Hart Engineering Corporation

SUBMITTAL:
15500-22

PROJECT: 9900. - Veolia/Taunton WWTF Phase 1 Improvements **DATE: 05/03/2022**

SUBMITTAL: 15500-22 - HVAC Equipment O&M Manual
REVISION: 0
STATUS: Eng
SPEC #: 15500

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Item	Revision	Description	Status	Date Sent	Date Returned
15500-22	0	HVAC Equipment O&M Manual	Eng	05/03/2022	
Notes:					

Additional Notes:

Status Codes
1-APP – No Exceptions Taken
2-ANR – Make Corrections Noted
3-R&R – Revise and Resubmit
4-REJ – Rejected
5-IPO – For Information Purposes Only
6-NRR – Not Required for Review
ENG – Submitted to Engineer

Sincerely,
Hart Engineering Corporation

_____ DATE: 05/03/2022

Installation, Operation and Maintenance Manuals

Job Title: **Taunton Wastewater Treat Facility Solids Handling**

Job Site: RC METALWORKS
65 NORTH MAIN STREET

ASSONET, MA 02702
United States

Customer PO#: 7261-BAI-11367
Engineer: SAR ENGINEERING
Contractor: AERO MECHANCIAL
Elevation: (ft) 180
Date: 4/21/2022
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Job Name: Taunton Wastewater Treat Facility Solids Handling

Product IOMs

Mark Name	Model Name
5EF-2	AER
5EF-1	SE
9LEF-1	VEKTOR-H
9LEF-1	GPFHL (See below)
LOUVERS (REVISED 2-16-22)	EHH-501 (No IOMs)

Vari-Green Motor and Controls IOMs

Mark Name	IOM Name
5EF-1, 5EF-2	VG Motors

Accessory IOMs

Accessory IOM Name	Mark Names
Assembly and Installation Wall Housing_471832	5EF-1
Install Operation Maint Manual VG Motor and Controls	5EF-1, 5EF-2

GREENHECK
Building Value in Air.

Document 471755
Sidewall Propeller Fans
Belt Drive and Direct Drive
Exhaust, Supply, Filtered Supply and Reversible

Installation, Operation and Maintenance Manual

Please read and save these instructions for future reference. Read carefully before attempting to assemble, install, operate or maintain the product described. Protect yourself and others by observing all safety information. Failure to comply with these instructions will result in voiding of the product warranty and may result in personal injury and/or property damage.

Models AER, SE1, SS1, SE2, SS2, SCR3, SBE-1, SBS-1, SBE-2, SBS-2, SBE-3, SBS-3, SBCE, SBCS, SBCR
Models SCE3, SCS3 (Mexico Only)

Axial Propeller Wall Fans

Axial propeller wall fans are ideal for factory and warehouse applications where high volumes of air and low pressures are required. From general ventilation to industrial duty, the range of construction and performance capabilities offered represent the most comprehensive sidewall propeller fan line in the industry.

Wall mounted fans include both direct- and belt-driven fans with various impeller styles for exhaust, supply, filtered supply, and reversible applications.

Filtered Supply

Optional filtered supply wall housings are designed with the draw-thru concept to achieve the highest filter and fan efficiencies. Permanent 2-inch (51 mm) washable filters are accessed through a bolted panel and can be easily removed for cleaning.

General Safety Information

Only qualified personnel should install this fan. Personnel should have a clear understanding of these instructions and should be aware of general safety precautions. Improper installation can result in electric shock, possible injury due to coming in contact with moving parts, as well as other potential hazards. Other considerations may be required if high winds or seismic activity are present. If more information is needed, contact a licensed professional engineer before moving forward.

1. Follow all local electrical and safety codes, as well as the National Electrical Code (NEC) and the National Fire Protection Agency (NFPA), where applicable. Follow the Canadian Electric Code (CEC) in Canada.
2. The rotation of the propeller is critical. It must be free to rotate without striking or rubbing any stationary objects.
3. Motor must be securely and adequately grounded.
4. Do not spin fan propeller faster than max cataloged fan RPM. Adjustments to fan speed significantly affects motor load. If the fan RPM is changed, the motor current should be checked to make sure it is not exceeding the motor nameplate amps.
5. Do not allow the power cable to kink or come in contact with oil, grease, hot surfaces or chemicals. Replace cord immediately if damaged.
6. Verify that the power source is compatible with the equipment.
7. Never open access doors to a duct while the fan is running.

DANGER
Always disconnect, lock and tag power source before installing or servicing. Failure to disconnect power source can result in fire, shock or serious injury.
CAUTION
When servicing the fan, motor may be hot enough to cause pain or injury. Allow motor to cool before servicing.
CAUTION
Precaution should be taken in explosive atmospheres.

DANGER
Pour écarter les risques d'incendie, de choc électrique ou de blessure grave, veiller à toujours débrancher, verrouiller et étiqueter la source de courant avant l'installation ou l'entretien.
ATTENTION
Lors de toute intervention sur la soufflante, le moteur peut être suffisamment chaud pour provoquer une douleur voire une blessure. Laisser le moteur refroidir avant toute maintenance.
ATTENTION
Faire preuve de précaution dans les atmosphères explosives.

Receiving

Upon receiving the product, check to ensure all items are accounted for by referencing the delivery receipt or packing list. Inspect each crate or carton for shipping damage before accepting delivery. Alert the carrier of any damage detected. The customer will make notification of damage (or shortage of items) on the delivery receipt and all copies of the bill of lading which is countersigned by the delivering carrier. If damaged, immediately contact your Representative. Any physical damage to the unit after acceptance is not the responsibility of the Manufacturer.

Unpacking

Verify that all required parts and the correct quantity of each item have been received. If any items are missing, report shortages to your local representative to arrange for obtaining missing parts. Sometimes it is not possible that all items for the unit be shipped together due to availability of transportation and truck space. Confirmation of shipment(s) must be limited to only items on the bill of lading.

Note: The filtered supply unit ships with all ordered components completely factory-assembled. The optional weatherhood ships knocked down for field assembly and installation.

Storage

Fans are protected against damage during shipment. If the unit cannot be installed and operated immediately, precautions need to be taken to prevent deterioration of the unit during storage. The user assumes responsibility of the fan and accessories while in storage. The manufacturer will not be responsible for damage during storage. These suggestions are provided solely as a convenience to the user.

Indoor - The ideal environment for the storage of fans and accessories is indoors, above grade, in a low humidity atmosphere which is sealed to prevent the entry of blowing dust, rain or snow. Temperatures should be evenly maintained between 30° to 110°F (-1° to 43°C). Wide temperature swings may cause condensation and "sweating" of metal parts. All accessories must be stored indoors in a clean, dry atmosphere.

Remove any accumulations of dirt, water, ice or snow and wipe dry before moving to indoor storage. To avoid "sweating" of metal parts allow cold parts to reach room temperature. To dry parts and packages use a portable electric heater to get rid of any moisture build up. Leave coverings loose to permit air circulation and to allow for periodic inspection. The unit should be stored at least 3-1/2 inch (89 mm) off the floor on wooden blocks covered with moisture proof paper or polyethylene sheathing. Aisles between parts and along all walls should be provided to permit air circulation and space for inspection.

Outdoor - Fans designed for outdoor applications may be stored outdoors, if absolutely necessary. Roads or aisles for portable cranes and hauling equipment are needed.

The fan should be placed on a level surface to prevent water from leaking into the fan. The fan should be elevated on an adequate number of wooden blocks so that it is above water and snow levels and has enough blocking to prevent it from settling into soft ground. Locate parts far enough apart to permit air circulation, sunlight and space for periodic inspection. To minimize water accumulation, place all fan parts on blocking supports so that rain water will run off. Do not cover parts with plastic film or tarps as these cause condensation of moisture from the air passing through heating and cooling cycles. Fan propellers should be blocked to prevent spinning caused by strong winds.

Inspection & Maintenance During Storage

While in storage, inspect fans once per month. Keep a record of inspection and maintenance performed.

If moisture or dirt accumulations are found on parts, the source should be located and eliminated. At each inspection, rotate the wheel by hand ten to fifteen revolutions to distribute lubricant on motor. If paint deterioration begins, consideration should be given to touch-up or repainting. Fans with special coatings may require special techniques for touch-up or repair.

Machined parts coated with rust preventive should be restored to good condition promptly if signs of rust occur. Immediately remove the original rust preventive coating with petroleum solvent and clean with lint-free cloths. Polish any remaining rust from surface with crocus cloth or fine emery paper and oil. Do not destroy the continuity of the surfaces. Thoroughly wipe clean with Tectyl® 506 (Ashland Inc.) or the equivalent. For hard to reach internal surfaces or for occasional use, consider using Tectyl® 511M Rust Preventive, WD-40® or the equivalent.

Removing from Storage

As fans are removed from storage to be installed in their final location, they should be protected and maintained in a similar fashion until the fan equipment goes into operation.

Pre-Installation Checks

- Check chart below for correct wall opening dimensions.
- Check motor voltage and amperage rating for compatibility with electrical supply. Supply wiring must be properly fused and conform to local and national codes.
- Motor load amperage must be checked and compared to nameplate rating to avoid serious damage to motor when speed is increased.

Wall Opening Requirements

Wall opening size and propeller-to-damper distance are two important dimensions for fan installation. Fans mounted to the wall require a different wall opening (W.O.) size than those mounted in collars or wall housings. Propeller-to-damper distance (M) is important to reduce turbulence and damper flutter which may lead to premature damper failure.

Figure 1 and 2 show the wall opening (W.O.) required for installations with either a wall housing or collar.

Figure 3 shows the recommended wall opening (W.O.) and the minimum distance (M) suggested between the fan and damper for direct to wall installations.

Figure 4 shows the dimensions and wall opening (W.O.) required for installations with a filtered supply wall housing.

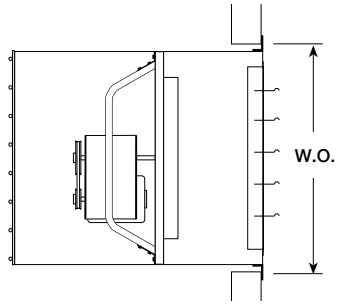


Figure 1 - Wall Housing Installation

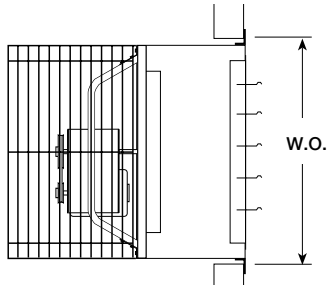


Figure 2 - Wall Collar Installation

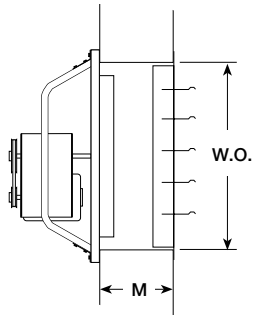


Figure 3 - Direct to Wall Installation

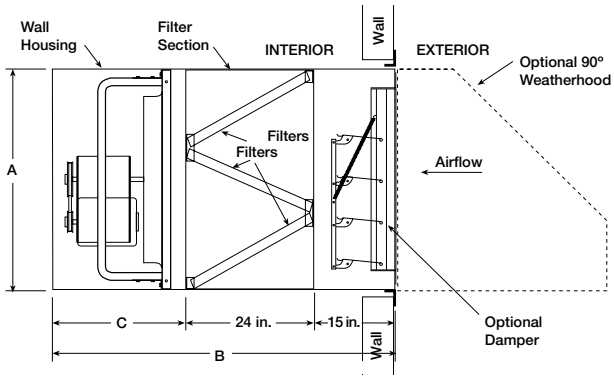


Figure 4 - Filtered Supply Wall Housing Installation

Fan Size	Damper Size Square	Recommended Wall Opening (W.O.) Square			M Minimum	Filtered Supply Wall Housing Only				
		Figures 1 & 2	Figure 3	Figure 4		A	B	C	Filter Quantity & Size	
8	10 *(254)*	14-1/4 *(362)*	10-1/2 *(267)*	-	6 *(152)*	-	-	-	-	-
10	12 *(305)*	16-1/4 *(413)*	12-1/2 *(318)*	-	6 *(152)*	-	-	-	-	-
12	14 *(356)*	19-1/4 *(489)*	14-1/2 *(368)*	-	7 *(178)*	-	-	-	-	-
14	16 *(406)*	21-1/4 *(540)*	16-1/2 *(419)*	-	8 *(203)*	-	-	-	-	-
16	18 *(457)*	23-1/4 *(591)*	18-1/2 *(470)*	-	9 *(229)*	-	-	-	-	-
18	20 *(508)*	25-1/4 *(641)*	20-1/2 *(521)*	-	10 *(254)*	-	-	-	-	-
20	22 *(559)*	27-1/4 *(692)*	22-1/2 *(572)*	-	12 *(305)*	-	-	-	-	-
24	26 *(660)*	33-3/4 *(857)*	26-1/2 *(673)*	33-3/4 *(857)*	13 *(330)*	32-1/4 *(819)*	63 *(1600)*	24 *(610)*	4	23-1/4 x 16-1/4 *(591 x 413)*
30	32 *(813)*	39-3/4 *(1010)*	32-1/2 *(826)*	39-3/4 *(1010)*	13 *(330)*	38-1/4 *(972)*	65 *(1651)*	26 *(660)*	4	24-5/8 x 19-1/4 *(625 x 489)*
36	38 *(965)*	45-3/4 *(1162)*	38-1/2 *(978)*	45-3/4 *(1162)*	14 *(356)*	44-1/4 *(1124)*	67-1/4 *(1708)*	28-1/4 *(718)*	6	23-1/4 x 22-1/8 *(591 x 562)*
42	44 *(1118)*	51-3/4 *(1314)*	44-1/2 *(1130)*	51-3/4 *(1314)*	15 *(381)*	50-1/8 *(1273)*	72-7/8 *(1851)*	34 *(864)*	6	24-1/8 x 25-1/8 *(613 x 638)*
48	50 *(1270)*	57-3/4 *(1467)*	50-1/2 *(1283)*	57-3/4 *(1467)*	16 *(406)*	56-1/8 *(1426)*	72-7/8 *(1851)*	34 *(864)*	12	23-1/4 x 18-3/4 *(591 x 476)*
54	56 *(1422)*	63-3/4 *(1619)*	56-1/2 *(1435)*	63-3/4 *(1619)*	17 *(432)*	62-3/8 *(1584)*	79-11/16 *(2024)*	40-11/16 *(1033)*	12	23-1/4 x 20-3/4 *(591 x 527)*
60	62 *(1575)*	69-3/4 *(1772)*	62-1/2 *(1588)*	-	19 *(483)*	-	-	-	-	-
72	74 *(1880)*	84-3/4 *(2153)*	74-1/2 *(1892)*	-	19 *(483)*	-	-	-	-	-

All dimensions given in inches *(millimeters)*. Filters are 2 inch *(51 mm)* nominal thickness. Above filter sizes are actual dimensions.

Typical Installation

DANGER

Always disconnect, lock and tag power source before installing or servicing. Failure to disconnect power source can result in fire, shock or serious injury.

DANGER

Pour écarter les risques d'incendie, de choc électrique ou de blessure grave, veiller à toujours débrancher, verrouiller et étiqueter la source de courant avant l'installation ou l'entretien.

Move fan to the desired location and determine the method by which the fan is to be mounted as shown in Figures 1-4 shown on page 3. Optional wall mount housings (Figure 1) and wall mount collars (Figure 2) provide a convenient means of mounting sidewall propeller fans while maintaining the proper distance between propeller and damper.

Attach the fan by inserting a suitable fastener through each of the prepunched mounting holes in the fan panel. Care should be taken not to bend or distort the fan panel or drive components during installation.

Support Braces

Wall Housing sizes 42 and larger with heavy motors and all Filtered Supply Wall Housings need additional bracing.

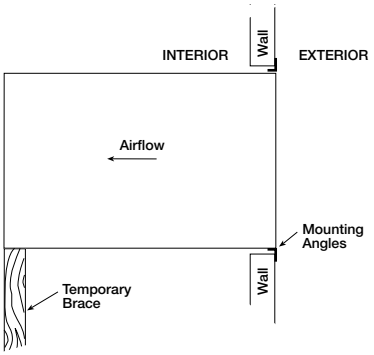
Filtered Supply Wall Housing Installation

Step 1 Install Housing

Install housing through wall opening from outside.

Temporarily brace end of unit until permanent support braces are installed.

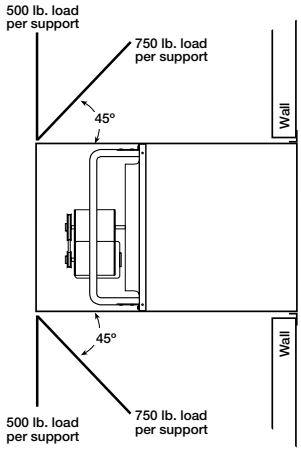
Secure through prepunched holes in angles with suitable fasteners.



Step 2 Install Support Braces

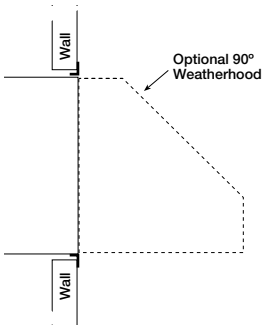
Choose method of support. Attach support to end of unit (above or below housing) with rods, cable, angle, etc. (supplied by others) as shown.

Vertical braces must carry a minimum load of 500 pounds per support, and angled (45°) braces a minimum of 750 pounds per support based on two supports.



Step 3 Install Weatherhood

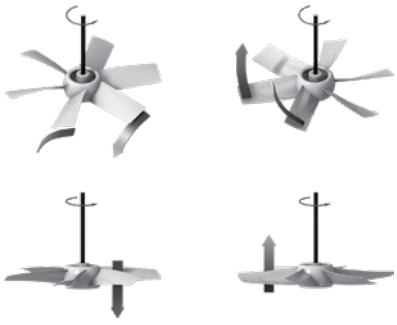
Position weatherhood over end of wall housing and fasten through mounting holes with self-tapping screws. Caulk, flash and complete electrical hook-up to finish installation.



Pre-Start-Up Checks

Check all fasteners and setscrews for tightness. This is especially important for bearing setscrews.

The propeller should rotate freely and not rub on the fan panel venturi. Rotation direction of the propeller should be checked by momentarily turning the unit on. Propeller blade should cup and throw the air when rotating in the correct rotation as shown in the figure. Rotation should be in the same direction as the rotation decal affixed to the unit.



For 3-phase installations, fan rotation can be reversed by simply interchanging any two of the three electrical leads. For single-phase installations follow the wiring diagram located on the motor.

For belt drive fans, the adjustable motor pulley is preset at the factory for the specified fan RPM. Fan speed can be increased by closing or decreased by opening the adjustable pulley. Two or three groove variable pitch pulleys must be adjusted an equal number of turns open. Any increase in fan speed represents a substantial increase in horsepower required from the motor. Always check motor load amperage and compare to nameplate rating when changing fan speed.

Maintenance

DANGER

Always disconnect, lock and tag power source before installing or servicing. Failure to disconnect power source can result in fire, shock or serious injury.

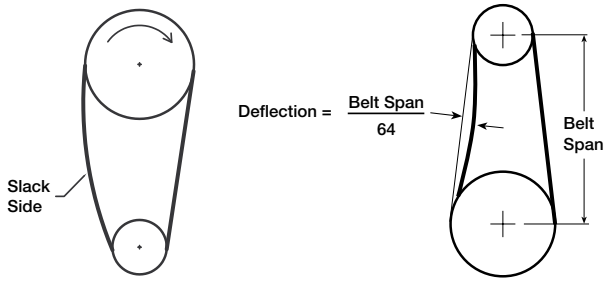
DANGER

Pour écarter les risques d'incendie, de choc électrique ou de blessure grave, veiller à toujours débrancher, verrouiller et étiqueter la source de courant avant l'installation ou l'entretien.

Once the fan has been put into operation, a periodic maintenance program should be set up to preserve the reliability and performance of the fan. Items to be included in this program are belts, bearings, fasteners and setscrews, lubrication, and removal of dust and dirt.

