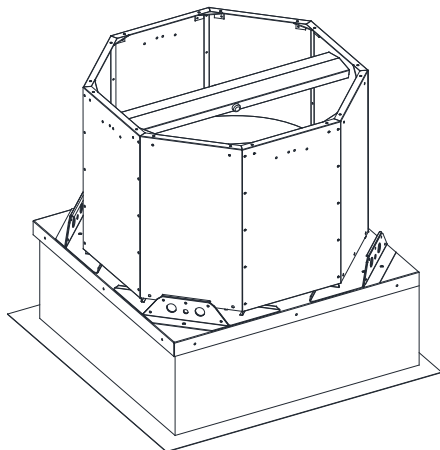
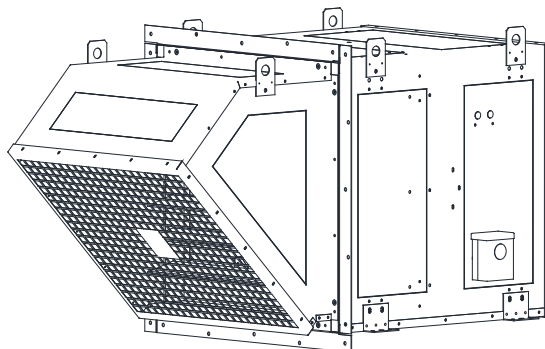


# Installation, Operation, and Maintenance Manual

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Roof Mount Prop Fan



Wall Mount PropFan

## RECEIVING AND INSPECTION

Upon receiving unit, check for any interior and exterior damage, and if found, report it immediately to the carrier. Also check that all accessory items are accounted for and are damage free. Turn the fan by hand to verify free rotation and check the damper (if supplied) for free operation.

## 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.

**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 5-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, 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 5-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.

# INSTALLATION

It is imperative that this unit is installed and operated with the designed airflow and electrical supply in accordance with this manual. For warranty and technical support, refer to for contact information.

## Mechanical

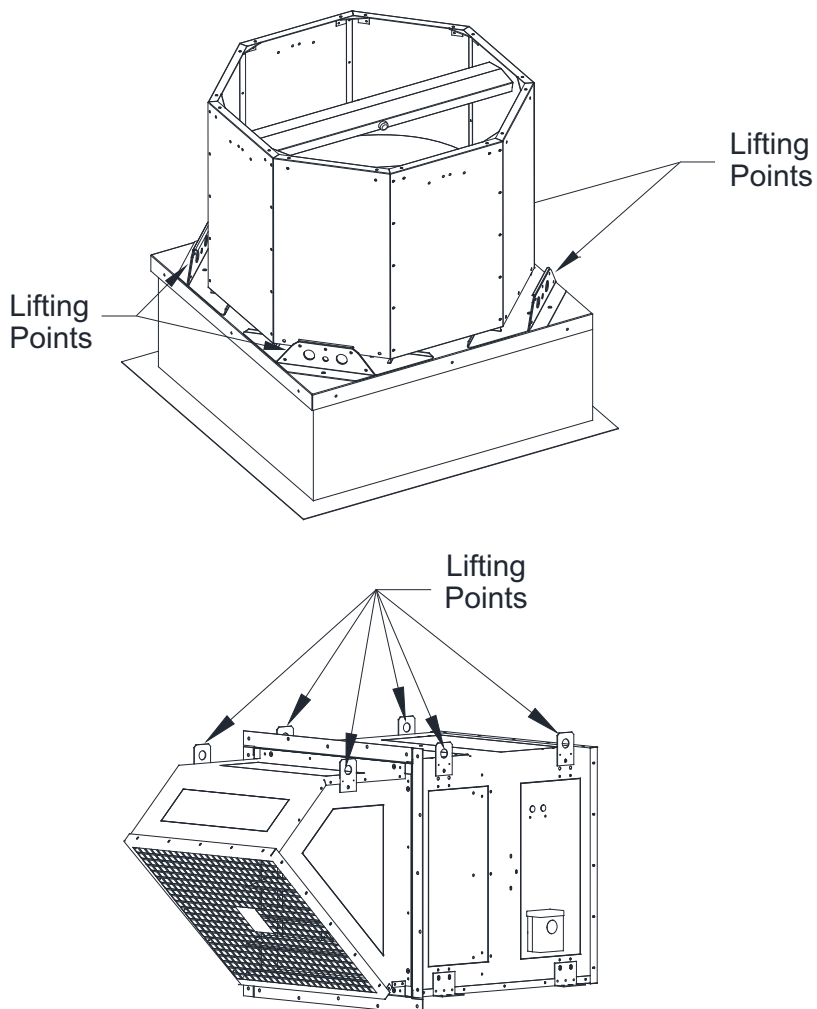
**WARNING: DO NOT RAISE VENTILATOR BY THE HOOD, BLOWER OR MOTOR SHAFT – USE LIFTING POINTS PROVIDED OR A SLING.**

### 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. The fan discharge shall be in accordance with the applicable building code provisions.

**CAUTION: Never Lift Fans From Shafts.**

**Figure 1 - Recommended Lifting Points**



## Roof Mounting

Ventilators are designed for installation on top of a prefabricated or factory-built roof curb. Refer to Authority Having Jurisdiction (AHJ) requirements prior to installation. Follow manufacturer's instructions for proper curb installation.

1. Secure ventilator curb through vertical portion of the ventilator base assembly flange using a minimum of eight (8) lag screws, anchor bolts, or other suitable fasteners (not furnished).
2. 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.
3. Connect power supply wiring to the motor as indicated on the motor nameplate or terminal box cover.
4. Before powering up fan, check ventilator prop for free rotation.
5. Check all fasteners for tightness.

## 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.
2. **Masonry Wall/Steel Studs:** Around the wall opening, install an angle iron frame at least 2" x 2" x 1/4". 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. 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.
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.

**IMPORTANT: OSHA REGULATIONS REQUIRE THE VENTILATOR TO BE MOUNTED AT LEAST EIGHT (8) FEET ABOVE GROUND OR FLOOR LEVEL.**

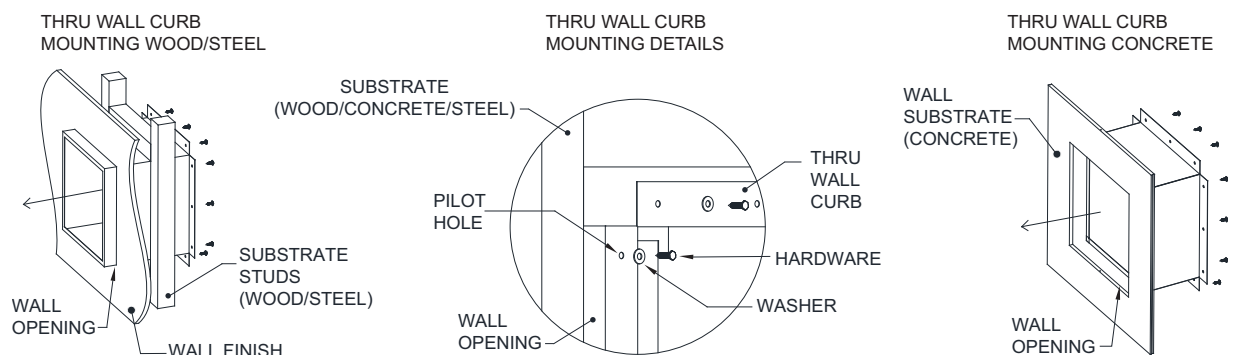
## Curb

**There must be at least 3 duct diameters of straight duct leading to the inlet and outlet of the exhaust fan.** An example of a curb installation: Curbs should be secured to structural members, such as wooden studs, steel studs, or concrete wall. 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 4** 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. Refer to **Figure 3** for wall opening requirements.

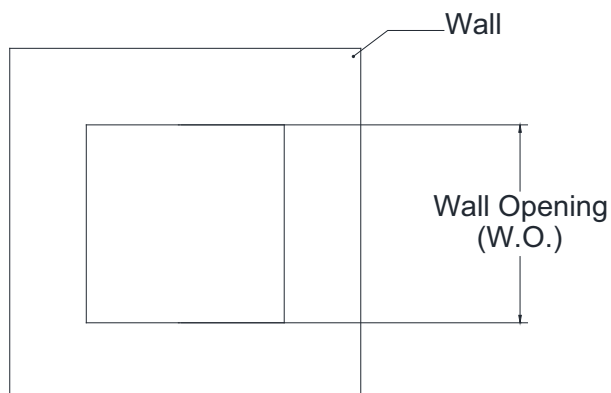
The fan base is secured to the curb with 1/4"-14 x 2" galvanized self-drilling screws. Shims may be required depending upon curb installation and wall/roofing material. Check all fasteners for tightness.

**Figure 2 - Curb Mount Details**



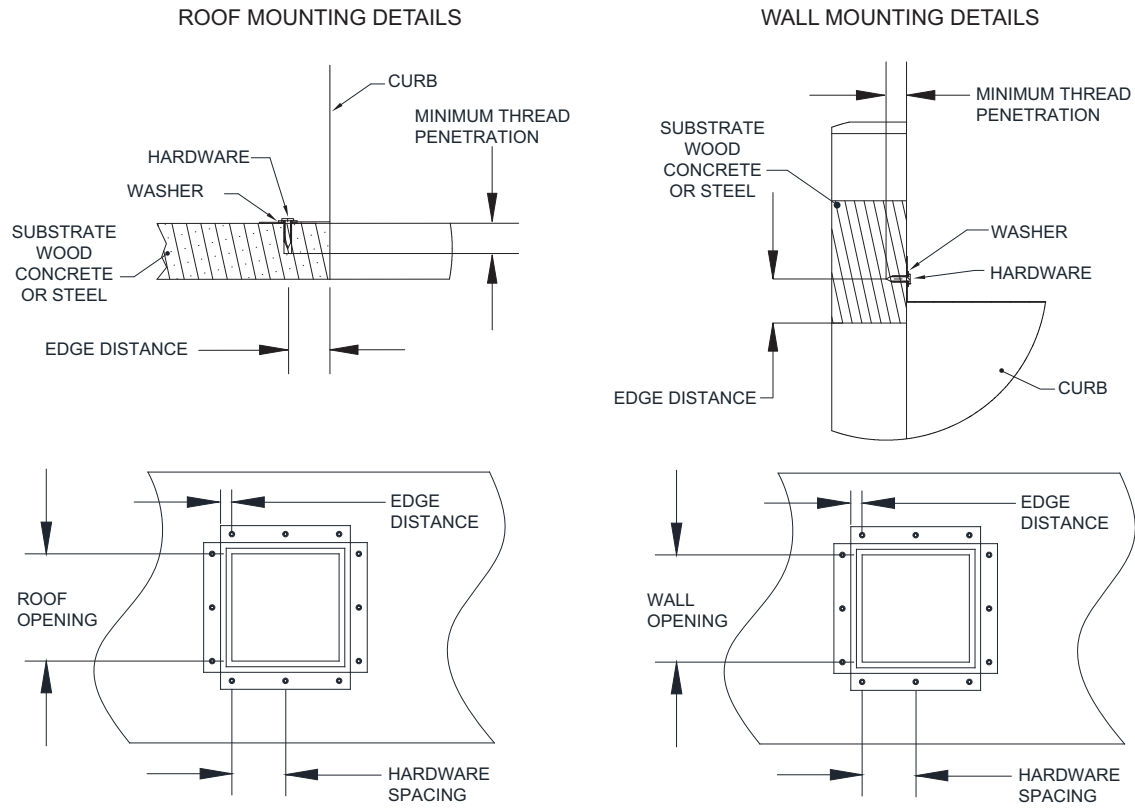
## Wall Prop Fans

**Figure 3 - Wall Prop Opening Requirements**



Model	Wall Opening
WP-10/12	17-1/2"
WP-14/16	21-1/2"
WP-18/20	25-1/2"
WPD-20/24	33-5/8"
WPD-30/36	45-5/8"
WPD-42/48	57-3/4"
WPD-54/60	70"
WPD-72	82"

**Figure 4 - 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 3/8" x 2-1/2" with 3/8" washer	2"	1-1/2"
Concrete - 2500 Minimum PSI	Hilti Kwik Bolt 3/8" Diameter TZ2 Expansion Anchor with 3/8" washer	2-5/16"	3"
Steel (Studs/Roof Truss)	Dril-Flex Self-Drilling Screws 1/4"-14 Min. 1/2" Through with 1/4" washer	12 Gauge or 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)

