubricating. **Caution: Use care when touching the exterior of an operating motor. Motors normally run hot and may be hot enough to be painful or cause injury.**
- All fasteners should be checked for tightness each time maintenance checks are performed prior to restarting unit.
- Fans require very little attention when moving clean air. Occasionally oil and dust may accumulate causing imbalance. If the fan is installed in a corrosive or dirty atmosphere, periodically inspect and clean the wheel, inlet, and other moving parts to ensure smooth and safe operation.
- The Energy Wheel will require very little attention when moving clean air. Occasionally oil and dust may accumulate, degrading performance. If the ERV is installed in a dirty atmosphere, periodically inspect and clean the wheel, belt, and other moving parts to ensure smooth and safe operation.
- Before each heating season, verify that the drain on the bottom of each common flue box of every furnace in the unit is clear.

## Every 3 Months

Filters must be cleaned and/or replaced quarterly, and more often in severe conditions. Washable filters, located in the intake louver or ERV module, can be washed in warm soapy water. When re-installing filters, be sure to install with the same size and rated filter and with **airflow in the correct direction** as indicated on the filter. Refer to **“Filters” on page 164** for sizing and quantity.

E-coated coils should be inspected and cleaned quarterly. Standard coils should be inspected and cleaned every six months during the **“Cooling Season Maintenance” on page 162**. Refer to **“Coil Cleaning Procedure” on page 163** for coil maintenance information.

## Heating Season Maintenance

- Verify that the drain on the bottom of the flue box in the unit is clear.
- Inspect bolts and set screws for tightness. Tighten as necessary.
- Inspect the wiring on the unit and replace components where necessary.
- Inspect motor for cleanliness. Clean exterior surfaces only. Remove dust and grease from the motor housing to ensure proper motor cooling. Remove dirt and grease from the wheel and housing to prevent imbalance and damage.
- The heat exchanger should be checked for cracks. The heat exchanger should be replaced immediately if cracks are detected. With a soft cloth, remove any built-up dirt or oil on the exterior surface of the heat exchanger.
- Inspect the combustion blower motor for cleanliness. Clean exterior surfaces of the combustion blower motor only. Removing excess dust and grease guarantees proper motor cooling.
- Before each heating season, examine the burner and gas orifices. Inspect burner ports for foreign debris. Check the heat exchanger, and spark igniter for cleanliness. Use a wire brush to remove any soot, dirt, or grease from the burner or orifices.
- If equipped with an ERV, inspect the energy wheel, belt, and drive motor. Inspect for foreign debris or residue build-up, segments of the energy wheel can be removed and washed clean with warm water.

## Cooling Season Maintenance

- Before each cooling season, verify that the drain on the bottom indoor coil drain pan is clear. Inspect bolts and set screws for tightness. Tighten as necessary.
- Inspect the wiring on the unit and replace components where necessary.
- Inspect motor for cleanliness. Clean exterior surfaces only. Remove dust and grease from the motor housing to ensure proper motor cooling. Remove dirt and grease from the wheel and housing to prevent imbalance and damage.
- Inspect the indoor and outdoor coil for dirt and bent fins. Clean or replace as necessary. Refer to **“Coil Cleaning Procedure” on page 163**.
- Check the outdoor fans for proper rotation and operation. Clean all debris from fan guards.
- Inspect all return air dampers, fresh air dampers, and linkage to ensure free operation. Lubricate as necessary.
- With the unit running, check and record the ambient temperature, superheat, compressor suction, and discharge pressures. Record this data on the back of this manual.
- If equipped with an ERV, inspect the energy wheel, belt, and drive motor. Inspect for foreign debris or residue build-up, segments of the energy wheel can be removed and washed clean with warm water.

**NOTE: Do NOT release refrigerant to the atmosphere! If adding or removing refrigerant is required, the service technician must comply with all federal, state, and local laws.**

## Coil Cleaning Procedure

**Do not use a pressure washer or high-water pressure when cleaning the coil.**

Proper maintenance and cleaning will help preserve the performance of coils and avoid corrosion over the length of the equipment's life. Equipment exposed to dusty, dirty, or corrosive environments, requires an inspection and cleaning more frequently. Always use water to rinse the coil down. Hot and cold water with mild dish soap are acceptable.

**CAUTION: NO COIL CLEANERS ARE PERMITTED. IF COIL CLEANERS ARE UTILIZED, THE UNIT'S WARRANTY IS VOID.**

**NOTE: Always wear eye protection, gloves, and other protective clothing when cleaning.**

1. Shut the system OFF. Spray the coil surface with only water to rinse off loose residue. Allow the water to soak for 10-20 minutes to loosen surface residue.
2. Thoroughly rinse the coil with only warm water (~100°F) until all signs of residue are eliminated (it should not be brackish or contain excessive dissolved minerals).
3. Verify the coil is clean, and that no deposits are present. Repeat steps 1 and 2 if the coil is not fully clean.
4. Allow the unit to dry completely before turning the electrical power on or returning the unit to service.
5. Always clean tools, sprayer, roof, nearby areas, and equipment thoroughly with water.
6. Place the system back into service.

**Coil cleaners cannot be utilized. These are aggressive products that are corrosive and damage the equipment.**

**Extensively rinse coils from the bottom of the equipment and all other surrounding metal surfaces.**

## Maintenance Quick Reference Chart

| Component | Maintenance | Interval |
|---|---|---|
| Filters | Clean or replaced. | Every 3 months |
| Damper assembly | Inspect and clean louvers and gutters. | Every 3 months |
| Drain Pans | Clean and clear of obstruction. | Every heating/cooling season |
| Bolts and Screws | Inspect bolts and screws.<br>Verify all hardware is secure and tight. | Every heating/cooling season |
| Wiring and Electrical | Inspect all wiring, and electrical components. | Every heating/cooling season |
| Blower Motor | Inspect motor for cleanliness, and proper rotation. | Every heating/cooling season |
| Heat Exchanger | Inspect for cracks or damage. | Every heating/cooling season |
| Power Vent Motor | Inspect motor for cleanliness. | Every heating/cooling season |
| Burner and Gas Orifices | Inspect for cleanliness. | Every heating/cooling season |
| Indoor/Outdoor Coil | Check for damaged fins and cleanliness of the coil. | Every heating/cooling season |
| Outdoor Fans | Check for proper rotation, operation, and cleanliness. | Every heating/cooling season |
| Damper Assembly | Inspect the linkage and movement. | Every heating/cooling season |
| Unit Operation | Verify the unit pressures. Refer to **"Basic Service" on page 124**. | Every heating/cooling season |

## Filters

**Table 21 - Louvered Intake Filter Quantity Chart (Washable)**

| Unit Housing Size | 16” x 20” x 2” | 16” x 25” x 2” | 20” x 20” x 2” | 20” x 25” x 2” |
|---|---|---|---|---|
| Size 1 | 2 | x | x | x |
| Size 2 | x | x | x | 2 |
| Size 3 | x | 4 | x | x |
| Size 4 | x | x | 8 | x |

| Unit Housing Size | 16” x 20” x 2” | 16” x 25” x 2” |
|---|---|---|
| Size 1 ERV | 4 | x |
| Size 2 ERV | 4 | x |
| Size 3 ERV | x | 4 |
| Size 4 ERV | 8 | x |

**Table 22 - Internal Filter Quantity Chart (Throw Away)**

| Unit Housing Size | 16” x 16” x 2” | 16” x 20” x 2” | 20” x 20” x 2” | 20” x 25” x 2” |
|---|---|---|---|---|
| Size 1 | 4 | x | x | x |
| Size 2 | x | 4 | x | x |
| Size 3 | x | x | x | 4 |
| Size 4 | x | x | 12 | x |

| Unit Housing Size | 16” x 16” x 2” | 16” x 20” x 2” | 20” x 20” x 2” | 16” x 25” x 2” | 25” x 25” x 2” |
|---|---|---|---|---|---|
| Size 1 ERV | 4 | x | 4 | x | x |
| Size 2 ERV | x | 4 | 2 | x | x |
| Size 3 ERV | x | x | x | 8 | x |
| Size 4 ERV | x | 16 | x | x | x |

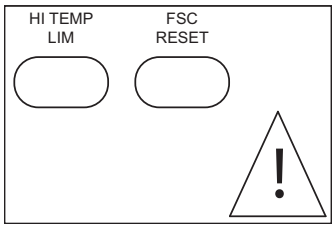
**NOTE: Quantity subject to change based on filter options. Optional 4” thick filters available upon request.**

## Resetting Unit

If the flame safety control is locked out (alarm light on), reset the unit by:

1. Press the FSC Reset push-button, refer to **Figure 87**. If pressing the reset fails, continue to step 2.
2. Turn OFF power to the unit.
3. Turn power to the unit back ON.

**Figure 87 - Reset Buttons (MUA Board)**




## Emergency Shutdown of Unit

To shutdown the unit in the event of an emergency, do the following:

1. Turn power OFF to the unit from main building disconnect.
2. Turn the external disconnect switch to the OFF position.
3. CLOSE the inlet gas valve located on the heater.

## Prolonged Shutdown of Unit

For prolonged shutdown, the following steps should be done:

1. Turn the external disconnect switch to the OFF position.
2. CLOSE the inlet gas valve located on the heater.

To re-start the unit, the following steps should be done:

1. Turn the external disconnect switch to the ON position.
2. OPEN the inlet gas valve located on the heater.

# UNIT DECOMMISSIONING

Equipment shall be labeled stating that it has been decommissioned and emptied of refrigerant. The label shall be dated and signed. For applications containing R454B refrigerant, ensure that there are labels on the equipment stating the equipment contains R454B (flammable refrigerant).

When removing refrigerant from the system, either for servicing or decommissioning, it is recommended good practice that all refrigerants are removed safely.

When transferring refrigerant into cylinders, ensure that only appropriate refrigerant recovery cylinders are employed. Ensure that the correct number of cylinders for holding the total system charge is available. All cylinders to be used are designated for the recovery of refrigerant and labeled for R454B. Cylinders shall be complete with pressure-relief valve and associated shut off valves in good working order. Empty recovery cylinders are evacuated and, if possible, cooled before recovery occurs.

The recovery equipment shall be in good working order with a set of instructions concerning the equipment that is at hand and shall be suitable for the recovery of the flammable refrigerant. If in doubt, contact service, refer to **page 168** for contact information.

In addition, a set of calibrated weighing scales shall be available and in good working order. Hoses shall be complete with leak free disconnect couplings and in good condition.

The recovery refrigerant shall be processed according to local legislation in the correct recovery cylinder, and the relevant waste transfer note arranged. Do not mix refrigerant in recovery units and especially in recovery cylinders.

If compressors or compressor oils are to be removed, ensure they have been evacuated to an acceptable level to make certain that the flammable refrigerant shall not remain in the lubricant. The compressor body shall not be heated by open flames or other ignition sources to accelerate this process. When oil is drained from a system, it shall be carried out safely.

# START-UP AND MAINTENANCE DOCUMENTATION

**START-UP AND MEASUREMENTS SHOULD BE PERFORMED AFTER THE SYSTEM HAS BEEN AIR BALANCED AND WITH THE COOLING ON (warranty will be void without completion of this form).**

## Job Information

| | | | |
|---|---|---|---|
| Job Name | | Service Company | |
| Address | | Address | |
| City | | City | |
| State | | State | |
| Zip | | Zip | |
| Phone Number | | Phone Number | |
| Fax Number | | Fax Number | |
| Contact | | Contact | |
| Purchase Date | | Start-up Date | |

## Unit Information

| Name Plate and Unit Information | |
|---|---|
| Model Number | |
| Serial Number | |
| Unit Voltage | |
| Unit Hertz | |
| Unit Phase | |
| Unit FLA | |
| Unit Supply HP | |
| Gas Type | |
| Min. Btu/Hr | |
| Max. Btu/Hr | |
| Measured Temp Rise °F/C | |
| Airflow Pressure Reading | |

| Field Measure Information | | |
|---|---|---|
| Motor Voltage | | |
| Motor Amperage* | | |
| MUA Blower RPM | | |
| Ambient Wet Bulb Temp °F/C | | |
| Ambient Dry Bulb Temp °F/C | | |
| Cond Suction Pressure psi | C1 | C2 |
| Cond Suction Temp °F/C | C1 | C2 |
| Cond Liquid Pressure psi | C1 | C2 |
| Cond Liquid Temp °F/C | C1 | C2 |
| Cond Subcooling °F/C | C1 | C2 |
| Cond Superheat °F/C | C1 | C2 |
| Airflow Pressure Reading | | |
| Airflow Direction - Correct? | | |

## Maintenance Record

## Date of Visit

| Field Measured Information – Initial Readings | | |
|---|---|---|
| Motor Voltage | | |
| Motor Amperage* | | |
| MUA Blower RPM | | |
| Ambient Wet Bulb Temp °F/C | | |
| Ambient Dry Bulb Temp °F/C | | |
| Cond Suction Pressure psi | C1 | C2 |
| Cond Suction Temp °F/C | C1 | C2 |
| Cond Liquid Pressure psi | C1 | C2 |
| Cond Liquid Temp °F/C | C1 | C2 |
| Cond Subcooling °F/C | C1 | C2 |
| Cond Superheat °F/C | C1 | C2 |
| Airflow Pressure Reading | | |

| Field Measured Information – Final Readings | | |
|---|---|---|
| Motor Voltage | | |
| Motor Amperage* | | |
| MUA Blower RPM | | |
| Ambient Wet Bulb Temp °F/C | | |
| Ambient Dry Bulb Temp °F/C | | |
| Cond Suction Pressure psi | C1 | C2 |
| Cond Suction Temp °F/C | C1 | C2 |
| Cond Liquid Pressure psi | C1 | C2 |
| Cond Liquid Temp °F/C | C1 | C2 |
| Cond Subcooling °F/C | C1 | C2 |
| Cond Superheat °F/C | C1 | C2 |
| Airflow Pressure Reading | | |

***If measured amps exceed the FLA rating on the nameplate, fan RPM must be reduced to decrease the measured amps below the nameplate FLA rating.**

**Maintenance Record**

**Date of Visit**

| Field Measured Information – Initial Readings | | |
|---|---|---|
| Motor Voltage | | |
| Motor Amperage* | | |
| MUA Blower RPM | | |
| Ambient Wet Bulb Temp °F/C | | |
| Ambient Dry Bulb Temp °F/C | | |
| Cond Suction Pressure psi | C1 | C2 |
| Cond Suction Temp °F/C | C1 | C2 |
| Cond Liquid Pressure psi | C1 | C2 |
| Cond Liquid Temp °F/C | C1 | C2 |
| Cond Subcooling °F/C | C1 | C2 |
| Cond Superheat °F/C | C1 | C2 |
| Airflow Pressure Reading | | |

| Field Measured Information – Final Readings | | |
|---|---|---|
| Motor Voltage | | |
| Motor Amperage* | | |
| MUA Blower RPM | | |
| Ambient Wet Bulb Temp °F/C | | |
| Ambient Dry Bulb Temp °F/C | | |
| Cond Suction Pressure psi | C1 | C2 |
| Cond Suction Temp °F/C | C1 | C2 |
| Cond Liquid Pressure psi | C1 | C2 |
| Cond Liquid Temp °F/C | C1 | C2 |
| Cond Subcooling °F/C | C1 | C2 |
| Cond Superheat °F/C | C1 | C2 |
| Airflow Pressure Reading | | |

**Maintenance Record**

**Date of Visit**

| Field Measured Information – Initial Readings | | |
|---|---|---|
| Motor Voltage | | |
| Motor Amperage* | | |
| MUA Blower RPM | | |
| Ambient Wet Bulb Temp °F/C | | |
| Ambient Dry Bulb Temp °F/C | | |
| Cond Suction Pressure psi | C1 | C2 |
| Cond Suction Temp °F/C | C1 | C2 |
| Cond Liquid Pressure psi | C1 | C2 |
| Cond Liquid Temp °F/C | C1 | C2 |
| Cond Subcooling °F/C | C1 | C2 |
| Cond Superheat °F/C | C1 | C2 |
| Airflow Pressure Reading | | |

| Field Measured Information – Final Readings | | |
|---|---|---|
| Motor Voltage | | |
| Motor Amperage* | | |
| MUA Blower RPM | | |
| Ambient Wet Bulb Temp °F/C | | |
| Ambient Dry Bulb Temp °F/C | | |
| Cond Suction Pressure psi | C1 | C2 |
| Cond Suction Temp °F/C | C1 | C2 |
| Cond Liquid Pressure psi | C1 | C2 |
| Cond Liquid Temp °F/C | C1 | C2 |
| Cond Subcooling °F/C | C1 | C2 |
| Cond Superheat °F/C | C1 | C2 |
| Airflow Pressure Reading | | |

***If measured amps exceed the FLA rating on the nameplate, fan RPM must be reduced to decrease the measured amps below the nameplate FLA rating.**

**Circuit Trimming Record**

| Factory Charge Circuit 1 | | |
|---|---|---|
| Trim # | Trim Amount (lbs) | New Total Charge (lbs) |
| 1 | | |
| 2 | | |
| 3 | | |
| 4 | | |
| 5 | | |
| 6 | | |
| 7 | | |
| 8 | | |
| 9 | | |
| 10 | | |

| Factory Charge Circuit 2 | | |
|---|---|---|
| Trim # | Trim Amount (lbs) | New Total Charge (lbs) |
| 1 | | |
| 2 | | |
| 3 | | |
| 4 | | |
| 5 | | |
| 6 | | |
| 7 | | |
| 8 | | |
| 9 | | |
| 10 | | |

**As a result of our dedication to constant improvements and quality, the MANUFACTURER reserves the right to update specifications without notice. Please refer to MANUFACTURER'S website for up to date documentation.**

## Technical Support Information

CASLink

Technical Support

Parts Store

# Endeavor® Line Air Handlers



## RH2TZ

Constant Torque Motor
Two-Stage Airflow
Efficiencies: 13.4 to 16.0 SEER2
Expansion Device: Thermal Expansion Valve (TXV)

ISO 9001:2015

c UL us LISTED

AHRI CERTIFIED
www.ahridirectory.org
Unitary Small AC
AHRI Standard 210/240

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Airflow Directional Data .....7
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Electrical Data ..... 13-18
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## Features and Benefits