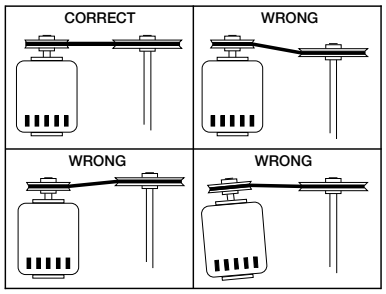
Belts

Premature belt failures are frequently caused by improper belt tension (either too tight or too loose) or misaligned pulleys. The proper tension for operating a V-belt is the lowest tension at which the belts will not slip at peak load conditions. For initial tensioning, the proper belt deflection halfway between pulley centers is 1/64 inch (0.4 mm) for each inch of belt span. For example, if the belt span is 64 inches (1626 mm), the belt deflection should be one inch (25 mm) using moderate thumb pressure at midpoint of the drive. See figure shown below.



Check belt tension two times during the first 24 hours of operation and periodically thereafter. To adjust belt tension, simply loosen four fasteners (two on each side of the motor plate) and slide the motor plate away from the fan shaft until proper belt tension is attained. On some fans, fasteners attaching the motor to the motor plate must be loosened in order to adjust the belt.

It is very important that the drive pulleys remain in proper alignment after adjustments are made. Misalignment of pulleys will result in premature belt wear noise, vibration and power loss.



Bearings (for belt drive fans only)

Bearings are the most critical moving part of the fan and should be inspected at periodic intervals. Locking collars and setscrews, in addition to fasteners attaching the bearings to the bearing plate, must be checked for tightness. In a clean environment and temperatures above 32ºF (0ºC) and below 200ºF (93ºC), fan shaft bearings with grease fittings should be lubricated semi-annually using a high-quality lithium based grease. If unusual environmental conditions exist, temperatures below 32ºF (0ºC) and above 200ºF (93ºC), moisture or contaminants, more frequent lubrication is required.

With the unit running, add grease very slowly with a manual grease gun until a slight bead of grease forms at the seal. Be careful not to unseat the seal by over lubricating or using excessive pressure. Bearings without grease fittings are lubricated for life.

Fasteners and Setscrews

Any fan vibration has a tendency to loosen mechanical fasteners. A periodic inspection should include checking all fasteners and setscrews for tightness. Particular attention should be paid to setscrews or taper-lock bushings attaching the propeller to the motor shaft and the motor shaft to the bearings. Loose bearing setscrews will lead to premature failure of the fan shaft. In addition, check all fasteners attaching the motor to the motor plate.

Lubrication

Refer to the paragraph on bearings for bearing lubrication. Many fractional horsepower motors installed on the smaller fans are lubricated for life and require no further attention. Motors equipped with oil holes should be oiled in accordance with the manufacturer's instructions printed on the motor. Use a high grade SAE 20 machine oil and use caution not to over lubricate. Motors supplied with grease fittings should be greased according to directions printed on the motor.

Removal of Dust and Dirt

Dirt clogs cooling openings on the motor housing, contaminates bearing lubricant and collects on propeller blades causing severe imbalance if left unchecked. The exterior surface of the motor, fan panel and entire propeller should be thoroughly cleaned periodically. Use caution and do not allow water or solvents to enter the motor or bearings. Motors or bearings must not be sprayed with steam or water.

The filters also require periodic cleaning. The 2 inch (51 mm) washable aluminum filters are accessed through the bolted access panel.

Troubleshooting

WARNING

Before taking any corrective action, make certain unit is not capable of operation during repairs.

AVERTISSEMENT

Avant d'entreprendre toute action corrective, s'assurer que l'appareil ne pourra pas fonctionner durant les réparations.

PROBLEM	CAUSE	CORRECTIVE ACTION
Too much airflow	Resistance lower than designed	Decrease fan speed.
Reduced airflow	System resistance too high	Check backdraft dampers for proper operation. Remove obstructions in ductwork. Clean dirty filters. Check for adequate supply air for exhaust fans or exhaust air for supply fans.
	Fan too close to damper	Increase distance between fan and damper.
	Fan speed too low	Increase fan speed.
	Excessive dirt buildup on propeller	Clean propeller.
Excessive noise	Bearings	Tighten collars and fasteners. Lubricate bearings. Replace defective bearings.
	V-belt drive	Tighten pulleys on motor and fan shaft. Adjust belt tension. Align pulleys properly. Replace worn belts or pulleys. See Maintenance.
	Excessive vibration	Clean dirt buildup from propeller. Check all setscrews and fasteners for tightness. Check for worn bearing. Correct propeller imbalance. Check for loose dampers, guards or ductwork.
	Defective motor	Replace motor.
	Variable frequency drive (VFD)	Check VFD for drive setting, some controllers are able to be adjusted to lower the harmonic noises sometimes heard during operation by adjusting a simple setting on the controller.
	Debris	Remove all debris from the fan.
Fan does not operate	Electrical supply	Check fuses/circuit breakers. Check for switches turned off or disconnected. Check for correct supply voltage.
	Drive	Check for broken or worn belts. Tighten loose pulleys.
	Motor	Assure motor is correct horsepower and not tripping overload protector.

Maintenance Documentation

Job Information

Job Name:_____
Address:_____
City: _____
State: _____ Zip:_____
Phone: _____
Contact Person: _____

Service Organization:_____
Address: _____
City:_____
State: _____ Zip: _____
Phone: _____
Work Done By: _____

Nameplate Information

Model: _____
Volts:_____ Hertz: _____ Phase: _____
Amps:_____ Mark: _____
Supply hp: _____ Exhaust hp:_____
Serial Number: _____
Model Voltage: _____
Motor Amperage: _____
Fan RPM:_____

Field Start-Up Documentation

Actual Voltage: _____ Hertz: _____ Phase:_____
Actual Amperage:_____
Blower Rotation:_____
Air Volume: Design cfm: _____
Actual cfm: _____
Level of fan (L or H):_____
Fan RPM Range (min.)_____ (max.) _____

Parts List

Each fan bears a manufacturer's nameplate with model number and serial number embossed. This information will assist the local representative and the factory in providing service and replacement parts. Before taking any corrective action, make certain unit is not capable of operation during repairs.

CAUTION

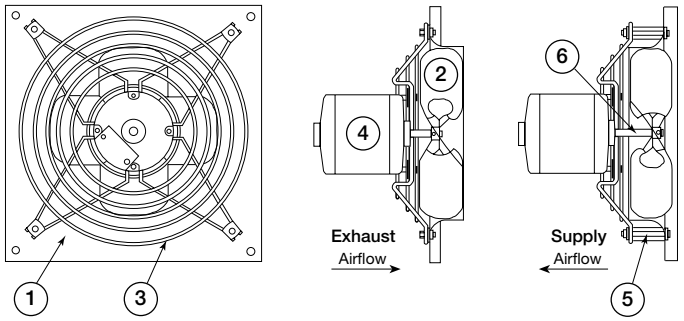
A fan manufactured with an explosion resistant motor does not certify the entire unit to be explosion proof. Refer to UL Listing Mark for the fans approved usage.

CAUTION

La présence d'un moteur antidéflagrant sur un ventilateur ne garantit pas que tout l'appareil est antidéflagrant. Pour connaître les emplois autorisés de l'appareil, voir son marquage de conformité UL.

Direct Drive

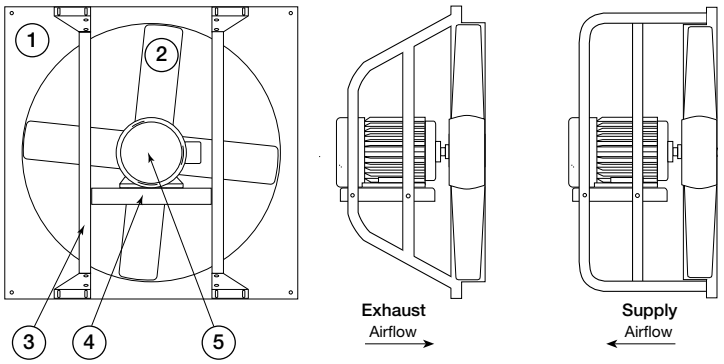
SE1 and SS1 (Sizes 8 thru 12 - D, G and E Motor Speeds)



1. Fan Panel
2. Propeller
3. Drive Frame/Motor Support
4. Motor
5. Riser Blocks (4) - supply fan only
6. Shaft Extension - supply fan only

Direct Drive

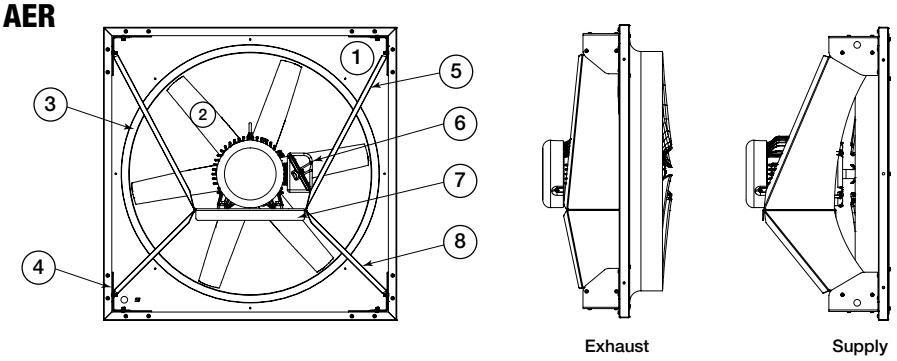
SE1 and SS1 (Sizes 12 thru 24 - A, B and C Motor Speeds)
SE2, SS2 and SCR3
SCE3 and SCS3 (Mexico Only)



1. Fan Panel
2. Propeller
3. Drive Frame Channels (2)
4. Motor Plate
5. Motor

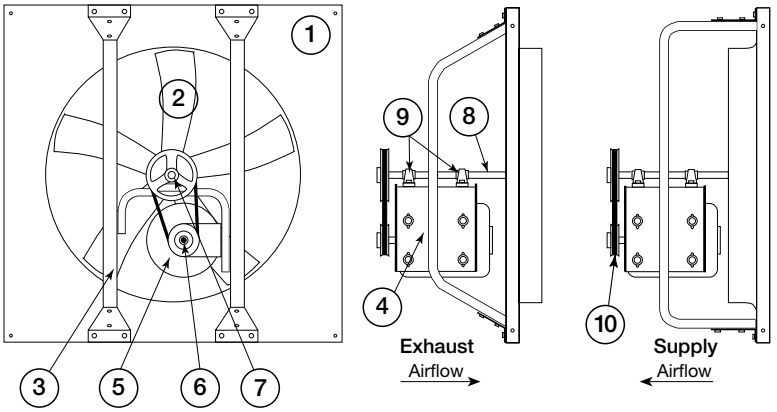
Direct Drive

AER



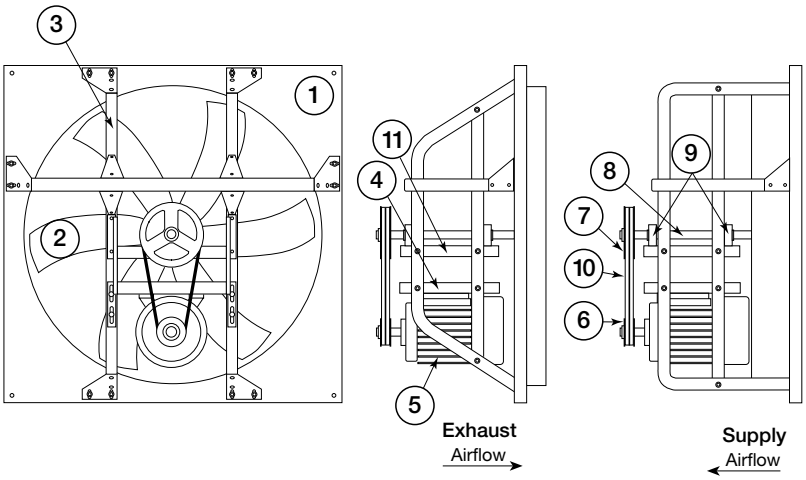
1. Fan Panel
2. Propeller
3. Venturi Insert
4. Corner Brackets (4)
5. Drive Frame Upper Arm (2)
6. Motor
7. Motor Plate
8. Drive Frame Lower Arm (2)

Belt Drive
SBE-1, SBS-1, SBE-2 and SBS-2 (L and H propellers)



1. Fan Panel
2. Propeller
3. Drive Frame Channel (2)
4. Motor /Bearing Plate
5. Motor
6. Motor Pulley
7. Shaft Pulley
8. Fan Shaft
9. Bearings (2)
10. Belt

Belt Drive
SBE-3, SBS-3, SBCE, SBCS and SBCR (L and H propellers)



1. Fan Panel
2. Propeller
3. Drive Frame Channel (2)
4. Motor Plate
5. Motor
6. Motor Pulley
7. Shaft Pulley
8. Fan Shaft
9. Bearings (2)
10. Belt
11. Bearing Plate

Our Commitment

As a result of our commitment to continuous improvement, Greenheck reserves the right to change specifications without notice.

Product warranties can be found online at Greenheck.com, either on the specific product page or in the literature section of the website at Greenheck.com/Resources/Library/Literature.

Greenheck's Sidewall Propeller Fans catalog provides additional information describing the equipment, fan performance, available accessories, and specification data.

AMCA Publication 410-96, Safety Practices for Users and Installers of Industrial and Commercial Fans, provides additional safety information. This publication can be obtained from AMCA International, Inc. at www.amca.org.

GREENHECK
Building Value in Air.

Phone: 715.359.6171 • Fax: 715.355.2399 • Parts: 800.355.5354 • E-mail: gfcinfo@greenheck.com • Website: www.greenheck.com

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Document 469003
Model Vektor®-H and Vektor®-HS
Laboratory Exhaust System

Installation, Operation and Maintenance Manual

Please read and save these instructions for future reference. Read carefully before attempting to assemble, install, operate or maintain the product described. Protect yourself and others by observing all safety information. Failure to comply with these instructions will result in voiding of the product warranty and may result in personal injury and/or property damage.

Vektor®-H Belt Drive

Vektor®-H Direct Drive

Vektor®-HS Belt Drive

General Safety Information

Only qualified personnel should install this fan system. Personnel should have a clear understanding of these instructions and should be aware of general safety precautions. Improper installation can result in electric shock, possible injury due to coming in contact with moving parts, as well as other potential hazards. Other considerations may be required if high winds or seismic activity are present. If more information is needed, contact a licensed professional engineer before moving forward.

1. Follow all local electrical and safety codes, as well as the National Electrical Code (NEC), the National Fire Protection Agency (NFPA), where applicable. Follow the Canadian Electrical Code (CEC) in Canada.
2. The rotation of the wheel is critical. It must be free to rotate without striking or rubbing any stationary objects.
3. Motor must be securely and adequately grounded.
4. Do not spin fan wheel faster than maximum cataloged fan RPM. Adjustments to fan speed significantly effects motor load. If the fan RPM is changed, the motor current should be checked to make sure it is not exceeding the motor nameplate amps.
5. Do not allow the power cable to kink or come in contact with oil, grease, hot surfaces or chemicals. Replace cord immediately if damaged.
6. Verify that the power source is compatible with the equipment.
7. Never open access doors to a duct while the fan is running.

DANGER
Always disconnect, lock and tag power source before installing or servicing. Failure to disconnect power source can result in fire, shock or serious injury.
CAUTION
When servicing the fan, motor may be hot enough to cause pain or injury. Allow motor to cool before servicing.
CAUTION
Precaution should be taken in explosive atmospheres.

Receiving

Greenheck models Vektor-H and Vektor-HS fans are thoroughly inspected, test run at the factory, and shipped on a skid or packaged to minimize damage during shipment. The transportation carrier has the responsibility of delivering all items in their original condition as received from the manufacturer. The individual receiving the equipment is responsible for inspecting the unit for obvious or hidden damage and recording any damage on the bill of lading before acceptance of the equipment. All claims (if necessary) shall be filed with the final carrier.

Unpacking

Verify that all required parts and the correct quantity of each item have been received, including accessory kit containing gasketing, etc. If any items are missing, report shortages to your local representative to arrange for obtaining missing parts. Sometimes it is not possible that all items for the unit be shipped together due to availability of transportation and truck space. Confirmation of shipment(s) must be limited to only items on the bill of lading.

Handling

The Vektor-H and Vektor-HS laboratory exhaust system is shipped in subassembly sections for easy rigging and installation. Depending on the fan size, the sections can include: Blower Assembly, Stack Extension, and Discharge Nozzle.

The Vektor-H and Vektor-HS are designed to be self-supporting and standing (without the use of guy wires) when assembled per the instructions provided within this manual. All subassembly sections have lifting lugs as shown.

Storage

Fans are protected against damage during shipment. If the unit cannot be installed and operated immediately, precautions need to be taken to prevent deterioration of the unit during storage. The user assumes responsibility of the fan and accessories while in storage. The manufacturer will not be responsible for damage during storage. These suggestions are provided solely as a convenience to the user.

INDOOR

The ideal environment for the storage of fans and accessories is indoors, above grade, in a low humidity atmosphere which is sealed to prevent the entry of blowing dust, rain, or snow. Temperatures should be evenly maintained between 30°F and 110°F. (*-1°C and 43°C*). Wide temperature swings may cause condensation and “sweating” of metal parts. All accessories must be stored indoors in a clean, dry atmosphere.

Remove any accumulations of dirt, water, ice or snow and wipe dry before moving to indoor storage. To avoid “sweating” of metal parts allow cold parts to reach room temperature. To dry parts and packages use a portable electric heater to get rid of any moisture build up. Leave coverings loose to permit air circulation and to allow for periodic inspection.

The unit should be stored at least 3-1/2 in. (*89 mm*) off the floor on wooden blocks covered with moisture proof paper or polyethylene sheathing. Aisles between parts and along all walls should be provided to permit air circulation and space for inspection.

OUTDOOR

Fans designed for outdoor applications may be stored outdoors, if absolutely necessary. Roads or aisles for portable cranes and hauling equipment are needed.

The fan should be placed on a level surface to prevent water from leaking into the fan. The fan should be elevated on an adequate number of wooden blocks so that it is above water and snow levels and has enough blocking to prevent it from settling into soft ground. Locate parts far enough apart to permit air circulation, sunlight, and space for periodic inspection. To minimize water accumulation, place all fan parts on blocking supports so that rain water will run off.

Do not cover parts with plastic film or tarps as these cause condensation of moisture from the air passing through heating and cooling cycles.

Fan wheels should be blocked to prevent spinning caused by strong winds.

Inspection and Maintenance during Storage

While in storage, inspect fans once per month. Keep a record of inspection and maintenance performed; see backcover.

If moisture or dirt accumulations are found on parts, the source should be located and eliminated. At each inspection, rotate the wheel by hand ten to fifteen revolutions to distribute lubricant on motor and bearings. If paint deterioration begins, consideration should be given to touch-up or repainting. Fans with special coatings may require special techniques for touch-up or repair.

Machined parts coated with rust preventive coating should be restored to good condition promptly if signs of rust

occur. Immediately remove the original rust preventive coating with petroleum solvent and clean with lint-free cloths. Polish any remaining rust from surface with crocus cloth or fine emery paper and oil. Do not destroy the continuity of the surfaces. Wipe clean thoroughly with Tectyl® 506 (Ashland Inc.) or the equivalent. For hard to reach internal surfaces or for occasional use, consider using Tectyl® 511M Rust Preventive or WD-40® or the equivalent.

REMOVING FROM STORAGE

As fans are removed from storage to be installed in their final location, they should be protected and maintained in a similar fashion, until the fan equipment goes into operation.

Prior to assembly and installation of the Vektor fan and system components, inspect the fan assembly to make sure it is in working order.

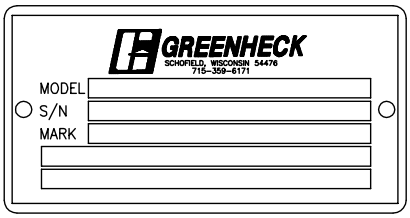
1. Check all fasteners, set screws on the fan, wheel, bearings, drive, motor base and accessories for tightness.
2. Rotate the fan wheel(s) by hand and assure no parts are rubbing. Access to the wheel is obtained through a bolted panel located on the side of the fan housing.

General Information

To ensure a successful installation, the instructions in this manual should be read and adhered to. Failure to comply with proper installation procedures may void the warranty.

Unit and System Identification Tags

Each fan has a permanently affixed manufacturer's engraved metal nameplate containing the model number and individual serial number.