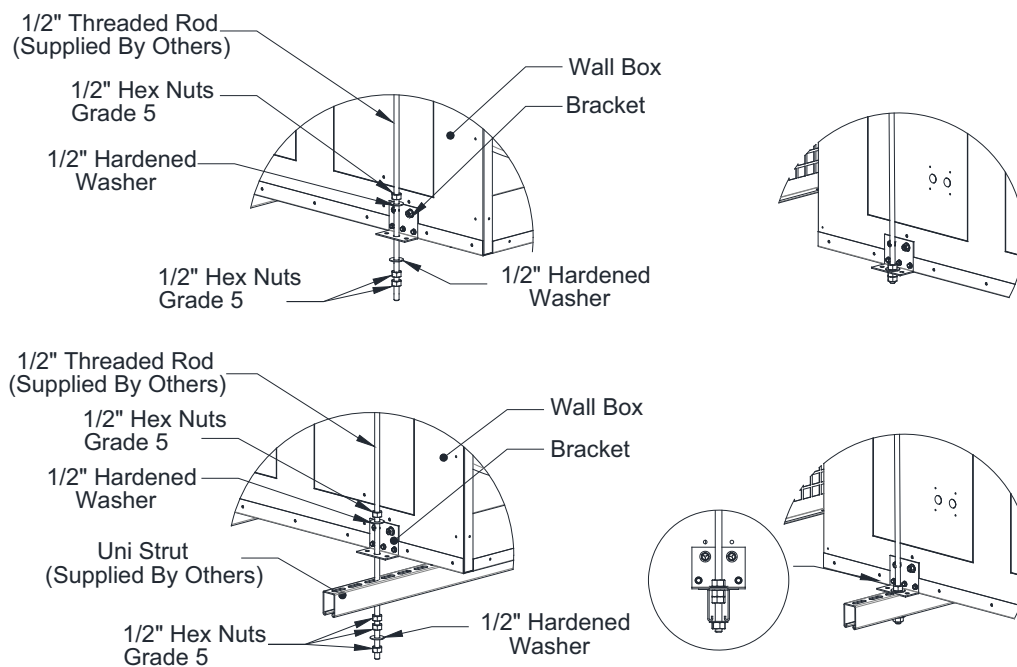
Fan Base Size	Hardware Quantity Wood	Hardware Quantity Concrete	Hardware Quantity Steel
41" x 27"	Long Side 14 (7 per side) Short Side 10 (5 per side)	Long Side 14 (7 per side) Short Side 10 (5 per side)	Long Side 16 (8 per side) Short Side 12 (6 per side)
59" x 27"	Long Side 22 (11 per side) Short Side 10 (5 per side)	Long Side 20 (10 per side) Short Side 10 (5 per side)	Long Side 20 (10 per side) Short Side 12 (6 per side)
61" x 27"	Long Side 22 (11 per side) Short Side 10 (5 per side)	Long Side 20 (10 per side) Short Side 10 (5 per side)	Long Side 20 (10 per side) Short Side 12 (6 per side)
64" x 27"	Long Side 24 (12 per side) Short Side 10 (5 per side)	Long Side 20 (10 per side) Short Side 10 (5 per side)	Long Side 20 (10 per side) Short Side 12 (6 per side)
45" x 31"	Long Side 20 (10 per side) Short Side 12 (6 per side)	Long Side 18 (9 per side) Short Side 12 (6 per side)	Long Side 22 (11 per side) Short Side 14 (7 per side)
74" x 31"	Long Side 28 (14 per side) Short Side 12 (6 per side)	Long Side 24 (12 per side) Short Side 12 (6 per side)	Long Side 24 (12 per side) Short Side 14 (7 per side)
52" x 42.5"	Long Side 22 (11 per side) Short Side 20 (10 per side)	Long Side 20 (10 per side) Short Side 18 (9 per side)	Long Side 22 (11 per side) Short Side 22 (11 per side)
94" x 42.5"	Long Side 28 (14 per side) Short Side 20 (10 per side)	Long Side 24 (12 per side) Short Side 18 (9 per side)	Long Side 24 (12 per side) Short Side 22 (11 per side)
62" x 51"	Long Side 22 (11 per side) Short Side 20 (10 per side)	Long Side 20 (10 per side) Short Side 20 (10 per side)	Long Side 20 (10 per side) Short Side 20 (10 per side)
108" x 51"	Long Side 34 (17 per side) Short Side 20 (10 per side)	Long Side 28 (14 per side) Short Side 20 (10 per side)	Long Side 28 (14 per side) 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.**

## Wall Prop Fan Mounting Detail

Refer to **Figure 5** for details on mounting a fan with threaded rod and brackets/Uni Strut.

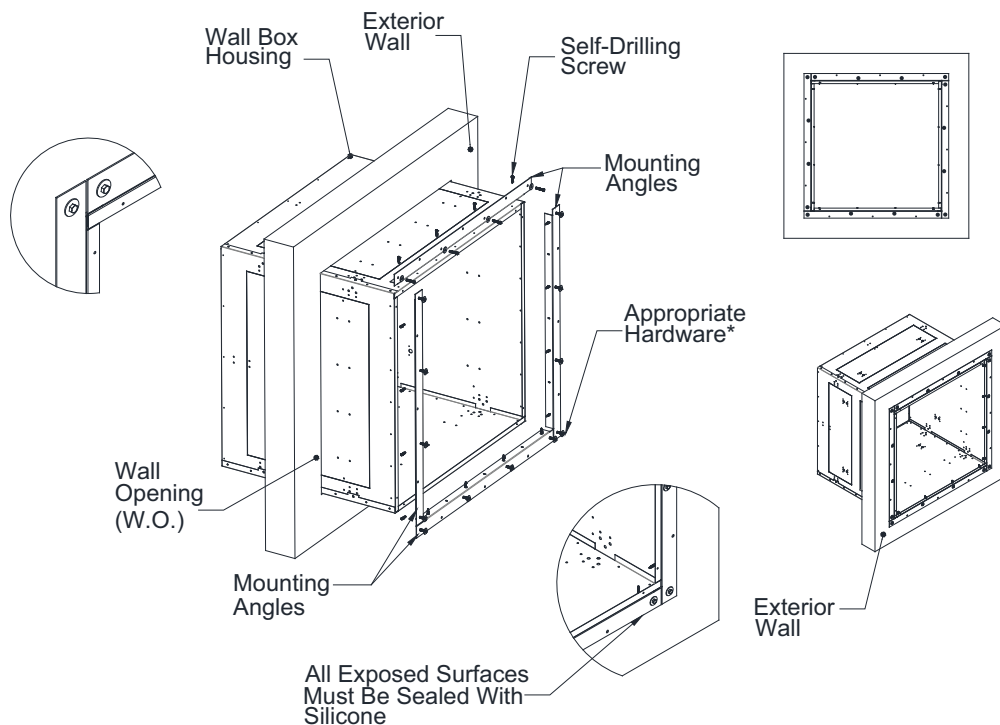
**Figure 5 - Fan Mounting Detail**



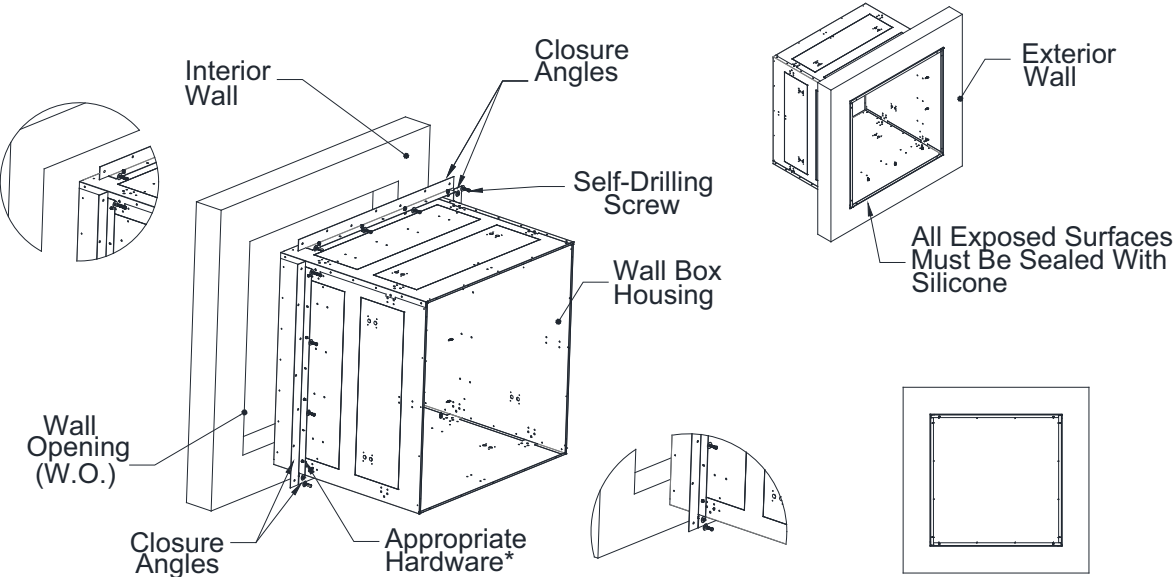
## Wall Prop Mounting Angle & Closure Angle Installation

Refer to **Figure 6** through **Figure 8** for details on mounting fan through a wall. Appropriate type and size fastener/washer should be used to secure mounting angle & closure angle to the wall\*.

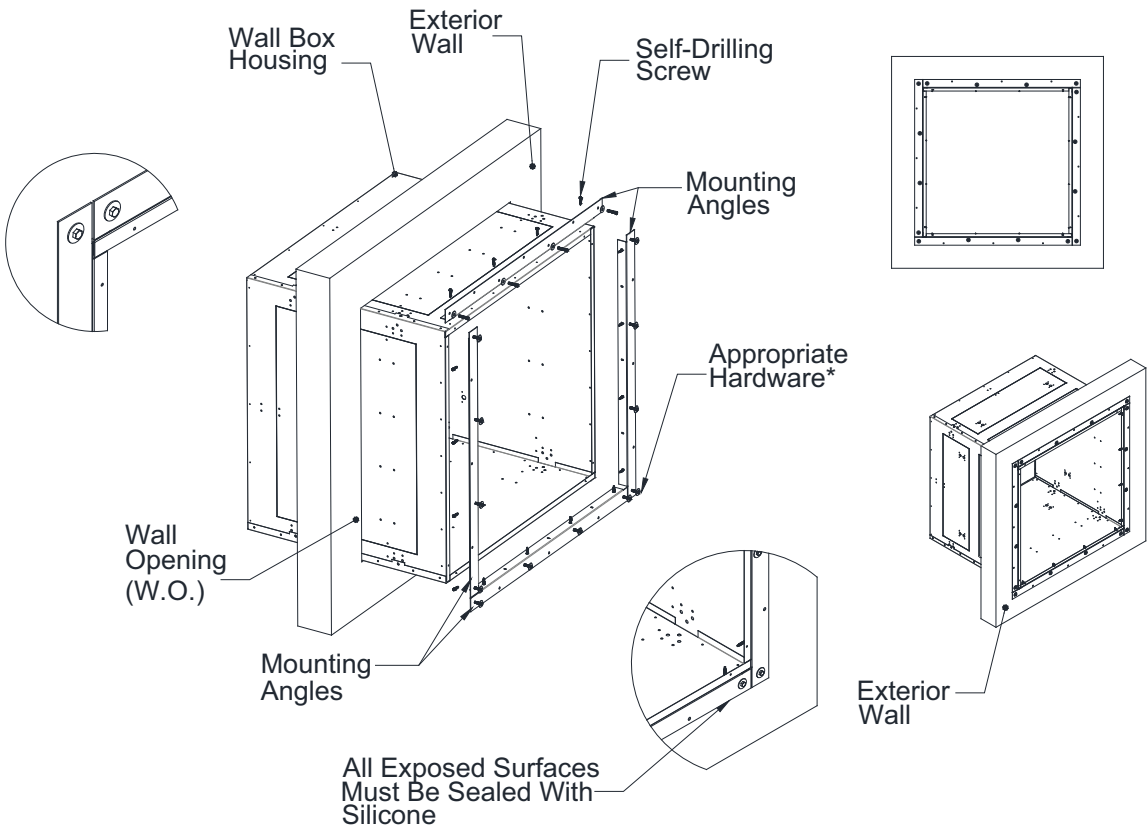
**Figure 6 - Mounting Angle**



**Figure 7 - Closure Angle**



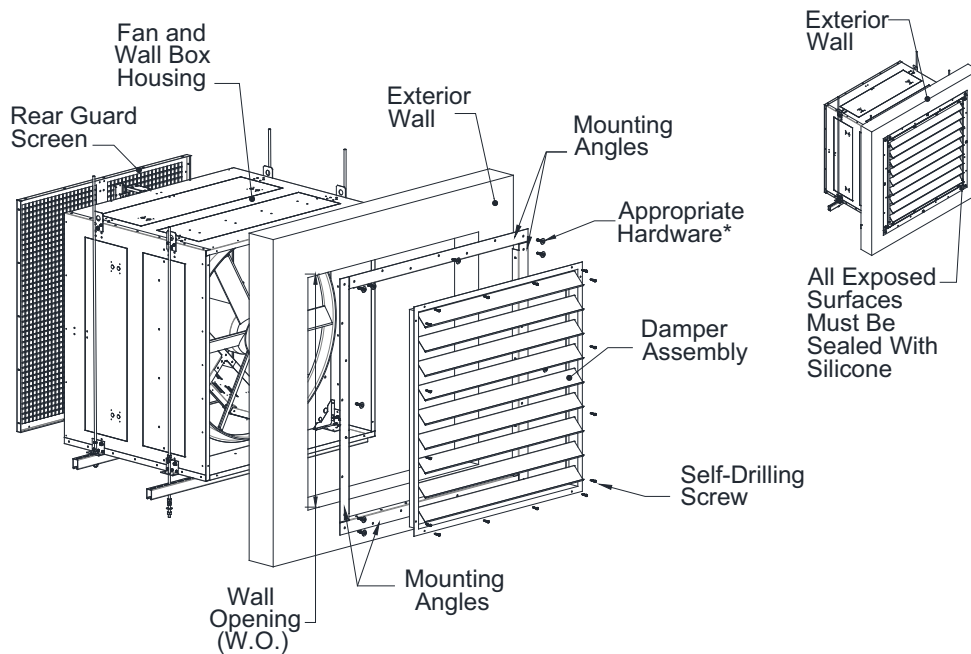
**Figure 8 - Mounting and Closure Angle**



## Wall Prop Damper Installation

Figure 9 provides details for damper installation. Appropriate type and size fastener/washer should be used to secure mounting angle & closure angle to the wall\*.