- **Quiet Operation[1]:** Provided by a cabinet construction with 1.0 inch of foil faced insulation for quieter sound characteristics
- **Aluminum Indoor Coil Design:** Constructed of aluminum fins bonded to internally grooved aluminum tubing and are more corrosion resistant
- **Versatile 4-Way Convertible Compact Design:** Allow for upflow, downflow, horizontal left and horizontal right applications even in the smallest of spaces
- **Rugged Steel, Compact Cabinet Construction:** Designed for added strength and versatility
- **Field Installed Auxiliary Heater Kits:** Provide exact heat for indoor comfort and include circuit breakers which meet UL and cUL requirements for service disconnect
- **Less than 2% Cabinet Air Leakage at 1-inch $H_2O$:** When tested in accordance with ASHRAE Standard 193

[1]*Based on manufacturer's air handler offering, and the product's airflow stages, motor type and cabinet insulation. Sound levels are also dependent on air handler location and installation.*

# Air Handlers

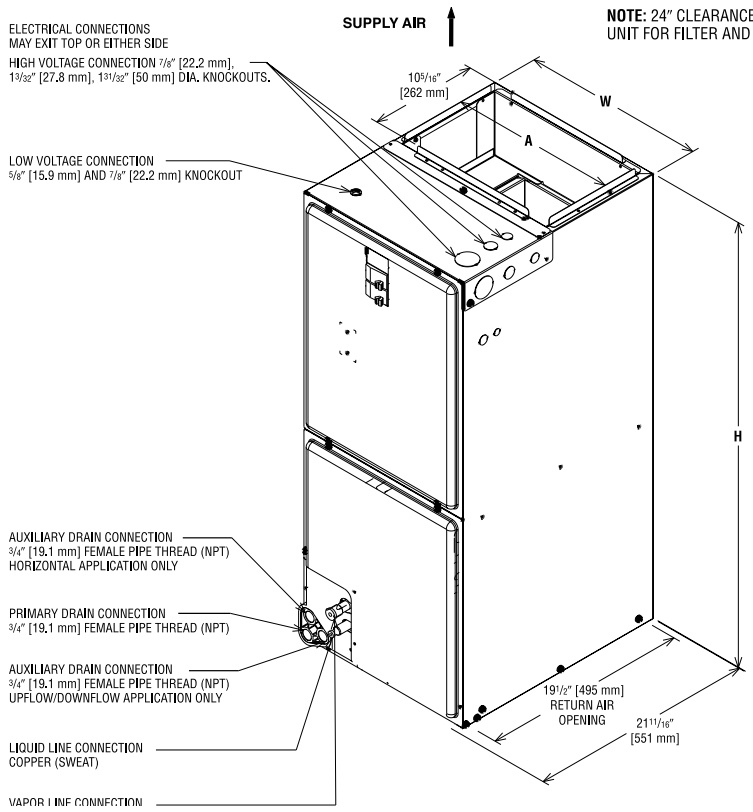
| R | H | 2 | T | Z | 24 | 17 | S | T | A | N | N | A |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Brand** | **Product Category** | **Stages of Airflow** | **Motor Type** | **Refrigerant** | **Capacity BTU/HR** | **Width** | **Coil Size** | **Metering Device** | **Major Series*** | **Controls** | **Coil Series** | **Voltage** |
| R - Rheem | H - Air Handlers | 2 - Two-Stage | T - Constant Torque | Z - R-410A | 24 - 24,000 [7.03 kW]<br>36 - 36,000 [10.55 kW]<br>48 - 48,000 [14.07 kW]<br>60 - 60,000 [17.58 kW] | 17 - 17.5"<br>21 - 21"<br>24 - 24.5" | S - Standard Eff.<br>M - Mid | T - TXV | A - 1st Design | N - Non-comm. | N - N Coil<br>A - A Coil | A - 1ph, 115/60<br>J - 1ph, 208-240/60 |

**[ ] Designates Metric Conversions**

| Available Models |
|---|
| RH2TZ2417STANNA |
| RH2TZ2417STANNJ |
| RH2TZ3617STANNA |
| RH2TZ3617STANNJ |
| RH2TZ3621MTANAA |
| RH2TZ3621MTANAJ |
| RH2TZ3621MTANNA |
| RH2TZ3621MTANNJ |
| RH2TZ3621STANNA |
| RH2TZ3621STANNJ |
| RH2TZ4821STANAA |
| RH2TZ4821STANAJ |
| RH2TZ4821STANNA |
| RH2TZ4821STANNJ |
| RH2TZ4824STANNA |
| RH2TZ4824STANNJ |
| RH2TZ6021STANAA |
| RH2TZ6021STANAJ |
| RH2TZ6024STANNA |
| RH2TZ6024STANNJ |

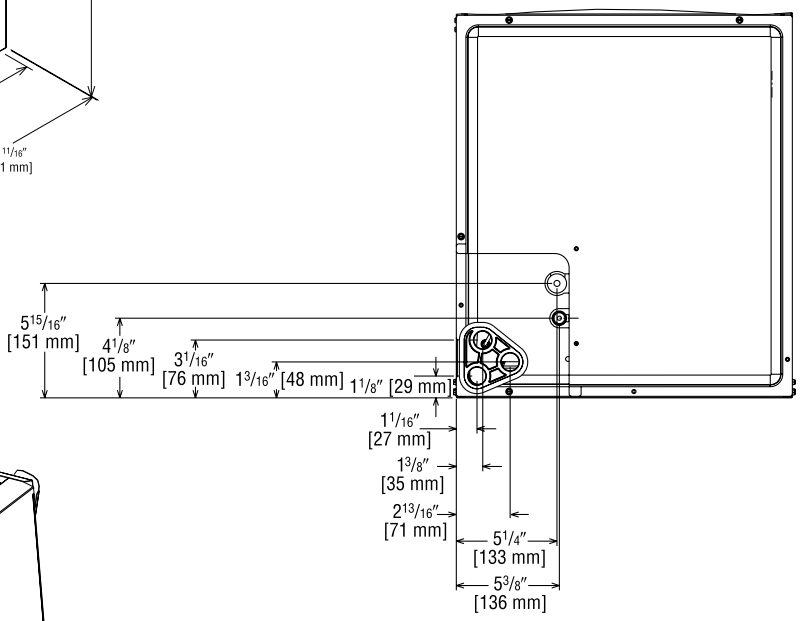
| Standard Equipment |
|---|
| Pre-painted cabinet |
| Four leg blower mount motor |
| Slide out blower design for service and maintenance convenience |
| Traditional open wire element design for heat applications |
| Field convertible for vertical downflow, horizontal left hand or right hand air supply |
| 3 combustible floor base accessories fit all sizes for downflow installations |
| Indoor coil design provides low air side pressure drop, high performance and extremely compact size |
| Expansion valve on indoor coil provides for operation with air conditioning or heat pump |
| Coils are tested at the factory with an extensive refrigerant leak check |
| Coils have copper sweat refrigerant connections and utilize chatleff metering device connections |
| Supply duct flanges |
| Side or top provisions for field electrical connections |
| Inside connection for high voltage wiring |
| Outside connection for low voltage wiring |
| Concentric knockouts are provided for power connection |
| Front refrigerant and drain connections |

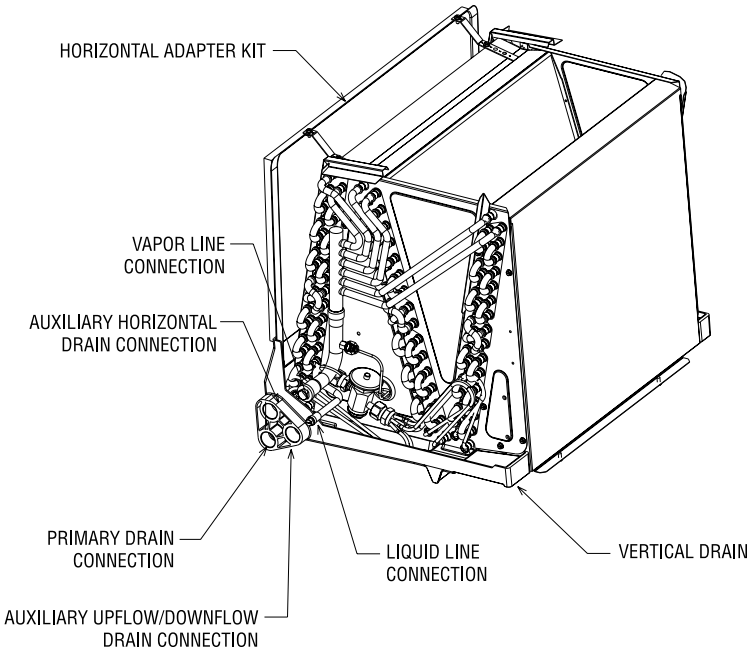
# Unit Dimensions




## Return Air Opening Dimensions

| Model Cabinet Size | Return Air Opening Width (Inches) | Return Air Opening Depth/Length (Inches) |
|---|---|---|
| 17 | 15 7/8 | 19 3/4 |
| 21 | 19 3/8 | 19 3/4 |
| 24 | 22 7/8 | 19 3/4 |




**UPFLOW UNIT SHOWN: UNIT MAY BE INSTALLED UPFLOW, DOWNFLOW, HORIZONTAL RIGHT OR LEFT AIR SUPPLY.**

**[ ] Designates Metric Conversions**

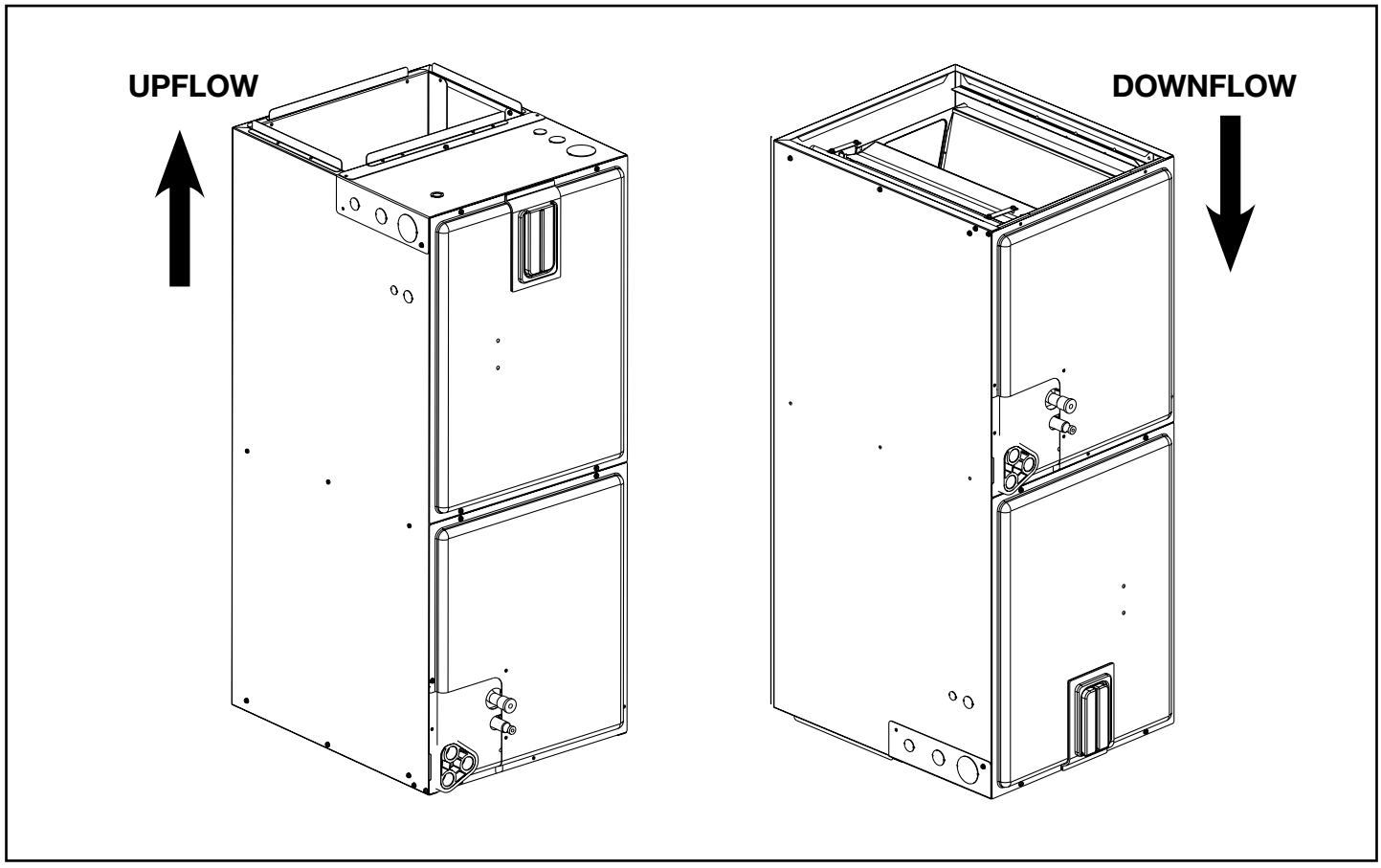
**( ) Designates Unit with Double Coil Cabinet**

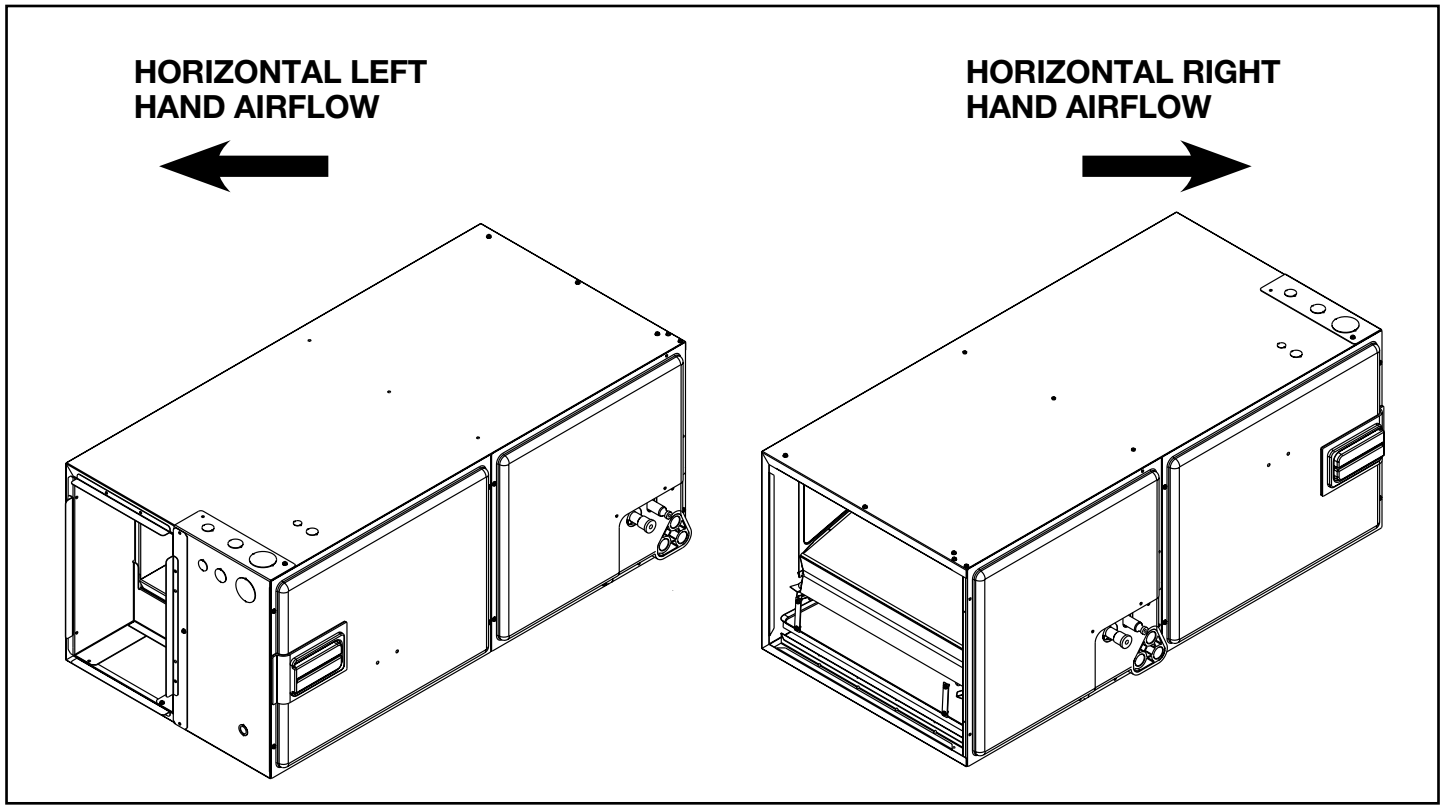
# Unit Dimensions & Weights

| Model Size RH2TZ | Refrigerant Connections Sweat (In.) [mm] ID | | Unit Width "W" In. [mm] | Unit Height "H" In. [mm] | Supply Duct "A" In. [mm] | Air Flow CFM (Nom.) [L/s] | | Unit Weight/Shipping Weight (Lbs.) [kg] |
|---|---|---|---|---|---|---|---|---|
| | Liquid | Vapor | | | | Lo | Hi | Unit With Coil (Max. KW) |
| 2417ST | 3/8 [9.53] | 3/4 [19.05] | 17 1/2 [445] | 42 1/2 [1080] | 16 [406] | 600 [283] | 800 [378] | 92/106 [42/48] |
| 3617ST | 3/8 [9.53] | 3/4 [19.05] | 17 1/2 [445] | 42 1/2 [1080] | 16 [406] | 1000 [472] | 1200 [566] | 96/110 [44/50] |
| 3621ST | 3/8 [9.53] | 3/4 [19.05] | 21 [533] | 42 1/2 [1080] | 19 1/2 [495] | 525 [248] | 700 [330] | 111/126 [50/57] |
| 3621MT**N | 3/8 [9.53] | 7/8 [22.23] | 21 [533] | 50 1/2 [1282] | 19 1/2 [495] | 1000 [472] | 1200 [566] | 126/142 [57/64] |
| 3621MT**A | 3/8 [9.53] | 7/8 [22.23] | 21 [533] | 57 [1448] | 19 1/2 [495] | 1000 [472] | 1200 [566] | 137/149 [62/68] |
| 4821ST**N | 3/8 [9.53] | 7/8 [22.23] | 21 [533] | 50 1/2 [1282] | 19 1/2 [495] | 1400 [661] | 1600 [755] | 128/144 [56/65] |
| 4821ST**A | 3/8 [9.53] | 7/8 [22.23] | 21 [533] | 57 [1448] | 19 1/2 [495] | 1400 [661] | 1600 [755] | 139/151 [63/68] |
| 4824ST**N | 3/8 [9.53] | 7/8 [22.23] | 24 1/2 [622] | 55 1/2 [1410] | 23 [584] | 1050 [495] | 1400 [660] | 128/146 [58/66] |
| 6021ST**A | 3/8 [9.53] | 7/8 [22.23] | 21 [533] | 57 [1448] | 19 1/2 [495] | 1600 [755] | 1725 [814] | 139/151 [63/68] |
| 6024ST | 3/8 [9.53] | 7/8 [22.23] | 24 1/2 [622] | 55 1/2 [1410] | 23 [584] | 1200 [566] | 1600 [755] | 161/178 [73/81] |

**[ ] Designates Metric Conversions**

## Airflow Directional Data



# Airflow Performance

**Airflow performance data is based on cooling performance with a coil and no filter in place.** Select performance table for appropriate unit size, voltage and number of electric heaters to be used. Make sure external static applied to unit allows operation within the minimum and maximum limits shown in table below for both cooling and electric heat operation. For optimum blower performance, operate the unit in the .3 [8 mm] to .7 inches [18 mm] W.C. external static range. Units with coils should be applied with a minimum of .1 inch [3 mm] W.C. external static range.