The tag shown is an example of an identification nameplate on the fan. The information provides general details about the fan, as well as containing specific information unique to the unit. When contacting your local manufacturer's representative with future needs or questions, please have the information on this label available. Tags are mounted in an area which is clearly visible, usually on the side of the fan cabinet.

Vektor fan systems may arrive in component pieces due to shipping restrictions. Individual components of a system have matching identification tags which should be used to identify and assemble the complete system. Assembling systems with different identification tags can cause reductions in the fan(s) performance.

Prior to fully assembling and installing the Vektor-H or Vektor-HS fans, inspect bypass air plenums and the fan assembly to make sure they are in working order.

Pre-Installation Information

Before installation, it is important to be certain the mounting surface will bear the operating weight of the unit. For proper unit operation, it is also important that it be operated in a completely level position.

For further details on safety practices involving industrial and commercial fans, please refer to AMCA Publication 410.

Electrical Disconnects

All fan motors should have disconnects located in close visual proximity to turn off electrical service. Service disconnects shall be locked-out when maintenance is being performed.

Moving Parts

All moving parts must have guards to protect personnel. Refer to local codes for requirements as to the number, type and design. Fully secure fan wheel before performing any maintenance. The fan wheel may start "free wheeling" even if all electrical power has been disconnected. Before the initial start-up or any restart, check the following items to make sure that they are installed and secure.

- Do not spin fan wheel faster than the maximum cataloged fan rpm.
- Adjustments to fan speed significantly affects motor load. If the fan RPM is changed, the motor current should be checked to make sure it is not exceeding the motor nameplate amps.

Guards (Motor Cover, Weatherhoods)

Do not operate fans without proper protective devices in place. Failure to do so may result in serious bodily injury and property damage. Check local codes to ensure compliance for all protective devices.

Air Pressure and Suction

In addition to the usual hazards associated with rotating machinery, fans also create a dangerous suction at the inlet. Special caution needs to be used when moving around a fan, whether it is in operation or not. Before start-up, make sure the inlet area is clear of personnel and loose objects.

Rigging and Lifting

The steel cone is to be lifted by the points at the top, separately and individually from the fan assembly. **Polyethylene nozzles do not have lifting points.** If needed, attach polyethylene nozzle to fan or stack prior to lifting and use component lifting points.

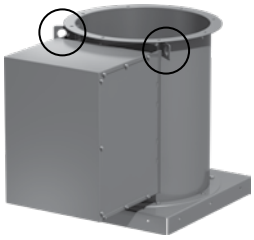
Fans and bypass air plenums (BAP) should be disassembled prior to lifting and lifted individually. Fans and BAP are to be rigged and moved by the lifting points provided or by the skid when a forklift is used. Location of the brackets varies by model and size. Handle in such a manner as to keep from scratching or chipping the coating. Damaged finish may reduce the ability of the fan to resist corrosion. Spreader bars are recommended to prevent damage to the unit. Failure to use spreader bars may result in damage which becomes the installer's responsibility.

1. Before lifting, be sure that all shipping materials have been removed from the unit.
2. Use standard lifting and rigging practices.
3. All lifting brackets on each unit must be utilized at the same time.
4. Fan to be kept level during lifting and installation.
5. Spreader bars must span the unit to prevent damage to the unit by the lifting cables.
6. Always test-lift the unit to check for proper balance and rigging before hoisting to desired location.
7. Never lift unit in windy conditions.
8. Preparation of roof opening should be completed prior to lifting the unit onto the roof.
9. Use well-padded chains to protect the unit from damage.

Vektor-H

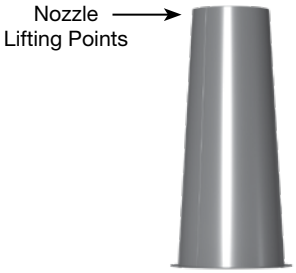
Unit Assembly Lifting Lugs

Belt Drive
Sizes 9-12



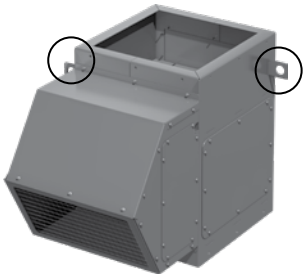
Belt Drive
Sizes 13-36

Direct Drive
Lift as an assembly with all four (4) lifting lugs.
Image shows if motor and wheel assembly needs to be removed.

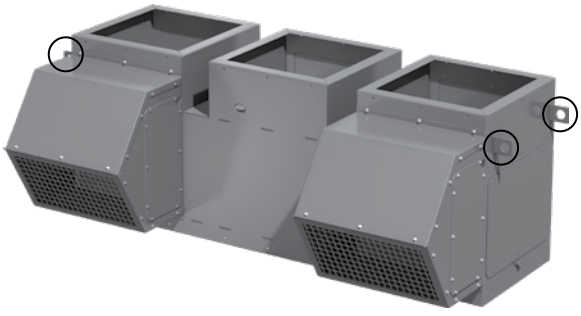


Nozzle sizes 13-36

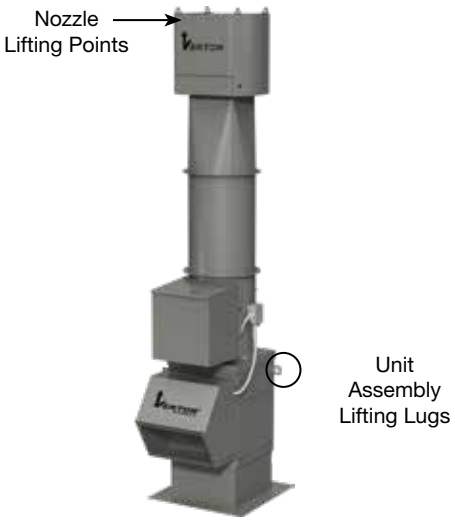
Vektor-HS with VGN Technology



Bypass Air Plenum
Sizes 9-22



3x1 Fan System with Bypass Air Plenum
Sizes 9-13, 18-36



Rigging and Lifting (continued)

Unit Lifting Points		
Fan		
Size	**Quantity**	**Placement**
Belt – 9-12	2	Inside fan body, on top of belt tube
Belt – 13-36	2	Exterior of fan body
Direct – All	4	Outside of core and outside of fan body, All (4) to be used to “balance” the lift.
Bypass Air Plenum (BAP)		
Size	**Quantity**	**Placement**
1x1 – 9-22	2	Opposite sides of plenum
1x1 – 24-36	4	Two on each end of plenum
2x1 – 9-16	2	Opposite sides of plenum
2x1 – 18-36	4	Two on each end of plenum
3x1 – 16	2	Opposite sides of plenum
3x1 – 9-13, 18-36	4	Two on each end of plenum

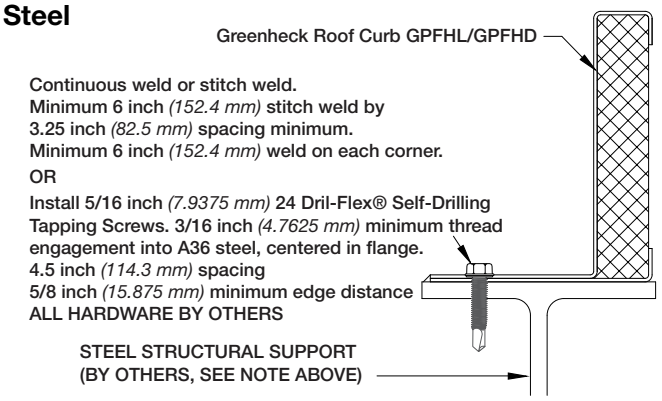
Roof Curb and Mounting Details

NOTE

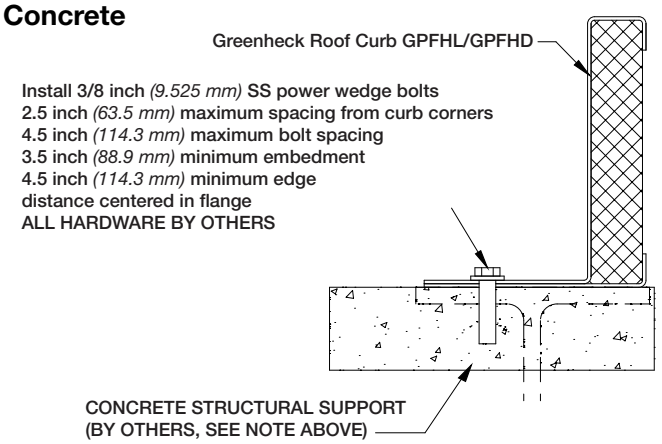
Steel, concrete or wood roof support is per structural engineer and in accordance with load requirements and applicable building codes.

The figures below illustrates three common methods used to install Vektor systems. Methods used to attach a Vektor unit are dependent on local codes, roof construction design and roof construction materials. Consult an architect or structural engineer for proper means of attachment.

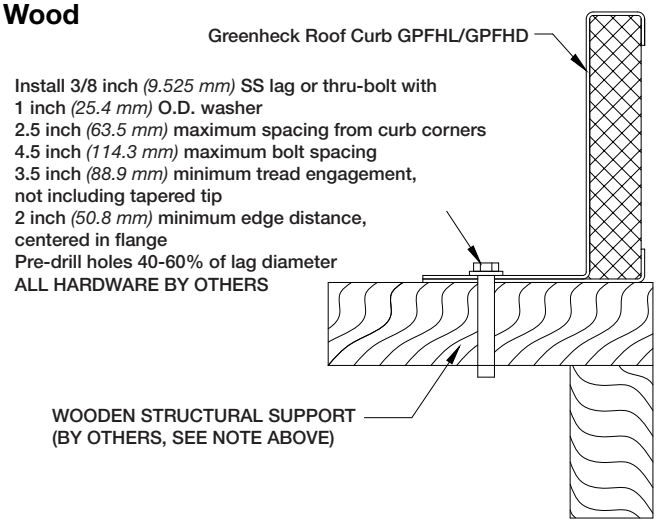
Steel



Concrete



Wood

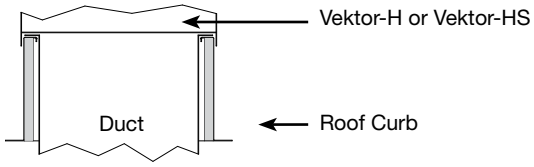


Duct Installation

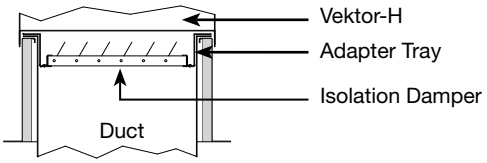
Bottom Inlet Duct Connection

The end of the duct (customer-supplied) is secured between the roof curb's top edge and the curb cap of either the Vektor-H or bypass air plenum. If an isolation damper is present in the roof curb, the duct is located between the roof curb and the damper adapter tray.

Option 1:
- No isolation damper in roof curb
- Bottom inlet on bypass air plenum



Option 2:
- With isolation damper in roof curb



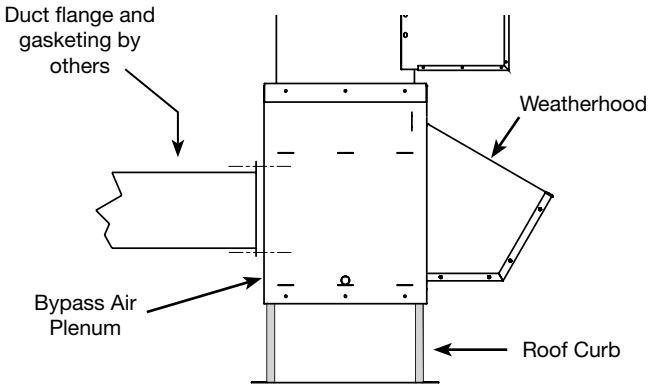
Duct Connection to Curb

Side or End Duct Connection

- Vektor-H or Vektor-HS
- With bypass air plenum

NOTE

Plenum is provided with removable side or end panels, allowing the proper duct connection.



Duct to Bypass Air Plenum

Stack Extensions

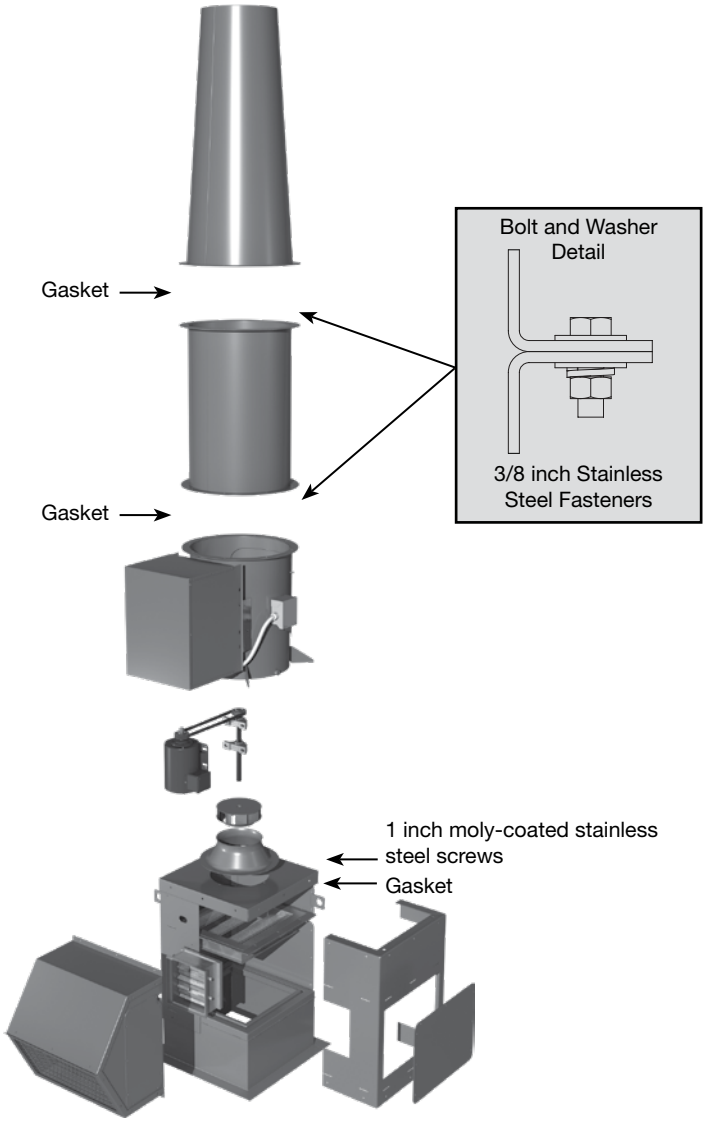
Systems with multiple stack extensions require all sections assembled and installed on site between the main fan body and the discharge cone. Each section has guy wire attachment brackets located on the upper end of each section. The order sections are installed in are universal. Gasketing (3/16 x 1/2 inch with sticky back) is provided and is to be installed between each joining section.

Guy wires are required on system with multiple stack extensions. Location of connections, wiring and anchorage is determined by a structural engineer.

System Assembly

NOTE

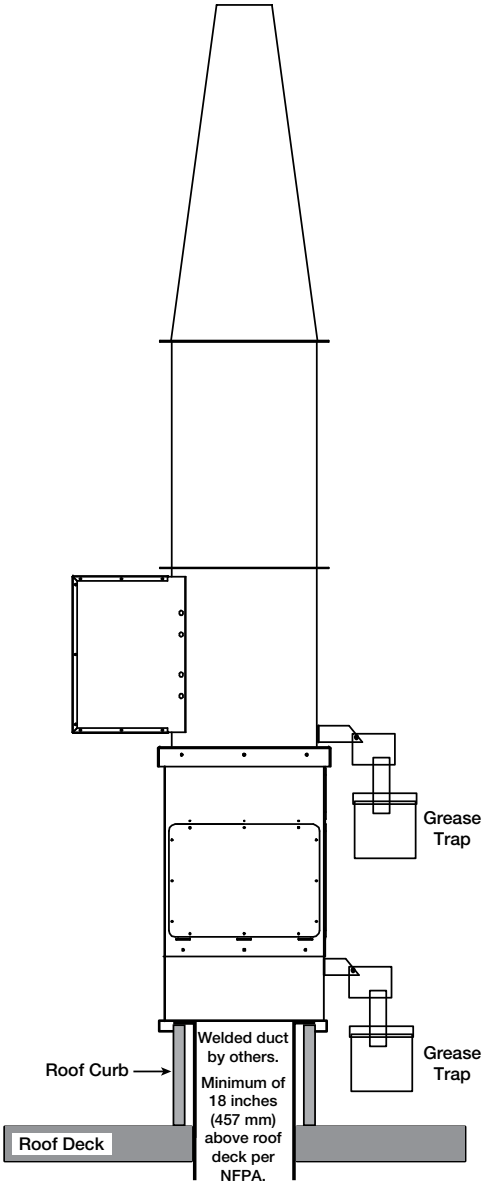
When installing each section, be certain to rig each section separately using the lifting lugs provided.



1. Mount roof curb to roof deck in accordance with local codes.
2. Place the bypass air plenum (BAP) onto the secured roof curb. Pre-drill pilot holes into the roof curb using pre-existing holes in plenum as a guide. Use thread cutters to add threads to holes in roof curb. Attach the BAP to the roof curb with mounting hardware (by others).

   If a BAP is not provided for the unit, skip to Step 4.
3. Install 3/16-inch thick x 1/2-inch wide, closed-cell gasket on the top edge of BAP, adhesive side down (gasket provided). Leave no gaps between gasket sections to ensure a tight seal.
4. Place the panel of the fan housing onto the gasket and BAP or onto roof curb if BAP is not provided. Use thread cutters to add threads to holes, securing with 1-inch moly-coated stainless steel screws. Must use every hole for proper coverage.
5. Install the final nozzle subassemblies as shown in the submittal drawing. Align flange bolt holes and fasten sections using the 3/8-inch 316 stainless steel bolts, washers, and lock washers provided.
6. Follow electrical connection and pre-start-up checks as listed on pages 10 and 11.

Kitchen Roof Mounting Installation



Typical Commercial Kitchen Installation

WARNING

In a kitchen exhaust application, do not use a speed control or isolation damper.

NOTE

In a kitchen fan and high temperature applications exhaust upblast fans must have external wiring.

UL/cUL 762 installation for restaurant applications

1. The size of the duct must be equal to the inlet opening.
2. Secure the fan to curb at all four corners using a minimum eight anchor bolts, lag screws or other suitable fasteners.
3. Use optional grease trap and external junction box.
4. Area codes may require a continuous weld between duct and inlet.
5. To comply with NFPA 96, the discharge is required to be a minimum of 40 inches *(1016 mm)* above the roof deck and a minimum of 10 ft. from any building air intake. The minimum velocity in the duct should be 500 ft/min. or greater.
6. Ductwork to an upblast discharge exhaust fan is constructed of carbon steel not less than 16 MSG *(1.6 mm)* and extends a minimum of 18 inches *(457 mm)* above the roof surface.
7. Ensure that a minimum of 500 ft/min. of air velocity through the fan is maintained per NFPA 96, clause 8.2.1.1, 2008 edition and UL 762, Issue #5, December 19, 2003, clause 6.2.

Grease Trap

A grease trap is an aluminum trap designed to collect grease residue to avoid drainage onto roof surface. It contains a built-in water separating baffle.

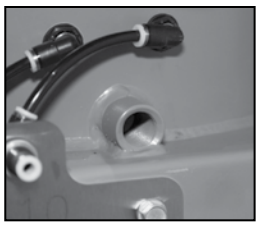
Instructions

1. Apply cover to grease trap. Install clip nuts to trap over holes provided. Attach cover with two #10 - 24 x 1/2 fasteners.
2. Position the container under the grease drain so the drain spout enters the cover approximately 1-1/2 to 2 in. *(38-51 mm)*.
3. Locate and mark the container mounting holes on the extended base or roof curb.
4. Drill 3/16 in. (*5 mm*) diameter holes in marked locations.
5. Apply container with #10 - 24 x 3/4 fasteners.
6. For most climates, fill container with water (at installation and after each cleaning) until it flows out the drain hole. The unit is now ready for use.