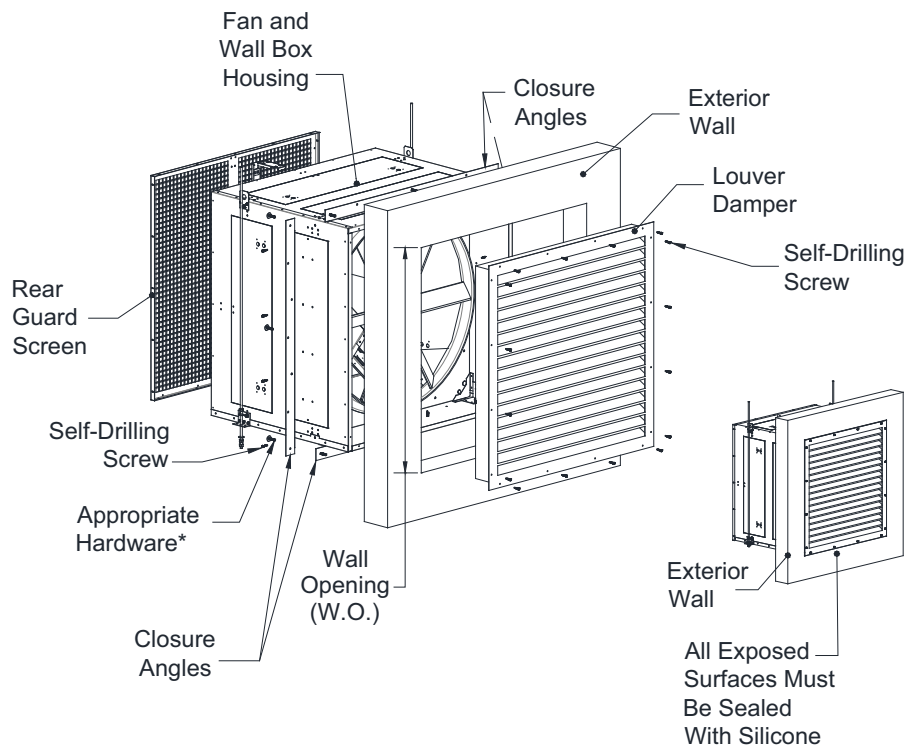
**Figure 9 - Damper Installation**



## Wall Prop Louver Installation

Figure 10 provides details for louver installation.

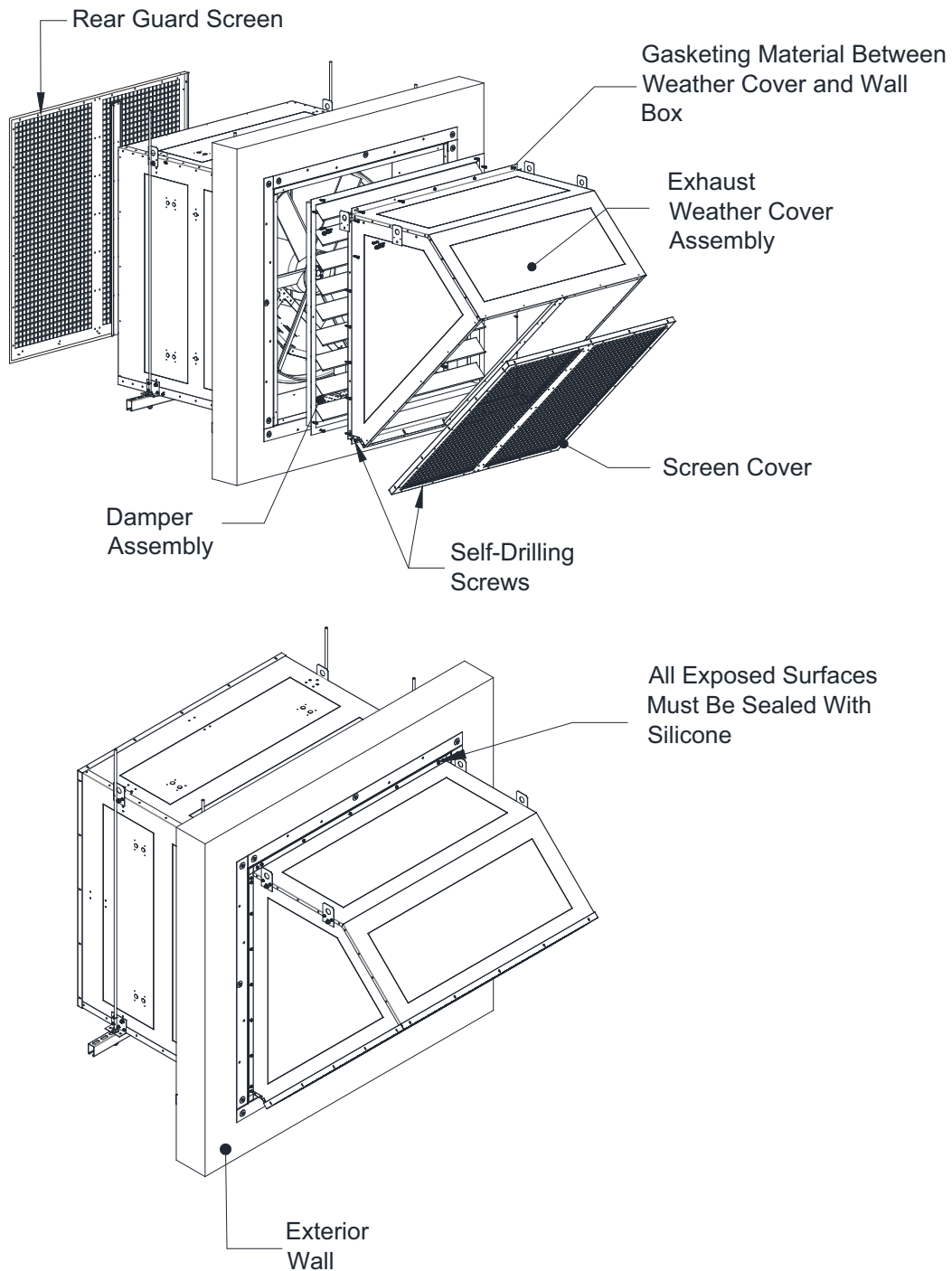
**Figure 10 - Louver Installation**



## Wall Prop Exhaust Weather Cover Installation

Figure 11 provides details for exhaust weather cover installation.

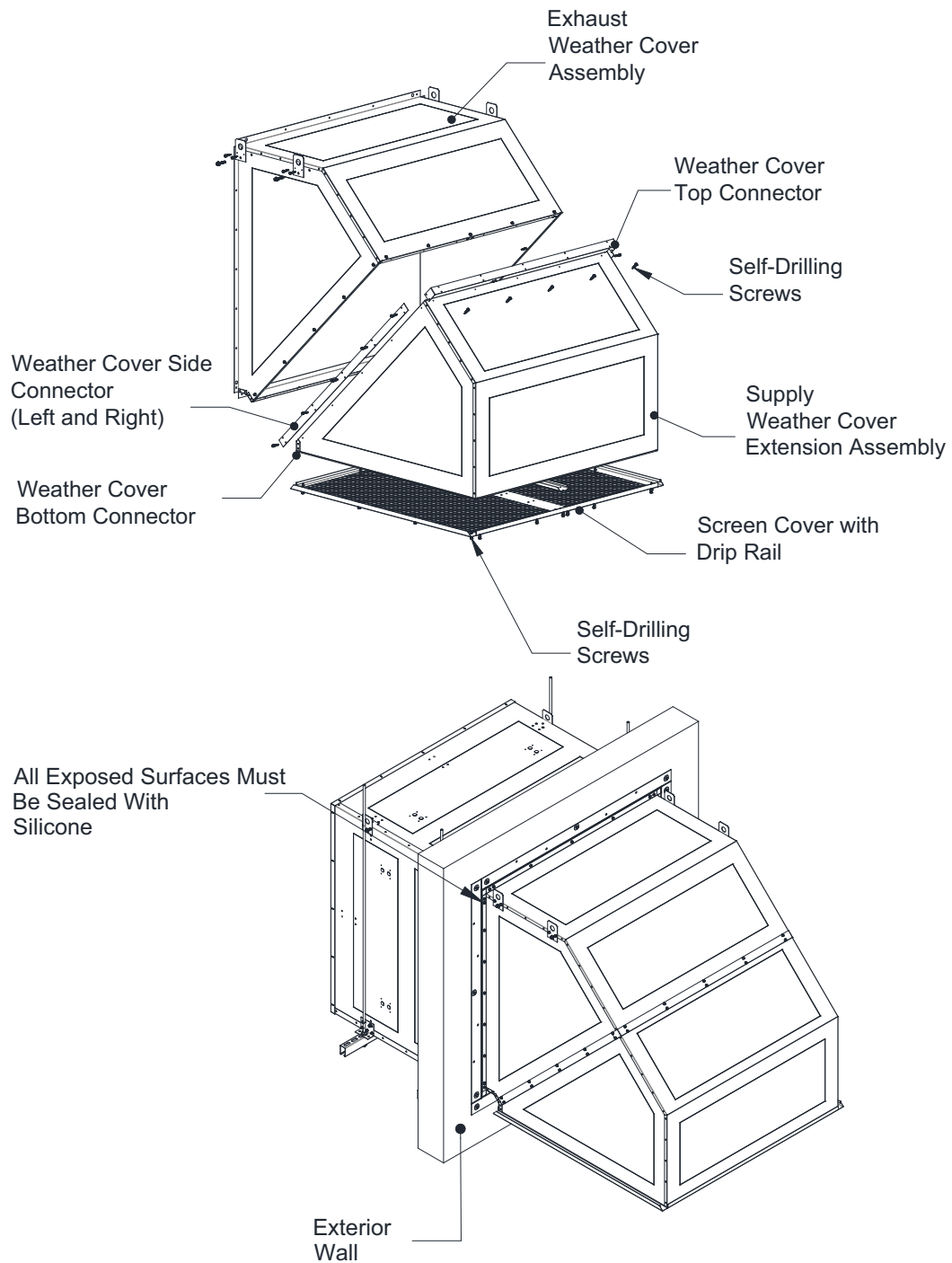
**Figure 11 - Weather Cover Installation**



## Wall Prop Supply Weather Cover Installation

Figure 12 provides details for exhaust weather cover installation.