# Airflow Operating Limits

| **Cabinet Width** | **17** | | **17/21** | | **21** | | | **24** | |
|---|---|---|---|---|---|---|---|---|---|
| Cooling BTUH x 1,000<br>Cooling Tons Nominal | 18<br>1.5 | 24<br>2 | 30<br>2.5 | 36<br>3 | 42<br>3.5 | 48<br>4 | 60<br>5 | 48<br>4 | 60<br>5 |
| Heat Pump or Air Conditioning<br>Maximum Heat/Cool CFM [L/s]<br>(37.5 CFM [18 L/s]/1,000 BTUH)<br>(450 CFM [212 L/s]/Ton Nominal) | 675<br>[319] | 900<br>[425] | 1125<br>[531] | 1350<br>[637] | 1575<br>[743] | 1800<br>[850] | 1925<br>[907] | 1800<br>[850] | 1930*<br>[911] |
| Heat Pump or Air Conditioning<br>Nominal Heat/Cool CFM [L/s]<br>(33.3 CFM [16 L/s]/1,000 BTUH)<br>(400 CFM [189 L/s]/Ton Nominal) | 600<br>[283] | 800<br>[378] | 1000<br>[472] | 1200<br>[566] | 1400<br>[661] | 1600<br>[755] | 1750<br>[826] | 1550<br>[732] | 1800*<br>[850] |
| Heat Pump or Air Conditioning<br>Minimum Heat/Cool CFM [L/s]<br>(30.0 CFM [14 L/s]/1,000 BTUH)<br>(360 CFM [170 L/s]/Ton Nominal) | 540<br>[255] | 720<br>[340] | 900<br>[425] | 1080<br>[510] | 1260<br>[595] | 1440<br>[680] | 1575<br>[743] | 1440<br>[680] | 1620*<br>[765] |
| Maximum kW Electric Heating &<br>Minimum Electric Heat CFM [L/s] | 13<br>487 [230] | 13<br>617 [291] | 18<br>814 [384] | 18<br>1054 [497] | 20<br>1171 [553] | 25<br>1502 [709] | 25<br>1502 [709] | 25<br>1502 [709] | 30<br>1666 [786] |
| Maximum Electric Heat Rise °F [°C] | 80 [26.7] | 63 [17.2] | 66 [18.9] | 51 [10.6] | 49 [9.4] | 50 [10] | 50 [10] | 50 [10] | 54 [12.2] |

**[ ] Designates Metric Conversions**

# 115V/208V/240V Airflow Performance Data – RH2TZ (Constant Torque (ECM) Motor)

| Model No. RH2TZ | Tonnage Application | Motor Speed From Factory | Blower Size/ Motor HP [W] # of Speed | Motor Speed | | CFM/RPM/WATTS — Dry Coil — No Filter | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | External Static Presure Inches of W.C. | | | | | | | | | |
| | | | | | | 0.1 | 0.2 | 0.3 | 0.4 | 0.5 | 0.6 | 0.7 | 0.8 | 0.9 | 1.0 |
| 2417ST No Heater | 1.5 Ton | 4/5 | 10x8 1/3 HP [373] 5 Speed | 2 | CFM | 835 | 664 | 501 | 434 | 362 | 294 | 273 | 243 | 217 | 194 |
| | | | | | RPM | 570 | 581 | 617 | 687 | 746 | 814 | 846 | 894 | 934 | 998 |
| | | | | | Watts | 89 | 70 | 59 | 66 | 72 | 78 | 78 | 82 | 86 | 90 |
| | | | | 3 | CFM | 852 | 790 | 740 | 695 | 649 | 589 | 545 | 489 | 441 | 383 |
| | | | | | RPM | 586 | 634 | 686 | 740 | 791 | 851 | 899 | 951 | 990 | 1049 |
| | | | | | Watts | 94 | 98 | 105 | 113 | 121 | 129 | 136 | 144 | 149 | 159 |
| 2417ST with Heater | 1.5 Ton | 4/5 | 10x8 1/3 HP [373] 5 Speed | 2 | CFM | 810 | 644 | 486 | 421 | 352 | 285 | 265 | 236 | 210 | 188 |
| | | | | | RPM | 599 | 610 | 648 | 721 | 783 | 854 | 889 | 939 | 981 | 1048 |
| | | | | | Watts | 96 | 77 | 65 | 71 | 78 | 85 | 85 | 89 | 93 | 98 |
| | | | | 3 | CFM | 878 | 814 | 763 | 715 | 629 | 572 | 528 | 474 | 428 | 372 |
| | | | | | RPM | 558 | 604 | 654 | 705 | 830 | 894 | 944 | 998 | 1040 | 1101 |
| | | | | | Watts | 86 | 90 | 96 | 104 | 132 | 141 | 148 | 157 | 163 | 174 |
| 2417ST No Heater | 2 Ton | 4/5 | 10x8 1/3 HP [373] 5 Speed | 4 | CFM | 829 | 662 | 555 | 482 | 430 | 363 | 303 | 260 | 202 | 181 |
| | | | | | RPM | 573 | 584 | 635 | 705 | 757 | 814 | 876 | 925 | 990 | 1027 |
| | | | | | Watts | 88 | 70 | 68 | 75 | 80 | 86 | 93 | 98 | 105 | 109 |
| | | | | 5 | CFM | 974 | 927 | 882 | 838 | 799 | 761 | 710 | 660 | 611 | 563 |
| | | | | | RPM | 643 | 689 | 737 | 784 | 833 | 882 | 931 | 979 | 1023 | 1067 |
| | | | | | Watts | 127 | 135 | 143 | 151 | 159 | 168 | 176 | 185 | 192 | 200 |
| 2417ST with Heater | 2 Ton | 4/5 | 10x8 1/3 HP [373] 5 Speed | 4 | CFM | 805 | 642 | 538 | 467 | 417 | 352 | 294 | 252 | 196 | 175 |
| | | | | | RPM | 602 | 613 | 666 | 741 | 795 | 855 | 920 | 971 | 1039 | 1079 |
| | | | | | Watts | 96 | 76 | 74 | 82 | 87 | 94 | 101 | 107 | 115 | 119 |
| | | | | 5 | CFM | 970 | 955 | 907 | 850 | 775 | 736 | 701 | 650 | 609 | 566 |
| | | | | | RPM | 618 | 659 | 709 | 751 | 871 | 919 | 966 | 1024 | 1066 | 1110 |
| | | | | | Watts | 113 | 120 | 127 | 135 | 178 | 187 | 197 | 207 | 217 | 225 |
| 3617ST No Heater | 2.5 Ton | 4/5 | 10x10 1/2 HP [373] 5 Speed | 2 | CFM | 857 | 721 | 665 | 594 | 539 | 473 | 401 | 342 | 318 | 284 |
| | | | | | RPM | 586 | 596 | 648 | 712 | 768 | 827 | 895 | 950 | 989 | 1056 |
| | | | | | Watts | 91 | 77 | 83 | 91 | 106 | 114 | 112 | 119 | 122 | 127 |
| | | | | 3 | CFM | 1122 | 1079 | 1036 | 990 | 943 | 902 | 859 | 814 | 771 | 723 |
| | | | | | RPM | 710 | 750 | 784 | 817 | 859 | 899 | 883 | 735 | 744 | 720 |
| | | | | | Watts | 173 | 181 | 188 | 195 | 204 | 212 | 221 | 230 | 240 | 249 |
| 3617ST with Heater | 2.5 Ton | 4/5 | 10x10 1/2 HP [373] 5 Speed | 2 | CFM | 831 | 700 | 645 | 576 | 523 | 459 | 389 | 332 | 308 | 276 |
| | | | | | RPM | 615 | 625 | 680 | 748 | 807 | 869 | 940 | 998 | 1038 | 1108 |
| | | | | | Watts | 99 | 84 | 90 | 99 | 116 | 124 | 121 | 130 | 133 | 138 |
| | | | | 3 | CFM | 1157 | 1112 | 1068 | 1020 | 914 | 875 | 833 | 790 | 748 | 701 |
| | | | | | RPM | 508 | 546 | 731 | 662 | 902 | 944 | 966 | 1003 | 1045 | 1082 |
| | | | | | Watts | 159 | 166 | 172 | 179 | 222 | 231 | 241 | 251 | 261 | 271 |
| 3617ST No Heater | 3 Ton | 4/5 | 10x10 1/2 HP [373] 5 Speed | 4 | CFM | 855 | 762 | 705 | 655 | 597 | 536 | 470 | 404 | 353 | 315 |
| | | | | | RPM | 588 | 617 | 662 | 716 | 777 | 831 | 875 | 953 | 937 | 973 |
| | | | | | Watts | 103 | 87 | 93 | 100 | 116 | 115 | 123 | 130 | 136 | 141 |
| | | | | 5 | CFM | 1259 | 1213 | 1168 | 1132 | 1094 | 1056 | 1016 | 974 | 937 | 901 |
| | | | | | RPM | 771 | 813 | 846 | 824 | 824 | 669 | 723 | 265 | 123 | 100 |
| | | | | | Watts | 234 | 245 | 253 | 261 | 270 | 280 | 287 | 299 | 308 | 317 |

**[ ] Designates Metric Conversions**

# 115V/208V/240V Airflow Performance Data – RH2TZ (Constant Torque (ECM) Motor) (Con't.)

| Model No. RH2TZ | Tonnage Application | Motor Speed From Factory | Blower Size/ Motor HP [W] # of Speed | Motor Speed | | CFM/RPM/WATTS — Dry Coil — No Filter | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | External Static Presure Inches of W.C. | | | | | | | | | |
| | | | | | | 0.1 | 0.2 | 0.3 | 0.4 | 0.5 | 0.6 | 0.7 | 0.8 | 0.9 | 1.0 |
| 3617ST with Heater | 3 Ton | 4/5 | 10x10 1/2 HP [373] 5 Speed | 4 | CFM | 829 | 739 | 683 | 635 | 579 | 520 | 456 | 392 | 342 | 306 |
| | | | | | RPM | 618 | 647 | 696 | 752 | 816 | 872 | 919 | 1000 | 984 | 1021 |
| | | | | | Watts | 112 | 95 | 101 | 109 | 126 | 125 | 133 | 141 | 148 | 154 |
| | | | | 5 | CFM | 1298 | 1251 | 1204 | 1167 | 1061 | 1024 | 986 | 945 | 909 | 874 |
| | | | | | RPM | 112 | 81 | 133 | 119 | 940 | 973 | 1001 | 1040 | 1072 | 1102 |
| | | | | | Watts | 214 | 224 | 232 | 239 | 294 | 305 | 313 | 326 | 336 | 345 |
| 3621ST No Heater | 2.5 Ton | 4/5 | 10x10 1/2 HP [373] 5 Speed | 2 | CFM | 987 | 793 | 662 | 611 | 549 | 489 | 417 | 371 | 331 | 296 |
| | | | | | RPM | 591 | 598 | 640 | 700 | 755 | 817 | 882 | 929 | 970 | 1036 |
| | | | | | Watts | 97 | 74 | 66 | 75 | 80 | 89 | 95 | 99 | 110 | 114 |
| | | | | 3 | CFM | 1148 | 1091 | 1049 | 993 | 941 | 898 | 852 | 809 | 755 | 712 |
| | | | | | RPM | 639 | 690 | 729 | 772 | 821 | 864 | 910 | 955 | 1006 | 1042 |
| | | | | | Watts | 139 | 145 | 153 | 162 | 171 | 179 | 188 | 196 | 207 | 216 |
| 3621ST with Heater | 2.5 Ton | 4/5 | 10x10 1/2 HP [373] 5 Speed | 2 | CFM | 957 | 763 | 632 | 581 | 519 | 459 | 395 | 351 | 316 | 285 |
| | | | | | RPM | 616 | 623 | 665 | 725 | 780 | 842 | 914 | 966 | 1009 | 1072 |
| | | | | | Watts | 92 | 69 | 61 | 70 | 75 | 84 | 90 | 93 | 103 | 108 |
| | | | | 3 | CFM | 1193 | 1129 | 1089 | 1035 | 911 | 868 | 822 | 779 | 725 | 682 |
| | | | | | RPM | 621 | 674 | 710 | 753 | 846 | 889 | 935 | 980 | 1031 | 1067 |
| | | | | | Watts | 142 | 149 | 157 | 166 | 166 | 174 | 183 | 191 | 202 | 211 |
| 3621ST No Heater | 3 Ton | 4/5 | 10x10 1/2 HP [373] 5 Speed | 4 | CFM | 983 | 808 | 723 | 706 | 654 | 580 | 529 | 466 | 411 | 358 |
| | | | | | RPM | 593 | 600 | 623 | 641 | 695 | 770 | 820 | 880 | 934 | 986 |
| | | | | | Watts | 96 | 75 | 71 | 72 | 79 | 87 | 92 | 105 | 106 | 115 |
| | | | | 5 | CFM | 1253 | 1218 | 1174 | 1139 | 1099 | 1058 | 1017 | 975 | 937 | 905 |
| | | | | | RPM | 708 | 740 | 779 | 814 | 859 | 895 | 939 | 983 | 1020 | 1054 |
| | | | | | Watts | 187 | 194 | 203 | 212 | 223 | 231 | 241 | 251 | 263 | 276 |
| 3621ST with Heater | 3 Ton | 4/5 | 10x10 1/2 HP [373] 5 Speed | 4 | CFM | 953 | 778 | 676 | 624 | 550 | 499 | 449 | 402 | 356 | 310 |
| | | | | | RPM | 620 | 625 | 648 | 666 | 720 | 795 | 850 | 917 | 975 | 1028 |
| | | | | | Watts | 91 | 70 | 67 | 74 | 82 | 87 | 87 | 101 | 106 | 114 |
| | | | | 5 | CFM | 1291 | 1256 | 1213 | 1176 | 1069 | 1028 | 987 | 945 | 907 | 875 |
| | | | | | RPM | 689 | 722 | 758 | 792 | 884 | 920 | 964 | 1008 | 1045 | 1079 |
| | | | | | Watts | 190 | 198 | 207 | 216 | 218 | 226 | 236 | 246 | 258 | 271 |
| 4821ST***N No Heater | 3.5 Ton | 4/5 | 10x10 3/4 HP [373] 5 Speed | 2 | CFM | 892 | 817 | 737 | 632 | 564 | 487 | 429 | 381 | 338 | 294 |
| | | | | | RPM | 611 | 660 | 718 | 817 | 864 | 910 | 976 | 1037 | 1092 | 1153 |
| | | | | | Watts | 81 | 89 | 96 | 108 | 114 | 120 | 128 | 139 | 147 | 159 |
| | | | | 3 | CFM | 1552 | 1492 | 1447 | 1403 | 1336 | 1290 | 1240 | 1198 | 1147 | 1085 |
| | | | | | RPM | 831 | 878 | 918 | 957 | 1006 | 1048 | 1084 | 1121 | 1170 | 1235 |
| | | | | | Watts | 290 | 303 | 315 | 327 | 341 | 356 | 367 | 379 | 396 | 421 |
| 4821ST***N with Heater | 3.5 Ton | 4/5 | 10x10 3/4 HP [373] 5 Speed | 2 | CFM | 892 | 817 | 737 | 632 | 564 | 487 | 403 | 342 | 287 | 264 |
| | | | | | RPM | 611 | 660 | 718 | 817 | 864 | 910 | 1014 | 1080 | 1139 | 1200 |
| | | | | | Watts | 81 | 89 | 96 | 108 | 114 | 120 | 132 | 144 | 147 | 152 |
| | | | | 3 | CFM | 1604 | 1542 | 1496 | 1450 | 1336 | 1290 | 1240 | 1198 | 1147 | 1085 |
| | | | | | RPM | 810 | 854 | 893 | 933 | 1006 | 1048 | 1084 | 1121 | 1170 | 1235 |
| | | | | | Watts | 296 | 308 | 321 | 334 | 341 | 356 | 367 | 379 | 396 | 421 |