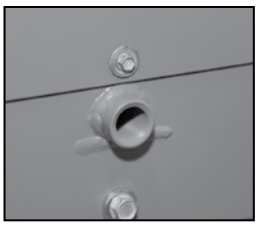
Maintenance

Regular inspection of grease trap is recommended. Depending on the amount of grease discharged through the fan, the grease trap should be changed accordingly to ensure proper operation.

Fan and Plenum Drainage Piping / Trap Detail (By Others)



Fan Drain Connection



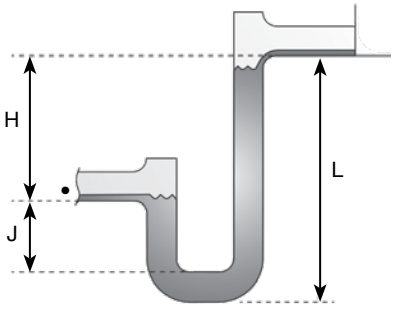
Plenum Drain Connection

There is a location for a pipe connection on each tubular fan housing and bypass air plenum. Each drain may need to be connected to a drainage system to ensure proper disposal of any water or condensate that may occur.

- Drain connections are 1/2-inch NPT
- Installed piping to have a downward angle to allow for drainage
- Fill traps to recommended level before start-up

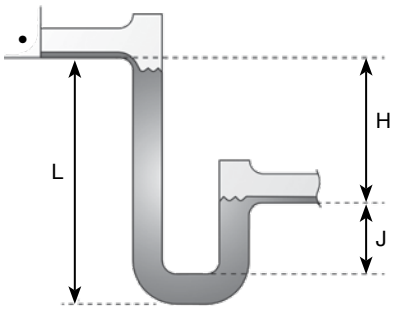
Note: A conservative method of trap design is to set N = total static pressure.

• Connect this end to the fan drain



* A trap is needed for each fan

• Connect this end to the optional BAP drain



H = 1 in. for each inch of maximum negative static pressure plus 1 in.

J = 1/2 of H

L = H + J + Pipe diameter

Electrical Connections

NOTE

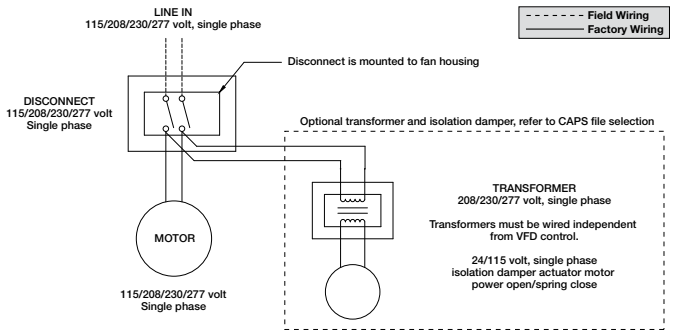
Refer to the Vektor Laboratory Exhaust with Variable Geometry Nozzle (VGN) Technology Electrical Controls Installation, Operation and Maintenance Manual for electrical wiring and connection information.

Before electrical connections are made, the supply voltage, phase and ampere capacity must be checked for compatibility with the fan motor. In addition, the supply wiring must be properly fused and conform to local and national electrical codes. If unit is supplied with a safety disconnect switch, ensure proper wiring to the fan motor. Be sure the disconnect is switched to the "OFF" position before connecting supply wires. If no disconnect is supplied, ensure the supply wire is not live before connection. Supply wires are then connected to the optional safety disconnect switch (if supplied) or motor.

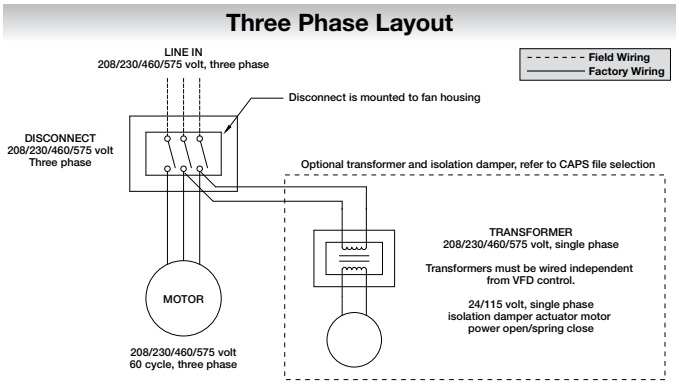
Vektor-H Motor Disconnect and Isolation Damper Wiring Diagram

Disconnect is mounted to fan housing. Transformers are mounted to bypass air plenum with damper actuator motors. For systems that ship unassembled because of physical size, this connection at disconnect from transformers must be field-installed. Wires with conduit and fittings are provided pre-connected to transformers.

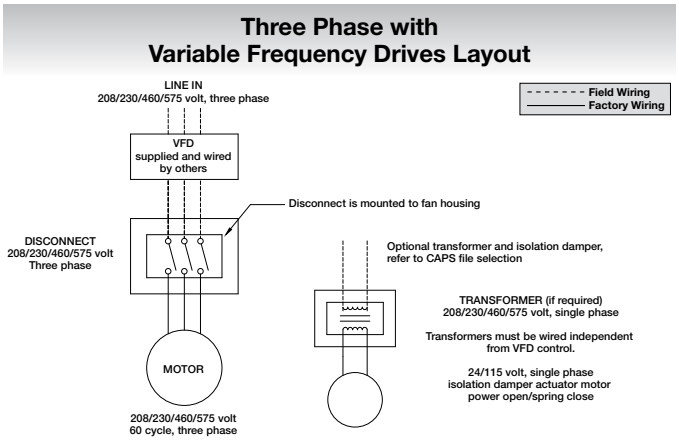
Single Phase Layout



Three Phase Layout



Three Phase with Variable Frequency Drives Layout



Vektor-H Applications with Variable Frequency Drive (VFD)

For Vektor systems with single-point, three-phase wiring per blower, the isolation damper actuator will be powered via a step-down transformer, which is wired to the fan disconnect, as shown in the wiring diagrams on page 10.

If fan flow (motor speed) is to be controlled using a variable frequency drive with this wiring, the reduced voltage and frequency supplied to the fan will cause control problems with the isolation damper actuator.

When a project's Vektor control sequence requires the use of a VFD, it is suggested that the control contractor supply the isolation damper actuator voltage, independent of the power supplied to the Vektor fan motor.

NOTE

For Vektor-HS fans provided from the factory with a VFD, refer to the Vektor Laboratory Exhaust with Variable Geometry Nozzle (VGN) Technology Electrical Controls Installation, Operation and Maintenance Manual for electrical wiring and connection information.

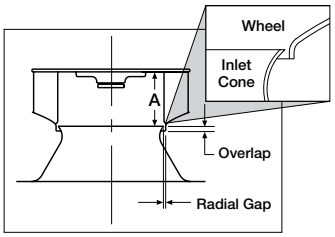
Pre-Start-Up Checks

Check all fasteners for tightness.

Check radial gap, overlap and wheel alignment. The wheel should be aligned as shown. Although the wheel position is preset and the unit is test run at the factory, movement may occur during shipment.

The radial gap should be consistent at all locations between the centrifugal wheel and the inlet cone. Centering may be accomplished by loosening the inlet cone bolts and repositioning the inlet cone.

To obtain the optimum performance, the centrifugal wheel must overlap the inlet cone. Adjustments can be made by loosening the set screws in the wheel and moving the wheel to the desired position.



Wheel rotation should be in the same direction as the rotation decal affixed to the unit. (Counterclockwise rotation is correct as viewed from fan inlet). For 3-phase installations, fan rotation can be reversed by simply interchanging any two of the three electrical leads. For single phase installations, follow the wiring diagram located on the motor.

NOTE

Any increase in fan speed represents a substantial increase in horsepower required from the motor. Always check motor load amperage and compare to nameplate rating when changing fan speed.

	Belt Drive			
	Inlet Cone to Backplate			
Unit Size	A Dimension ± Tolerance		A Dimension ± Tolerance	
	Inches		millimeter	
9	3-3/16	± 1/8	81	± 3
10	3-7/16	± 1/8	87	± 3
12	4	± 1/8	102	± 3
13	4-7/16	± 1/8	113	± 3
16	5-7/16	± 1/8	138	± 3
18	6-3/8	± 1/8	162	± 3
22	7-13/16	± 3/16	198	± 5
24	8-5/8	± 1/4	219	± 6
30	10-9/16	± 3/8	268	± 10
36	12-3/4	± 3/8	324	± 10

	Direct Drive			
	Inlet Cone to Backplate			
Unit Size	A Dimension ± Tolerance		A Dimension ± Tolerance	
	Inches		millimeter	
10	3-1/2	± 1/8	89	± 3
12	4-5/16	± 1/8	125	± 3
13	4-7/8	± 1/8	124	± 3
14	5-7/16	± 1/8	138	± 3
16	6-1/16	± 1/8	154	± 3
18	6-7/8	± 1/8	175	± 3
20	7-11/16	± 1/8	195	± 3

Radial Gap is adjusted by loosening the inlet cone bolts and centering the cone on the wheel. If additional adjustment is required to maintain a constant radial gap, loosening the bearing bolts and centering the wheel is acceptable as a secondary option.

Overlap or offset, is adjusted by loosening the wheel hub from the shaft and moving the wheel to the desired position along the shaft. The transition between the inlet cone and wheel should be as shown above; there is a smooth feel to the profile when moving from one component to the other.

Maintenance

WARNING

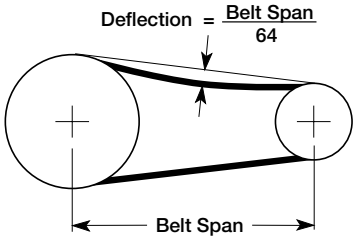
Disconnect all electrical power to the fan and secure to the 'OFF' position prior to inspection or servicing. Failure to comply with this safety precaution could result in serious injury or death.

Once the fan has been put into operation, a periodic maintenance program should be set up to preserve the reliability and performance of the fan. Items to be included in this program are:

- Belts
- Fasteners
- Set Screws
- Motors
- Removal of dust and dirt
- Fan shaft bearings
- Vektor-HS nozzle bearings
- Relubrication schedule

Belts

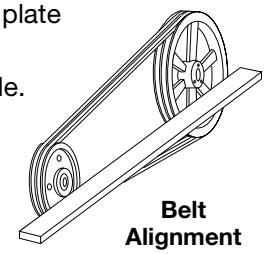
Premature belt failures are frequently caused by improper belt tension (either too tight or too loose) or misaligned pulleys. The proper tension for operating a V-belt is the lowest tension at which the belts will not slip at peak load conditions. For initial tensioning, the proper belt deflection half-way between pulley centers is 1/64-inch for each inch of belt span. For example, if the belt span is 64 inches, the belt deflection should be one inch using moderate thumb pressure at midpoint of the drive.



Belt Tension

Check belt tension two times during the first 24 hours of operation and periodically thereafter. To adjust belt tension, simply loosen four fasteners (two on each side of the motor plate) and slide the motor plate away from the fan shaft until proper belt tension is attained. On some fans, fasteners attaching the motor to the motor plate must be loosened in order to adjust the belt.

It is very important that the drive pulleys remain in proper alignment after adjustments are made. Misalignment of pulleys will result in premature belt wear, noise, vibration and power loss.



Belt Alignment

Fasteners and Set Screws

A periodic inspection should include checking all fasteners and set screws for tightness. Particular attention should be paid to set screws attaching the wheel to the shaft.

Motors

Belt Drive:
Many fractional horsepower motors installed on the smaller fans are lubricated for life and require no further attention. Motors supplied with grease fittings should be greased according to directions printed on the motor.

Direct Drive:
Motor bearings are lubed for life, with no maintenance required.

If motor or wheel needs to be serviced or replaced, use the lifting lugs to pull assembly cartridge out.

Removal of Dust and Dirt

Dirt clogs cooling openings on the motor housing, contaminates bearing lubricant, and collects on the impeller causing severe imbalance if left unchecked. The exterior surface of the motor and impeller should be thoroughly cleaned periodically. Use caution and do not allow water or solvents to enter the motor or bearings. Under no circumstances should motors or bearings be sprayed with steam or water.

Fan Shaft Bearings

The bearings for Greenheck fans are carefully selected to match the maximum load and operating conditions of the specific class, arrangement, and fan size. The instructions provided in this manual and those provided by the bearing manufacturer will minimize any bearing problems. Bearings are the most critical moving part of the fan; therefore, special care is required when mounting them on the unit and maintaining them. Locking collars and set screws, in addition to fasteners attaching the bearing to the bearing plate must be checked for tightness. Greenheck Fan Corporation recommends bearings to be relubricated quarterly at a minimum. All Vektor-H and Vektor-HS fans use Mobil Mobilith SHC 100 synthetic grease conforming to NCGI Grade 2. Never mix greases made with different bases as this will cause a breakdown of the grease and possible failure of the bearing. For specific information, contact the factory representative or the fan system submittals.

- For conditions including temperatures, moisture, dirt or excessive vibration, consult the factory for a specific lubrication interval for your application.
- Lubricant should be a high quality lithium complex synthetic grease conforming to NLGI Grade 2.

- The use of non-synthetic grease will decrease lubrication intervals by approximately 3 times.
- Storage periods of 3 months or longer require monthly rotation of the shaft and purging grease prior to storage and start-up.

Recommended Bearing Lubrication Schedule Relubrication Schedule in Months*				
Fan Size	9 - 13	16 - 22	24	30 - 36
Fan RPM	Bearing Bore (inches)			
	½ - 1	1⅛ - 1½	1⅝ - 1⅞	1 15/16 - 2 3/16
to 250	12	12	12	12
500	12	12	12	12
750	12	12	12	12
1000	12	12	12	12
1250	12	12	12	12
1500	12	12	12	10
2000	12	10	8	6
2500	12	7	5	4
3000	12	5	3	2
3500	12	3	2	0.75
4000	12	2	0.5	
5000	12	1		
Number of shots of grease**	4	8	8	10

* Lubrication interval is based on 12 hour per day operation and maximum 160°F. housing temperature. For 24 hour per day operation, the interval should be cut in half.

** Lubricant should be added with the shaft rotating and until clean grease is seen purging from the bearing. The lubrication interval may be modified based on the condition of the purged grease. If bearing is not visible to observe purged grease, lubricate with number of shots indicated for bore size.

Damper and Damper Actuators

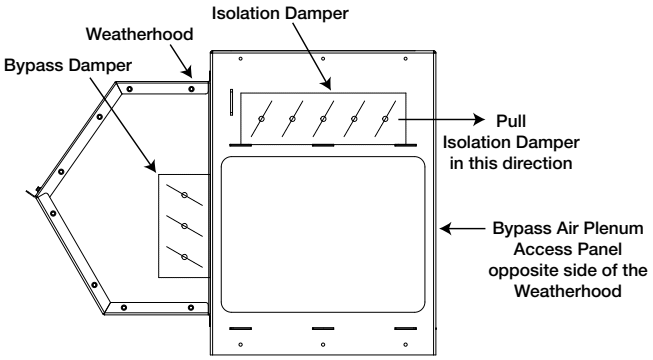
CAUTION

If performing maintenance on the dampers or replacing actuators, disconnect power to damper actuators.

If access is required to a gravity isolation damper, remove the panel opposite the weatherhood on the bypass air plenum section and slide the damper straight out toward you.

When performing maintenance on an isolation damper **with** an actuator, remove the bolted weatherhood, and disconnect the actuator from damper. Then remove the panel opposite the weatherhood on the bypass air plenum section and slide the isolation damper out.

Damper actuators, when supplied by Greenheck, are designed to be maintenance free. No lubrication is required.



Vektor-HS Nozzle Bearings

The bearings for the HS nozzle assembly are permanently lubricated and do not require additional grease.

Field Coating Touch-Up for Scratched Areas

Standard coating and color is LabCoat™ RAL 7023 Concrete Grey.

Failure to perform touch-ups may result in rust or corrosion which can accelerate color fade. This not covered under warranty.

TOUCH-UP PAINT REPAIR KIT CONTENTS

- One Zinc Clad Aerosol Can
- One pint (recoat epoxy primer grey) with one pint (recoat epoxy primer catalyst)
- One quart H.S. Polyurethane
- One Scotch-Brite scratch pad
- Two 1-1/2 inch wide paint brushes
- Four pint-sized empty cans for mixing
- One quart-sized empty can for mixing
- Zinc repair instructions
- MSDS sheets

NOTE

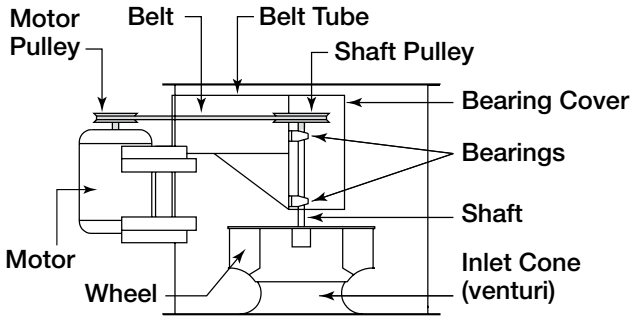
While the manufacturer provides heavy-duty, quality products for marine environments, routine paint touch-ups may be required in coastal regions where salt or marine air could damage the coating. The severe environment will accelerate the damage from any scratches or chips and it is recommended that those be repaired immediately.

To order a coating repair kit, please reference part number **HAZ2597 PNT FIELD REPAIR KIT, RAL7023 CONCRETE GREY**. Please contact factory with your fan's serial number for colors other than our standard.

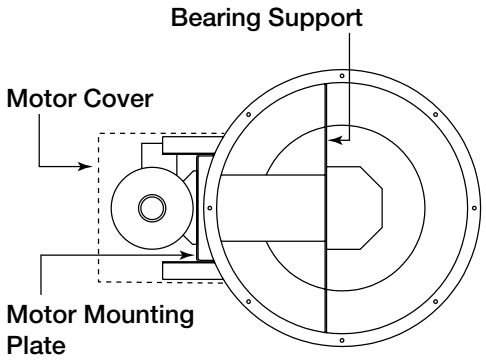
Vektor-H and Vektor-HS Exhaust Fan Parts List and Assembly

Each fan bears a manufacturer's nameplate with model number and serial number embossed. This information in addition to the parts list shown, will assist the local sales representative and the factory in providing service and replacement parts.

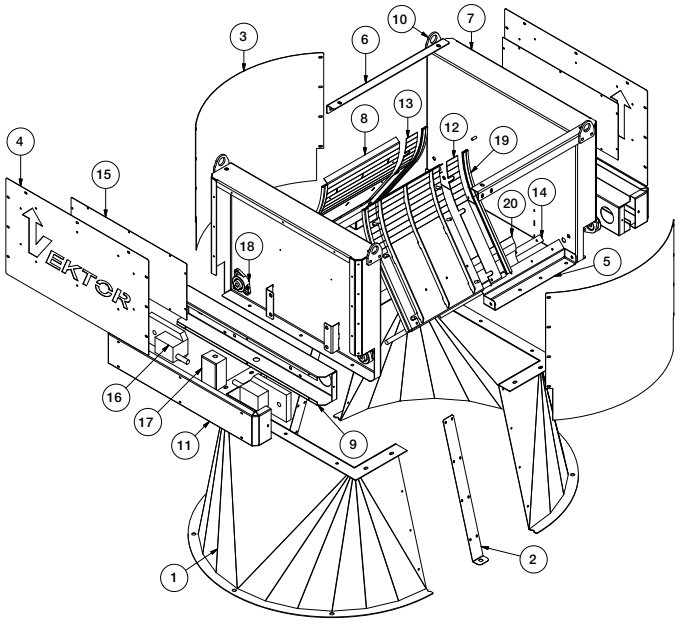
Side View

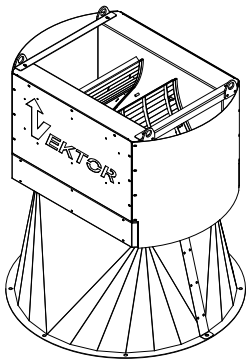


Top View



Vektor-HS Nozzle Parts List and Assembly





Item	Quantity	Description
1	2	Transition Weld
2	2	Transition side cover
3	2	Wind wrap round
4	2	Wind wrap flat
5	2	Frame bottom bar
6	2	Frame top bar
7	2	Frame weld
8	2	Blade weld
9	1 or 2*	Actuator mount
10	4	Lifting point
11	1 or 2*	Actuator cover
12	2	Blade seal, right
13	6	Blade seal, left
14	4	Flex backing
15	2	Vektor backing
16	1 or 2*	Actuator
17	1	Electrical box
18	4	Bearing
19	4	Blade seal
20	2	Flex seal

*Quantity 1 for sizes 9 thru 13
Quantity 2 for sizes 16 thru 36

Maintenance Log

Date _____Time _____ AM/PM

Notes:_____

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Date _____Time _____ AM/PM

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Our Commitment

As a result of our commitment to continuous improvement, Greenheck reserves the right to change specifications without notice.