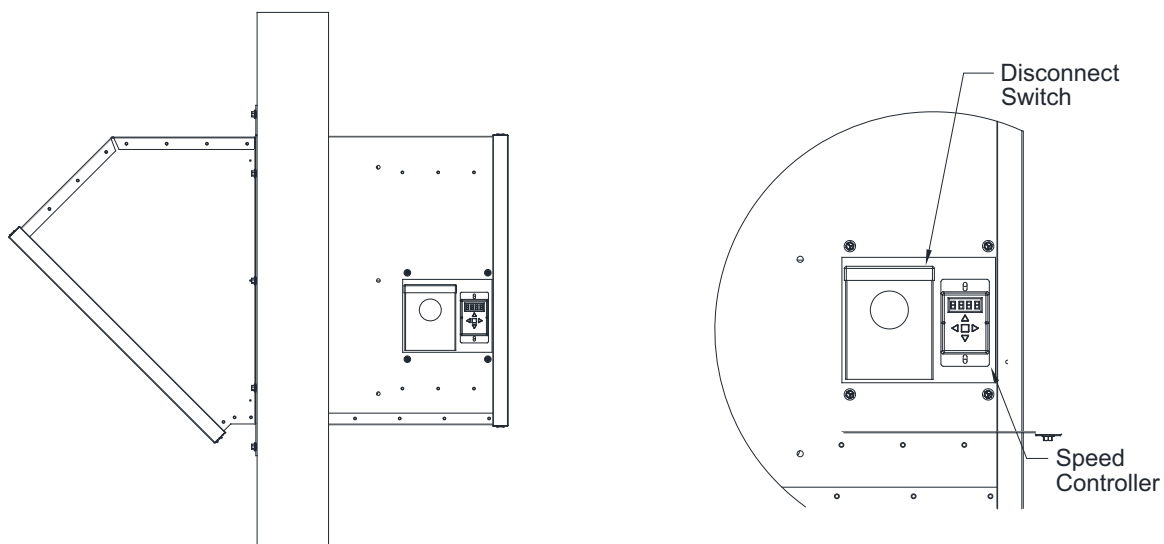
**Figure 12 - Supply Weather Cover**



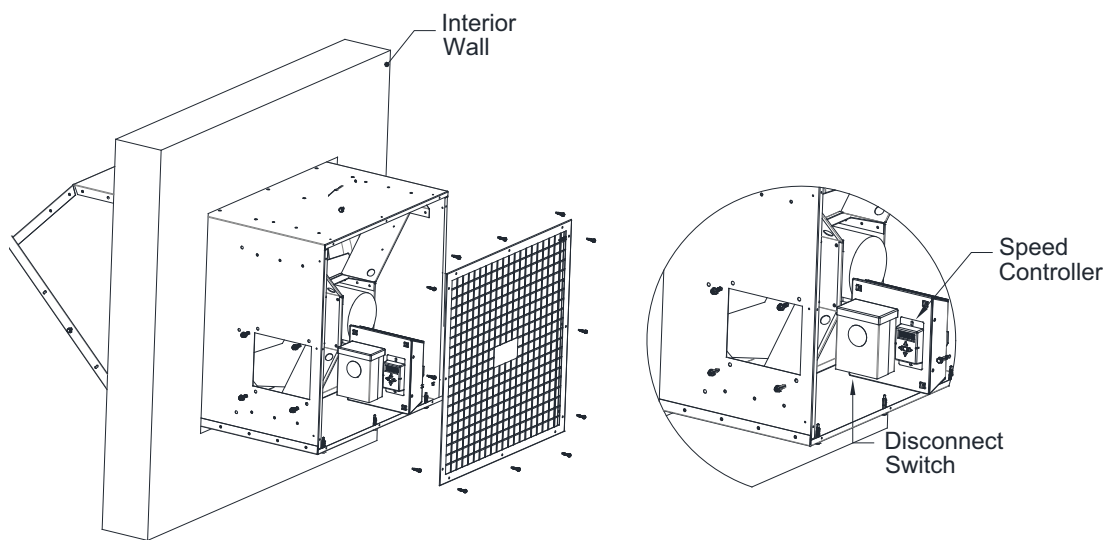
## Wall Prop Speed Control Panel

A speed control panel may be mounted externally (**Figure 13**) or internally (**Figure 14**) to the wall box.

**Figure 13 - Externally Mounted**



**Figure 14 - Internally Mounted**

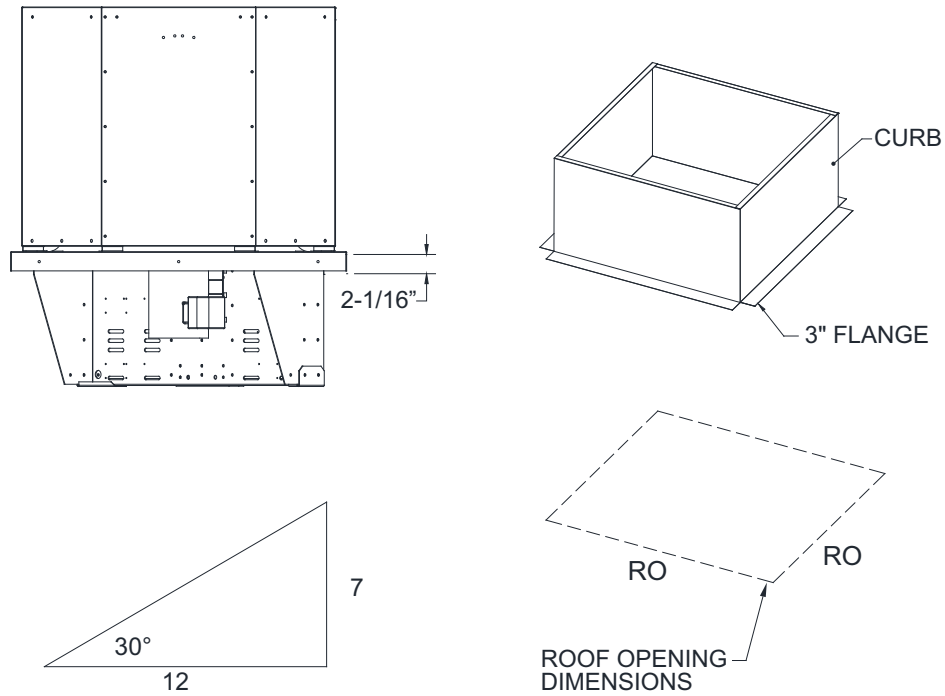


**NOTE:** Junction box can be unbolted and pushed into the housing. This will allow the wall box to slide into the wall opening without disconnecting factory wiring.

## Roof Mount Prop Fan

Pitched curbs are available. Specify pitch when ordering, for example: 7/12 Pitch = 30° Slope. **Figure 15** through **Figure 20** provide details on roof mount prop fan assemblies, features, and options.

**Figure 15 - Mount Installation**



Model	Roof Opening
RPUD-20/24	31"
RPUD-30/36	43"
RPUD-42/48	55"
RPUD-54/60	67"
RPUD-72	79"

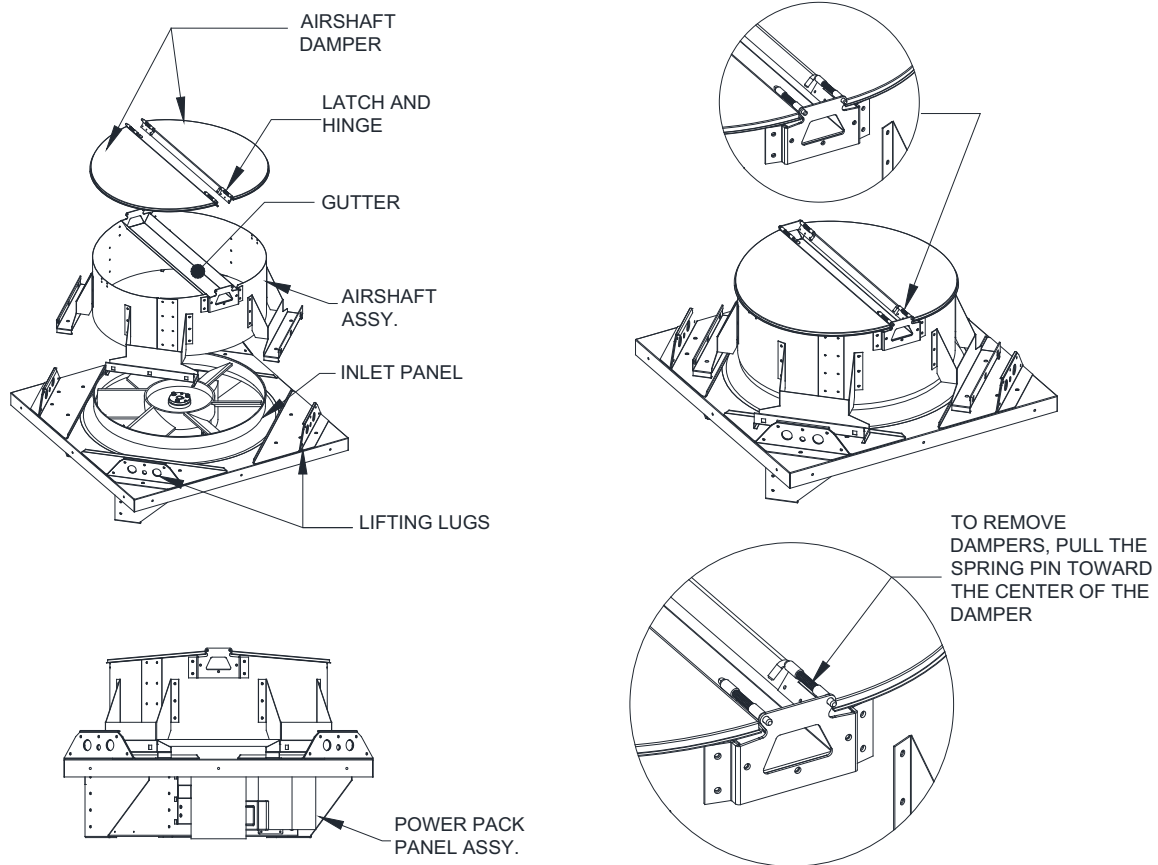


## 20-48" Roof Mount Prop Fan Assembly

During maintenance, clean out debris from the gutter that may block water runoff and cause water to overflow into the building.

**Note: Gutters Must be Free of Debris**

**Figure 16 - Roof Mount Prop Fan Assembly**



## 20-48" Roof Mount Prop Fan Features

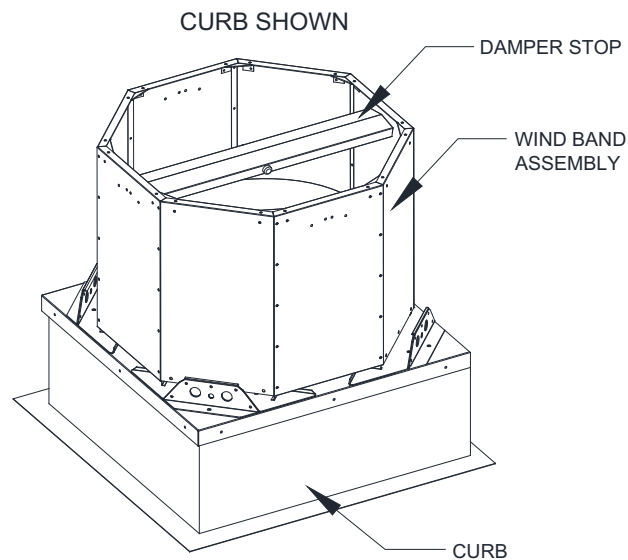
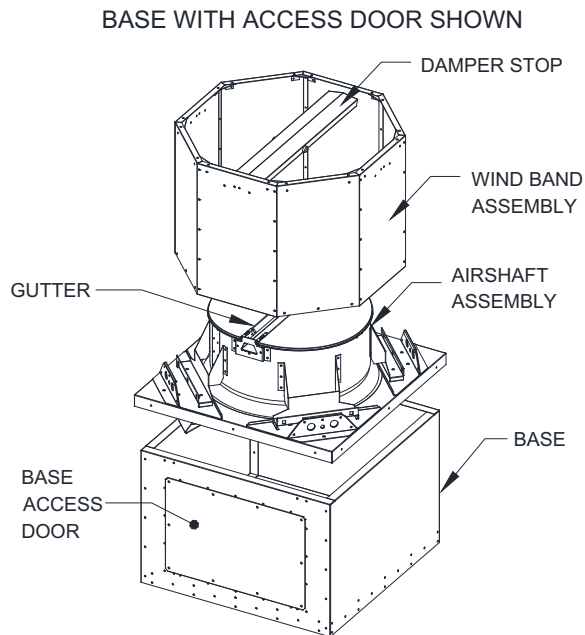
To access the power pack assembly, you may:

- Remove base access door, if applicable.
- Remove wind band assembly and air-shaft assembly independently or together.

Damper stop must be parallel to the gutter.

**Note: Gutters Must be Free of Debris**

**Figure 17 - Roof Mount Prop Fan Features**



## 54-72" Roof Mount Prop Fan Assembly

During maintenance, clean out any debris that may be in the gutter. This will allow for rain water to properly drain and prevent water from leaking into the roof.