**[ ] Designates Metric Conversions**

# 115V/208V/240V Airflow Performance Data – RH2TZ (Constant Torque (ECM) Motor) (Con't.)

| Model No. RH2TZ | Tonnage Application | Motor Speed From Factory | Blower Size/ Motor HP [W] # of Speed | Motor Speed | | CFM/RPM/WATTS — Dry Coil — No Filter | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | External Static Presure Inches of W.C. | | | | | | | | | |
| | | | | | | 0.1 | 0.2 | 0.3 | 0.4 | 0.5 | 0.6 | 0.7 | 0.8 | 0.9 | 1.0 |
| 4821ST***N No Heater | 4 Ton | 5 | 10x10 3/4 HP [373] 5 Speed | 4 | CFM | 1106 | 1032 | 973 | 901 | 819 | 712 | 628 | 556 | 494 | 430 |
| | | | | | RPM | 698 | 727 | 770 | 821 | 893 | 972 | 1042 | 1108 | 1167 | 1232 |
| | | | | | Watts | 129 | 134 | 142 | 150 | 163 | 178 | 190 | 206 | 218 | 236 |
| | | | | 5 | CFM | 1720 | 1654 | 1604 | 1555 | 1472 | 1430 | 1392 | 1349 | 1308 | 1272 |
| | | | | | RPM | 876 | 925 | 967 | 1008 | 1068 | 1104 | 1134 | 1171 | 1205 | 1243 |
| | | | | | Watts | 362 | 378 | 393 | 409 | 430 | 445 | 457 | 473 | 487 | 504 |
| 4821ST***N with Heater | 4 Ton | 4/5 | 10x10 3/4 HP [373] 5 Speed | 4 | CFM | 1106 | 1032 | 973 | 901 | 819 | 712 | 590 | 500 | 436 | 415 |
| | | | | | RPM | 698 | 727 | 770 | 821 | 893 | 972 | 1083 | 1156 | 1212 | 1277 |
| | | | | | Watts | 129 | 134 | 142 | 150 | 163 | 178 | 197 | 213 | 220 | 240 |
| | | | | 5 | CFM | 1771 | 1704 | 1660 | 1606 | 1472 | 1430 | 1392 | 1349 | 1308 | 1272 |
| | | | | | RPM | 854 | 903 | 942 | 984 | 1068 | 1104 | 1134 | 1171 | 1205 | 1243 |
| | | | | | Watts | 370 | 386 | 402 | 417 | 430 | 445 | 457 | 473 | 487 | 504 |
| 4824ST No Heater | 3.5 Ton | 4/5 | 10x10 3/4 HP [373] 5 Speed | 2 | CFM | 964 | 882 | 809 | 676 | 581 | 464 | 395 | 344 | 215 | 190 |
| | | | | | RPM | 445 | 501 | 552 | 610 | 651 | 698 | 729 | 762 | 800 | 884 |
| | | | | | Watts | 79 | 88 | 96 | 104 | 111 | 113 | 117 | 122 | 128 | 135 |
| | | | | 3 | CFM | 1586 | 1525 | 1479 | 1434 | 1372 | 1312 | 1257 | 1201 | 1126 | 1035 |
| | | | | | RPM | 621 | 661 | 699 | 730 | 765 | 803 | 837 | 875 | 910 | 948 |
| | | | | | Watts | 242 | 256 | 269 | 279 | 292 | 305 | 317 | 330 | 342 | 354 |
| 4824ST with Heater | 3.5 Ton | 4/5 | 10x10 3/4 HP [373] 5 Speed | 2 | CFM | 934 | 852 | 779 | 646 | 551 | 434 | 382 | 331 | 207 | 181 |
| | | | | | RPM | 470 | 526 | 577 | 635 | 676 | 723 | 758 | 798 | 831 | 929 |
| | | | | | Watts | 74 | 83 | 91 | 99 | 106 | 108 | 112 | 116 | 122 | 127 |
| | | | | 3 | CFM | 1625 | 1565 | 1517 | 1471 | 1342 | 1282 | 1227 | 1171 | 1096 | 1005 |
| | | | | | RPM | 604 | 643 | 679 | 711 | 790 | 828 | 862 | 900 | 935 | 973 |
| | | | | | Watts | 246 | 260 | 273 | 284 | 287 | 300 | 312 | 325 | 337 | 349 |
| 4824ST No Heater | 4 Ton | 4/5 | 10x10 3/4 HP [373] 5 Speed | 4 | CFM | 1152 | 1080 | 1004 | 926 | 837 | 734 | 662 | 581 | 518 | 463 |
| | | | | | RPM | 493 | 539 | 587 | 636 | 687 | 726 | 768 | 801 | 845 | 872 |
| | | | | | Watts | 113 | 122 | 131 | 141 | 151 | 159 | 165 | 175 | 182 | 188 |
| | | | | 5 | CFM | 1725 | 1675 | 1621 | 1563 | 1507 | 1459 | 1412 | 1360 | 1308 | 1241 |
| | | | | | RPM | 658 | 692 | 728 | 764 | 798 | 833 | 861 | 894 | 922 | 960 |
| | | | | | Watts | 298 | 310 | 325 | 338 | 350 | 364 | 378 | 389 | 400 | 415 |
| 4824ST with Heater | 4 Ton | 4/5 | 10x10 3/4 HP [373] 5 Speed | 4 | CFM | 1122 | 1050 | 974 | 896 | 807 | 704 | 641 | 565 | 505 | 450 |
| | | | | | RPM | 518 | 564 | 612 | 661 | 712 | 751 | 803 | 842 | 878 | 906 |
| | | | | | Watts | 108 | 117 | 126 | 136 | 146 | 154 | 159 | 167 | 176 | 181 |
| | | | | 5 | CFM | 1767 | 1713 | 1655 | 1598 | 1477 | 1429 | 1382 | 1330 | 1278 | 1211 |
| | | | | | RPM | 639 | 672 | 709 | 743 | 823 | 858 | 886 | 919 | 947 | 985 |
| | | | | | Watts | 302 | 315 | 329 | 342 | 345 | 359 | 373 | 384 | 395 | 410 |
| 6024ST No Heater | 4.5 Ton | 4/5 | 11x11 3/4 HP [373] 5 Speed | 2 | CFM | 1321 | 1127 | 914 | 512 | 398 | 321 | 342 | 367 | 389 | 411 |
| | | | | | RPM | 567 | 573 | 579 | 588 | 629 | 667 | 705 | 801 | 810 | 875 |
| | | | | | Watts | 164 | 138 | 115 | 78 | 81 | 86 | 83 | 79 | 76 | 74 |
| | | | | 3 | CFM | 1710 | 1659 | 1613 | 1563 | 1511 | 1467 | 1414 | 1356 | 1301 | 1243 |
| | | | | | RPM | 698 | 729 | 761 | 791 | 822 | 850 | 879 | 906 | 937 | 968 |
| | | | | | Watts | 324 | 338 | 351 | 363 | 375 | 386 | 397 | 405 | 418 | 431 |

**[ ] Designates Metric Conversions**

# 115V/208V/240V Airflow Performance Data – RH2TZ (Constant Torque (ECM) Motor) (Con't.)

| Model No. RH2TZ | Tonnage Application | Motor Speed From Factory | Blower Size/ Motor HP [W] # of Speed | Motor Speed | | CFM/RPM/WATTS — Dry Coil — No Filter | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | External Static Presure Inches of W.C. | | | | | | | | | |
| | | | | | | 0.1 | 0.2 | 0.3 | 0.4 | 0.5 | 0.6 | 0.7 | 0.8 | 0.9 | 1.0 |
| 6024ST with Heater | 4.5 Ton | 5 | 11x11 3/4 HP [373] 5 Speed | 2 | CFM | 1281 | 1093 | 886 | 497 | 386 | 311 | 332 | 356 | 378 | 399 |
| | | | | | RPM | 595 | 602 | 608 | 618 | 660 | 700 | 740 | 841 | 851 | 919 |
| | | | | | Watts | 179 | 150 | 126 | 85 | 88 | 93 | 90 | 86 | 83 | 80 |
| | | | | 3 | CFM | 1762 | 1710 | 1662 | 1612 | 1466 | 1423 | 1372 | 1315 | 1262 | 1205 |
| | | | | | RPM | 665 | 694 | 724 | 753 | 864 | 893 | 923 | 951 | 984 | 1016 |
| | | | | | Watts | 297 | 310 | 322 | 333 | 408 | 420 | 432 | 442 | 456 | 470 |
| 6024ST No Heater | 5 Ton | 4/5 | 11x11 3/4 HP [373] 5 Speed | 4 | CFM | 1367 | 1193 | 1097 | 1032 | 957 | 869 | 791 | 719 | 644 | 580 |
| | | | | | RPM | 583 | 588 | 622 | 661 | 700 | 746 | 790 | 824 | 856 | 888 |
| | | | | | Watts | 176 | 154 | 156 | 165 | 174 | 184 | 194 | 199 | 207 | 215 |
| | | | | 5 | CFM | 2065 | 2015 | 1966 | 1922 | 1877 | 1837 | 1797 | 1754 | 1707 | 1673 |
| | | | | | RPM | 808 | 836 | 866 | 891 | 924 | 946 | 967 | 995 | 1018 | 1045 |
| | | | | | Watts | 541 | 554 | 572 | 587 | 602 | 614 | 628 | 643 | 656 | 673 |
| 6024ST with Heater | 5 Ton | 4/5 | 11x11 3/4 HP [373] 5 Speed | 4 | CFM | 1326 | 1157 | 1064 | 1001 | 928 | 843 | 767 | 697 | 624 | 562 |
| | | | | | RPM | 612 | 618 | 653 | 694 | 735 | 783 | 830 | 866 | 899 | 933 |
| | | | | | Watts | 192 | 167 | 170 | 180 | 190 | 200 | 211 | 217 | 226 | 235 |
| | | | | 5 | CFM | 2128 | 2077 | 2027 | 1982 | 1821 | 1781 | 1743 | 1701 | 1656 | 1623 |
| | | | | | RPM | 769 | 796 | 825 | 849 | 970 | 994 | 1016 | 1045 | 1069 | 1097 |
| | | | | | Watts | 496 | 508 | 525 | 538 | 656 | 670 | 684 | 701 | 714 | 734 |
| 6021ST No Heater | 4.5 Ton | 4/5 | 11x11 3/4 HP [373] 5 Speed | 2 | CFM | 1120 | 1061 | 997 | 875 | 819 | 777 | 719 | 678 | 621 | 561 |
| | | | | | RPM | 657 | 710 | 773 | 859 | 892 | 917 | 953 | 981 | 1021 | 1057 |
| | | | | | Watts | 133 | 143 | 154 | 170 | 176 | 180 | 187 | 191 | 201 | 208 |
| | | | | 3 | CFM | 1683 | 1640 | 1602 | 1563 | 1515 | 1464 | 1416 | 1363 | 1295 | 1248 |
| | | | | | RPM | 901 | 939 | 969 | 998 | 1047 | 1089 | 1134 | 1175 | 1228 | 1259 |
| | | | | | Watts | 386 | 399 | 411 | 421 | 439 | 454 | 471 | 486 | 507 | 519 |
| 6021ST with Heater | 4.5 Ton | 4/5 | 11x11 3/4 HP [373] 5 Speed | 2 | CFM | 1080 | 1021 | 957 | 835 | 779 | 737 | 688 | 653 | 593 | 539 |
| | | | | | RPM | 682 | 735 | 798 | 884 | 917 | 942 | 985 | 1017 | 1051 | 1097 |
| | | | | | Watts | 128 | 138 | 149 | 165 | 171 | 175 | 182 | 185 | 194 | 201 |
| | | | | 3 | CFM | 1735 | 1686 | 1652 | 1613 | 1475 | 1424 | 1376 | 1323 | 1255 | 1208 |
| | | | | | RPM | 883 | 920 | 949 | 976 | 1072 | 1114 | 1159 | 1200 | 1253 | 1284 |
| | | | | | Watts | 390 | 403 | 416 | 425 | 434 | 449 | 466 | 481 | 502 | 514 |
| 6021ST No Heater | 5 Ton | 4/5 | 11x11 3/4 HP [373] 5 Speed | 4 | CFM | 1223 | 1171 | 1113 | 1057 | 967 | 892 | 853 | 804 | 749 | 704 |
| | | | | | RPM | 702 | 750 | 807 | 859 | 927 | 966 | 990 | 1017 | 1053 | 1083 |
| | | | | | Watts | 167 | 178 | 190 | 201 | 216 | 224 | 229 | 235 | 244 | 251 |
| | | | | 5 | CFM | 2038 | 1999 | 1968 | 1934 | 1896 | 1861 | 1829 | 1790 | 1730 | 1568 |
| | | | | | RPM | 1071 | 1100 | 1124 | 1150 | 1180 | 1210 | 1240 | 1277 | 1301 | 1302 |
| | | | | | Watts | 666 | 682 | 697 | 711 | 727 | 742 | 759 | 780 | 771 | 683 |
| 6021ST with Heater | 5 Ton | 4/5 | 11x11 3/4 HP [373] 5 Speed | 4 | CFM | 1183 | 1131 | 1073 | 1017 | 927 | 852 | 824 | 776 | 722 | 680 |
| | | | | | RPM | 727 | 775 | 832 | 884 | 952 | 991 | 1021 | 1052 | 1085 | 1117 |
| | | | | | Watts | 162 | 173 | 185 | 196 | 211 | 219 | 223 | 228 | 238 | 244 |
| | | | | 5 | CFM | 2090 | 2043 | 2016 | 1980 | 1856 | 1821 | 1789 | 1750 | 1690 | 1528 |
| | | | | | RPM | 1050 | 1079 | 1102 | 1128 | 1205 | 1235 | 1265 | 1302 | 1326 | 1327 |
| | | | | | Watts | 670 | 687 | 701 | 716 | 722 | 737 | 754 | 775 | 766 | 678 |

**[ ] Designates Metric Conversions**

## Electrical Data – Blower Motor Only – No Electric Heat RH2TZ

| Model RH2TZ | Voltage | Phase* | Hertz | HP [W] | RPM | Speeds | Motor Amps. | Minimum Circuit Ampacity | Maximum Overcurrent Protection |
|---|---|---|---|---|---|---|---|---|---|
| 2417S | 115 | 1 | 60 | 1/3 [249] | 300-1100 | 4 | 2.7 | 4.0 | 15 |
| 3617S/3621M*/3621M | | | | 1/2 [373] | 300-1100 | 4 | 3.4 | 5.0 | 15 |
| 3621S | | | | 1/3 [249] | 300-1100 | 4 | 3.4 | 5.0 | 15 |
| 4821S | | | | 3/4 [559] | 300-1100 | 4 | 3.4 | 5.0 | 15 |
| 4821S*/4824S | | | | 3/4 [559] | 300-1100 | 4 | 6.5 | 9.0 | 15 |
| 4824M | | | | 3/4 [559] | 300-1100 | 4 | 4.8 | 6.0 | 15 |
| 6021S*/6024S | | | | 3/4 [559] | 300-1100 | 4 | 8.0 | 10.0 | 15 |
| 2417S | 208/240 | 1 | 60 | 1/3 [249] | 300-1100 | 4 | 1.8 | 3.0 | 15 |
| 3617S/3621M*/3621M | | | | 1/2 [373] | 300-1100 | 4 | 2.4 | 3.0 | 15 |
| 3621S | | | | 1/3 [249] | 300-1100 | 4 | 2.3 | 3.0 | 15 |
| 4821S* | | | | 3/4 [559] | 300-1100 | 4 | 3.9 | 5.0 | 15 |
| 4821S | | | | 3/4 [559] | 300-1100 | 4 | 3.7 | 5.0 | 15 |
| 4824S | | | | 3/4 [559] | 300-1100 | 4 | 3.2 | 4.0 | 15 |
| 6021S* | | | | 3/4 [559] | 300-1100 | 4 | 5.6 | 7.0 | 15 |
| 6024S | | | | 3/4 [559] | 300-1100 | 4 | 4.7 | 6.0 | 15 |

**[ ] Designates Metric Conversions**

## Electrical Data – With Electric Heat RH2TZ

Installation of the U.L. Listed original equipment manufacturer provided heater kits listed in the following table is recommended for all auxiliary heating requirements.

| Air Handler Model RH2TZ | Heater Model Number | Heater kW (208/240V) | Ph/Hz | No. Elements - kW per | Type Supply Circuit Single Circuit Multiple Circuit | Heater Amps. | Motor Amps | Minimum Circuit Ampacity | Maximum Overcurrent Protection |
|---|---|---|---|---|---|---|---|---|---|
| 2417STANNJ | RXBH-17?03J-B | 2.25/3.0 | 1/60 | 1-3.0 | SINGLE | 10.8/12.5 | 1.8 | 16/18 | 20/20 |
| | RXBH-1724?03J-B | 2.25/3.0 | 1/60 | 1-3.0 | SINGLE | 10.8/12.5 | 1.8 | 16/18 | 20/20 |
| | RXBH-1724?05J-B | 3.6/4.8 | 1/60 | 1-4.8 | SINGLE | 17.3/20.0 | 1.8 | 24/28 | 30/30 |
| | RXBH-1724?07J-B | 5.4/7.2 | 1/60 | 2-3.6 | SINGLE | 26.0/30.0 | 1.8 | 35/40 | 40/40 |
| | RXBH-1724?10J-B | 7.2/9.6 | 1/60 | 2-4.8 | SINGLE | 34.6/40.0 | 1.8 | 46/53 | 50/60 |
| | RXBH-1724A13J-B | 9.4/12.5 | 1/60 | 3-4.17 | SINGLE | 45.1/52.1 | 1.8 | 59/68 | 60/70 |
| | RXBH-1724A13J-B | 3.1/4.2 | 1/60 | 1-4.17 | MULTIPLE CKT 1 | 15.0/17.4 | 1.8 | 21/24 | 30/30 |
| | | 6.3/8.3 | 1/60 | 2-4.17 | MULTIPLE CKT 2 | 30.1/34.7 | 0.0 | 38/44 | 40/50 |
| 3617STANNJ | RXBH-17?03J-B | 2.25/3.0 | 1/60 | 1-3.0 | SINGLE | 10.8/12.5 | 2.4 | 17/19 | 20/20 |
| | RXBH-1724?03J-B | 2.25/3.0 | 1/60 | 1-3.0 | SINGLE | 10.8/12.5 | 2.4 | 17/19 | 20/20 |
| | RXBH-1724?05J-B | 3.6/4.8 | 1/60 | 1-4.8 | SINGLE | 17.3/20.0 | 2.4 | 25/28 | 30/30 |
| | RXBH-1724?07J-B | 5.4/7.2 | 1/60 | 2-3.6 | SINGLE | 26.0/30.0 | 2.4 | 36/41 | 40/50 |
| | RXBH-1724?10J-B | 7.2/9.6 | 1/60 | 2-4.8 | SINGLE | 34.6/40.0 | 2.4 | 47/53 | 50/60 |
| | RXBH-1724A13J-B | 9.4/12.5 | 1/60 | 3-4.17 | SINGLE | 45.1/52.1 | 2.4 | 60/69 | 60/70 |
| | RXBH-1724A13J-B | 3.1/4.2 | 1/60 | 1-4.17 | MULTIPLE CKT 1 | 15.0/17.4 | 2.4 | 22/25 | 30/30 |
| | | 6.3/8.3 | 1/60 | 2-4.17 | MULTIPLE CKT 2 | 30.1/34.7 | 0.0 | 38/44 | 40/50 |
| | RXBH-1724A15J-B | 10.8/14.4 | 1/60 | 3-4.18 | SINGLE | 51.9/60.0 | 2.4 | 68/78 | 70/80 |
| | RXBH-1724A15J-B | 3.6/4.8 | 1/60 | 1-4.18 | MULTIPLE CKT 1 | 17.3/20.0 | 2.4 | 25/28 | 30/30 |
| | | 7.2/9.6 | 1/60 | 2-4.18 | MULTIPLE CKT 2 | 34.6/40.0 | 0.0 | 44/50 | 50/50 |
| | RXBH-1724A18J-B | 12.8/17.0 | 1/60 | 4-4.26 | SINGLE | 61.6/70.8 | 2.4 | 80/92 | 90/100 |
| | RXBH-1724A18J-B | 4.3/5.7 | 1/60 | 1-5.68 | MULTIPLE CKT 1 | 20.5/23.6 | 2.4 | 29/33 | 30/40 |
| | | 8.5/11.3 | 1/60 | 2-5.68 | MULTIPLE CKT 2 | 41.1/47.2 | 0.0 | 52/59 | 60/60 |