Product warranties can be found online at Greenheck.com, either on the specific product page or in the literature section of the website at Greenheck.com/Resources/Library/Literature.

Greenheck's Vektor-H and Vektor-HS,Vektor-MS and Vektor-CS catalogs provides additional information describing the equipment, fan performance, available accessories, and specification data.

AMCA Publication 410-96, Safety Practices for Users and Installers of Industrial and Commercial Fans, provides additional safety information. This publication can be obtained from AMCA International, Inc. at www.amca.org.

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Installation, Operation and Maintenance Manual

Please read and save these instructions for future reference. Read carefully before attempting to assemble, install, operate or maintain the product described. Protect yourself and others by observing all safety information. Failure to comply with these instructions will result in voiding of the product warranty and may result in personal injury and/or property damage.

Sure-Aire™ Electronics Features:

- NEMA-4/IP56 enclosure rating
- Factory calibrated
- 24 VDC/24 VAC or 100-240 VAC 50/60 Hz input voltage
- Part numbers and pressure ranges:
  - 386719 – 0-4.15 in. wg
  - 386720 – 0-8.30 in. wg
  - 386721 – 0-22.14 in. wg
  - 386722 – 0-41.52 in. wg
  - 386723 – 0-83.14 in. wg
  - 386724 – 0-138.40 in. wg

Pressure ranges reflect differential pressures between the fan inlet and inlet cone, not system static pressure.

- Isolated output transmitter linear to differential pressure or volume
  - 4-20 mA
  - 2-10 VDC
- Communication protocols
  - BACnet MSTP
  - Modbus
- LCD display with user-friendly touch panel interface
- Temperature compensation for air density
- Remote duct temperature sensor
- Programmable elevation
- English or metric readings

Hardware Required:

- Four (4) #8-32 screws
- 1/4-inch nylon tubing (length dependent on distance between fan and Sure-Aire electronics, maximum 75 feet *(23 m)* each line)
- Sensor wiring for temperature sensor (if temperature sensor is being used)

Flow Accuracy +/- 3.0% of actual flow

Transducer in Electronics:

- Accuracy +/- 0.5% of full scale at 77°F (*25°C*)
- Pressure limit: 70 psi (1938 in. wg)
- Thermal effects: 0.015%/°F (*0.027%/°C*) from -13° thru 185°F (*25° thru 85°C*)

WARNING

Improper installation, adjustment, alterations, service or maintenance may cause injury and/or property damage, as well as possibly void the factory warranty. No person may install, operate, or maintain a Sure-Aire™ electronics without first being fully trained and qualified in the installation, operation and maintenance, and carefully reading and understanding the contents of this manual. If you have any questions about these instructions, contact your local representative.

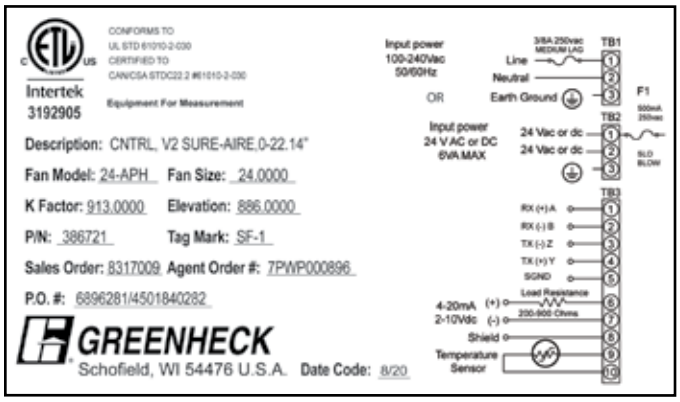
CAUTION

Risk of electrical shock! More than one disconnect switch may be required to de-energize the equipment before servicing.

Table of Contents

Label Information 2
General Information 3
Installation and Setup 3
Menu Structure. 6
Display Setting Options and Parameter Setup 8
4-20 mA Transmitter Calibration Procedure 12
2-10 VDC Transmitter Calibration Procedure 13
Temperature Sensor 14
Network Protocol - Optional 14
Analog Output Signal - Optional. 15
Calculation Using Manual Pressure Gauge or Third Party Transducer 15
K-Factors. 16

Label Information



Match the Tag Mark on the Sure-Aire electronics tag to the Tag Mark on the fan nameplate. Sure-Aire electronics are supplied set-up individually for a specific model and performance. Contact factory if Sure-Aire electronics are being used on a different Tag Mark then specified.

General Information

This instruction manual provides installation, operating, maintenance, and other information for the Sure-Aire™ series differential pressure electronics.

Receiving

Upon receiving the electronics, check to ensure all items are accounted for by referencing the packing list. Inspect each crate or carton for shipping damage before accepting delivery. Alert the carrier of any damage detected. The customer will make notification of damage (or shortage of items) on the packing list and all copies of the bill of lading which is countersigned by the delivering carrier. If damaged, immediately contact your local sales representative. Any physical damage to the unit after acceptance is not the responsibility of the manufacturer.

Unpacking

Verify that all required parts and the correct quantity of each item have been received. If any items are missing, report shortages to your local representative to arrange for obtaining missing parts.

Storage

Electronics are protected against damage during shipment. If the electronics cannot be installed and operated immediately, precautions need to be taken to prevent deterioration during storage. The user assumes responsibility of the electronics and any accessories while in storage. The manufacturer will not be responsible for damage during storage. These suggestions are provided solely as a convenience to the user.

The ideal environment for the storage of electronics is indoors, above grade, in a low humidity atmosphere which is sealed to prevent the entry of blowing dust, rain or snow. Temperatures should be evenly maintained between 30° to 110°F (*-1° to 43°C*). Wide temperature swings may cause condensation and “sweating” of metal parts. All accessories must be stored indoors in a clean, dry atmosphere.

Removing from Storage

As electronics are removed from storage to be installed in their final location, they should be protected and maintained in a similar fashion until the control goes into operation. Environmental Operation Range: -4° to 140°F (*-20° to 60°C*).

Installation and Setup

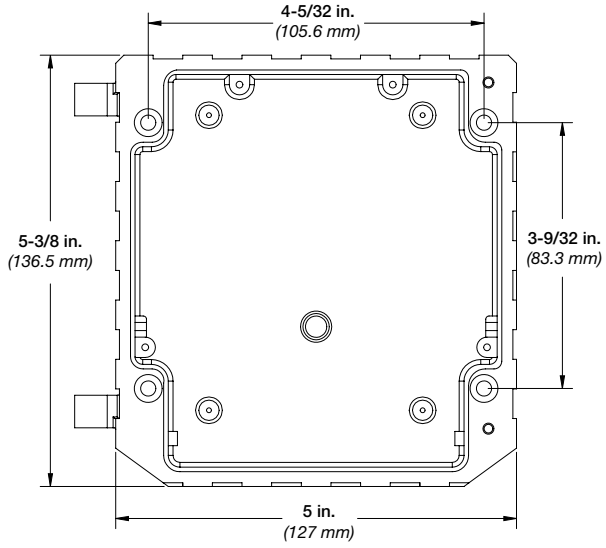
WARNING

When wiring the electronics, you must follow industry standard practices for controls and protect against electrostatic discharge (ESD). Failure to exercise good ESD practices may cause damage to the electronics.

1. Mount the electronics in the vertical plane using four (4) #8-32 screws, field supplied. Open the front cover by unscrewing the two captive thumb screws to gain access to the four mounting locations.

   Note: Mount the Sure-Aire™ electronics within 75 feet of the termination plate on the fan.

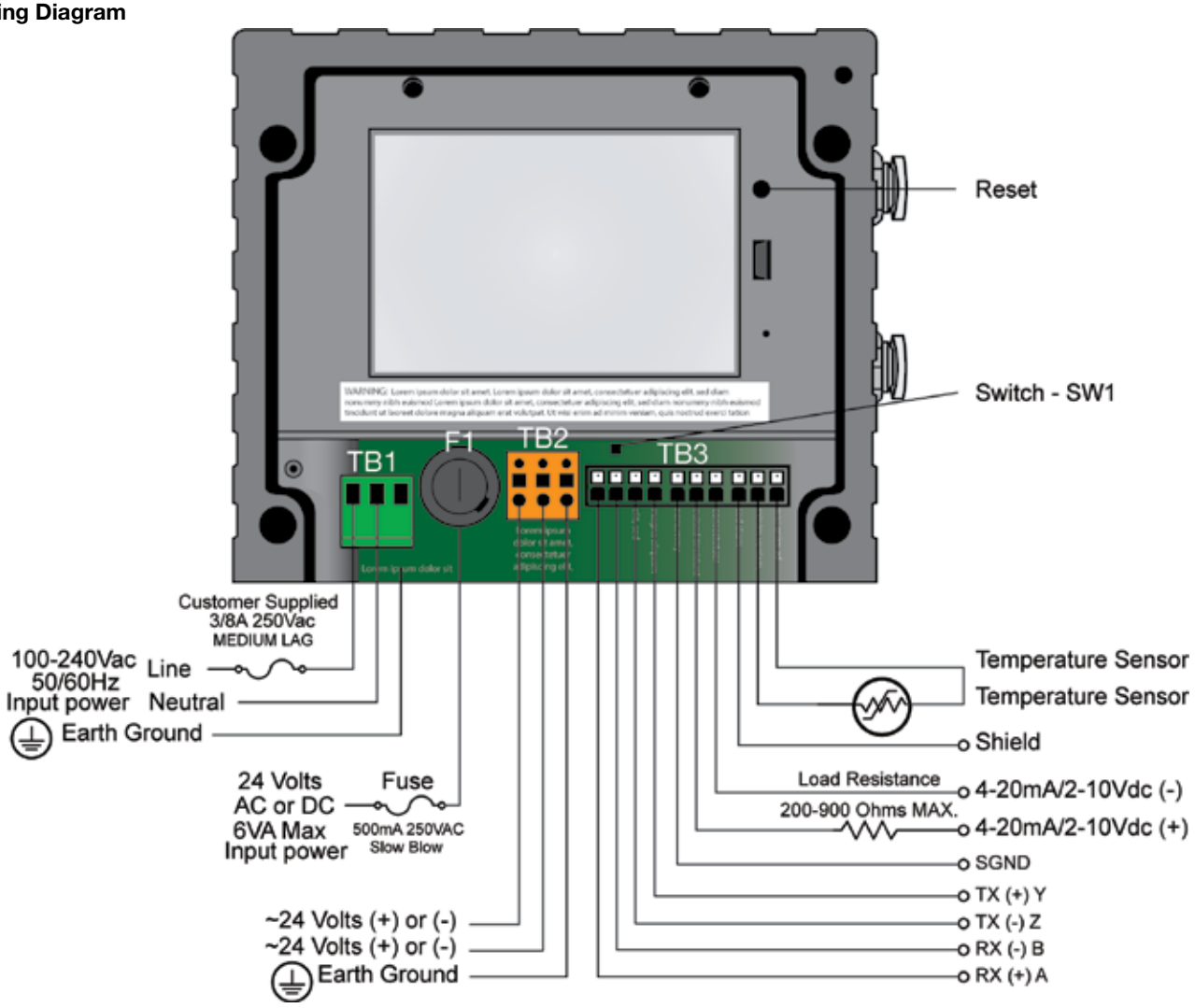
Dimensions and Hole Mounting Pattern



2. Use 1/4-inch nylon tubing to connect the corresponding High (H) and Low (L), 1/4-inch quick connect, pressure ports of the Sure-Aire electronics to the high and low pressure ports on the fan.

Installation and Setup (continued)

Wiring Diagram



3. Remove terminal block TB1 and perform wiring for the pins if you are using AC. If using low voltage AC/DC, plug the wires into TB2. For liquid tight applications, use only 1/2-inch liquid tight conduit.

   Terminal Block TB1: AC Input Power:
   Pin 1 = 100-240VAC Line
   Pin 2 = 100-240VAC Neutral
   Pin 3 = Earth Ground

   Terminal Block TB2: Low Voltage AC/DC Input Power:
   Pin 1 = 24V, AC or DC (+ or -)
   Pin 2 = 24V, AC or DC (+ or -)
   Pin 3 = Earth Ground

4. Provide power to the electronics to turn it on.
5. Select the desired Output Signal of the electronics for the Building Automation System. Use the touch screen to select the 4-20 mA or 2-10 VDC output signal via the monitor's setup menu. (Refer to Setup Menu, Output Signal, page 9).
6. Wire TB3 appropriately for the selected Output Signal in Step 5.

   Terminal Block TB3: Transmitter/Temperature Sensor:
   Pin 6 = 4-20 mA or 2-10 VDC (+) (output)

   Note: 4 to 20 mA requires a load resistor 200-900 ohms
   Pin 7 = 4-20 mA or 2-10 VDC (+) (output)
   Pin 8 = Shield
   Pin 9 = Remote Temperature Sensor (input)
   Pin 10 = Remote Temperature Sensor (input)

   Note: Signal isolator may be required when two or more output signals share a common connections at the PLC/electronics.

7. Select the desire network protocol of the electronics for the Building Automation System. Use the touch screen to select Modbus/BACnet, baud rate, and the network address of the electronics. This is done via the setup menu. (Refer to Setup Menu, Output Signal, page 9)

8. Wire TB3 appropriately if the networking features of the electronics are being used. There are two wiring options for the network protocol: 2-Wire and 4-Wire. The currently selected option is based on the position of SW1.

   Switch SW1: 2-Wire/4-Wire Select:

   Left Position = 2-Wire
   Right Position = 4-Wire

   Terminal Block TB3: 4-Wire Communication:

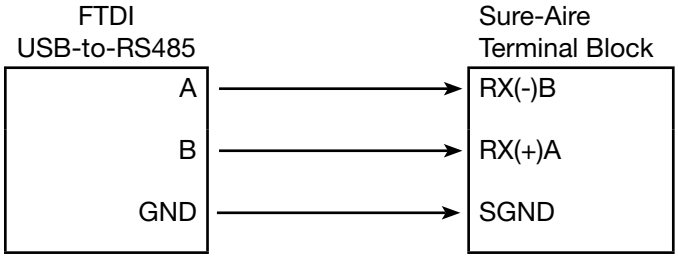
   Pin 1: RX+ (A)
   Pin 2: RX- (B)
   Pin 3: TX- (Z)
   Pin 4: TX+ (Y)
   Pin 5: Signal Ground (SGND)

   Terminal Block TB3: 2-Wire Communication:

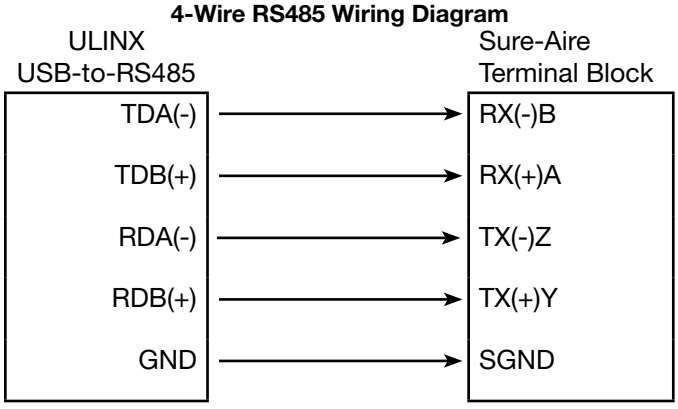
   Pin 1 or Pin 4: RX+ (A)/TX+ (Z)
   Pin 2 or Pin 3: RX- (B)/TX- (Y)
   Pin 5: Signal Ground (SGND)

9. If not using temperature compensation, change Temperature Compensation to “No” via the setup menu. If temperature compensation is desired, mount the provided temperature sensor in contact with the airstream. Wire the temperature sensor into TB3 and confirm Temperature Comp is “Yes” via the setup menu. (Refer to Setup Menu, Temperature Compensation, page 9).
10. When the above steps are completed, make sure the front cover is properly aligned to the housing and the two captive thumbscrews are securely tightened.