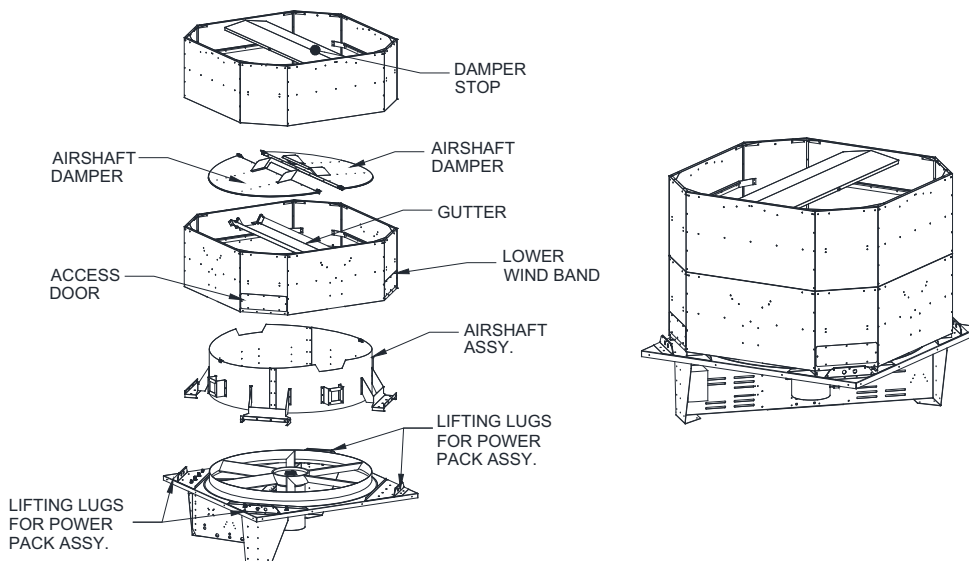
Align top wind band assembly with lower section. Use sheet metal screws to attach the two sections together, pilot holes are provided.

Remove access door on the lower wind band to access the airshaft supports and hardware.

Damper stop must be parallel to the gutter.

**Note: Gutters Must be Free of Debris**

**Figure 18 - Roof Mount Prop Fan Assembly**



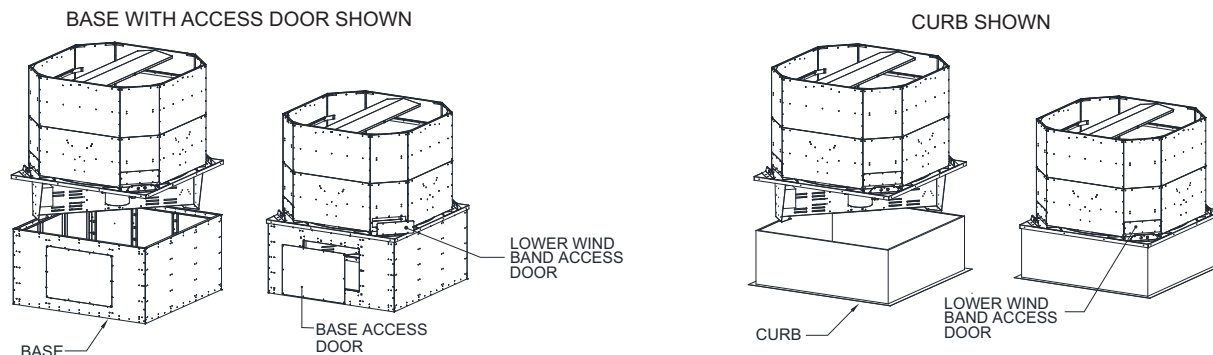
## 54-72" Roof Mount Prop Fan Assembly

To access the power pack assembly, you may:

- Remove base access door, if applicable.
- Remove wind band assembly and air-shaft assembly independently or together.

Remove access door on the lower wind band to access the airshaft supports and hardware. Airshaft supports and wind bands will need to be removed to access the propeller.

**Figure 19 - Roof Mount Prop Fan Features**

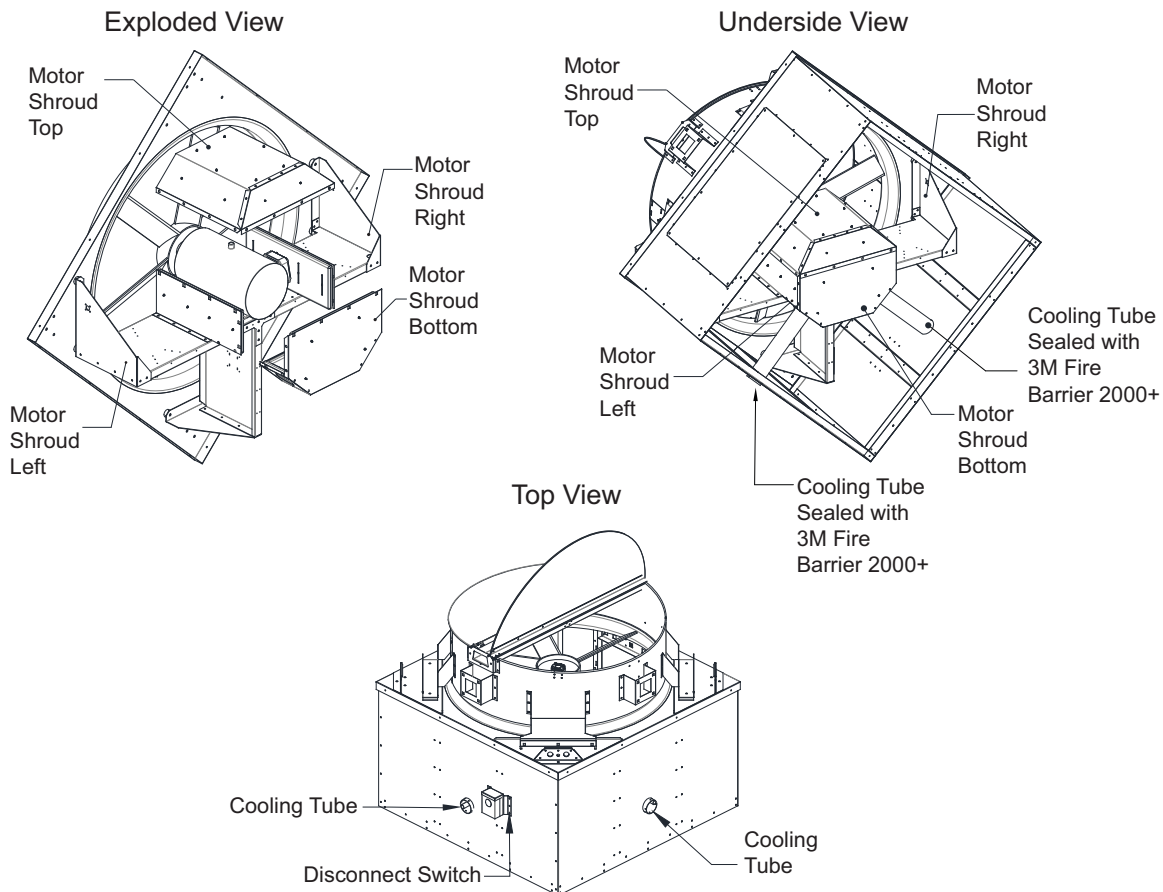


## Roof Mount Prop Fan Assembly – Optional Features

### Heat and Smoke Motor Shroud Assembly – (Steel Prop Only)

Factory installed option for Roof-Prop fans that range in size 20-72". When installed, this option protects the motor assembly from heat and smoke that may enter the fan's base. Cooling tubes are used to provide air to the motor assembly.

**Figure 20 - Heat and Smoke Option**

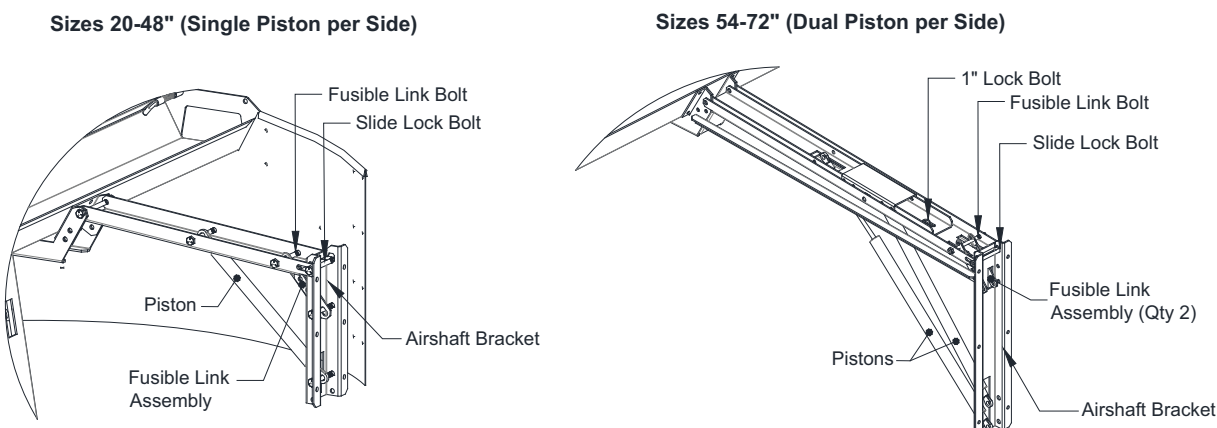


- Maintenance on the unit may be performed by removing the 1/4"-20 hardware that hold the right and top motor shroud to the unit. This provides access to the motor assembly and junction box.
- The disconnect switch wiring is installed through the cooling tube. Make sure to keep the wiring installed through the cooling tube if testing, checking or repairing disconnect switch or wiring.
- Apply 3M Fire Barrier 2000+ sealant to the cooling tube and hole locations if sealant is damaged.

## UL793 – Automatic Operated Roof Vents

Automatic operation does not depend on electrical power or other energy sources. A temperature rated fusible link is used for automatic operation. When the temperature rises above the fusible link's temperature setting (165°F), the link(s) will break. The dampers will open on each side, allowing heat and smoke to escape. **Figure 21** illustrates the components used for automatic operation.

**Figure 21 - Arm(s) Shown in Locked Position**



### Setting the Arm(s) and Fusible Link Assembly

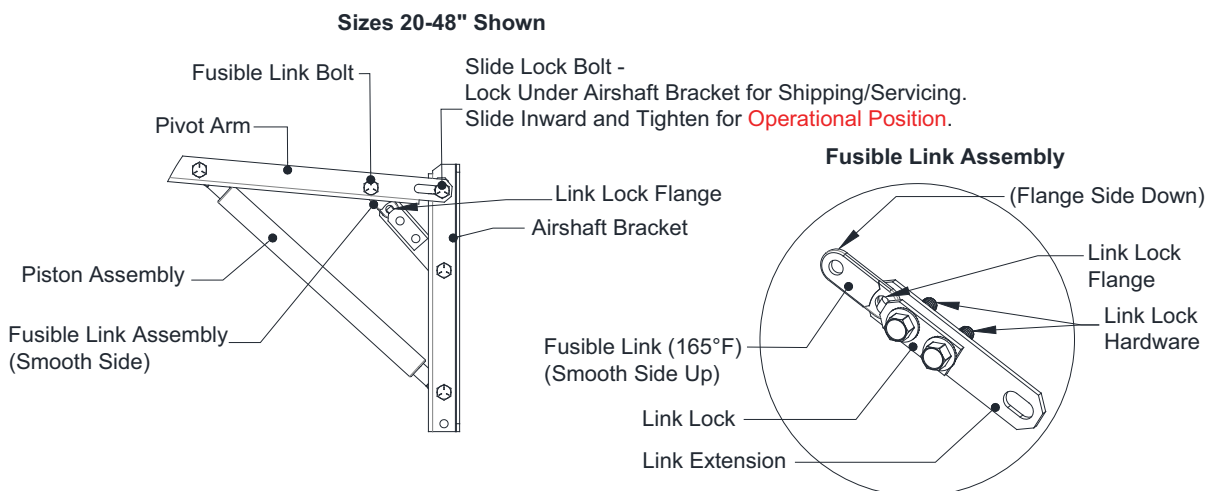
Once the unit is installed, the arm(s) will need to be set per side (unlocked from shipping position). This procedure is the same for all sizes. Press down on the pivot arm (close to the fusible link bolt) to release pressure. Move the slide lock bolt away from the airshaft bracket. Release pressure off of the pivot arm. Tighten the slide lock bolt away from the airshaft. The force of the piston will be held back by the fusible link(s).

**Note:** When performing maintenance or servicing the linkage or arms, place the slide lock bolt back into the airshaft bracket. Secure the bolt until the unit is ready to be reset.

**WARNING: FAILURE TO MOVE THE SLIDE LOCK BOLT TO THE OPERATIONAL POSITION WILL PROHIBIT THE DAMPERS FROM OPENING IF THE FUSIBLE LINKS ARE ACTIVATED IN A FIRE CONDITION.**

Verify correct orientation of the fusible link, refer to **Figure 22**. The link must be set so that the smooth side is up and the flange side is down. The link lock flange must be in the lower fusible link hole and through the link extension slot.