# Electrical Data – With Electric Heat RH2TZ (Con't.)

| Air Handler Model RH2TZ | Heater Model Number | Heater kW (208/240V) | Ph/Hz | No. Elements - kW per | Type Supply Circuit Single Circuit Multiple Circuit | Heater Amps. | Motor Amps | Minimum Circuit Ampacity | Maximum Overcurrent Protection |
|---|---|---|---|---|---|---|---|---|---|
| 3621STANNJ | RXBH-17?03J-B | 2.25/3.0 | 1/60 | 1-3.0 | SINGLE | 10.8/12.5 | 2.3 | 17/19 | 20/20 |
| | RXBH-1724?03J-B | 2.25/3.0 | 1/60 | 1-3.0 | SINGLE | 10.8/12.5 | 2.3 | 17/19 | 20/20 |
| | RXBH-1724?05J-B | 3.6/4.8 | 1/60 | 1-4.8 | SINGLE | 17.3/20.0 | 2.3 | 25/28 | 30/30 |
| | RXBH-1724?07J-B | 5.4/7.2 | 1/60 | 2-3.6 | SINGLE | 26.0/30.0 | 2.3 | 36/41 | 40/50 |
| | RXBH-1724?10J-B | 7.2/9.6 | 1/60 | 2-4.8 | SINGLE | 34.6/40.0 | 2.3 | 47/53 | 50/60 |
| | RXBH-1724A13J-B | 9.4/12.5 | 1/60 | 3-4.17 | SINGLE | 45.1/52.1 | 2.3 | 60/68 | 60/70 |
| | RXBH-1724A13J-B | 3.1/4.2 | 1/60 | 1-4.17 | MULTIPLE CKT 1 | 15.0/17.4 | 2.3 | 22/25 | 30/30 |
| | | 6.3/8.3 | 1/60 | 2-4.17 | MULTIPLE CKT 2 | 30.1/34.7 | 0.0 | 38/44 | 40/50 |
| | RXBH-1724A15J-B | 10.8/14.4 | 1/60 | 3-4.18 | SINGLE | 51.9/60.0 | 2.3 | 68/78 | 70/80 |
| | RXBH-1724A15J-B | 3.6/4.8 | 1/60 | 1-4.18 | MULTIPLE CKT 1 | 17.3/20.0 | 2.3 | 25/28 | 30/30 |
| | | 7.2/9.6 | 1/60 | 2-4.18 | MULTIPLE CKT 2 | 34.6/40.0 | 0.0 | 44/50 | 50/50 |
| | RXBH-1724A18J-B | 12.8/17.0 | 1/60 | 4-4.26 | SINGLE | 61.6/70.8 | 2.3 | 80/92 | 90/100 |
| | RXBH-1724A18J-B | 4.3/5.7 | 1/60 | 1-5.68 | MULTIPLE CKT 1 | 20.5/23.6 | 2.3 | 29/33 | 30/40 |
| | | 8.5/11.3 | 1/60 | 2-5.68 | MULTIPLE CKT 2 | 41.1/47.2 | 0.0 | 52/59 | 60/60 |
| 3621MTANAJ 3621MTANNJ | RXBH-17?03J-B | 2.25/3.0 | 1/60 | 1-3.0 | SINGLE | 10.8/12.5 | 2.4 | 17/19 | 20/20 |
| | RXBH-1724?03J-B | 2.25/3.0 | 1/60 | 1-3.0 | SINGLE | 10.8/12.5 | 2.4 | 17/19 | 20/20 |
| | RXBH-1724?05J-B | 3.6/4.8 | 1/60 | 1-4.8 | SINGLE | 17.3/20.0 | 2.4 | 25/28 | 30/30 |
| | RXBH-1724?07J-B | 5.4/7.2 | 1/60 | 2-3.6 | SINGLE | 26.0/30.0 | 2.4 | 36/41 | 40/50 |
| | RXBH-1724?10J-B | 7.2/9.6 | 1/60 | 2-4.8 | SINGLE | 34.6/40.0 | 2.4 | 47/53 | 50/60 |
| | RXBH-1724A13J-B | 9.4/12.5 | 1/60 | 3-4.17 | SINGLE | 45.1/52.1 | 2.4 | 60/69 | 60/70 |
| | RXBH-1724A13J-B | 3.1/4.2 | 1/60 | 1-4.17 | MULTIPLE CKT 1 | 15.0/17.4 | 2.4 | 22/25 | 30/30 |
| | | 6.3/8.3 | 1/60 | 2-4.17 | MULTIPLE CKT 2 | 30.1/34.7 | 0.0 | 38/44 | 40/50 |
| | RXBH-1724A15J-B | 10.8/14.4 | 1/60 | 3-4.18 | SINGLE | 51.9/60.0 | 2.4 | 68/78 | 70/80 |
| | RXBH-1724A15J-B | 3.6/4.8 | 1/60 | 1-4.18 | MULTIPLE CKT 1 | 17.3/20.0 | 2.4 | 25/28 | 30/30 |
| | | 7.2/9.6 | 1/60 | 2-4.18 | MULTIPLE CKT 2 | 34.6/40.0 | 0.0 | 44/50 | 50/50 |
| | RXBH-1724A18J-B | 12.8/17.0 | 1/60 | 4-4.26 | SINGLE | 61.6/70.8 | 2.4 | 80/92 | 90/100 |
| | RXBH-1724A18J-B | 4.3/5.7 | 1/60 | 1-5.68 | MULTIPLE CKT 1 | 20.5/23.6 | 2.4 | 29/33 | 30/40 |
| | | 8.5/11.3 | 1/60 | 2-5.68 | MULTIPLE CKT 2 | 41.1/47.2 | 0.0 | 52/59 | 60/60 |

# Electrical Data – With Electric Heat RH2TZ (Con't.)

| Air Handler Model RH2TZ | Heater Model Number | Heater kW (208/240V) | Ph/Hz | No. Elements - kW per | Type Supply Circuit Single Circuit Multiple Circuit | Heater Amps. | Motor Amps | Minimum Circuit Ampacity | Maximum Overcurrent Protection |
|---|---|---|---|---|---|---|---|---|---|
| 4821STANNJ | RXBH-1724?05J-B | 3.6/4.8 | 1/60 | 1-4.8 | SINGLE | 17.3/20.0 | 3.7 | 27/30 | 30/30 |
| | RXBH-1724?07J-B | 5.4/7.2 | 1/60 | 2-3.6 | SINGLE | 26.0/30.0 | 3.7 | 38/43 | 40/50 |
| | RXBH-1724?10J-B | 7.2/9.6 | 1/60 | 2-4.8 | SINGLE | 34.6/40.0 | 3.7 | 48/55 | 50/60 |
| | RXBH-1724A15J-B | 10.8/14.4 | 1/60 | 3-4.18 | SINGLE | 51.9/60.0 | 3.7 | 70/80 | 70/80 |
| | RXBH-1724A15J-B | 3.6/4.8 | 1/60 | 1-4.18 | MULTIPLE CKT 1 | 17.3/20.0 | 3.7 | 27/30 | 30/30 |
| | | 7.2/9.6 | 1/60 | 2-4.18 | MULTIPLE CKT 2 | 34.6/40.0 | 0.0 | 44/50 | 50/50 |
| | RXBH-1724A18J-B | 12.8/17.0 | 1/60 | 4-4.26 | SINGLE | 61.6/70.8 | 3.7 | 82/94 | 90/100 |
| | RXBH-1724A18J-B | 4.3/5.7 | 1/60 | 1-5.68 | MULTIPLE CKT 1 | 20.5/23.6 | 3.7 | 31/35 | 40/40 |
| | | 8.5/11.3 | 1/60 | 2-5.68 | MULTIPLE CKT 2 | 41.1/47.2 | 0.0 | 52/59 | 60/60 |
| | RXBH-24A20J-B | 14.4/19.2 | 1/60 | 4-4.8 | SINGLE | 69.2/80 | 3.7 | 92/105 | 100/110 |
| | RXBH-24A20J-B | 7.2/9.6 | 1/60 | 2-4.8 | MULTI CKT 1 | 34.6/40.0 | 3.7 | 48/55 | 50/60 |
| | | 7.2/9.6 | 1/60 | 2-4.8 | MULTI CKT 2 | 34.6/40.0 | 0.0 | 44/50 | 50/50 |
| | RXBH-24A25J-B | 18.0/24.0 | 1/60 | 6-4.0 | SINGLE | 86.4/99.9 | 3.7 | 113/130 | 120/150 |
| | RXBH-24A25J-B | 6.0/8.0 | 1/60 | 2-4.0 | MULTI CKT 1 | 28.8/33.3 | 3.7 | 41/47 | 50/50 |
| | | 6.0/8.0 | 1/60 | 2-4.0 | MULTI CKT 2 | 28.8/33.3 | 0.0 | 36/42 | 40/50 |
| | | 6.0/8.0 | 1/60 | 2-4.0 | MULTI CKT 3 | 28.8/33.3 | 0.0 | 36/42 | 40/50 |
| 4821STANAJ | RXBH-1724?05J-B | 3.6/4.8 | 1/60 | 1-4.8 | SINGLE | 17.3/20.0 | 3.9 | 27/30 | 30/30 |
| | RXBH-1724?07J-B | 5.4/7.2 | 1/60 | 2-3.6 | SINGLE | 26.0/30.0 | 3.9 | 38/43 | 40/50 |
| | RXBH-1724?10J-B | 7.2/9.6 | 1/60 | 2-4.8 | SINGLE | 34.6/40.0 | 3.9 | 48/55 | 50/60 |
| | RXBH-1724A15J-B | 10.8/14.4 | 1/60 | 3-4.18 | SINGLE | 51.9/60.0 | 3.9 | 70/80 | 70/80 |
| | RXBH-1724A15J-B | 3.6/4.8 | 1/60 | 1-4.18 | MULTIPLE CKT 1 | 17.3/20.0 | 3.9 | 27/30 | 30/30 |
| | | 7.2/9.6 | 1/60 | 2-4.18 | MULTIPLE CKT 2 | 34.6/40.0 | 0.0 | 44/50 | 50/50 |
| | RXBH-1724A18J-B | 12.8/17.0 | 1/60 | 4-4.26 | SINGLE | 61.6/70.8 | 3.9 | 82/94 | 90/100 |
| | RXBH-1724A18J-B | 4.3/5.7 | 1/60 | 1-5.68 | MULTIPLE CKT 1 | 20.5/23.6 | 3.9 | 31/35 | 40/40 |
| | | 8.5/11.3 | 1/60 | 2-5.68 | MULTIPLE CKT 2 | 41.1/47.2 | 0.0 | 52/59 | 60/60 |
| | RXBH-24A20J-B | 14.4/19.2 | 1/60 | 4-4.8 | SINGLE | 69.2/80 | 3.9 | 92/105 | 100/110 |
| | RXBH-24A20J-B | 7.2/9.6 | 1/60 | 2-4.8 | MULTI CKT 1 | 34.6/40.0 | 3.9 | 49/55 | 50/60 |
| | | 7.2/9.6 | 1/60 | 2-4.8 | MULTI CKT 2 | 34.6/40.0 | 0.0 | 44/50 | 50/50 |
| | RXBH-24A25J-B | 18.0/24.0 | 1/60 | 6-4.0 | SINGLE | 86.4/99.9 | 3.9 | 113/130 | 120/150 |
| | RXBH-24A25J-B | 6.0/8.0 | 1/60 | 2-4.0 | MULTI CKT 1 | 28.8/33.3 | 3.9 | 41/47 | 50/50 |
| | | 6.0/8.0 | 1/60 | 2-4.0 | MULTI CKT 2 | 28.8/33.3 | 0.0 | 36/42 | 40/50 |
| | | 6.0/8.0 | 1/60 | 2-4.0 | MULTI CKT 3 | 28.8/33.3 | 0.0 | 36/42 | 40/50 |

# Electrical Data – With Electric Heat RH2TZ (Con't.)

| Air Handler Model RH2TZ | Heater Model Number | Heater kW (208/240V) | Ph/Hz | No. Elements - kW per | Type Supply Circuit Single Circuit Multiple Circuit | Heater Amps. | Motor Amps | Minimum Circuit Ampacity | Maximum Overcurrent Protection |
|---|---|---|---|---|---|---|---|---|---|
| 4824STANNJ | RXBH-1724?05J-B | 3.6/4.8 | 1/60 | 1-4.8 | SINGLE | 17.3/20.0 | 3.2 | 26/29 | 30/30 |
| | RXBH-1724?07J-B | 5.4/7.2 | 1/60 | 2-3.6 | SINGLE | 26.0/30.0 | 3.2 | 37/42 | 40/45 |
| | RXBH-1724?10J-B | 7.2/9.6 | 1/60 | 2-4.8 | SINGLE | 34.6/40.0 | 3.2 | 48/54 | 50/60 |
| | RXBH-1724A15J-B | 10.8/14.4 | 1/60 | 3-4.18 | SINGLE | 51.9/60.0 | 3.2 | 69/79 | 70/80 |
| | RXBH-1724A15J-B | 3.6/4.8 | 1/60 | 1-4.18 | MULTIPLE CKT 1 | 17.3/20.0 | 3.2 | 26/29 | 30/35 |
| | | 7.2/9.6 | 1/60 | 2-4.18 | MULTIPLE CKT 2 | 34.6/40.0 | 0.0 | 44/50 | 50/50 |
| | RXBH-1724A18J-B | 12.8/17.0 | 1/60 | 4-4.26 | SINGLE | 61.6/70.8 | 3.2 | 81/93 | 90/100 |
| | RXBH-1724A18J-B | 4.3/5.7 | 1/60 | 1-5.68 | MULTIPLE CKT 1 | 20.5/23.6 | 3.2 | 30/34 | 30/35 |
| | | 8.5/11.3 | 1/60 | 2-5.68 | MULTIPLE CKT 2 | 41.1/47.2 | 0.0 | 52/59 | 60/60 |
| | RXBH-24A20J-B | 14.4/19.2 | 1/60 | 4-4.8 | SINGLE | 69.2/80.0 | 3.2 | 91/104 | 100/110 |
| | RXBH-24A20J-B | 7.2/9.6 | 1/60 | 2-4.8 | MULTIPLE CKT 1 | 34.6/40.0 | 3.2 | 48/54 | 50/60 |
| | | 7.2/9.6 | 1/60 | 2-4.8 | MULTIPLE CKT 2 | 34.6/40.0 | 0.0 | 44/50 | 50/50 |
| | RXBH-24A25J-B | 18.0/24.0 | 1/60 | 6-4.0 | SINGLE | 86.4/99.9 | 3.2 | 112/129 | 120/130 |
| | RXBH-24A25J-B | 6.0/8.0 | 1/60 | 2-4.0 | MULTIPLE CKT 1 | 28.8/33.3 | 3.2 | 42/48 | 50/50 |
| | | 6.0/8.0 | 1/60 | 2-4.0 | MULTIPLE CKT 2 | 28.8/33.3 | 0.0 | 36/42 | 40/50 |
| | | 6.0/8.0 | 1/60 | 2-4.0 | MULTIPLE CKT 3 | 28.8/33.3 | 0.0 | 36/42 | 40/50 |
| | RXBH-24A30J-B | 20.7/27.6 | 1/60 | 6-4.8 | SINGLE | 99.5/115.0 | 3.2 | 129/148 | 130/150 |