2-Wire RS485 Wiring Diagram



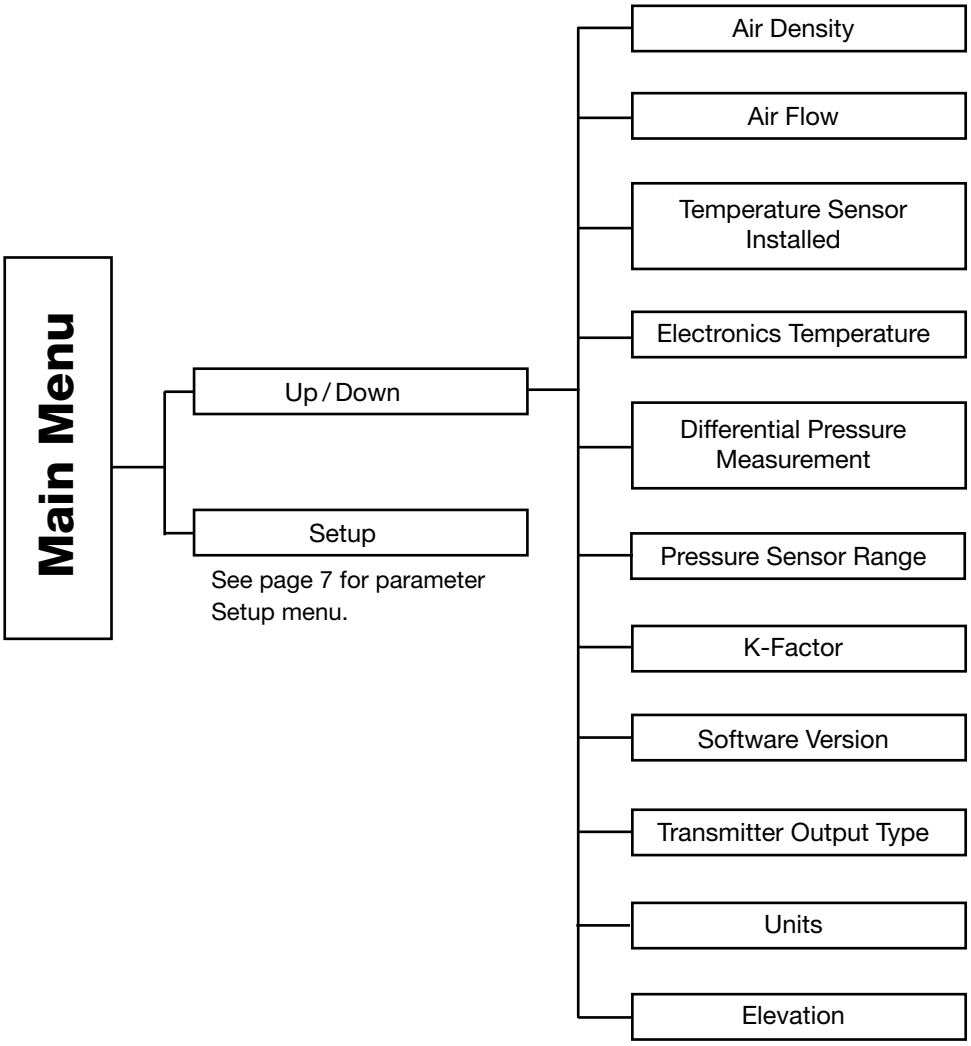
4-Wire RS485 Wiring Diagram

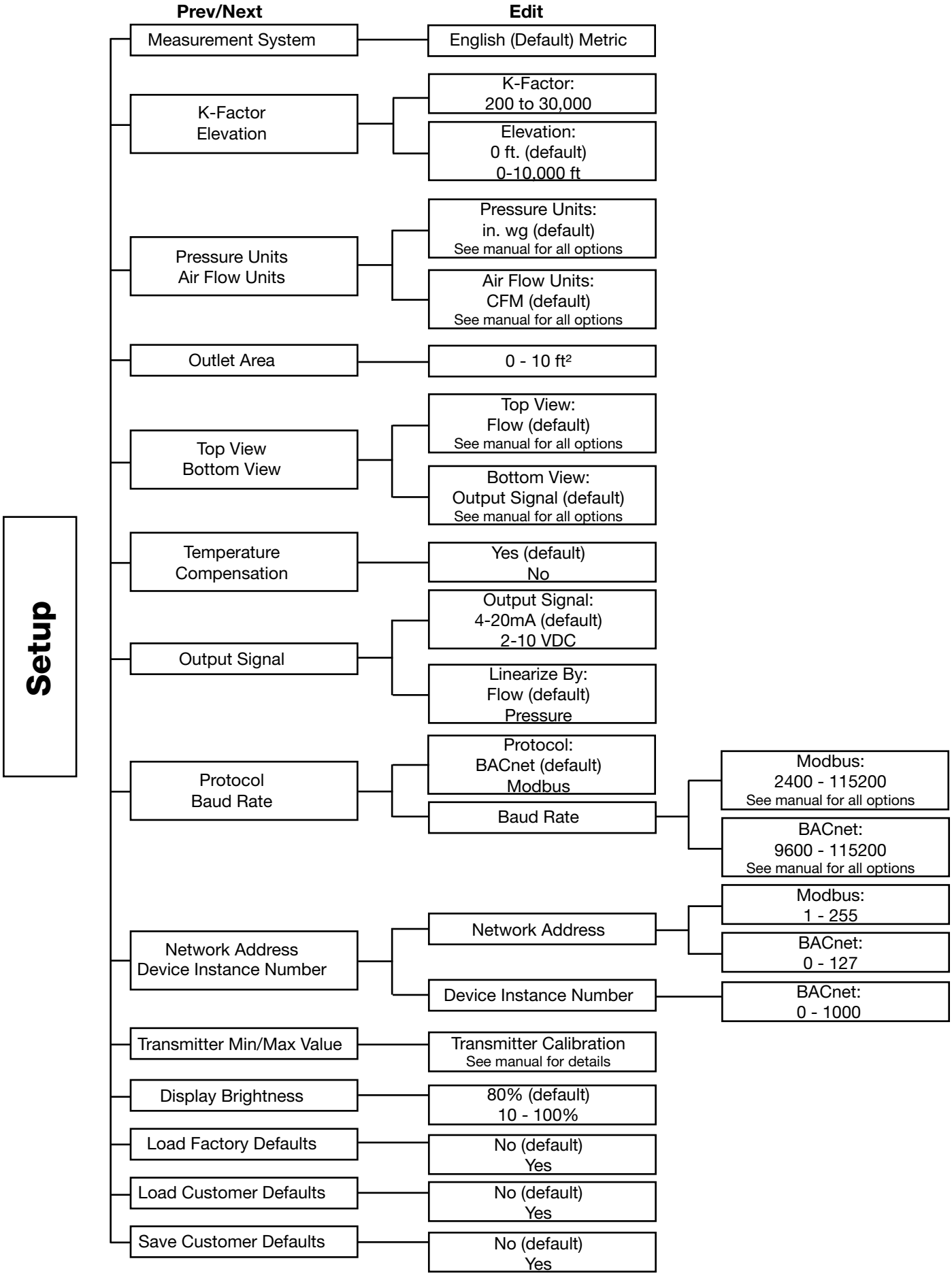


Network Input Register Address

Object Name	Modbus	BACnet
	16-bit address	16-bit address
K Factor	0	0
Elevation	1	1
Outlet Area	3	2
Flow Temperature	2	3
Pressure	4	4
Volume	5	5
Velocity	6	6

Menu Structure



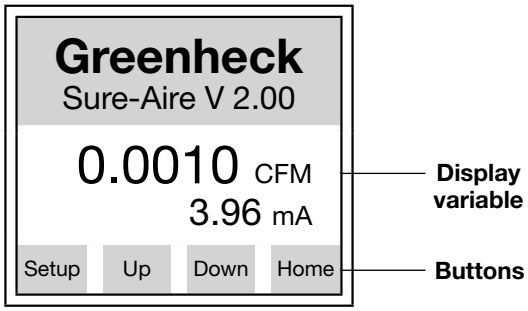

Prev/Next
Edit
Setup
Measurement System
English (Default) Metric
K-Factor
Elevation
K-Factor:
200 to 30,000
Elevation:
0 ft. (default)
0-10,000 ft
Pressure Units
Air Flow Units
Pressure Units:
in. wg (default)
See manual for all options
Air Flow Units:
CFM (default)
See manual for all options
Outlet Area
0 - 10 ft²
Top View
Bottom View
Top View:
Flow (default)
See manual for all options
Bottom View:
Output Signal (default)
See manual for all options
Temperature
Compensation
Yes (default)
No
Output Signal
Output Signal:
4-20mA (default)
2-10 VDC
Linearize By:
Flow (default)
Pressure
Protocol
Baud Rate
Protocol:
BACnet (default)
Modbus
Baud Rate
Modbus:
2400 - 115200
See manual for all options
BACnet:
9600 - 115200
See manual for all options
Network Address
Device Instance Number
Network Address
Modbus:
1 - 255
BACnet:
0 - 127
Device Instance Number
BACnet:
0 - 1000
Transmitter Min/Max Value
Transmitter Calibration
See manual for details
Display Brightness
80% (default)
10 - 100%
Load Factory Defaults
No (default)
Yes
Load Customer Defaults
No (default)
Yes
Save Customer Defaults
No (default)
Yes

Display Setting Options and Parameter Setup

Navigation Buttons

The monitor is equipped with a touchscreen LCD display. There are 4 navigation buttons on the bottom of the screen. Button names will change based on the parameter you are in (i.e. “Setup” will change to “Home” and “Home” will change to “Edit”).

Home Screen



To view display variables, use the “Up” and “Down” buttons to scroll through the list. To adjust parameters, press “Setup” and scroll through the settings.

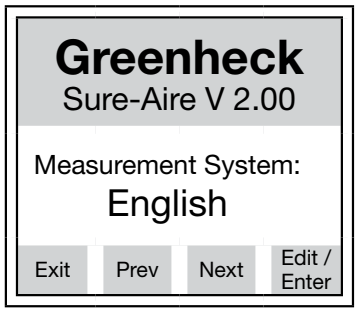
- Air density
- Flow
- Temperature sensor installed
- Electronics temperature
- Differential pressure measurement
- Pressure sensor range
- K-Factor
- Software version
- Transmitter output type
- Units
- Elevation

Press “Home” to return to the main screen.

Setup Menu

Following is information on the adjustable parameters that can be changed in the Setup menu of the electronics.

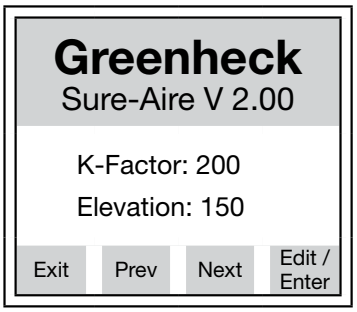
Measurement System



Press “Edit“ to change the measurement system units. Press “Prev“ or “Next“ to adjust, then press “Enter“ to store the value.

- English (default)
- Metric

K-Factor and Elevation



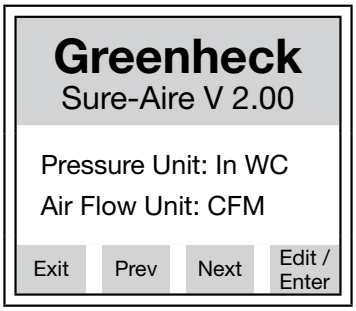
K-Factor: Press “Edit“ to change K-Factor. Press “Inc“ or “Dec“ to adjust, then press “Enter“ to store the value.

- 200 to 30,000
  (Factory set to fan model and size)

Elevation: Press “Edit“ to change elevation. Press “Inc“ or “Dec“ to adjust, then press “Enter“ to store the value.

- 0 - 10,000 ft
  (0 ft default)

Pressure and Air Flow Units



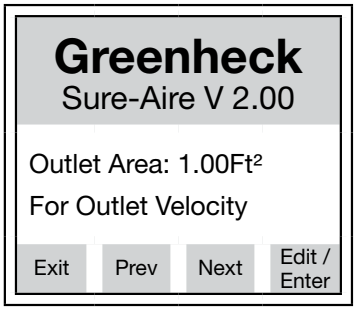
Pressure Units: Press “Edit” to change pressure units. Press “Prev” or “Next” to adjust, then press “Enter” to store the value.

- In. wg (default)
- Ft wg
- mm wg
- cm wg
- PSI
- In. Hg
- mm Hg
- mBar
- Pa
- kPa - kilopascals (1kPa = 1000 Pa)
- hPa - hectopascals (1hPA = 100 Pa)
- Oz. In.

Air Flow Units: Press “Edit” to change Air Flow Units. Press “Prev” or “Next” to adjust, then press Enter to store the value.

- CFM (default)
- m^3/hr
- m^3/min

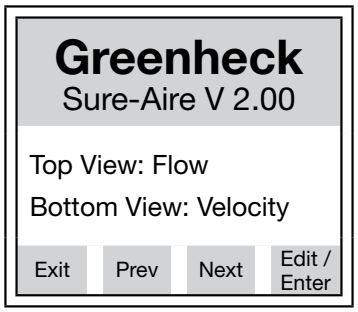
Outlet Area



Press “Edit“ to change the stack outlet area. Press “Inc“ or “Dec“ to increase or decrease the area, respectively. Then press “Enter“ to store the value.

- 0-10 Ft²

Top and Bottom Views

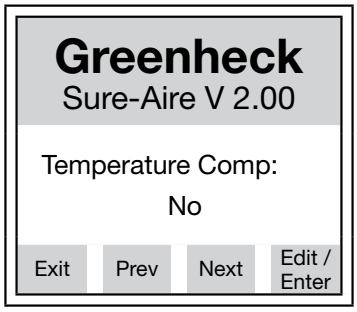


Top View: Press “Edit“ to change Main Display Value. Press “Prev“ or “Next“ to adjust what reading displays on the Home screen, then press “Enter“ to store the value.

- Flow (default top display)
- Pressure
- Temperature
- Air density
- Output signal (default bottom display)
- Velocity
- None

Bottom View: Press “Edit” to change Secondary Display. Press “Prev” or “Next” to adjust, then press “Enter” to store the value.

Temperature Compensation

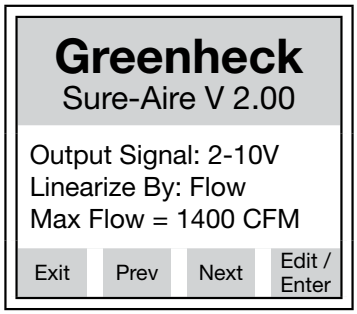


Press “Edit“ to change Temperature Compensation. Press “Prev“ or “Next“ to adjust, then press “Enter“ to store the value.

- Yes (default)
- No

Note: If temperature compensation is set to “No“, the air density will be a function of standard temperature (70°F/*21°C*).

Output Signal



Output Signal: Press “Edit“ to change Output Signal type. Press “Prev“ or “Next“ to adjust, then press “Enter“ to store the value.

- 4-20 mA (default)
- 2-10 VDC

Linearize By: Press “Edit“ to change the linearization settings. The electronics will linearize the transmitter output with respect to this setting.

- Flow (default)
- Pressure

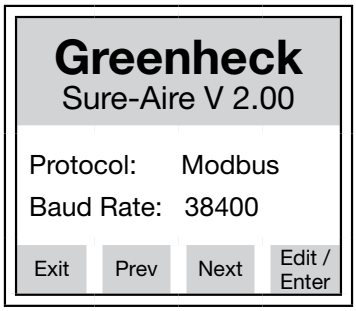
Note: The maximum measurable flow rate will automatically calculate based on the electronics settings. The maximum flow rate is displayed on the screen.

WARNING

Due to load resistance change from product to product, it may be necessary to recalibrate the 4-20 mA electronics. See 4-20 mA transducer calibration procedure.

Display Setting Options and Parameter Setup (continued)

Protocol and Baud Rate



Protocol: Press “Edit“ to change the current network protocol. Press “Prev“ or “Next“ to adjust, then press “Enter“ to store the value.

- BACnet (default)
- Modbus

Baud Rate: Press “Edit“ to change the protocol baud rate. Press “Prev” or “Next” to adjust, then press “Enter” to store the value.

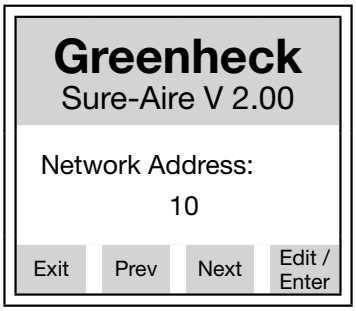
Baud Rate Options (Modbus):

- 2400
- 4800
- 9600
- 19200
- 38400
- 57600
- 115200

Baud Rate Options (BACnet):

- 9600
- 19200
- 38400
- 57600
- 76800
- 115200

Network Address



Press “Edit“ to adjust the network address, then press “Enter“ to store the value.

Network Address Options (Modbus):

- 1 – 255

Network Address Options (BACnet):

- 0 – 127

Note: The protocol and baud rate must be set before the network address can be modified.

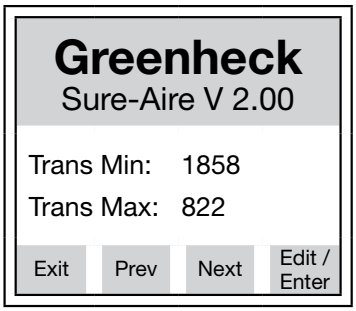
Device Instance Number (BACnet only):

The instance number is an unsigned decimal number that can range from 0 to 4,194,302. Every device on a BACnet network gets an instance number, and two devices must not have the same number.

Press “Edit” to adjust the Device Instance Number, then press “Enter” to store the value.

- 0 - 4,194,302

Transmitter Min/Max Value



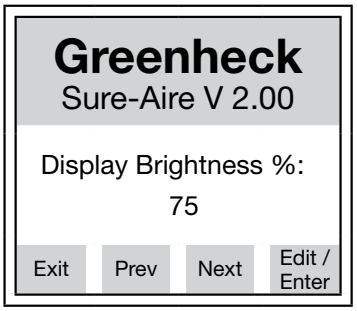
Transmitter Min Value: Press “Edit” to change Transmitter Min Value. Press “Inc” or “Dec” to adjust, then press “Enter” to store the value.

Note: See Transmitter Calibration Section.

Transmitter Max Value: Press “Edit” to change Transmitter Max Value. Press “Inc” or “Dec” to adjust, then press “Enter” to store the value.

Note: See Transmitter Calibration Section.

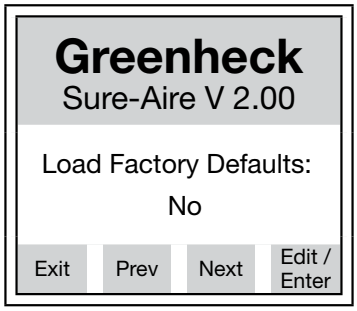
Display Brightness



Press “Edit“ to change brightness. Press “Inc“ or “Dec“ to adjust, then press “Enter“ to store the value.

- 10 - 100%
  (80% default)

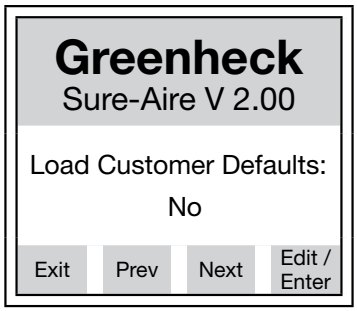
Load Factory Defaults



Press “Edit“ to load factory defaults. Press “Prev“ or “Next“ to select “Yes“,
then press “Enter“**.**

- No (default)
- Yes (changes all settings to factory default)

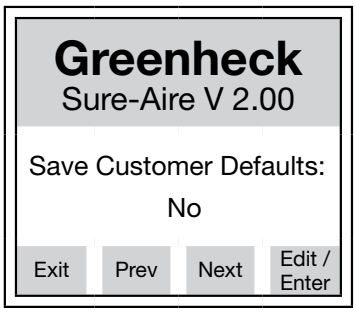
Load Customer Defaults



Press “Edit“ to load customer defaults. Press “Prev“ or “Next“ to select “Yes“,
then press “Enter“.

- No (default)
- Yes (loads all customer default settings)

Save Customer Defaults



Press “Edit“ to save current electronics settings as the customer default.
Press “Prev“ or “Next“ to select “Yes“, then press “Enter“.

- No (default)
- Yes (saves current settings as the customer default)

4-20 mA Transmitter Calibration Procedure

WARNING

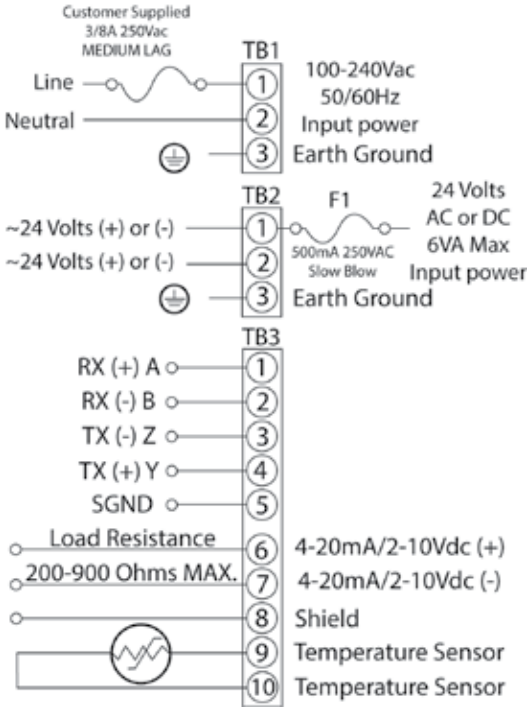
Due to load resistance change from product to product, it may be necessary to recalibrate the 4-20 mA transmitter.

1. Test Equipment

   1.1 Digital multimeter - set multimeter to read mA DC.

   1.2 Load resistor - select a series load resistor between 200 and 900 ohms.

2. Interconnect wiring



   2.1 Validate the electronics is set up for 4-20 mA output signal.

   2.2 Validate the power is OFF on the DC power supply and the Sure-Aire electronics.

   2.3 Validate the multimeter is set to read mA DC.

   2.4 Select a series Load Resistor between 200 and 900 ohms and install one end to TB3-6.

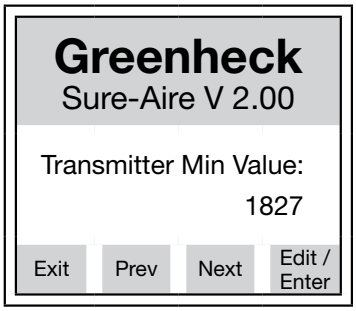
   2.5 Interconnect the multimeter (+) probe to the other end of the load resistor.

   2.6 Interconnect the multimeter (-) probe to TB3-7 to complete the current loop.

   2.7 Apply power to the Sure-Aire electronics.

   2.8 Press the “Setup” button on the touch panel interface.

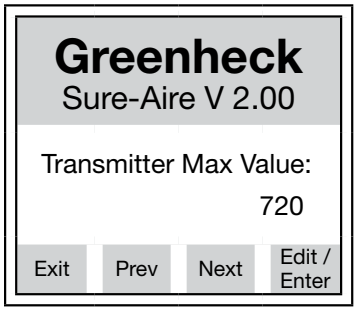
   2.9 Keep pressing the “Next” button until you reach the Transmitter Min Value parameter screen.



   2.10 Press “Edit”, then “Inc” or “Dec” until the digital multimeter reads exactly 4.00 mA.

   2.11 Press “Enter” to store the new value.

   2.12 Press “Next”.



   2.13 On the Transmitter Max Value screen, press “Edit”, then “Inc” or “Dec” until the digital multimeter reads exactly 20.00 mA.

   2.14 Press “Enter” to store the new value.

   2.15 Press “Exit” to return to the main screen.

The 4-20 mA transmitter calibration is complete.

NOTE

Apply a vacuum to the Low Port and the 4-20 mA transmitter to track the span of the pressure range.