**Figure 22 - Setting the Arm(s)**



## Resetting the Arm(s)/Fusible Link Field Replacement

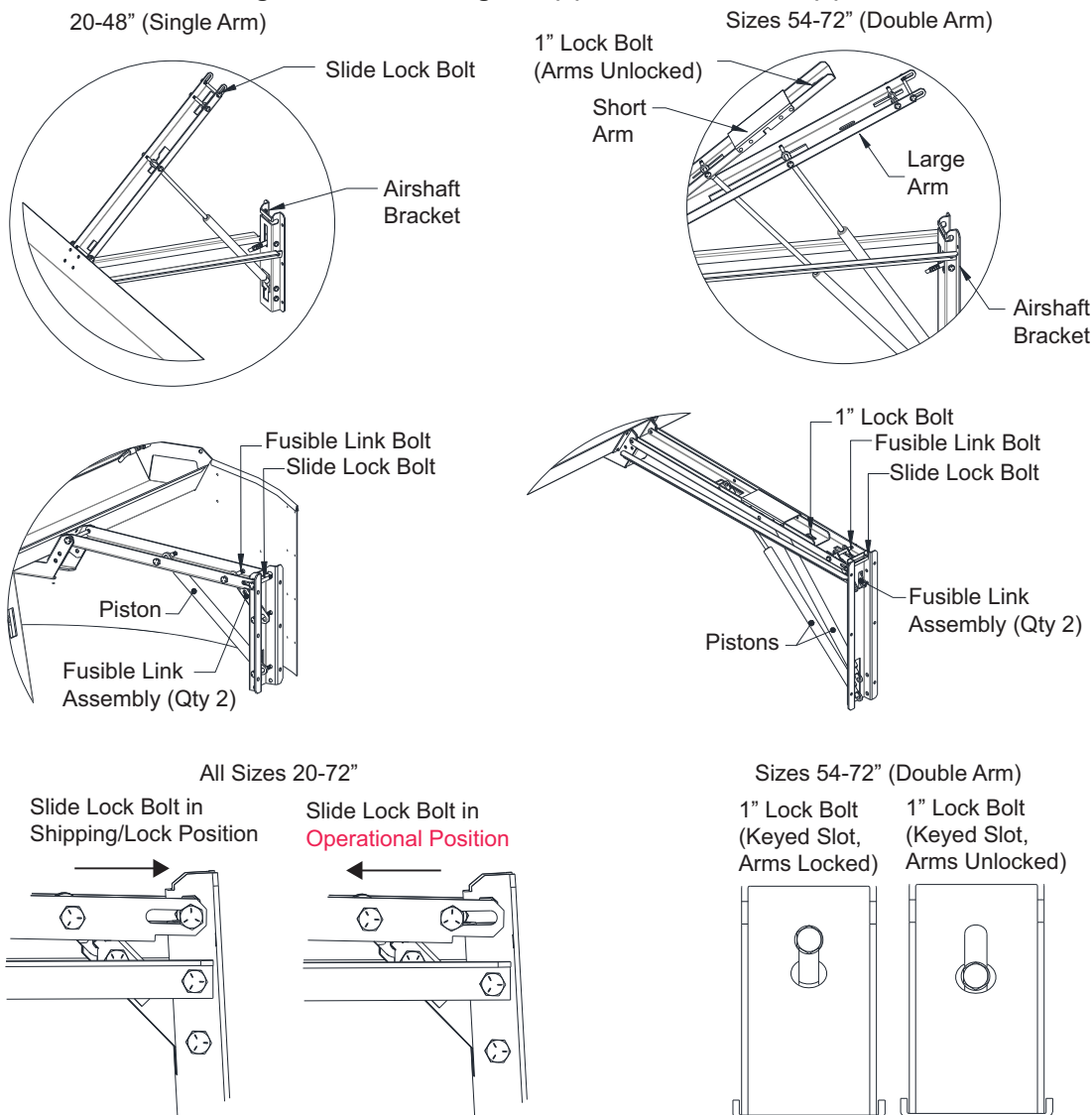
**Figure 23** illustrates how to reset the arms and replacement of fusible link. If the fusible link(s) should break and the piston(s) are extended, visually inspect parts for damage on each side. For sizes 20-48", press the arm down and place slide lock bolt into airshaft bracket.

Sizes 54-72" use two arms and two pistons. When resetting the linkage arms you must loosen the 1" lock bolt. Slide the 1" lock bolt down the keyed slot. This will allow for you to lower the long arm, lock arm into position; place the slide lock bolt into air shaft bracket. Lower the small arm, move the 1" lock bolt back into the locked position.

Refer to **Figure 22** for fusible link assembly. To replace the fusible link, remove fusible link bolt. Remove link lock and hardware from assembly. Discard any linkage remnants. When installing new fusible link, make sure the flange side faces away from link lock flange. Install fusible link, then the link lock. Secure with link lock hardware. Install fusible link to the arm, secure with fusible link bolt. Apply pressure to the arm, move the slide lock bolt away from airshaft bracket. The assembly is now set.

**WARNING: FAILURE TO MOVE THE SLIDE LOCK BOLT TO THE OPERATIONAL POSITION WILL PROHIBIT THE DAMPERS FROM OPENING IF THE FUSIBLE LINKS ARE ACTIVATED IN A FIRE CONDITION.**

**Figure 23 - Resetting Arm(s) after Fusible Link(s) Break**



## 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.
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
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.

**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

## Permanent Split Capacitor (PSC) Motor Speed Control

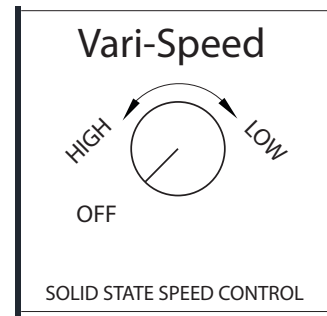
Some single-phase direct-drive fans contain speed controls that regulate the amount of voltage going to the motor. Specific PSC motors must be used in conjunction with speed controls. The speed control has a knob (**Figure 24**) with an off position along with high to low range. At high speed, the speed 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.**

Figure 24 - PSC Motor Speed Control





## Electronically Commutated Motor (ECM) Speed Control

An Electronically 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.

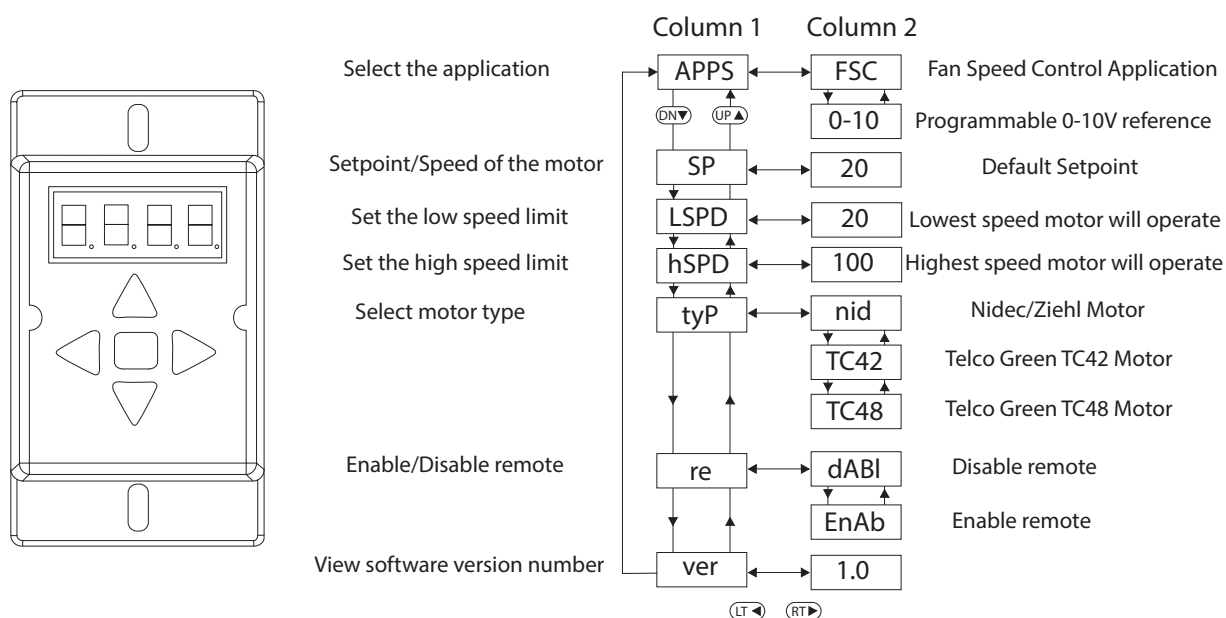
If the remote function (re) is enabled, the speed is controlled through a **0-10V** input. **0V = 0%** and **10V = 100%**, unless overridden by the low speed and high speed limits.

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.

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.

**NOTE: A Variable Frequency Drive (VFD) is required to adjust the speed control of a non-electrically commutated 3-phase direct-drive motor.**

**Figure 25 - RTC Speed Controller and Menu**

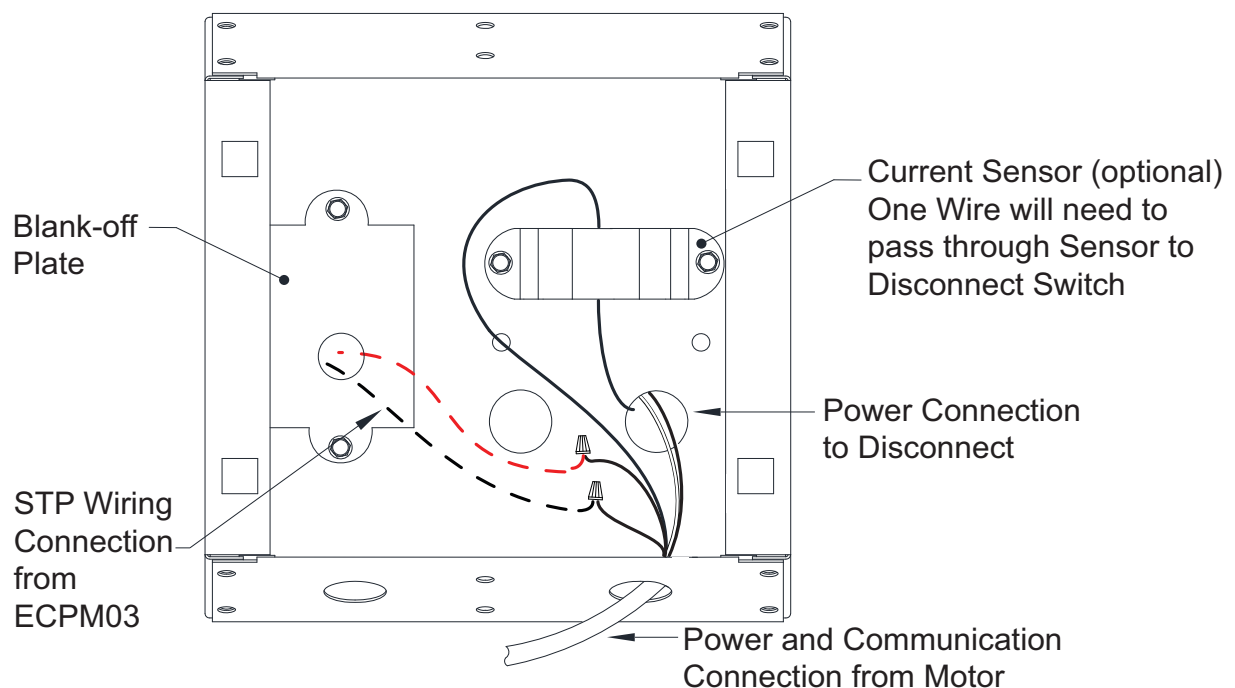


## External PWM Signal

**Figure 26** 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 screen cover. 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 opening in the front J-Box cover.
- Refer to wiring schematics to verify wiring and connections.