# Electrical Data – With Electric Heat RH2TZ (Con't.)

| Air Handler Model RH2TZ | Heater Model Number | Heater kW (208/240V) | Ph/Hz | No. Elements - kW per | Type Supply Circuit Single Circuit Multiple Circuit | Heater Amps. | Motor Amps | Minimum Circuit Ampacity | Maximum Overcurrent Protection |
|---|---|---|---|---|---|---|---|---|---|
| 6021STANAJ | RXBH-1724?05J-B | 3.6/4.8 | 1/60 | 1-4.8 | SINGLE | 17.3/20.0 | 5.6 | 29/32 | 30/35 |
| | RXBH-1724?07J-B | 5.4/7.2 | 1/60 | 2-3.6 | SINGLE | 26.0/30.0 | 5.6 | 40/45 | 40/45 |
| | RXBH-1724?10J-B | 7.2/9.6 | 1/60 | 2-4.8 | SINGLE | 34.6/40.0 | 5.6 | 51/57 | 50/60 |
| | RXBH-1724A15J-B | 10.8/14.4 | 1/60 | 3-4.18 | SINGLE | 51.9/60.0 | 5.6 | 72/82 | 80/90 |
| | RXBH-1724A15J-B | 3.6/4.8 | 1/60 | 1-4.18 | MULTIPLE CKT 1 | 17.3/20.0 | 5.6 | 29/32 | 30/35 |
| | | 7.2/9.6 | 1/60 | 2-4.18 | MULTIPLE CKT 2 | 34.6/40.0 | 0.0 | 50/56 | 50/60 |
| | RXBH-1724A18J-B | 12.8/17.0 | 1/60 | 4-4.26 | SINGLE | 61.6/70.8 | 5.6 | 83/95 | 90/100 |
| | RXBH-1724A18J-B | 4.3/5.7 | 1/60 | 1-5.68 | MULTIPLE CKT 1 | 20.5/23.6 | 5.6 | 33/37 | 35/40 |
| | | 8.5/11.3 | 1/60 | 2-5.68 | MULTIPLE CKT 2 | 41.1/47.2 | 0.0 | 52/59 | 60/60 |
| | RXBH-24A20J-B | 14.4/19.2 | 1/60 | 4-4.8 | SINGLE | 69.2/80.0 | 5.6 | 94/107 | 100/110 |
| | RXBH-24A20J-B | 7.2/9.6 | 1/60 | 2-4.8 | MULTIPLE CKT 1 | 34.6/40.0 | 5.6 | 51/57 | 50/60 |
| | | 7.2/9.6 | 1/60 | 2-4.8 | MULTIPLE CKT 2 | 34.6/40.0 | 0.0 | 44/50 | 50/50 |
| | RXBH-24A25J-B | 18.0/24.0 | 1/60 | 6-4.0 | SINGLE | 86.4/99.9 | 5.6 | 115/132 | 120/140 |
| | RXBH-24A25J-B | 6.0/8.0 | 1/60 | 2-4.0 | MULTIPLE CKT 1 | 28.8/33.3 | 5.6 | 43/49 | 50/50 |
| | | 6.0/8.0 | 1/60 | 2-4.0 | MULTIPLE CKT 2 | 28.8/33.3 | 0.0 | 36/42 | 40/50 |
| | | 6.0/8.0 | 1/60 | 2-4.0 | MULTIPLE CKT 3 | 28.8/33.3 | 0.0 | 36/42 | 40/50 |
| | RXBH-24A30J-B | 20.7/27.6 | 1/60 | 6-4.8 | SINGLE | 99.5/115.0 | 5.6 | 132/151 | 140/160 |
| | RXBH-24A30J-B | 6.9/9.2 | 1/60 | 2-4.8 | MULTIPLE CKT 1 | 33.2/38.3 | 5.6 | 49/55 | 50/60 |
| | | 6.9/9.2 | 1/60 | 2-4.8 | MULTIPLE CKT 2 | 33.2/38.3 | 0.0 | 42/48 | 50/50 |
| | | 6.9/9.2 | 1/60 | 2-4.8 | MULTIPLE CKT 3 | 33.2/38.3 | 0.0 | 42/48 | 50/50 |
| 6024STANNJ | RXBH-1724?05J-B | 3.6/4.8 | 1/60 | 1-4.8 | SINGLE | 17.3/20.0 | 4.7 | 28/31 | 30/35 |
| | RXBH-1724?07J-B | 5.4/7.2 | 1/60 | 2-3.6 | SINGLE | 26.0/30.0 | 4.7 | 39/44 | 40/45 |
| | RXBH-1724?10J-B | 7.2/9.6 | 1/60 | 2-4.8 | SINGLE | 34.6/40.0 | 4.7 | 50/56 | 50/60 |
| | RXBH-1724A15J-B | 10.8/14.4 | 1/60 | 3-4.18 | SINGLE | 51.9/60.0 | 4.7 | 71/81 | 80/90 |
| | RXBH-1724A15J-B | 3.6/4.8 | 1/60 | 1-4.18 | MULTIPLE CKT 1 | 17.3/20.0 | 4.7 | 28/31 | 30/35 |
| | | 7.2/9.6 | 1/60 | 2-4.18 | MULTIPLE CKT 2 | 34.6/40.0 | 0.0 | 50/56 | 50/60 |
| | RXBH-1724A18J-B | 12.8/17.0 | 1/60 | 4-4.26 | SINGLE | 61.6/70.8 | 4.7 | 83/95 | 90/100 |
| | RXBH-1724A18J-B | 4.3/5.7 | 1/60 | 1-5.68 | MULTIPLE CKT 1 | 20.5/23.6 | 4.7 | 32/36 | 35/40 |
| | | 8.5/11.3 | 1/60 | 2-5.68 | MULTIPLE CKT 2 | 41.1/47.2 | 0.0 | 52/59 | 60/60 |
| | RXBH-24A20J-B | 14.4/19.2 | 1/60 | 4-4.8 | SINGLE | 69.2/80.0 | 4.7 | 93/106 | 100/110 |
| | RXBH-24A20J-B | 7.2/9.6 | 1/60 | 2-4.8 | MULTIPLE CKT 1 | 34.6/40.0 | 4.7 | 50/56 | 50/60 |
| | | 7.2/9.6 | 1/60 | 2-4.8 | MULTIPLE CKT 2 | 34.6/40.0 | 0.0 | 44/50 | 50/50 |
| | RXBH-24A25J-B | 18.0/24.0 | 1/60 | 6-4.0 | SINGLE | 86.4/99.9 | 4.7 | 114/131 | 120/140 |
| | RXBH-24A25J-B | 6.0/8.0 | 1/60 | 2-4.0 | MULTIPLE CKT 1 | 28.8/33.3 | 4.7 | 42/48 | 50/50 |
| | | 6.0/8.0 | 1/60 | 2-4.0 | MULTIPLE CKT 2 | 28.8/33.3 | 0.0 | 36/42 | 40/50 |
| | | 6.0/8.0 | 1/60 | 2-4.0 | MULTIPLE CKT 3 | 28.8/33.3 | 0.0 | 36/42 | 40/50 |
| | RXBH-24A30J-B | 20.7/27.6 | 1/60 | 6-4.8 | SINGLE | 99.5/115.0 | 4.7 | 131/150 | 140/160 |
| | RXBH-24A30J-B | 6.9/9.2 | 1/60 | 2-4.8 | MULTIPLE CKT 1 | 33.2/38.3 | 4.7 | 48/54 | 50/60 |
| | | 6.9/9.2 | 1/60 | 2-4.8 | MULTIPLE CKT 2 | 33.2/38.3 | 0.0 | 42/48 | 50/50 |
| | | 6.9/9.2 | 1/60 | 2-4.8 | MULTIPLE CKT 3 | 33.2/38.3 | 0.0 | 42/48 | 50/50 |

# Electrical Wiring

### Power Wiring

- Field wiring must comply with the National Electrical Code (C.E.C. in Canada) and any applicable local ordinance.
- Supply wiring must be 75°C minimum copper conductors only.
- See electrical data for product Ampacity rating and Circuit Protector requirement.

### Grounding

- This product must be sufficiently grounded in accordance with National Electrical Code (C.E.C. in Canada) and any applicable local ordinance.
- A grounding lug is provided.

# Accessories

- **Combustible Floor Base RXHB-**

| Model Cabinet Size | Combustible Floor Base Model Number |
|---|---|
| 17 | RXHB-17 |
| 21 | RXHB-21 |
| 24 | RXHB-24 |

- **Jumper Bar Kit 3 Ckt. to 1 Ckt. RXBJ-A31** is used to convert single phase multiple three circuit units to a single supply circuit. Kit includes cover and screw for line side terminals.
- **Jumper Bar Kit 2 Ckt. to 1 Ckt. RXBJ-A21** is used to convert single phase multiple two circuit units to a single supply circuit. Kit includes cover and screw for line side terminals.
- **Note:** No jumper bar kit is available to convert three phase multiple two circuit units to a single supply circuit.
- **Auxiliary Horizontal Overflow Pan Accessory RXBM-**

| Nominal Cooling Capacity-Tons | Auxiliary Horizontal Overflow Pan Accessory Model Number |
|---|---|
| 1½ - 3 | RXBM-AC48 |
| 3½ - 5 | RXBM-AC61 |

- **Auxiliary Electric Heater Kits RXBH-**
  Heater Kits include circuit breakers which meet UL and cUL requirements for service disconnect. See the Electric Heat Electrical Data in this specification sheet for specific Heater Kit Model numbers.
- **Horizontal Adapter Kit RXHH-**
  This horizontal adapter kit is used to convert Upflow/Downflow only models to horizontal flow. See the following table to order proper horizontal adapter kit.

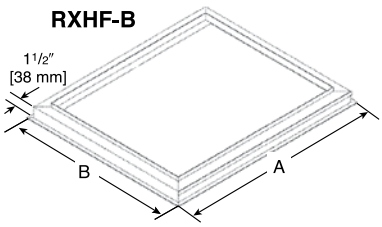
| Coil Model | Horizontal Adapter Kit Model Number (Single Qty.) | Horizontal Adapter Kit Model Number (10-Pack Qty.) |
|---|---|---|
| 2414 | RXHH-A01 | RXHH-A01 x 10 |
| 2417 | RXHH-A02 | RXHH-A02 x 10 |
| 3617/3621 | RXHH-A03 | RXHH-A03 x 10 |
| 3821/4821/4824 | RXHH-A04 | RXHH-A04 x 10 |
| 3621HT/4821MT/ 6021ST | RXHH-06 | RXHH-06 x 10 |
| 6024 | RXHH-A05 | RXHH-A05 x 10 |

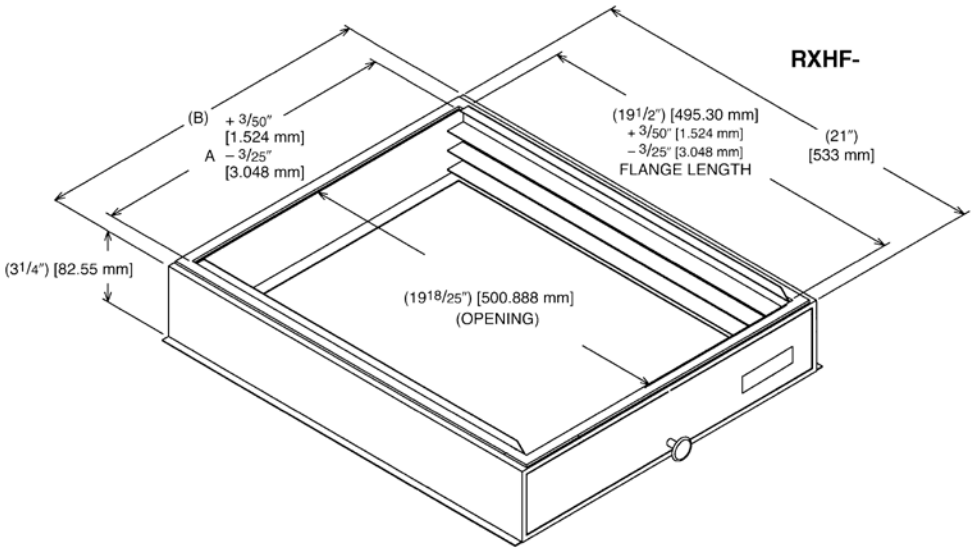
- **External Filter Base RXHF-**

| Model Cabinet Size | Filter Size In. [mm] | Part Number* | A | B |
|---|---|---|---|---|
| 17 | 16 x 20 [406 x 508] | RXHF-17 | 15.70 | 17.5 |
| 21 | 20 x 20 [508 x 508] | RXHF-21 | 19.20 | 21.0 |
| 24 | 25 x 20 [635 x 508] | RXHF-24 | 22.70 | 25.5 |

*Accommodates 1" or 2" filter

**[ ] Designates Metric Conversions**



## GENERAL TERMS OF LIMITED WARRANTY*

Rheem will furnish a replacement for any part of this product which fails in normal use and service within the applicable periods stated, in accordance with the terms of the limited warranty.

Conditional Parts
(Registration Required).....Ten (10) Years

***For complete details of the Limited and Conditional Warranties, including applicable terms and conditions, contact your local contractor or the Manufacturer for a copy of the product warranty certificate.**

**Before proceeding with installation, refer to installation instructions packaged with each model, as well as complying with all Federal, State, Provincial, and Local codes, regulations, and practices.**

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*In keeping with its policy of continuous progress and product improvement, Rheem reserves the right to make changes without notice.*

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Brampton, Ontario • L6Y 0P5 • rheem.ca

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The new degree of comfort.®

# Endeavor® Line *Classic*® Series iM Heat Pumps



## RP14AZ

Cooling Efficiencies up to: 14.3 SEER2/10.4 EER2
Heating Efficiencies up to: 7.6 HSPF
Nominal Sizes: 1.5 to 5 Tons [5.3 to 17.6 kW]
Cooling & Heating Capacities: 17.1 kBTU to 55.5 kBTU

ISO 9001:2015

AHRI CERTIFIED www.ahridirectory.org Unitary Small AC AHRI Standard 210/240

c UL us LISTED

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## Features and Benefits

- **Swept Wing Fan Technology[1]:** Features quieter operation and improved unit acoustics
- **Two-Stage Scroll Compressor[2]:** Features two speeds (high and low) of cooling and heating, providing more precise temperature control, lower humidity and greater efficiency when compared to single stage compressors
- **Inverted Reversing Valve:** Allows for faster heat transfer with gravity assist shifting and reduced joint stress for increased reliability
- **PlusOne® Expanded Valve Space:** 3 in. – 4 in. – 5 in. service valve space—provides a minimum working area of 27-square inches for easier access
- **PlusOne® Triple Service Access:** 15 in. wide, industry leading corner service access, two fastener, removeable corner and individual louver panels—makes repairs easier and faster

[1]Does not apply to the 3.5 and 4 Ton

[2]Does not apply to the 1.5 Ton 1-stage model

# Heat Pumps

| R | P | 14 | A | Z | 18 | A | J | 1 | N | A |
|---|---|---|---|---|---|---|---|---|---|---|
| **Brand** | **Product Category** | **SEER2** | **Region** | **Refrigerant** | **Capacity** | **Major Series** | **Voltage** | **Type** | **Controls** | **Minor Series** |
| R - Rheem | P - Heat Pump | 14 - 14.3 SEER2 | A - All Regions | Z - R-410A | 18 - 18,000 [5.28 kW]<br>24 - 24,000 [7.03 kW]<br>30 - 30,000 [8.79 kW]<br>36 - 36,000 [10.55 kW]<br>42 - 42,000 [12.31 kW]<br>48 - 48,000 [14.07 kW]<br>60 - 60,000 [17.58 kW] | A - 1st Design | J - 208/230/1/60 | 1 - 1-Stage<br>2 - 2-Stage | N - Non-Comm. | A - 1st Design |

**[ ] Designates Metric Conversions**

| AVAILABLE MODELS | DESCRIPTION |
|---|---|
| RP14AZ18AJ1NA | Endeavor® Line *Classic*® Series 1 1/2 ton 14.3 SEER2 1-Stage iM Heat Pump-208/230/1/60 |
| RP14AZ18AJ2NA | Endeavor® Line *Classic*® Series 1 1/2 ton 14.3 SEER2 2-Stage iM Heat Pump-208/230/1/60 |
| RP14AZ24AJ2NA | Endeavor® Line *Classic*® Series 2 ton 14.3 SEER2 2-Stage Heat iM Pump-208/230/1/60 |
| RP14AZ30AJ2NA | Endeavor® Line *Classic*® Series 2 1/2 ton 14.3 SEER2 2-Stage iM Heat Pump-208/230/1/60 |
| RP14AZ36AJ2NA | Endeavor® Line *Classic*® Series 3 ton 14.3 SEER2 2-Stage iM Heat Pump-208/230/1/60 |
| RP14AZ42AJ2NA | Endeavor® Line *Classic*® Series 3 1/2 ton 14.3 SEER2 2-Stage iM Heat Pump-208/230/1/60 |
| RP14AZ48AJ2NA | Endeavor® Line *Classic*® Series 4 ton 14.3 SEER2 2-Stage iM Heat Pump-208/230/1/60 |
| RP14AZ60AJ2NA | Endeavor® Line *Classic*® Series 5 ton 14.3 SEER2 2-Stage iM Heat Pump-208/230/1/60 |

| STANDARD EQUIPMENT |
|---|
| R-410A Refrigerant |
| Scroll Compressor |
| Field Installed Filter Drier |
| Front Seating Service Valves |
| Internal Pressure Relief Valve |
| Internal Thermal Overload |
| Long Line capability |
| Low Ambient capability with Kit |
| 3-4-5 Expanded Valve Space |
| Composite Basepan |
| 2 Screw Control Box Access |
| 15" Access to Internal Components |
| Quick release louver panel design |
| No fasteners to remove along bottom |
| Optimized Venturi Airflow |
| Single row condenser coil |
| Powder coated paint |
| Rust resistant screws |
| QR code |
| External gauge ports |
| Service trays |

## General Data

| MODEL NO. | RP14AZ18**1 | RP14AZ18**2 | RP14AZ24 | RP14AZ30 | RP14AZ36 | RP14AZ42 | RP14AZ48 | RP14AZ60 |
|---|---|---|---|---|---|---|---|---|
| **Nominal Tonnage** | 1.5 | 1.5 | 2.0 | 2.5 | 3.0 | 3.5 | 4.0 | 5.0 |
| **Valve Connections** | | | | | | | | |
| Liquid Line O.D. – in. | 3/8 | 3/8 | 3/8 | 3/8 | 3/8 | 3/8 | 3/8 | 3/8 |
| Suction Line O.D. – in. | 3/4 | 3/4 | 3/4 | 3/4 | 3/4 | 7/8 | 7/8 | 7/8 |
| **Refrigerant (R410A) furnished oz.[1]** | 84 | 88 | 88 | 108 | 118 | 148 | 148 | 247 |
| **Compressor Type** | Scroll | | | | | | | |
| **Outdoor Coil** | | | | | | | | |
| Net face area – Outer Coil | 10.9 | 10.9 | 10.9 | 14.4 | 19.5 | 19.5 | 19.5 | 28.4 |
| Net face area – Inner Coil | | | | | | | | |
| Tube diameter – in. | 0.276 | 0.276 | 0.276 | 0.276 | 0.276 | 0.276 | 0.276 | 0.375 |
| Number of rows | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| Fins per inch | 22 | 22 | 22 | 22 | 22 | 22 | 24 | 20 |
| **Outdoor Fan** | | | | | | | | |
| Diameter – in. | 20 | 20 | 20 | 24 | 24 | 24 | 24 | 26 |
| Number of blades | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 |
| Motor hp | 1/7 | 1/7 | 1/6 | 1/5 | 1/5 | 1/5 | 1/5 | 1/5 |
| CFM | 2401 | 2401 | 2620 | 3391 | 4077 | 4077 | 4096 | 4686 |
| RPM | 1075 | 1075 | 1075 | 850 | 850 | 850 | 850 | 850 |
| Watts | 146 | 141 | 145 | 175 | 234 | 222 | 236 | 239 |
| **Shipping weight – lbs.** | 157 | 157 | 158 | 196 | 209 | 239 | 245 | 285 |
| **Operating weight – lbs.** | 150 | 150 | 151 | 189 | 202 | 232 | 238 | 278 |

## Electrical Data

| Line Voltage Data (Volts-Phase-Hz) | 208/230-1-60 | 208/230-1-60 | 208/230-1-60 | 208/230-1-60 | 208/230-1-60 | 208/230-1-60 | 208/230-1-60 | 208/230-1-60 |
|---|---|---|---|---|---|---|---|---|
| **Maximum overcurrent protection (amps)[2]** | 20 | 20 | 25 | 25 | 35 | 45 | 50 | 50 |
| **Minimum circuit ampacity[3]** | 11 | 12 | 15 | 18 | 21 | 26 | 29 | 31 |
| **Compressor** | | | | | | | | |
| Rated load amps | 10 | 8 | 11 | 13 | 15 | 20 | 22 | 24 |
| Locked rotor amps | 46 | 49 | 66 | 71 | 78 | 151 | 127 | 118 |
| **Condenser Fan Motor** | | | | | | | | |
| Full load amps | 0.75 | 0.75 | 0.75 | 1.0 | 1.0 | 1.0 | 1.0 | 1.0 |
| Locked rotor amps | 1.4 | 1.4 | 1.5 | 2.6 | 2.56 | 2.56 | 2.56 | 2.6 |

[1]Refrigerant charge sufficient for 15 ft. length of refrigerant lines. For longer line set requirements see the installation instructions for information about set length and additional refrigerant charge required.
[2]HACR type circuit breaker of fuse.
[3]Refer to National Electrical Code manual to determine wire, fuse and disconnect size requirements.