For example, the Sure-Aire electronics with a pressure sensor of 0 - 41.51 in. wg installed, 4.00 mA = 0 in. wg, 20.00 mA = 41.52 in. wg.

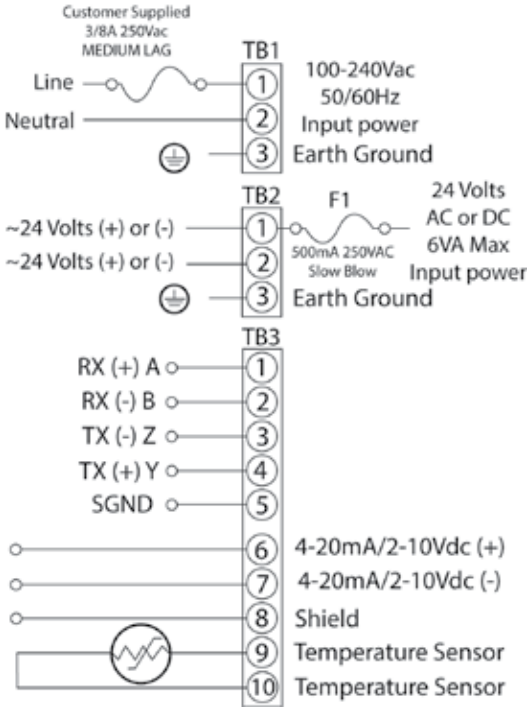
2-10 VDC Transmitter Calibration Procedure

1. Test Equipment

   1.1 Digital multimeter - set multimeter to read DC voltage.

   1.2 Make sure Output Signal type is set to 2-10 VDC.

2. Interconnect wiring



   2.1 Validate the power is OFF on the DC power supply and the Sure-Aire electronics.

   2.2 Validate the multimeter is set to read DC voltage.

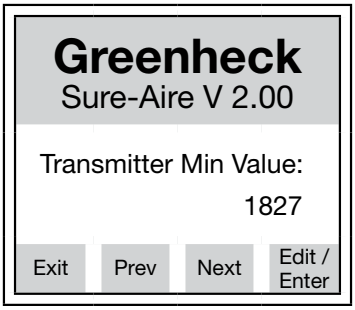
   2.3 Interconnect the multimeter (+) probe to TB3-6.

   2.4 Interconnect the multimeter (-) probe to TB3-7.

   2.5 Apply power to the Sure-Aire electronics.

   2.6 Press the “Setup” button on the touch panel interface.

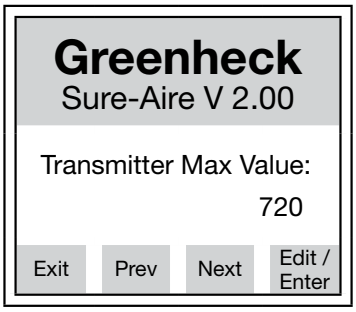
   2.7 Keep pressing the “Next” button until you reach the Transmitter Min Value screen.



   2.8 Press “Edit”, then “Inc” or “Dec” until the digital multimeter reads exactly 2.00 VDC.

   2.9 Press “Enter” to store the new value.

   2.10 Press “Next”.



   2.11 On the Transmitter Max Value screen, press “Enter”, then “Inc” or “Dec” until the digital multimeter reads exactly 10.00 mA.

   2.12 Press “Enter” to store the new value.

   2.13 Press “Exit” to return to the main screen.

The 2-10 VDC transmitter calibration is complete.

NOTE

Apply a vacuum to the Low Port and the 2-10 VDC transmitter to track the span of the pressure range.

For example, the Sure-Aire electronics with a pressure sensor of 0 - 41.51 in. wg installed, 2 VDC = 0 in. wg, 10 VDC = 41.52 in. wg.

Temperature Sensor

Interconnect the remote temperature sensor by connecting the temperature sensor to pins 4 and 5 of TB2. The Remote Temperature Sensor will adjust the air density value in the differential pressure electronics based on the sensor measurement when Temperature Compensation is set to “Yes”. This density compensation will affect the flow rate accordingly. If Temperature Compensation is set to “No”, the air density value will be a function of standard air. (70°F/21°C).

Network Protocol - Optional

Greenheck’s Sure-Aire™ electronics has the ability to connect to a Building Automation System (BAS) through the on-board RS-485 port. The electronics can be configured as either BACnet MS/TP or Modbus RTU Slave. When in the display menu, scroll through the options until the Network Protocol screen. Pressing edit will permit changing the network protocol type and associated data. This information should be set to match the BAS.

BACnet MS/TP Server

When the electronics is configured for BACnet, it will expose a total of eight (8) objects on the network.

BACnet MS/TP Server Device Settings	
Setting	Value
Baud Rate	Set to match BMS
Parity	No Parity (1 Stop Bit)
APDU Timeout (ms)	1000
Number of APDU Retries	3
Max Master Address	127
Max Info Frames	1

BACnet MS/TP Server Objects			
Object Name	Object Type	Data Type	Units
Sure-Aire™	Device Object	N/A	N/A
K-Factor	Analog Input	16-Bit Unsigned	None
Elevation	Analog Input	16-Bit Unsigned	None
Outlet Area	Analog Input	32-Bit Floating Point	None
Flow Temperature	Analog Input	16-Bit Signed	None
Pressure	Analog Input	32-Bit Floating Point	None
Volume	Analog Input	32-Bit Floating Point	None
Velocity	Analog Input	32-Bit Floating Point	None

Modbus RTU Slave

When the electronics is configured for Modbus, it will expose a total of seven (7) registers on the network. The Modbus RTU Slave settings and list of registers can be seen below.

Modbus RTU Slave Device Settings	
Setting	Value
Baud Rate	Set to match BMS
Parity	No Parity (1 Stop Bit)
Timeout (ms)	0
Response Delay (ms)	0

Modbus RTU Slave Registers			
Register Name	Register Type	Data Type	Units
K-Factor	Input Register	16-Bit Unsigned	None
Elevation	Input Register	16-Bit Unsigned	None
Outlet Area	Input Register	16-Bit Unsigned	None
Flow Temperature	Input Register	16-Bit Unsigned	None
Pressure	Input Register	16-Bit Unsigned	None
Volume	Input Register	16-Bit Unsigned	None
Velocity	Input Register	16-Bit Unsigned	None

NOTE

All of the objects/registers that are exposed on the network do not have a unit associated with them. The units of the values exposed on the network will be based on the units that are selected on the Sure-Aire™ electronics.

Analog Output Signal - Optional

Greenheck's Sure-Aire™ differential pressure electronics provides either a 2-10 VDC or 4-20 mA analog output signal. The output signal can be configured linearly proportional to either the pressure range or the flow within the setup. The ranges for Greenheck's Sure-Aire™ electronics are listed by model on cover.

Calculation Using Manual Pressure Gauge or Third Party Transducer

Calculating Flow from Differential Pressure

The volumetric flow through the fan (cfm) can be calculated from the equation:

$$CFM = K\sqrt{\frac{\Delta P}{\rho}}$$

where K is the K-Factor for the specific fan model and size, ΔP is the measured differential pressure across the inlet cone (in. wg), and ρ is the density of air (lb/ft³ °F). K-Factors for Greenheck models are found on the back cover.

Calculating Flow from Voltage Signal

If using the analog signal linear to flow, the max flow is automatically calculated based on the pressure range and K-factor input into the electronics. The max value is displayed in the setup menu.

If output signal is linear to pressure, the corresponding equations are used to calculate the flow.

Calculating flow for 2-10 VDC output signal:

$$CFM = K\sqrt{\frac{(V - 2)\ P_{max}}{8\rho}}$$

K	Constant dependent on fan model and size (see page 9)
Pmax	Maximum pressure of electronics (in. wg)
ρ	Air density (lb/ft³ °F) [0.075 at 70°F and 0 ft elevation]
V	Output voltage of 2-10 VDC signal
mA	Output current of 4-20 mA signal

Calculating flow for 4-20 mA output signal:

$$CFM = K\sqrt{\frac{(mA - 4)\ P_{max}}{16\rho}}$$

Density Corrections

Air density, ρ, is affected by elevation and temperature. The Sure-Aire differential pressure electronics allows the user to input the elevation for the application. This elevation input automatically updates the density used for the flow calculation.

The Remote Temperature sensor will adjust the air density value in the electronics based on the sensor measurement when Temperature Compensation is set to "Yes". This density compensation will affect the flow rate displayed on the transmitter. If Temperature Compensation is set to "No", the air density value will be a function of standard air (70°F/*21°C*).

The density being used by the Sure-Aire differential pressure measurement can be viewed on the main menu by scrolling up or down through the settings.

K-Factors

Size	APD	Size	APH / APM HPA	AFDW / BIDW	FJI	QEI / QEID	USF-500 & Vektor-C series	Vektor-H Belt Drive	Vektor-M series
315	257	7	not applicable	not applicable	179	not applicable	179	not applicable	not applicable
355	329	8	not applicable	not applicable	179	not applicable	179	not applicable	not applicable
400	406	9	not applicable	not applicable	179	408	179	248	not applicable
450	536	10	not applicable	not applicable	179	not applicable	179	202	not applicable
500	652	12	355	592	244	408	244	296	not applicable
560	847	13	not applicable	701	not applicable	not applicable	296	351	not applicable
630	1053	15	355	861	366	603	366	not applicable	526
		16	421	1062	not applicable	724	443	531	634
		18	517	1083	542	897	542		787
		20	617	1301	651	1088	651	not applicable	955
		22	759	1610	805	1321	805		1161
		24	913	1964	976	1631	976		1436
		27	1105	2369	not applicable	1962	1186	not applicable	1729
		30	1355	2928	not applicable	2400	1464		2116
		33	1625	3540	not applicable	2923	1771	not applicable	2581
		36	1967	4336	not applicable	3576	2167		3154
		40	2361	5259	not applicable	4331	2635	not applicable	3825
		44	2854	6440	not applicable	5318	3220	not applicable	4698
		49	3411	7808	not applicable	6525	3905	not applicable	5766
		54	4121	9571	not applicable	7891	4786	not applicable	6975
		60	4972	11707	not applicable	9648	5855	not applicable	not applicable
		66	5960	14166	not applicable	not applicable	7084	not applicable	not applicable
		73	7276	17330	not applicable	not applicable	8667	not applicable	not applicable

Vektor-H Direct Drive																
Fan Size	Nozzle Size															
	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
10	487	511	540	547	554	563	573	–	–	–	–	–	–	–	–	–
12	577	616	664	674	685	697	700	704	708	–	–	–	–	–	–	–
13	–	–	–	839	851	861	868	872	876	880	–	–	–	–	–	–
14	–	–	–	–	1223	1239	1257	1260	1263	1267	1272	–	–	–	–	–
16	–	–	–	–	1290	1409	1542	1563	1586	1587	1588	1597	1607	–	–	–
18	–	–	–	–	–	1923	1937	1952	1965	1979	1990	2003	1994	1983	1995	2007
20	–	–	–	–	–	2248	2296	2348	2367	2387	2408	2431	2432	2432	2429	2426

Our Commitment

As a result of our commitment to continuous improvement, Greenheck reserves the right to change specifications without notice.

Product warranties can be found online at Greenheck.com, either on the specific product page or in the literature section of the website at Greenheck.com/Resources/Library/Literature.

Greenheck's Sure-Aire™ Flow Monitoring System catalog provides additional information describing the equipment, fan performance, available accessories, and specification data.

AMCA Publication 410-96, Safety Practices for Users and Installers of Industrial and Commercial Fans, provides additional safety information. This publication can be obtained from AMCA International, Inc. at www.amca.org.

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Installation, Operation and Maintenance Manual

Please read and save these instructions for future reference. Read carefully before attempting to assemble, install, operate or maintain the product described. Protect yourself and others by observing all safety information. Failure to comply with these instructions will result in voiding of the product warranty and may result in personal injury and/or property damage.

Table of Contents

Reference part number listed in chart to locate specific motor information page number.

HP	Voltage	* RPM Range	Encl.	FLA	Control Method	Motor Part No.	Pg.
1/15	115-120/ 208-230	300-1750	TENV	1.3/0.65	0-5V Only	328447	5
					Pot Only	328448	5
1/10	115	300-1725	TENV	1.5	Pot/0-10V	318003	4
	115/208-230/277	300-1750	ODP	1.38/ 0.84/0.73	Pot/0-10V	319356	4
	115/208-230/277	350-1750	TENV	1.5/1.1/ 0.9	Pot/0-10V	328128	4
1/6	115/208-230/277	300-1750	ODP	2.2/1.3/ 1.1	Pot/0-10V	319357	4
	115/208-230/277	350-1750	TENV	2.3/1.5/ 1.2	Pot/0-10V	328129	4
	115	300-1750	TENV	2.6	Pot/0-10V	318004	4
				3.1	0-10V Only	311352	3
				3.1	Pot Only	311353	
				3.1	Pot/0-10V	311731	3
				2.45		312359	
						313712	
						317886	
	208-240	300-1750	TENV	1.6	Pot/0-10V	313233	3
						313713	
	277	350-1750	TENV	1.15	Pot/0-10V	316495	3
1/4	115/208-230/277	300-1750	ODP	2.85/ 1.7/1.5	Pot/0-10V	318013	4
	115/208-230/277	350-1750	ODP	4.2/2.6/ 2.4	Pot/0-10V	328130	4
	115	300-1725	ODP	3.9	0-10V Only	310107	3
					Pot Only	310108	
				3.5	Pot/0-10V	311377	3
						313714	
						317887	
	208-240	300-1725	ODP	2.3	Pot/0-10V	313234	3
						313715	
	277	300-1725	ODP	1.8	Pot/0-10V	316496	3
1/3	115/208-230/277	300-1750	ODP	4.4/2.6- 2.4/2.2	Pot/0-10V	320587	4
	115/208-230/277	350-1200	TENV	4.75/ 2.95/2.4	Pot/0-10V	328173	4
	115/208-230/277	350-1550	TENV	4.1/2.4 2.2	Pot/0-10V	328174	4
1/2	115	300-1725	ODP	6.2	0-10V Only	309025	3
				5.5	Pot Only	309028	
				6.2	Pot/0-10V	311812	3
	208-240	300-1725	ODP	4.2	Pot/0-10V	313235	3
	277	350-1725	ODP	3.3	Pot/0-10V	316497	3

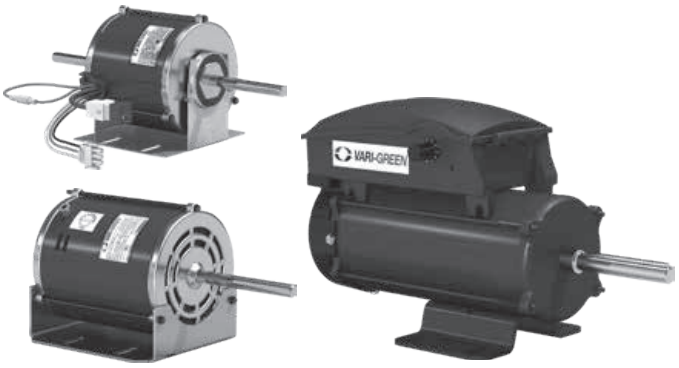
HP	Voltage	* RPM Range	Encl.	FLA	Control Method	Motor Part No.	Pg.
1/2	115	300-2500	ODP	4.0	0-10V Only	310307	3
				6.5	Pot Only	310476	
				6.9	Pot/0-10V	312360	3
	208-240	350-2500	ODP	4.9	Pot/0-10V	317706	3
	277	350-2500	ODP	3.27	Pot/0-10V	317707	3
	115/208-230/277	300-1750	ODP	6.4/3.8- 3.6/3.2	Pot/0-10V	320588	4
	115/208-230/277	350-1750	ODP	6.2/4.0/ 3.2	Pot/0-10V	328131	4
	115/208-230/277	350-2500	ODP	6.6/4.0/ 3.25	Pot/0-10V	328178	4
3/4	115	300-1725	ODP	10.1	0-10V Only	309026	3
				10.1	Pot Only	309029	
				10.6	Pot/0-10V	311388	3
						312619	
	208-240	300-1725	ODP	6.6	Pot/0-10V	314534	3
	277	350-1725	ODP	5.4	Pot/0-10V	316498	3
	115	300-2200	ODP	11.3	0-10V Only	310306	3
				11.3	Pot Only	310475	
				11.3	Pot/0-10V	312361	3
	208-240	350-2200	ODP	5.6	Pot/0-10V	317708	3
	277	350-2200	ODP	4.7	Pot/0-10V	317709	3
	115/208-230/277	300-1750	ODP	8.8/5.4- 5.0/4.8	Pot/0-10V	320589	4
	115/208-230/277	350-1750	ODP	11.0/ 7.0/6.3	Pot/0-10V	328132	4
	115/208-230/277	350-2200	ODP	10.5/ 6.5/5.0	Pot/0/10V	328179	4
1	115	300-1725	ODP	12.4	Pot/0-10V	310359	3
						312362	
	115/ 208-240	300-1725	TEFC	12.0/6.0	Pot/0-10V	311156	5
	208-240	300-1725	ODP	8.6	Pot/0-10V	314945	3
	277	350-1725	ODP	7.3	Pot/0-10V	316499	3
	115/208-230/277	300-1750	TENV	11.5/7.0- 6.5/5.8	Pot/0-10V	320590	4
	115/208-230/277	350-1750	ODP	13.0/ 8.0/6.7	Pot/0-10V	328133	4
2	208-240	300 - 1725	TEFC	12.0	Pot/0-10V	310420	5

*****Actual maximum RPM may vary. See RPM column in chart on page 11 for specific motor and fan combinations.

Controls 7-11
Maximum RPM Table 12

Vari-Green® Motor

The Vari-Green Motor is an electronically commutated (EC) motor that uses AC input power and internally converts it to a DC power supply which provides an 80% turndown capability and increased energy savings.



NOTE

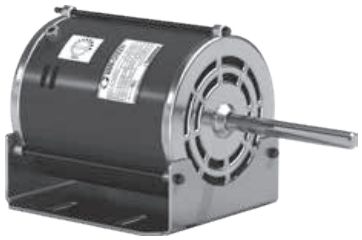
When using a clamp meter to measure input amp draw, the meter must be capable of reading a non-linear current. Erroneous readings will occur otherwise.

WARNING

To reduce the risk of fire or electric shock, do not use this motor with any solid-state speed control device.

Features, Operation and Wiring, and Troubleshooting

Features



Soft start – All motors feature soft-start technology which eliminates inrush current at start-up. The motors will reliably start at any speed setting.

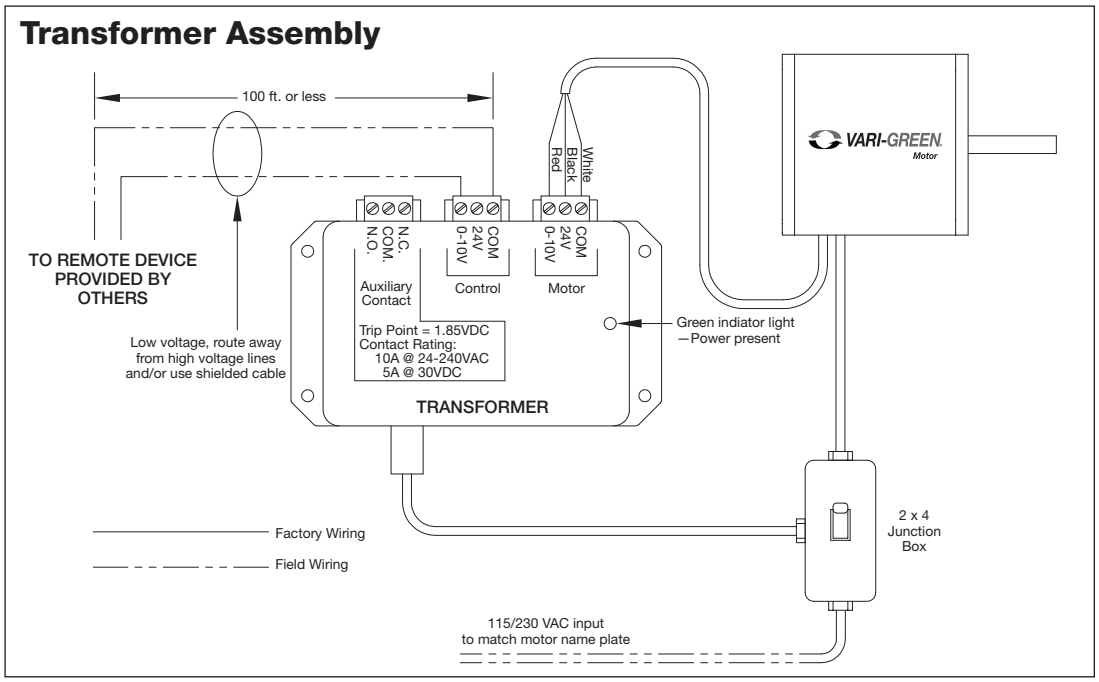
Overload protection – If the motor becomes overloaded, it will automatically reduce its speed until it is no longer overloaded. This means that the motor will never operate in the “service factor” which is possible with many AC motors.