**Figure 26 - 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.

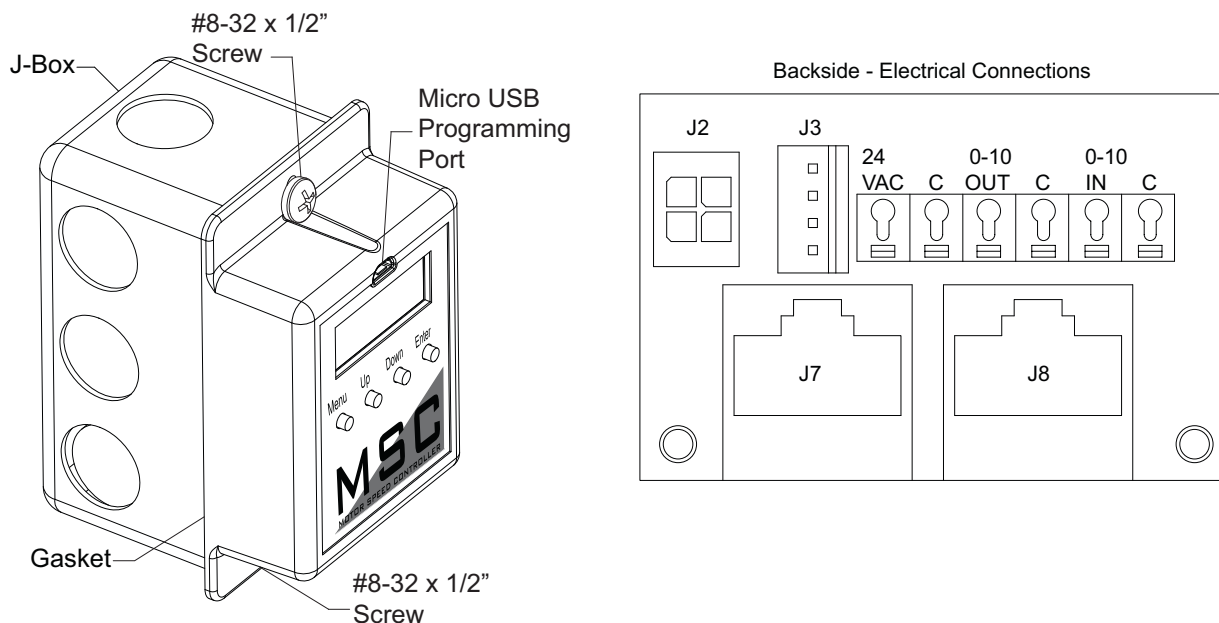
The MSC contains static sensitive components. Therefore, you must handle with care to avoid damage to these components. All operations concerning installation, commissioning, and maintenance must be carried out by qualified, skilled personnel who are familiar with the installation, assembly, commissioning, 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 27** 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 27 - Installation/Electrical Connections**



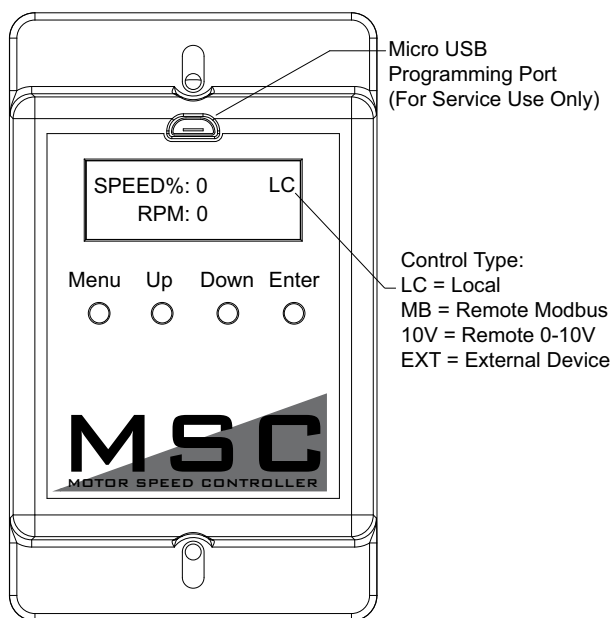
## MSC Controls Overview

There are four buttons to navigate through the menu screens, refer to **Figure 28**.

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 28 - 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 0-10V. 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 29 on page 30** 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."

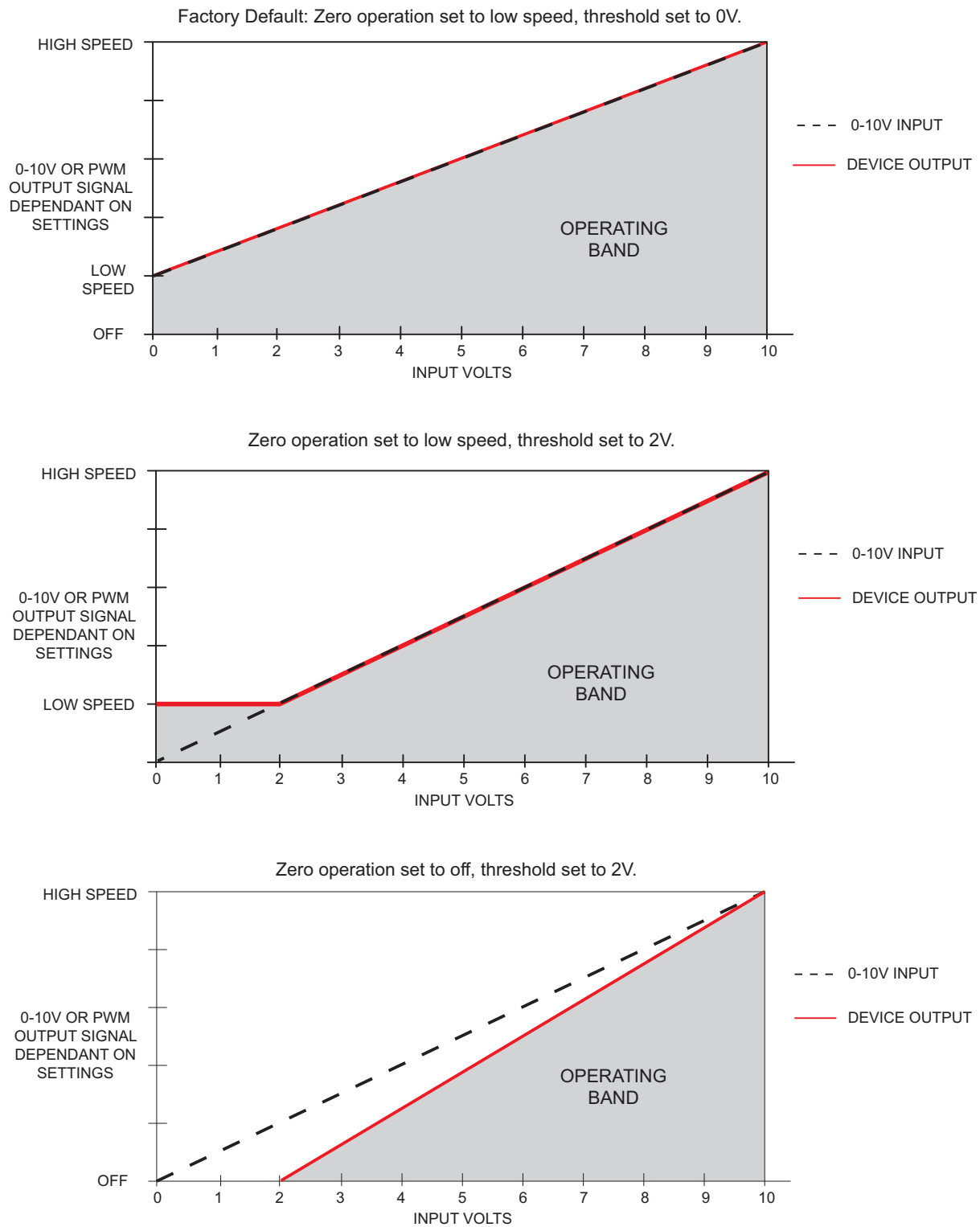
- **Fault History** - Displays fault history and board reboots in chronological order. Possible displayed faults are:
  - **No Faults** - There are no active faults with the system.
  - **Feedback Fault** - Only displayed for motors with feedback capabilities.
  - **Reboot** - Any time the fan goes from 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

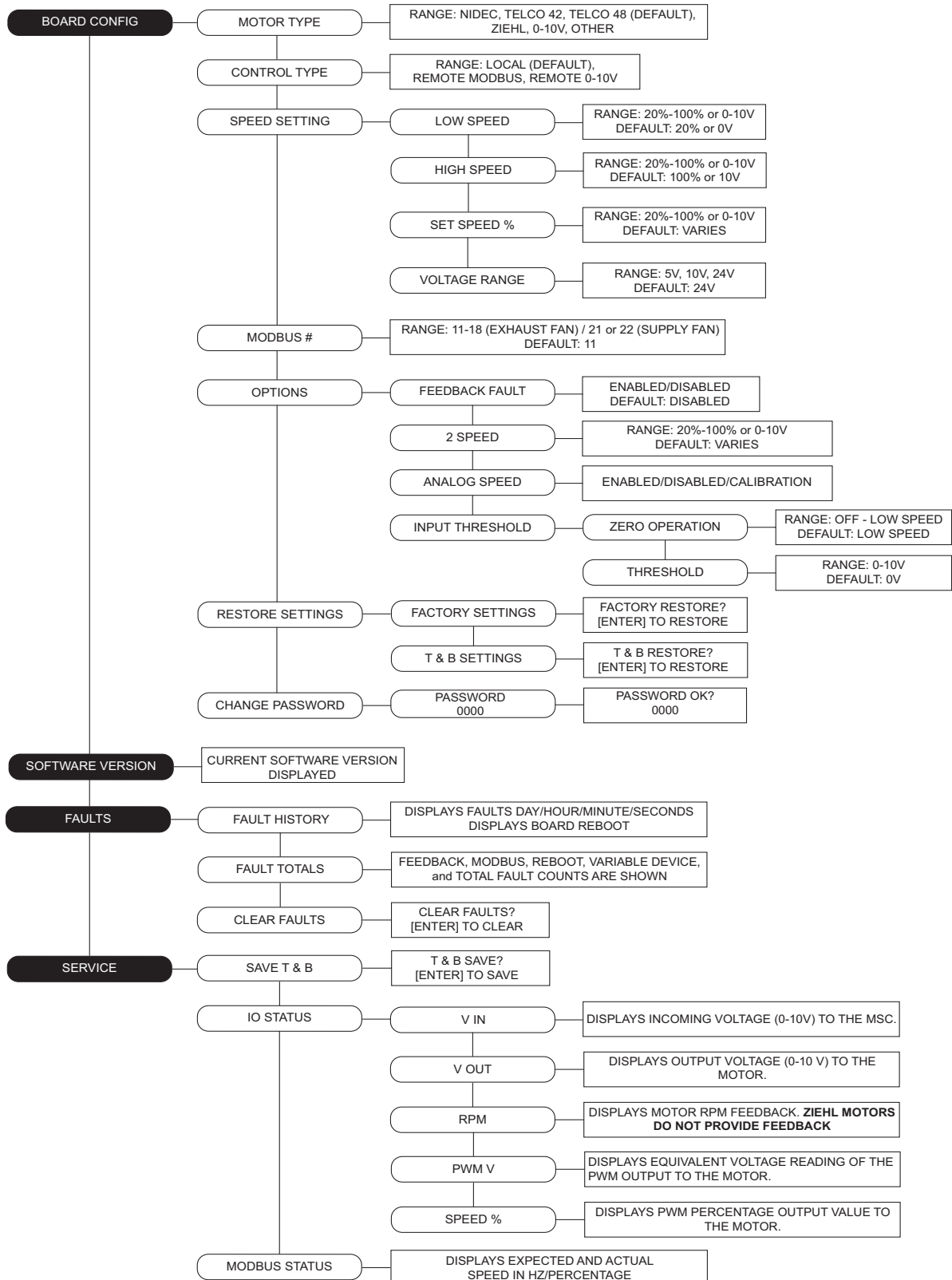
- **Save T & B** - After the test & balance process has been completed, save adjustments under this menu.
- **IO Status** - Provides access to information about the inputs and outputs of the MSC board.
  - **V In** - Displays the incoming voltage (0-10V) to the MSC.
  - **V Out** - Displays the output 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 29 - Input Threshold Examples**