## Accessories

| MODEL NO. | | RP14AZ18**1 | RP14AZ18**2 | RP14AZ24 | RP14AZ30 | RP14AZ36 | RP14AZ42 | RP14AZ48 | RP14AZ60 |
|---|---|---|---|---|---|---|---|---|---|
| Compressor crankcase heater* | | 44-17402-44 | 44-17402-44 | 44-17402-44 | 44-17402-44 | 44-17402-44 | 44-17402-45 | 44-17402-45 | Factory Standard |
| Low ambient control | | RXAD-A08 | RXAD-A08 | RXAD-A08 | RXAD-A08 | RXAD-A08 | RXAD-A08 | RXAD-A08 | RXAD-A08 |
| Compressor sound cover | | 68-23427-26 | 68-23427-26 | 68-23427-26 | 68-23427-26 | 68-23427-26 | 68-23427-25 | 68-23427-25 | 68-23427-25 |
| Compressor hard start kit | | SK-A1 | SK-A1 | SK-A1 | SK-A1 | SK-A1 | SK-A1 | SK-A1 | SK-A1 |
| Low pressure control | | Factory Standard | Factory Standard | Factory Standard | Factory Standard | Factory Standard | Factory Standard | Factory Standard | Factory Standard |
| High pressure control | | Factory Standard | Factory Standard | Factory Standard | Factory Standard | Factory Standard | Factory Standard | Factory Standard | Factory Standard |
| Liquid Line Solenoid (24 VAC, 50/60 Hz) | Solenoid Valve | 200RD2T3TVLC | 200RD2T3TVLC | 200RD2T3TVLC | 200RD2T3TVLC | 200RD2T3TVLC | 200RD2T3TVLC | 200RD3T3TVLC | 200RD3T3TVLC |
| | Solenoid Coil | 61-AMG24V | 61-AMG24V | 61-AMG24V | 61-AMG24V | 61-AMG24V | 61-AMG24V | 61-AMG24V | 61-AMG24V |
| Liquid Line Solenoid (120/240 VAC, 50/60 Hz) | Solenoid Valve | 200RD2T3TVLC | 200RD2T3TVLC | 200RD2T3TVLC | 200RD2T3TVLC | 200RD2T3TVLC | 200RD2T3TVLC | 200RD3T3TVLC | 200RD3T3TVLC |
| | Solenoid Coil | 61-AMG120/240V | 61-AMG120/240V | 61-AMG120/240V | 61-AMG120/240V | 61-AMG120/240V | 61-AMG120/240V | 61-AMG120/240V | 61-AMG120/240V |
| Classic Top Cap w/Label | | 91-101123-21 | 91-101123-21 | 91-101123-21 | 91-101123-21 | 91-101123-21 | 91-101123-21 | 91-101123-21 | 91-101123-21 |

*Bi-flow kits are required when installing a liquid line solenoid on a heat pump.

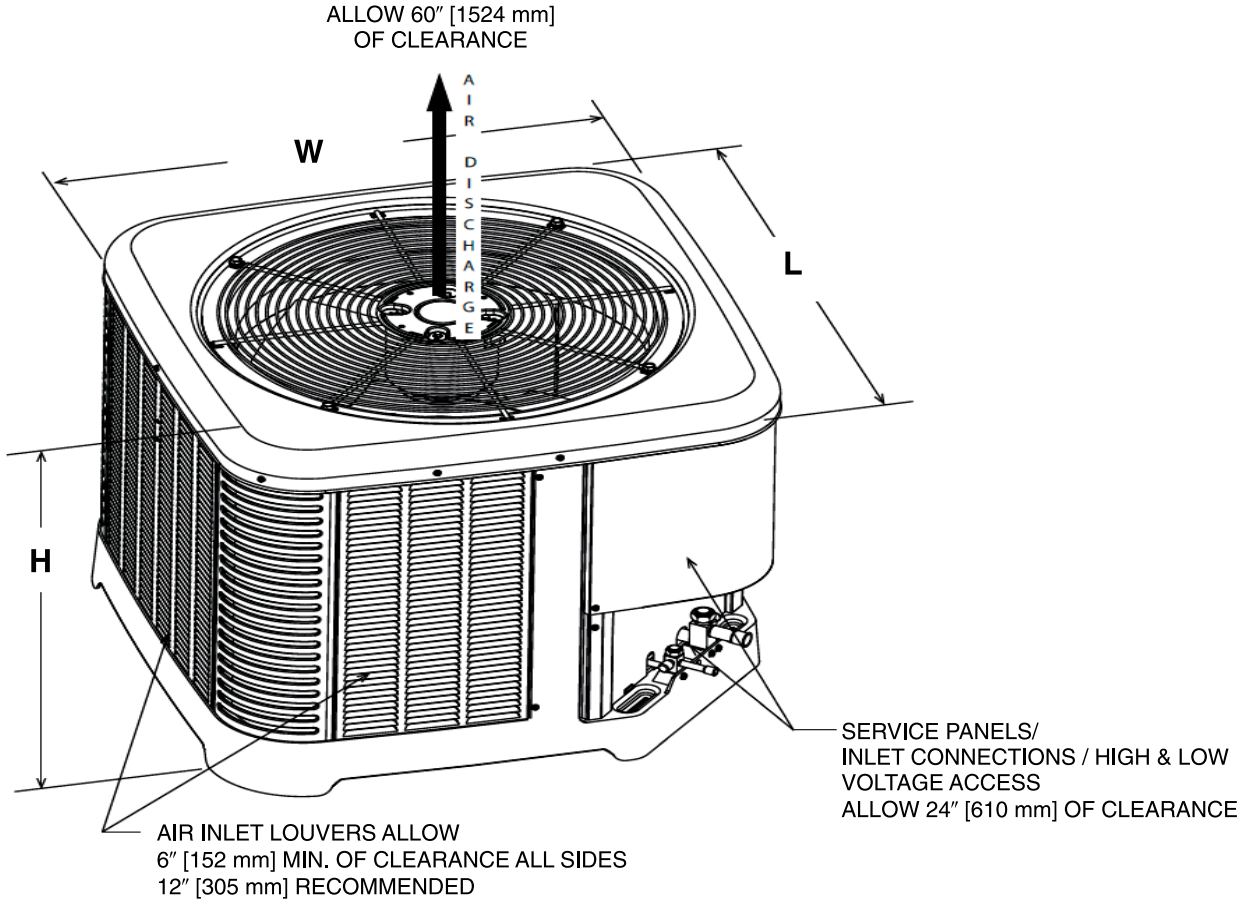
## Weighted Sound Power Level (dBA)

| UNIT SIZE - VOLTAGE, SERIES | STANDARD RATING (DBA) | TYPICAL OCTAVE BAND SPECTRUM (dBA without tone adjustment) | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | 125 | 250 | 500 | 1000 | 2000 | 4000 | 8000 |
| RP14AZ18A | 73 | 39.8 | 55.0 | 62.1 | 67.0 | 60.0 | 57.4 | 51.2 |
| RP14AZ24A | 73 | 40.4 | 55.4 | 62.5 | 65.9 | 58.7 | 56.4 | 48.9 |
| RP14AZ30A | 72 | 48.9 | 55.3 | 63.6 | 61.0 | 59.1 | 56.5 | 48.7 |
| RP14AZ36A | 72 | 50.1 | 55.8 | 64.4 | 61.5 | 58.7 | 55.1 | 50.9 |
| RP14AZ42A | 72 | 48.6 | 56.2 | 63.1 | 61.7 | 60.0 | 56.0 | 50.0 |
| RP14AZ48A | 74 | 49.3 | 56.0 | 64.5 | 64.5 | 60.1 | 54.9 | 47.7 |
| RP14AZ60A | 74 | 43.9 | 55.2 | 63.4 | 65.8 | 61.7 | 57.9 | 52.9 |

**NOTE:** Tested in accordance with AHRI Standard 270-08 (not listed in AHRI)

# Unit Dimensions

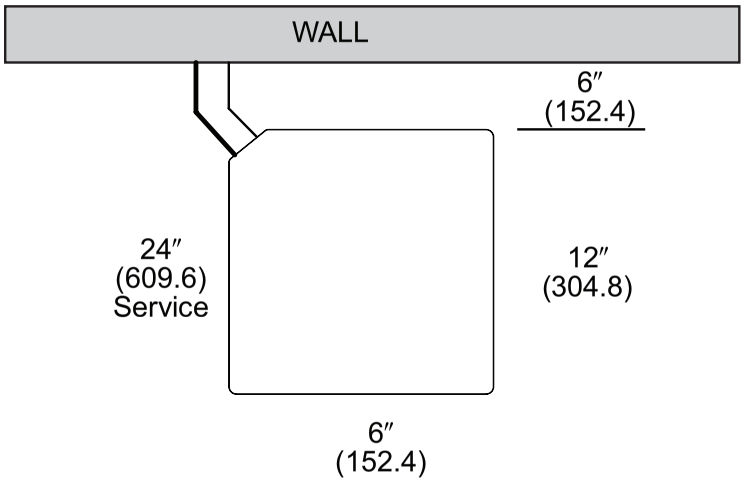
| MODEL NO. | OPERATING | | | | | | SHIPPING | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | H (Height) | | L (Length) | | W (Width) | | H (Height) | | L (Length) | | W (Width) | |
| | INCHES | mm | INCHES | mm | INCHES | mm | INCHES | mm | INCHES | mm | INCHES | mm |
| RP14AZ18**1 | 25.00 | 635 | 29.75 | 756 | 29.75 | 756 | 27.90 | 709 | 33.25 | 845 | 33.25 | 845 |
| RP14AZ18**2 | 25.00 | 635 | 29.75 | 756 | 29.75 | 756 | 27.90 | 709 | 33.25 | 845 | 33.25 | 845 |
| RP14AZ24 | 25.00 | 635 | 29.75 | 756 | 29.75 | 756 | 27.90 | 709 | 33.25 | 845 | 33.25 | 845 |
| RP14AZ30 | 27.00 | 686 | 33.75 | 857 | 33.75 | 857 | 30.08 | 764 | 37.64 | 956 | 37.64 | 956 |
| RP14AZ36 | 35.00 | 889 | 33.75 | 857 | 33.75 | 857 | 38.35 | 974 | 37.64 | 956 | 37.64 | 956 |
| RP14AZ42 | 35.00 | 889 | 33.75 | 857 | 33.75 | 857 | 38.35 | 974 | 37.64 | 956 | 37.64 | 956 |
| RP14AZ48 | 35.00 | 889 | 33.75 | 857 | 33.75 | 857 | 38.35 | 974 | 37.64 | 956 | 37.64 | 956 |
| RP14AZ60 | 45.00 | 1143 | 35.75 | 908 | 35.75 | 908 | 48.50 | 1232 | 39.37 | 1000 | 39.37 | 1000 |

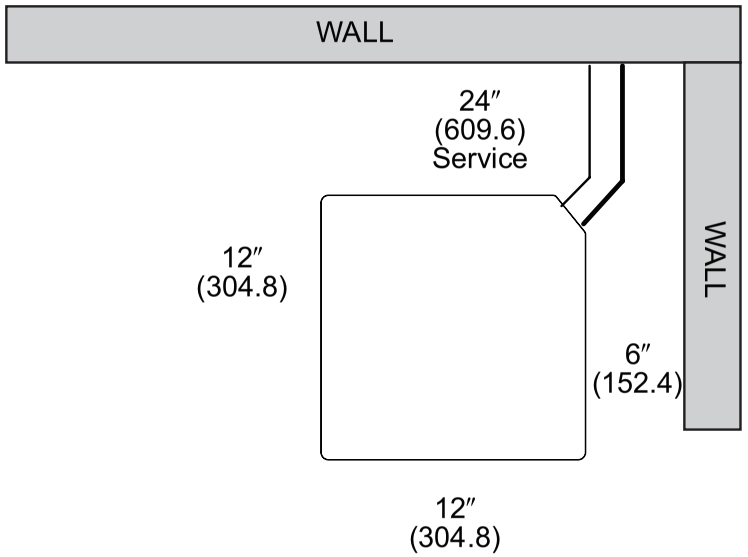


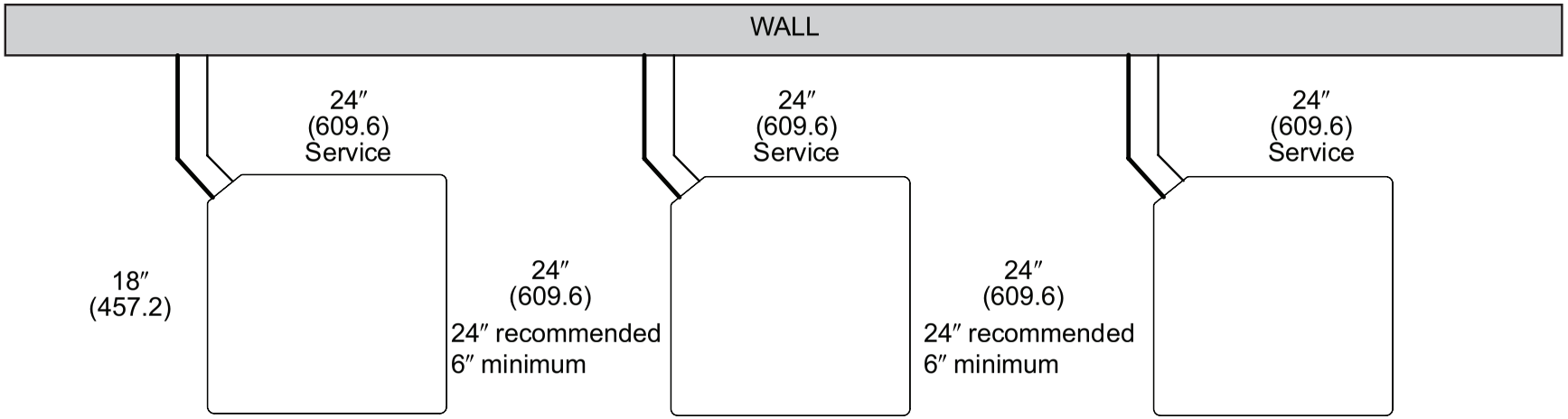

**[ ] Designates Metric Conversions**

ST-A1226-02-00

# CLEARANCES




NOTE: NUMBERS IN () = mm

IMPORTANT: When installing multiple units in an alcove, roof well or partially enclosed area, ensure there is adequate ventillation to prevent re-circulation of discharge air.

# Refrigerant Line Size Information

| 14.3 SEER2 HEAT PUMPS | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| **UNIT SIZE** | **LIQUID LINE SIZE** | **SUCTION LINE SIZE** | **OUTDOOR UNIT ABOVE OR BELOW INDOOR UNIT EQUIVALENT LENGTH (FEET)** | | | | | | |
| | | | **0-15** | **16-25** | **26-50** | **51-80** | **81-100** | **101-125** | **126-150** |
| | | | **MAXIMUM VERTICAL RISE (OUTDOOR UNIT BELOW INDOOR UNIT) * / CAPACITY MULTIPLIERER** | | | | | | |
| 1.5 Ton | 1/4" | 1/2" | 15 / 1 | 25 / 0.99 | 50 / 0.98 | 75 / 0.97 | 60 / 0.94 | 40 / 0.93 | 20 / 0.91 |
| | 5/16" | 1/2" | 15 / 1 | 25 / 0.99 | 50 / 0.98 | 80 / 0.97 | 100 / 0.94 | 110 / 0.93 | 115 / 0.91 |
| | 3/8" | 1/2" | 15 / 1 | 25 / 1 | 50 / 0.99 | 80 / 0.97 | 100 / 0.97 | 115 / 0.96 | 115 / 0.95 |
| | 1/4" | 5/8" | 15 / 1 | 25 / 1 | 50 / 0.99 | 75 / 0.99 | 60 / 0.98 | 40 / 0.98 | 20 / 0.98 |
| | 5/16" | 5/8" | 15 / 1 | 25 / 1 | 50 / 0.99 | 80 / 0.99 | 100 / 0.98 | 110 / 0.98 | 115 / 0.98 |
| | 3/8" | 5/8" | 15 / 1 | 25 / 1 | 50 / 1 | 80 / 0.99 | 100 / 0.99 | 115 / 0.99 | 115 / 0.98 |
| | 1/4" | 3/4" | 15 / 1 | 25 / 1 | 50 / 1 | 75 / 0.99 | 60 / 0.99 | 40 / 0.99 | 20 / 0.99 |
| | 5/16" | 3/4" | 15 / 1 | 25 / 1 | 50 / 1 | 80 / 0.99 | 100 / 0.99 | 110 / 0.99 | 115 / 0.99 |
| | 3/8" | 3/4" | 15 / 1 | 25 / 1 | 50 / 1 | 80 / 0.99 | 100 / 0.99 | 115 / 0.99 | 115 / 0.98 |
| 2 Ton | 1/4" | 5/8" | 15 / 1 | 25 / 0.99 | 50 / 0.99 | 40 / 0.98 | 15 / 0.97 | 0 / 0.96 | 0 / 0.95 |
| | 5/16" | 5/8" | 15 / 1 | 25 / 0.99 | 50 / 0.99 | 80 / 0.98 | 100 / 0.97 | 95 / 0.96 | 85 / 0.95 |
| | 3/8" | 5/8" | 15 / 1 | 25 / 1 | 50 / 0.99 | 80 / 0.98 | 100 / 0.97 | 100 / 0.96 | 95 / 0.95 |
| | 1/4" | 3/4" | 15 / 1 | 25 / 1 | 50 / 0.99 | 40 / 0.99 | 15 / 0.99 | 0 / 0.99 | 0 / 0.98 |
| | 5/16" | 3/4" | 15 / 1 | 25 / 1 | 50 / 0.99 | 80 / 0.99 | 100 / 0.99 | 95 / 0.99 | 85 / 0.98 |
| | 3/8" | 3/4" | 15 / 1 | 25 / 1 | 50 / 1 | 80 / 0.99 | 100 / 0.99 | 100 / 0.99 | 95 / 0.98 |
| 2.5 Ton | 1/4" | 5/8" | 15 / 1 | 25 / 0.99 | 50 / 0.98 | 0 / 0.97 | 0 / 0.96 | 0 / 0.94 | 0 / 0.93 |
| | 5/16" | 5/8" | 15 / 1 | 25 / 0.99 | 50 / 0.98 | 80 / 0.97 | 85 / 0.96 | 75 / 0.94 | 60 / 0.93 |
| | 3/8" | 5/8" | 15 / 1 | 25 / 0.99 | 50 / 0.98 | 80 / 0.97 | 95 / 0.96 | 90 / 0.94 | 85 / 0.93 |
| | 1/4" | 3/4" | 15 / 1 | 25 / 1 | 50 / 0.99 | 0 / 0.99 | 0 / 0.98 | 0 / 0.98 | 0 / 0.97 |
| | 5/16" | 3/4" | 15 / 1 | 25 / 1 | 50 / 0.99 | 80 / 0.99 | 85 / 0.98 | 75 / 0.98 | 60 / 0.97 |
| | 3/8" | 3/4" | 15 / 1 | 25 / 1 | 50 / 0.99 | 80 / 0.99 | 95 / 0.98 | 90 / 0.98 | 85 / 0.97 |
| 3 Ton | 5/16" | 5/8" | 15 / 1 | 25 / 0.99 | 50 / 0.97 | 75 / 0.95 | 65 / 0.94 | 45 / 0.92 | 30 / 0.9 |
| | 5/16" | 3/4" | 15 / 1 | 25 / 1 | 50 / 0.99 | 75 / 0.98 | 65 / 0.98 | 45 / 0.97 | 30 / 0.96 |
| | 3/8" | 5/8" | 15 / 1 | 25 / 0.99 | 50 / 0.97 | 80 / 0.95 | 85 / 0.94 | 80 / 0.92 | 75 / 0.9 |
| | 3/8" | 3/4" | 15 / 1 | 25 / 1 | 50 / 0.99 | 80 / 0.98 | 85 / 0.98 | 80 / 0.97 | 75 / 0.96 |
| | 3/8" | 7/8" | 15 / 1 | 25 / 1 | 50 / 1 | 80 / 0.99 | 85 / 0.99 | 80 / 0.99 | 75 / 0.98 |
| | 1/2" | 3/4" | 15 / 1 | 25 / 1 | 50 / 0.99 | 80 / 0.98 | 100 / 0.98 | 125 / 0.97 | 130 / 0.96 |
| | 1/2" | 7/8" | 15 / 1 | 25 / 1 | 50 / 0.99 | 80 / 0.99 | 100 / 0.99 | 125 / 0.99 | 130 / 0.99 |
| 3.5 Ton | 3/8" | 3/4" | 15 / 1 | 25 / 0.99 | 50 / 0.98 | 80 / 0.97 | 80 / 0.97 | 70 / 0.96 | 65 / 0.95 |
| | 3/8" | 7/8" | 15 / 1 | 25 / 1 | 50 / 0.99 | 80 / 0.99 | 80 / 0.99 | 70 / 0.98 | 65 / 0.98 |
| | 1/2" | 3/4" | 15 / 1 | 25 / 0.99 | 50 / 0.98 | 80 / 0.97 | 100 / 0.97 | 125 / 0.96 | 125 / 0.94 |
| | 1/2" | 7/8" | 15 / 1 | 25 / 0.99 | 50 / 0.98 | 80 / 0.97 | 100 / 0.97 | 125 / 0.96 | 125 / 0.94 |
| 4 Ton | 3/8" | 3/4" | 15 / 1 | 25 / 0.99 | 50 / 0.98 | 75 / 0.97 | 70 / 0.96 | 60 / 0.95 | 50 / 0.94 |
| | 3/8" | 7/8" | 15 / 1 | 25 / 1 | 50 / 0.99 | 75 / 0.99 | 70 / 0.98 | 60 / 0.98 | 50 / 0.97 |
| | 1/2" | 3/4" | 15 / 1 | 25 / 0.99 | 50 / 0.98 | 80 / 0.97 | 100 / 0.96 | 125 / 0.95 | 125 / 0.94 |
| | 1/2" | 7/8" | 15 / 1 | 25 / 1 | 50 / 0.99 | 80 / 0.99 | 100 / 0.98 | 125 / 0.98 | 125 / 0.97 |
| 5 Ton | 3/8" | 3/4" | 15 / 1 | 25 / 0.99 | 50 / 0.97 | 65 / 0.95 | 45 / 0.94 | 30 / 0.92 | 15 / 0.9 |
| | 3/8" | 7/8" | 15 / 1 | 25 / 0.99 | 50 / 0.99 | 65 / 0.98 | 45 / 0.97 | 30 / 0.96 | 15 / 0.96 |
| | 1/2" | 3/4" | 15 / 0.99 | 25 / 0.99 | 50 / 0.97 | 80 / 0.95 | 100 / 0.94 | 120 / 0.92 | 115 / 0.9 |
| | 1/2" | 7/8" | 15 / 1 | 25 / 0.99 | 50 / 0.99 | 80 / 0.98 | 100 / 0.97 | 120 / 0.96 | 115 / 0.96 |

**NOTES:**

1) Maximum Equivelent Line Length may not exceed 250'.
2) Maximum Actual Line Length may not exceed 200'.
3) Light Grey shaded areas are considered long line and may require accessories as recommended in Long Line Set Guide.
4) **DO NOT** use suction line traps in the suction riser as this adds additional unwanted pressure drop in the system.

# Refrigerant Line Size Information (Con't.)

| 14.3 SEER2 HEAT PUMPS | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| UNIT SIZE | LIQUID LINE SIZE | SUCTION LINE SIZE | OUTDOOR UNIT ABOVE OR BELOW INDOOR UNIT EQUIVALENT LENGTH (METERS) | | | | | | |
| | | | 0-5 | 5.5-8 | 8.5-15 | 15.5-24 | 24.5-30 | 30.5-38 | 38.5-46 |
| | | | MAXIMUM VERTICAL RISE (OUTDOOR UNIT BELOW INDOOR UNIT) * / CAPACITY MULTIPLIERER | | | | | | |
| 1.5 Ton | 1/4" | 1/2" | 5 / 1 | 8 / 0.99 | 15 / 0.98 | 23 / 0.97 | 18 / 0.94 | 12 / 0.93 | 6 / 0.91 |
| | 5/16" | 1/2" | 5 / 1 | 8 / 0.99 | 15 / 0.98 | 24 / 0.97 | 30 / 0.94 | 34 / 0.93 | 35 / 0.91 |
| | 3/8" | 1/2" | 5 / 1 | 8 / 1 | 15 / 0.99 | 24 / 0.97 | 30 / 0.97 | 35 / 0.96 | 35 / 0.95 |
| | 1/4" | 5/8" | 5 / 1 | 8 / 1 | 15 / 0.99 | 23 / 0.99 | 18 / 0.98 | 12 / 0.98 | 6 / 0.98 |
| | 5/16" | 5/8" | 5 / 1 | 8 / 1 | 15 / 0.99 | 24 / 0.99 | 30 / 0.98 | 34 / 0.98 | 35 / 0.98 |
| | 3/8" | 5/8" | 5 / 1 | 8 / 1 | 15 / 1 | 24 / 0.99 | 30 / 0.99 | 35 / 0.99 | 35 / 0.98 |
| | 1/4" | 3/4" | 5 / 1 | 8 / 1 | 15 / 1 | 23 / 0.99 | 18 / 0.99 | 12 / 0.99 | 6 / 0.99 |
| | 5/16" | 3/4" | 5 / 1 | 8 / 1 | 15 / 1 | 24 / 0.99 | 30 / 0.99 | 34 / 0.99 | 35 / 0.99 |
| | 3/8" | 3/4" | 5 / 1 | 8 / 1 | 15 / 1 | 24 / 0.99 | 30 / 0.99 | 35 / 0.99 | 35 / 0.98 |
| 2 Ton | 1/4" | 5/8" | 5 / 1 | 8 / 0.99 | 15 / 0.99 | 12 / 0.98 | 5 / 0.97 | 0 / 0.96 | 0 / 0.95 |
| | 5/16" | 5/8" | 5 / 1 | 8 / 0.99 | 15 / 0.99 | 24 / 0.98 | 30 / 0.97 | 29 / 0.96 | 26 / 0.95 |
| | 3/8" | 5/8" | 5 / 1 | 8 / 1 | 15 / 0.99 | 24 / 0.98 | 30 / 0.97 | 30 / 0.96 | 29 / 0.95 |
| | 1/4" | 3/4" | 5 / 1 | 8 / 1 | 15 / 0.99 | 12 / 0.99 | 5 / 0.99 | 0 / 0.99 | 0 / 0.98 |
| | 5/16" | 3/4" | 5 / 1 | 8 / 1 | 15 / 0.99 | 24 / 0.99 | 30 / 0.99 | 29 / 0.99 | 26 / 0.98 |
| | 3/8" | 3/4" | 5 / 1 | 8 / 1 | 15 / 1 | 24 / 0.99 | 30 / 0.99 | 30 / 0.99 | 29 / 0.98 |
| 2.5 Ton | 1/4" | 5/8" | 5 / 1 | 8 / 0.99 | 15 / 0.98 | 0 / 0.97 | 0 / 0.96 | 0 / 0.94 | 0 / 0.93 |
| | 5/16" | 5/8" | 5 / 1 | 8 / 0.99 | 15 / 0.98 | 24 / 0.97 | 26 / 0.96 | 23 / 0.94 | 18 / 0.93 |
| | 3/8" | 5/8" | 5 / 1 | 8 / 0.99 | 15 / 0.98 | 24 / 0.97 | 29 / 0.96 | 27 / 0.94 | 26 / 0.93 |
| | 1/4" | 3/4" | 5 / 1 | 8 / 1 | 15 / 0.99 | 0 / 0.99 | 0 / 0.98 | 0 / 0.98 | 0 / 0.97 |
| | 5/16" | 3/4" | 5 / 1 | 8 / 1 | 15 / 0.99 | 24 / 0.99 | 26 / 0.98 | 23 / 0.98 | 18 / 0.97 |
| | 3/8" | 3/4" | 5 / 1 | 8 / 1 | 15 / 0.99 | 24 / 0.99 | 29 / 0.98 | 27 / 0.98 | 26 / 0.97 |
| 3 Ton | 5/16" | 5/8" | 5 / 1 | 8 / 0.99 | 15 / 0.97 | 23 / 0.95 | 20 / 0.94 | 14 / 0.92 | 9 / 0.9 |
| | 5/16" | 3/4" | 5 / 1 | 8 / 1 | 15 / 0.99 | 23 / 0.98 | 20 / 0.98 | 14 / 0.97 | 9 / 0.96 |
| | 3/8" | 5/8" | 5 / 1 | 8 / 0.99 | 15 / 0.97 | 24 / 0.95 | 26 / 0.94 | 24 / 0.92 | 23 / 0.9 |
| | 3/8" | 3/4" | 5 / 1 | 8 / 1 | 15 / 0.99 | 24 / 0.98 | 26 / 0.98 | 24 / 0.97 | 23 / 0.96 |
| | 3/8" | 7/8" | 5 / 1 | 8 / 1 | 15 / 1 | 24 / 0.99 | 26 / 0.99 | 24 / 0.99 | 23 / 0.98 |
| | 1/2" | 3/4" | 5 / 1 | 8 / 1 | 15 / 0.99 | 23 / 0.98 | 30 / 0.98 | 38 / 0.97 | 40 / 0.96 |
| | 1/2" | 7/8" | 5 / 1 | 8 / 1 | 15 / 0.99 | 23 / 0.99 | 30 / 0.99 | 38 / 0.99 | 40 / 0.99 |
| 3.5 Ton | 3/8" | 3/4" | 5 / 1 | 8 / 0.99 | 15 / 0.98 | 24 / 0.97 | 24 / 0.97 | 21 / 0.96 | 20 / 0.95 |
| | 3/8" | 7/8" | 5 / 1 | 8 / 1 | 15 / 0.99 | 24 / 0.99 | 24 / 0.99 | 21 / 0.98 | 20 / 0.98 |
| | 1/2" | 3/4" | 5 / 1 | 8 / 0.99 | 15 / 0.98 | 23 / 0.97 | 30 / 0.97 | 38 / 0.96 | 38 / 0.94 |
| | 1/2" | 7/8" | 5 / 1 | 8 / 0.99 | 15 / 0.98 | 23 / 0.97 | 30 / 0.97 | 38 / 0.96 | 38 / 0.94 |
| 4 Ton | 3/8" | 3/4" | 5 / 1 | 8 / 0.99 | 15 / 0.98 | 23 / 0.97 | 21 / 0.96 | 18 / 0.95 | 15 / 0.94 |
| | 3/8" | 7/8" | 5 / 1 | 8 / 1 | 15 / 0.99 | 23 / 0.99 | 21 / 0.98 | 18 / 0.98 | 15 / 0.97 |
| | 1/2" | 3/4" | 5 / 1 | 8 / 0.99 | 15 / 0.98 | 23 / 0.97 | 30 / 0.96 | 38 / 0.95 | 38 / 0.94 |
| | 1/2" | 7/8" | 5 / 1 | 8 / 1 | 15 / 0.99 | 23 / 0.99 | 30 / 0.98 | 38 / 0.98 | 38 / 0.97 |
| 5 Ton | 3/8" | 3/4" | 5 / 1 | 8 / 0.99 | 15 / 0.97 | 20 / 0.95 | 14 / 0.94 | 9 / 0.92 | 5 / 0.9 |
| | 3/8" | 7/8" | 5 / 1 | 8 / 0.99 | 15 / 0.99 | 20 / 0.98 | 14 / 0.97 | 9 / 0.96 | 5 / 0.96 |
| | 1/2" | 3/4" | 5 / 0.99 | 8 / 0.99 | 15 / 0.97 | 23 / 0.95 | 30 / 0.94 | 37 / 0.92 | 35 / 0.9 |
| | 1/2" | 7/8" | 5 / 1 | 8 / 0.99 | 15 / 0.99 | 23 / 0.98 | 30 / 0.97 | 37 / 0.96 | 35 / 0.96 |

**NOTES:**

1) Maximum Equivelent Line Length may not exceed 76 Meters.
2) Maximum Actual Line Length may not exceed 61 Meters.
3) Light Grey shaded areas are considered long line and may require accessories as recommended in Long Line Set Guide.
4) **DO NOT** use suction line traps in the suction riser as this adds additional unwanted pressure drop in the system.

# Performance Data @ AHRI Standard Conditions – Cooling

| DESIGNATED TESTED COMBINATION (DTC) | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **OUTDOOR UNIT** | **AIR HANDLER** | **TOTAL CAPACITY BTU/H [kW]** | **NET SENSIBLE BTU/H [kW]** | **NET LATENT BTU/H [kW]** | **SEER2** | **EER2** | **INDOOR CFM [L/S]** | **47 DEGREE HEATING CAPACITY BTU/H [KW]** | **47 DEGREE COP** | **17 DEGREE HEATING CAPACITY BTU/H [KW]** | **17 DEGREE COP** | **REGION IV HSPF2** |
| RP14AZ18AJ1 | RH2TZ2417STANN | 17,100 [5.0] | 13,100 [3.8] | 4,000 [1.2] | 14.3 | 9.0 | 575 [271.4] | 17,100 [5.0] | 3.78 | 11,100 [3.3] | 2.56 | 7.5 |
| RP14AZ18AJ2 | RH2TZ2417STANN | 17,100 [5.0] | 13,100 [3.8] | 4,000 [1.2] | 14.3 | 9.0 | 550 [259.6] | 17,100 [5.0] | 3.58 | 11,000 [3.2] | 2.52 | 7.5 |
| RP14AZ24AJ2 | RH2TZ2417STANN | 22,800 [6.7] | 17,500 [5.1] | 5,300 [1.6] | 14.3 | 9.0 | 775 [365.8] | 22,800 [6.7] | 3.51 | 14,600 [4.3] | 2.55 | 7.5 |
| RP14AZ30AJ2 | RH2TZ3617STANN | 28,600 [8.4] | 21,900 [6.4] | 6,700 [2.0] | 14.3 | 9.0 | 950 [448.4] | 28,600 [8.4] | 3.56 | 18,200 [5.3] | 2.57 | 7.5 |
| RP14AZ36AJ2 | RH2TZ3617STANN | 34,200 [10.0] | 26,200 [7.7] | 8,000 [2.3] | 14.3 | 9.0 | 1,050 [495.5] | 34,200 [10.0] | 3.27 | 23,600 [6.9] | 2.49 | 7.5 |
| RP14AZ42AJ2 | RH2TZ4821STANN | 39,500 [11.6] | 30,300 [8.9] | 9,200 [2.7] | 14.3 | 9.0 | 1,275 [601.7] | 39,500 [11.6] | 3.69 | 25,500 [7.5] | 2.67 | 7.5 |
| RP14AZ48AJ2 | RH2TZ4821STANN | 45,500 [13.3] | 34,900 [10.2] | 10,600 [3.1] | 14.3 | 9.0 | 1,450 [684.3] | 45,500 [13.0] | 3.65 | 27,500 [8.1] | 2.54 | 7.5 |
| RP14AZ60AJ2 | RH2TZ6024STANN | 55,500 [16.3] | 42,600 [12.5] | 12,900 [3.8] | 14.3 | 9.0 | 1,800 [849.5] | 55,500 [16.3] | 2.66 | 34,000 [10.0] | 2.56 | 7.5 |

**NOTE:** This data includes DTC (Designated Test Combination) ratings and is for reference purposes only. A full listing of official ratings and system match-ups, along with downloadable certificates, will be accessible from the AHRI website: www.ahridirectory.org later this year.

**[ ] Designates Metric Conversions**

The new degree of comfort.®

## GENERAL TERMS OF LIMITED WARRANTY*

Rheem will furnish a replacement for any part of this product which fails in normal use and service within the applicable period stated, in accordance with the terms of the limited warranty.

***For complete details of the Limited and Conditional Warranties, including applicable terms and conditions, contact your local contractor or the Manufacturer for a copy of the product warranty certificate.**

Conditional Parts
(Registration Required).....Ten (10) Years

**Before proceeding with installation, refer to installation instructions packaged with each model, as well as complying with all Federal, State, Provincial, and Local codes, regulations, and practices.**

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*In keeping with its policy of continuous progress and product improvement, Rheem reserves the right to make changes without notice.*

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