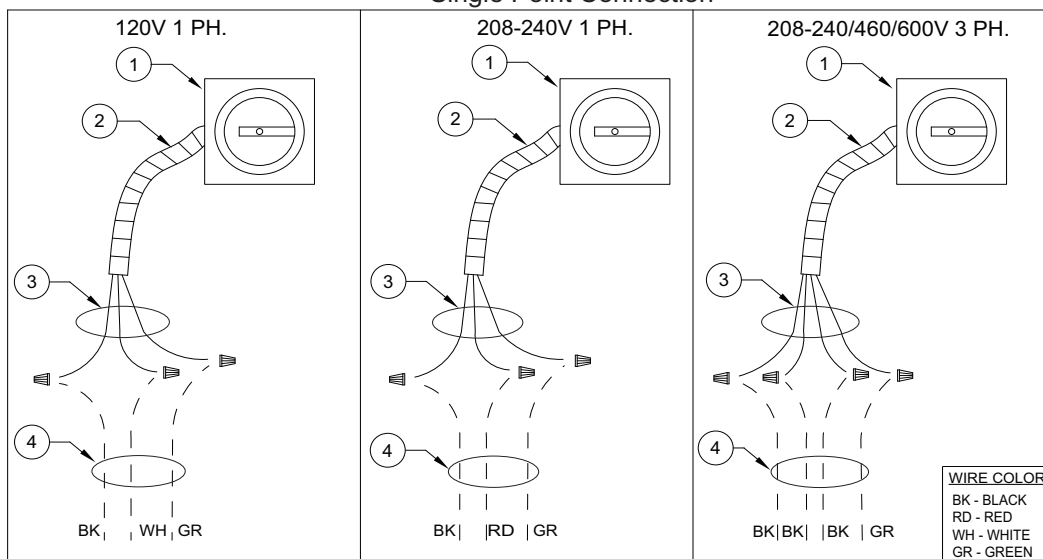
## MSC Menu Tree



## Fan to Building Wiring Connection

**Figure 30 - Wiring Connection Details**

### Single Point Connection





## 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 36**. 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

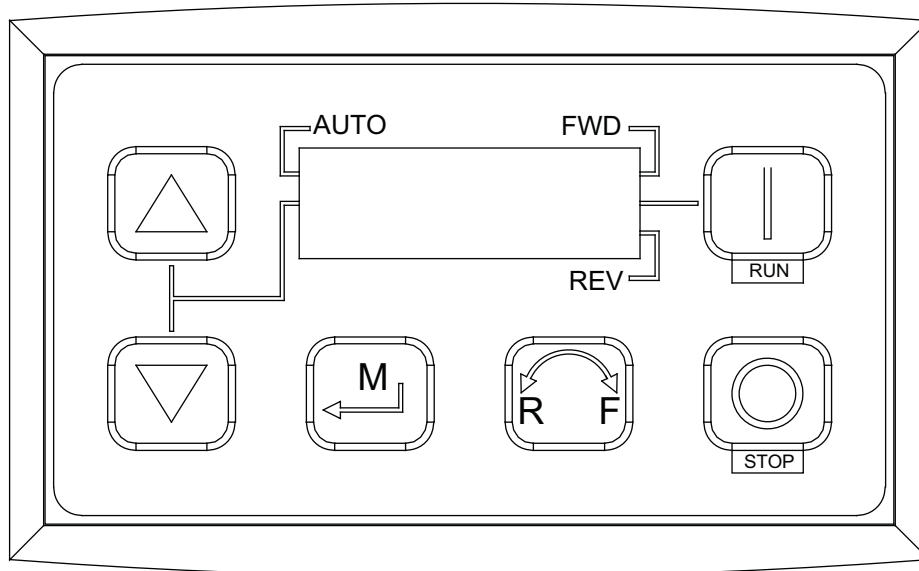
1. The Drive should be programmed for the proper motor voltage. P107 is set to 0 (Low) if motor voltage is 120V AC, 208V AC or 400V AC. P107 is set to 1 (High) if the motor voltage is 230V AC, 480V AC, or 575V AC.
2. The Drive should be programmed for the proper motor overload value. P108 is calculated as Motor FLA x 100 / Drive Output Rating (refer to ).

#### To enter the PROGRAM mode to access the parameters:

1. Use the buttons on the VFD screen (**Figure 31**) 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 31 - 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 prop fan. With power **OFF** to the unit or before connecting the unit to power, turn the prop fan 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. Inspect the condition of the intake damper and damper linkage, if applicable.
3. Inspect the air-stream for obstructions or debris in prop fan.
4. Compare the supplied **motor voltage** with the fan's nameplate voltage. If this does not match, correct the problem.
5. Place the external disconnect to the **ON** position to start the unit. Immediately place the disconnect switch off. **Check the rotation of the prop 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.
6. When the prop fan is started, observe the operation and check for any unusual noises.
7. Place the external disconnect switch back to the **ON** position. The system should be in full operation.
8. 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 40 for more information.
9. 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.

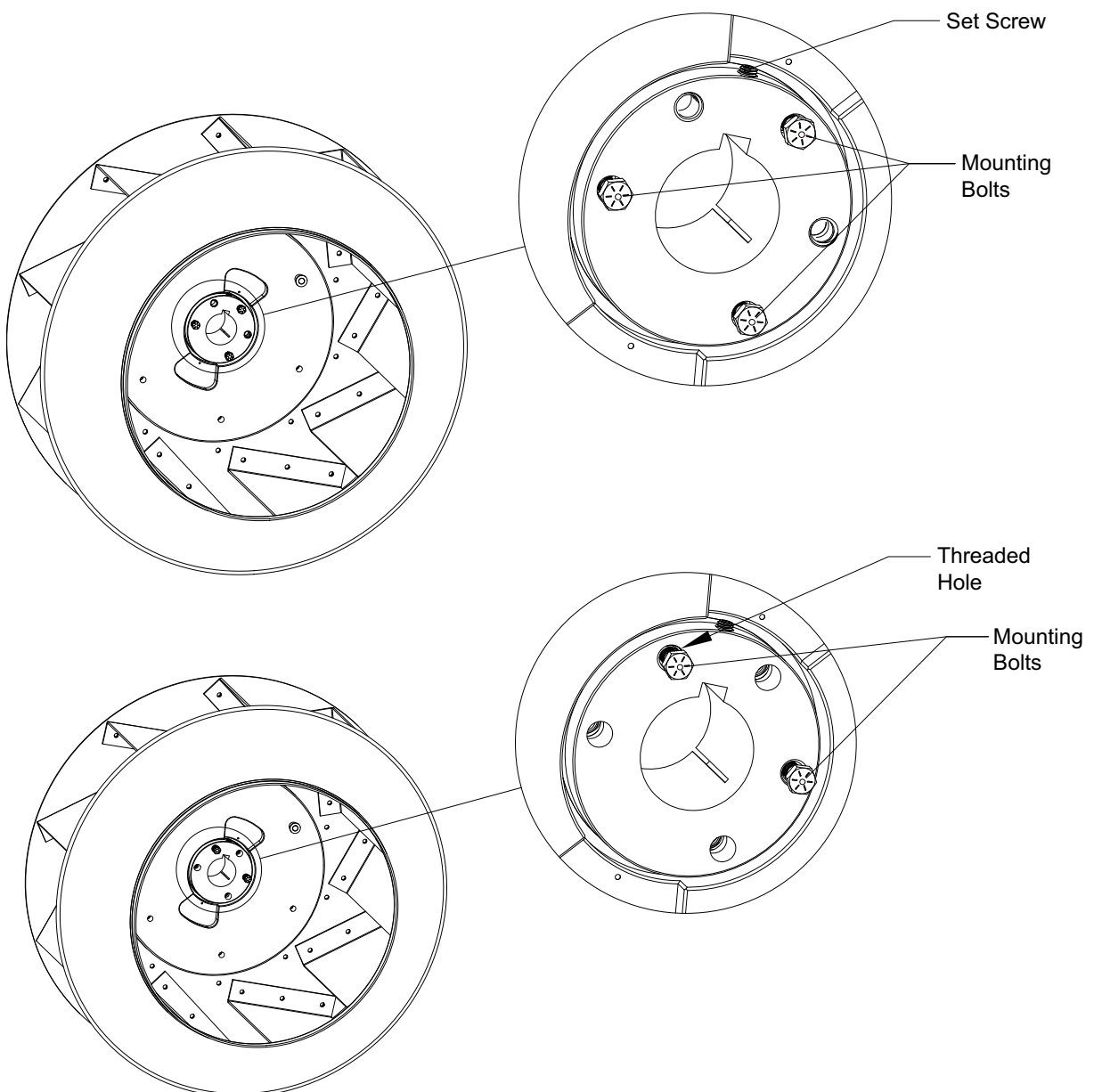
## Bushing Information

### Removing Fan Wheel

Location of hardware differs depending on hub configuration in **Figure 33 on page 39**. Refer to **Figure 32** 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 32 - Fan Wheel Removal from Motor Shaft**

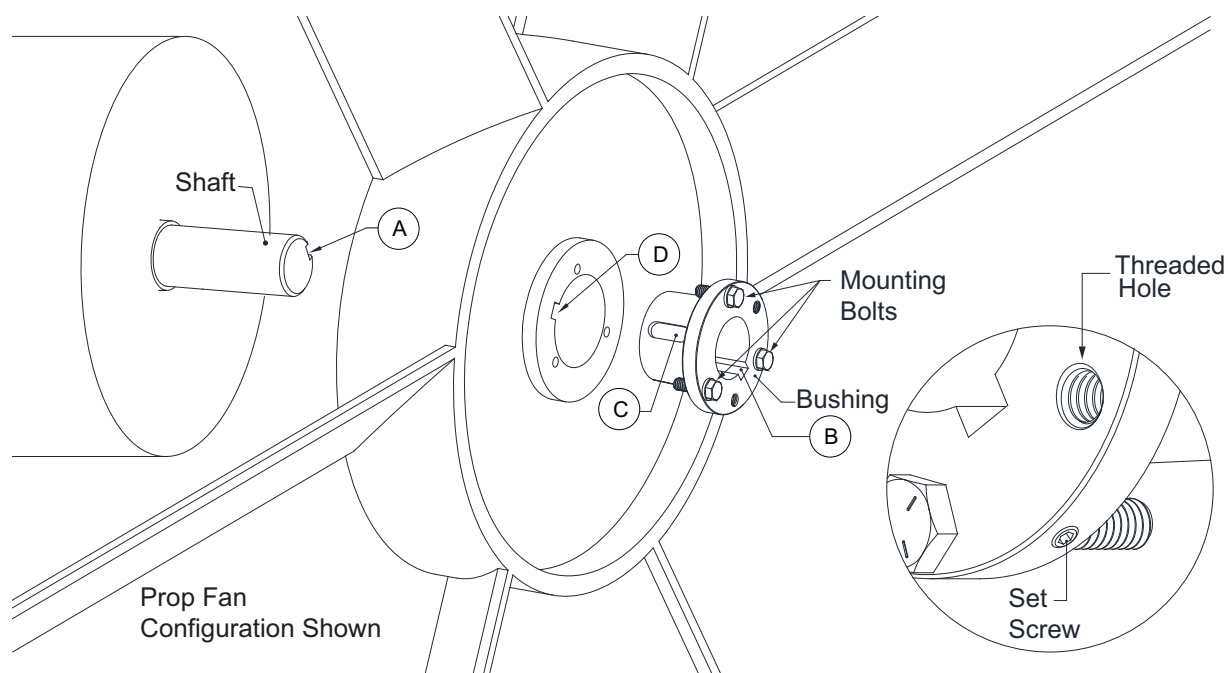


## Installing Fan Wheel

Refer to **Figure 33** 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 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. Make sure the bushing is flush to the tip of the motor shaft.
6. Tighten set screw to lock shaft key in place. Install bolts and torque to proper setting listed in **Table 6**.
7. There are threaded holes provided on the bushing. These holes are for removing the bushing when required.

**Figure 33 - Bushing Details**



**Table 6 - 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

## 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 Overload	Motor starter overloaded	Check amperage.
		Reset starter.
	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.
Insufficient Airflow	Overload in starter set too low	Set overload to motor's FLA value.
	Motor HP too low	Determine if HP is sufficient for job.
	Incorrect fan rotation	Verify that the fan is rotating in the direction shown on rotation label.
Excessive Airflow	Intake damper not fully open	Inspect damper linkage. If the linkage is damaged, replace damper motor.
	Blower speed too low	Increase fan RPM. Do not overload motor.
	Fan speed is too high	Reduce fan RPM.
Excessive Vibration and Noise	Filters not installed	Install filters.
	Duct static pressure lower than design	Reduce fan RPM.
	Damaged/Unbalanced prop	Replace prop.
	Fan is operating in unstable region of fan curve	Refer to performance curve for fan.
	Fan speed is too high	Reduce fan RPM.



## 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.

**WARNING: DO NOT ATTEMPT MAINTENANCE ON THE FAN UNTIL THE ELECTRICAL SUPPLY IS COMPLETELY DISCONNECTED.**

### 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 prop, inlet, and other moving parts to ensure smooth and safe operation.
- Motors are normally permanently lubricated. **CAUTION: Use care when touching the exterior of an operating motor. Components may be hot enough to burn or cause injury.**

### 2 Weeks After Start-up

- All fasteners should be checked for tightness each time maintenance checks are performed before restarting unit.

### Yearly

- Inspect bolts and 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 from the prop and housing to prevent imbalance and damage.

## CLEANING & MAINTENANCE RECORD

[illegible]

## 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		Blower Rotation	
Model Number		Correct	
Serial Number		Incorrect	
Volts			
Hertz		Field Measure Information	
Phase		Voltage	
FLA		Amperage**	
HP		RPM	
Blower Pulley			
Motor Pulley			
Belt Number			

\*\*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.**

### Contact Information

For technical support, find a Service Technician through the **CASService** website or scan the QR Code.