Locked rotor protection – If the motor ever encounters a locked-rotor scenario, the motor will automatically shut itself down. It will try to restart up to 3 times, and if after the 3rd time the motor will still not rotate, the motor will not attempt to start again until power is cycled.

Thermal protection – The motors have a one-shot fuse thermal protector. This is meant to protect the motor from a severe temperature rise. Additionally, the motors have on-board temperature sensors which will reduce the speed of the motor should it become too hot. The fuse is used as a last resort to prevent a fire.

RPM measurement – The motors have a small shaft extension on the end of the motor to measure motor RPM with either a contact or optical tachometer.

Fig. 1 **0-10 VDC External connection with factory mounted transformer (See page 4 for details)**



Operation and Wiring
- Potentiometer Dial Only

Part Numbers Covered in this Section				
309028	309029	310108	310475	310476
311353				

These motors feature a potentiometer dial on the motor for speed adjustment. A small screwdriver can be used to make the speed adjustment. To increase the speed, rotate the dial clockwise. To decrease the speed, rotate the dial counterclockwise.

The motor is pre-wired at the factory and cannot be changed inside the motor. Connect single-phase power at the voltage listed on the nameplate.

These motors cannot be converted to receive a remote control signal – a different motor is needed. Please consult the factory.

Operation and Wiring
- 0-10V Input Only

Part Numbers Covered in this Section				
309025	309026	310107	310306	310307
311352				

These motors will accept a 0-10 VDC control signal for speed control. From 0-1.9V, the motor will be off, and will operate in the 2-10V range. 24 VAC/DC power is also required for operation. The motor will consume 0.7VA at 24 VAC or 25mA at 24 VDC. A factory mounted transformer is available to supply this voltage. (See Fig. 1)

The motor is pre-wired at the factory and cannot be changed inside the motor. Connect single-phase power at the voltage listed on the nameplate, along with the 0-10 VDC and 24V signal for speed control.

NOTE: The motor will not operate without the proper control voltages.

Operation and Wiring
- Potentiometer Dial and 0-10V Input

Part Numbers Covered in this Section				
310359	311731	311377	311388	311812
312359	312360	312361	312362	312619
313233	313234	313235	313712	313713
313714	313715	314534	314945	316495
316496	316497	316498	316499	317706
317707	317708	317709	317886	317887

These motors have both a potentiometer dial on the motor for speed adjustment AND have the ability to accept a 0-10 VDC signal for remote speed control.

There is a 4 second delay between the application of power and the motor starting.

The motor is pre-wired at the factory and cannot be changed inside the motor. Connect single-phase power at the voltage listed on the nameplate. If remote control is desired, connect the 0-10 VDC and 24V signal for remote speed control.

Dial on Motor – A small screwdriver can be used to make the speed adjustment. To increase the speed, rotate the dial clockwise. To decrease the speed, rotate the dial counterclockwise. There is no need to connect the control wires.

0-10 VDC signal – The dial on the motor must be rotated fully clockwise to achieve the full speed range. If this is not done, the dial will act as a maximum speed limiter.

From 0-1.9V, the motor will be off, and will operate in the 2-10V range. 24 VAC/DC power is also required for operation. The motor will consume 0.7VA at 24 VAC or 25mA at 24 VDC. A factory mounted transformer is available to supply this voltage. (See Fig. 1, page 2)

A low voltage wiring harness is needed to supply the 0-10V signal to the motor. This harness is available from the factory if conversion is necessary.

Low Voltage Harness Part Numbers			
Type	**Use with Motor**	**18 in. long**	**36 in. long**
3-pin	311731, 310359	384431	384432
9-pin	311377, 311812, 311388, 312359, 312360, 312361, 312362, 312619, 313233, 313234, 313235, 313712, 313713, 313714, 313715, 314534, 314945, 316495, 316496, 316497, 316498, 316499, 317706, 317707, 317708, 317709, 317886, 317887	384804	384805

NOTE

The 9-pin connector on the motor contains 6 wires. The red, black and white wires are used for the external control signal and the other three are used for factory initialization and programing.

0-10V Analog input connection	
Red	+ 0-10 VDC
White	Common*
Black	+24 VAC/DC
*Common is shared between both 24V power and 0-10V signal.	
The impedance of 0-10V circuit is 12KΩ	

Troubleshooting

Motor does not operate

1. Check all wiring connections to ensure they are correct and secure.
2. Verify that all voltages are present at the motor, including 24V and 0-10 VDC, if applicable.
3. Make sure that the fan wheel will rotate freely and there are no foreign objects in the wheel. If fan wheel does not rotate freely, disconnect power from the motor and adjust the wheel or housing until the wheel can freely rotate. Apply power and the motor should restart.
4. If motor has both the dial on the motor and 0-10 VDC control option, control wiring issues can be tested by disconnecting the control wires from the motor. The motor should then operate using the dial on the motor for speed control.

Motor will not reach maximum speed

1. Make sure dial is rotated full clockwise, if applicable.
2. Make sure motor is receiving 10 VDC, if applicable.
3. There are some motor/fan combinations where the motor may not reach nameplate RPM. See Max RPM table on page 11 for the maximum motor speed for your application.

Factory Mounted Transformer (Fig. 1, page 2)

A factory mounted transformer is available to supply 24 VDC power to the motor when the 0-10V signal is by others. This transformer has the capability to power a remote device if desired. The power available to a remote device is 400mA at 24 VDC. If the remote device is powered by a different source, connect the analog output to the 0-10V and COM terminals of the transformer. This will pass the signal through to the motor.

WARNING

Do not connect an external 24V supply to the transformer's control terminal labeled 24V. If the external device providing the 0-10V signal is powered elsewhere, this terminal can remain unused.

Operation and Wiring

- Potentiometer and 0-10V Input

Part Numbers Covered in this Section				
318003	318004	318013	319356	319357
320587	320588	320589	320590	328128
328129	328130	328131	328132	328133
328173	328174	328178	328179	

These motors have the ability to accept a plug-in potentiometer for speed adjustment AND the ability to accept a 0-10V signal for remote control.

There is a 4 second delay between the application of power and the motor starting.

Motor part numbers 318003, 318004 – The motor is prewired at the factory and cannot be changed inside the motor. Connect single-phase power at the voltage listed on the nameplate.

Motor part numbers 318013, 319356, 319357, 320587, 320588, 320589, 320590, 328128, 328129, 328130, 328131, 328132, 328133, 328173, 328174, 328178, and 328179 – The motor is prewired at the factory and can operate on 115v up to 277v. Operating voltage is changed via voltage red jumper wire.

Voltage jumper – For 115v the red jumper wire on the side of the motor must be connected (closed). For 208v-277v operation the red jumper must be disconnected (open). If disconnected, red jumper wire has 120 VAC potential. Ensure leads are capped/ covered.

Dial on Motor – A potentiometer (PN 385806) can be plugged into the 9-pin connector of the motor. To increase speed, rotate the dial clockwise. To decrease speed, rotate the dial counterclockwise.

0-10 VDC Signal – From 0-1.9V, the motor will be off, and will operate in the 2-10V range. A low voltage wiring harness is needed to supply the 0-10V signal to the motor. The harness is available from the factory if conversion is necessary.

0-5 VDC Signal – From 0-0.9V, the motor will be off and will operate in the 1-5V range. A low voltage wiring harness is needed to supply the 0-5V signal to the motor. The harness is available from the factory if conversion is necessary.

Low Voltage Harness Part Numbers			
Type	Use with Motor	18 in. long	36 in. long
9-pin	318003, 318004, 318013, 319356, 319357, 320587, 320588, 320589, 320590, 328128, 328129, 328130, 328131, 328132, 328133, 328173, 328174, 328178, 328179	385821 (0-10 VDC only) 386518 (0-5 VCD and 0-10V DC compatible)	385822 (0-10 VDC only) 386519 (0-5 VCD and 0-10V DC compatible)

NOTE

The 9-pin connector on the motor contains 6 wires. The yellow, orange, red and white wires are used for external control. The other two wires are used for factory initialization and programming.

0-10V Analog Input Connection	
Red	+ 0-10 VDC
White	Common
Green	+0-5 VDC Signal
Black	5 VDC Supply

Troubleshooting

Motor does not operate

1. Verify the motor is wired correctly and all connections are secure.

2. If using dial on motor, verify the potentiometer is fully seated in the 9-pin connector.
3. If using 0-10 or 0-5 VDC, verify that all voltages are present at the motor.

Motor does not reach maximum speed

1. Make sure dial is rotated full clockwise, if applicable.
2. Make sure motor is receiving 10 or 5 VDC, if applicable.
3. There are some motor/fan combinations where the motor may not reach nameplate RPM. See Max RPM table on page 11 for the maximum motor speed for your application.
4. Make sure black wire is disconnected when using 0-10 VDC.

Operation and Wiring

- 0-5V Input

Part Numbers Covered in this Section	
328447	328448

Motor PN 328447 has the ability to accept 0-5V signal for speed adjustment via a 0-5V dial on fan, PN 386512.

Motor PN 328448 has the ability to accept a 0-5V signal for speed adjustment via a plug-in potentiometer PN 385806.

There is a four second delay between the application of power and the motor starting.

Motor part numbers 328447, 328448 - the motor is prewired at the factory and can operate at single phase 115-120V or 208-230V. The motor detects the incoming voltage and automatic switches adjust for it inside the motor. All that is required is to connect single phase power at the voltage listed on the nameplate.

Dial on Motor – A potentiometer (PN 385806) can be plugged into the 9-pin connector of the motor. To increase speed, rotate the dial clockwise. To decrease speed, rotate the dial counterclockwise.

0-5V Dial on Fan – From 0-1V, the motor will be off and will operate in the 2-5V range. The low voltage wiring harness is built into the design of the motor PN 328447.

NOTE
The 9-pin connector on the motor contains 3 wires. The green, white and black wires in the white jacketing are used for external control.

0-10V Analog Input Connection	
Green	+0-5 VDC Signal
White	Ground
Black	5 VDC Supply

Troubleshooting

Motor does not operate

1. Verify the motor is wired correctly and all connections are secure.
2. If using dial on motor, verify the potentiometer is fully seated in the 9-pin connector.
3. If using 0-5V dial on fan controller, verify that all voltages are present at the motor.

Motor does not reach maximum speed

1. Make sure dial is rotated full clockwise, if applicable.
2. Make sure motor is receiving 5 VDC.

Part Numbers Covered in this Section	
310420	311156

Features

Speed control - These motors can be controlled by either a dial on the motor or a 0-10 VDC signal for remote control.

Soft start – All motors feature soft-start technology which eliminates inrush current at start-up. The motors will reliably start at any speed setting. There will be up to a 30 second delay between the application of power and the motor starting. The motor will "rock" back and forth upon startup as part of its normal operation.

Overload protection – If the motor becomes overloaded, it will automatically shut itself down. The maximum programmed motor speeds have been selected to prevent this from happening in normal operation.

Locked rotor protection – If the motor encounters a locked-rotor scenario, it will automatically shut itself down. It will try to restart up to 3 times, and if after the 3rd time the motor will still not rotate, the motor will not attempt to start again until power is cycled.

Thermal protection – The motors have an automatic reset thermal protector. This is meant to protect the motor from a severe temperature rise.

RPM measurement – The motor RPM can be measured by removing the cooling fan cover and using a contact or optical tachometer. Be sure to replace the cooling fan cover when finished.

Reversible rotation – The motor direction has been pre-set at the factory for the rotation of the fan but can be reversed if necessary.

Operation and Wiring

These motors can be controlled by either a dial on the motor or a 0-10 VDC signal for remote control. The motor will be supplied from the factory with the correct accessory depending on what was ordered.

Dial on Motor - Turn the dial with your fingers to adjust. To increase the speed, rotate the dial clockwise. To decrease the speed, rotate the dial counterclockwise. Turning the dial full Counter Clock Wise will turn the motor off.

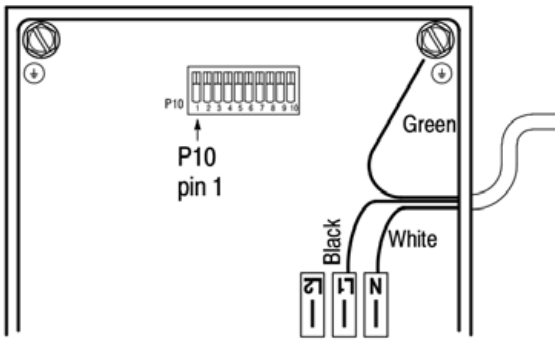
0-10 VDC Signal - From 0-1.9V, the motor will be off, and will operate in the 2-10V range. This motor does not require 24V power for operation.

0-10V Analog Input Connection	
Red	+ 0-10 VDC
White	Ground

Wiring

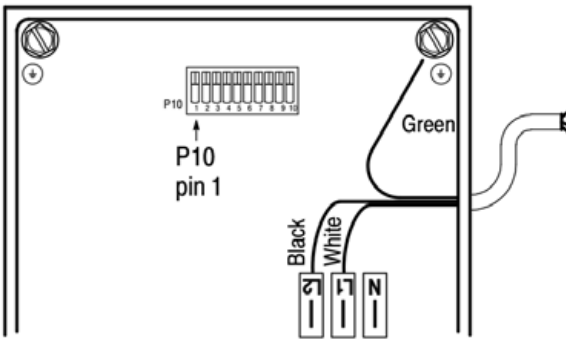
1. All high and low voltage wiring connections are made inside the motor control box at the factory. Normally, there is no reason to enter the control box of the motor. If there is a need to enter the control box, disconnect power and wait at least five minutes to allow the capacitors to discharge.
2. The motors are factory wired for the ordered voltage. If the factory wired voltage does not match the desired voltage, the voltage can be changed, with exception of the 2HP motor (310420), which is 208-240V only.

115V: Connect 115 VAC to L1, connect Neutral to N. The L2 terminal remains empty. Connect ground to grounding stud.



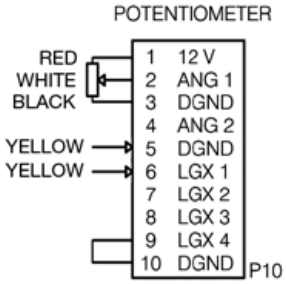
115V Connection inside control box

208-240V - Connect line voltage to L1 and L2. The N terminal remains empty. Connect the ground to the grounding stud.



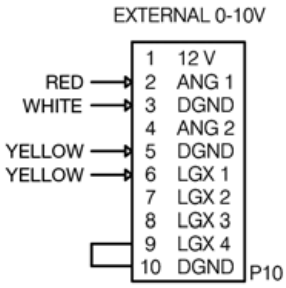
208-240V Connection inside control box

Dial on Motor - the dial is factory-wired into the low voltage terminal block inside the control box. The wires are connected as shown.



Dial on motor connection inside control box

0-10 VDC Signal - a two-wire pigtail is factory-wired into the low voltage terminal block. The wires are connected as shown.

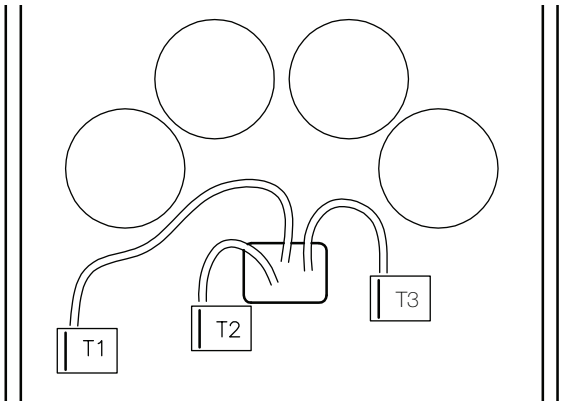


0-10 VDC signal connection inside control box

If the motor needs to be tested before the 0-10 VDC signal is available, a jumper can be placed between terminals 1 and 2. This will force the motor to run at full speed.

Motor Rotation

To reverse the rotation of the motor, swap any two of the red, black and blue wires connecting the control board to the motor at terminals T1, T2 and T3. Note that motor warranty is void if motor is rotating in the wrong direction. See fan instruction manual for correct rotation direction.



Rotation selection wires inside control box

Troubleshooting

These motors have a diagnostic red LED on the circuit board inside the control box, or on the exterior of the control box, that will be solid (not flashing) when power is applied to the motor and the motor is operating normally. The LED may be solid even if the motor is not spinning, such as when power is applied but the motor may be commanded to be off with a 0-1.9V VDC signal.

1. If external LED is not present, to view the status of the LED the control box cover must be removed while power is applied to the motor. If the control box cover is removed while power is applied, extreme care must be taken not to touch any of the components inside the box.
2. If a fault occurs, the LED will blink a specific number of times to identify the fault that has occurred. The fault indications are as follows:

Number of Blinks	Indicated Fault
2	Hardware Fault
3	Overvoltage
4	Undervoltage
5	Communication Error
6	Sync Loss
7	Spin Fault
8	Motor Overload
9	Motor Over Temperature

3. When the LED is blinking, it will consecutively blink from 2 to 9 times, followed by a pause, and repeat the blink sequence. It is best to count the number of flashes 2 or 3 times to ensure accuracy.
4. Under most fault conditions the motor will automatically restart. If a motor overload fault occurs more than 10 times in one hour, the motor will shut down and require a power cycle to reset.
5. If the fault persists, consult the factory.

Motor does not operate

1. Verify the motor is wired for the correct voltage.
2. Verify that the dial on the motor is properly connected to the control board - or - verify that the 0-10 VDC wires are properly connected to the control board.
3. Verify that the Status LED is solid red.
4. Verify that a jumper is in place between terminals 9 and 10. The motor will not run without this jumper in place.
5. Verify that the two yellow wires coming from the motor are in place on terminals 5 and 6.

Controls: Operation, Wiring and Troubleshooting

Remote Dial/Touch Remote and 2-Speed Control

Remote Dial

Installation Overview: The remote dial is provided with the fan, shipped loose for remote installation. It also includes a factory mounted 24 VDC transformer.

1. Disconnect power to the fan.
2. Identify where the remote dial will be mounted.
3. Mount a standard single-gang 2x4 junction box.
4. Run a 3-wire control cable from the remote dial to the fan motor compartment. The maximum distance from the fan to the remote dial is 100 feet. If a greater distance is required, signal loss may occur and cause the fan to operate erratically.
5. Connect control cable to transformer mounted inside fan motor compartment. Connect control cable to remote dial.
6. Secure remote dial to 2x4 junction box.

Remote Dial with Min/Max Setting

Remote dials (PN 385803) are capable of setting minimum and maximum voltage limits. Setting voltage limits will require a multi-meter. To set a voltage span:

1. Install and wire remote dial as previously instructed.
2. Install multi-meter probes into the red (0-10v) and black (ground) connectors.
3. To set maximum voltage limit, apply power to the motor, transformer and remote dial. With remote dial set to zero (0), hold the Upper Limit button down and turn the dial until the desired voltage is displayed on your multi-meter. Release button to save max voltage setting.
4. To set lower voltage, turn remote dial back to zero (0). Hold down Lower Limit button while turning dial to desired voltage on your multi-meter. Release button to set minimum voltage limit.
5. To reset to default (0-10v) limits, hold both Upper and Lower limit buttons down simultaneously until the LED indicator lights up. Then release buttons and default levels will be restored.

   NOTE: Upper voltage limit must be set prior to setting lower voltage limit. Upper and lower limits can only be within 0.5v of each other.

Touch Remote

Follow installation instructions for remote dial above. After power is applied to the system, operate as follows:

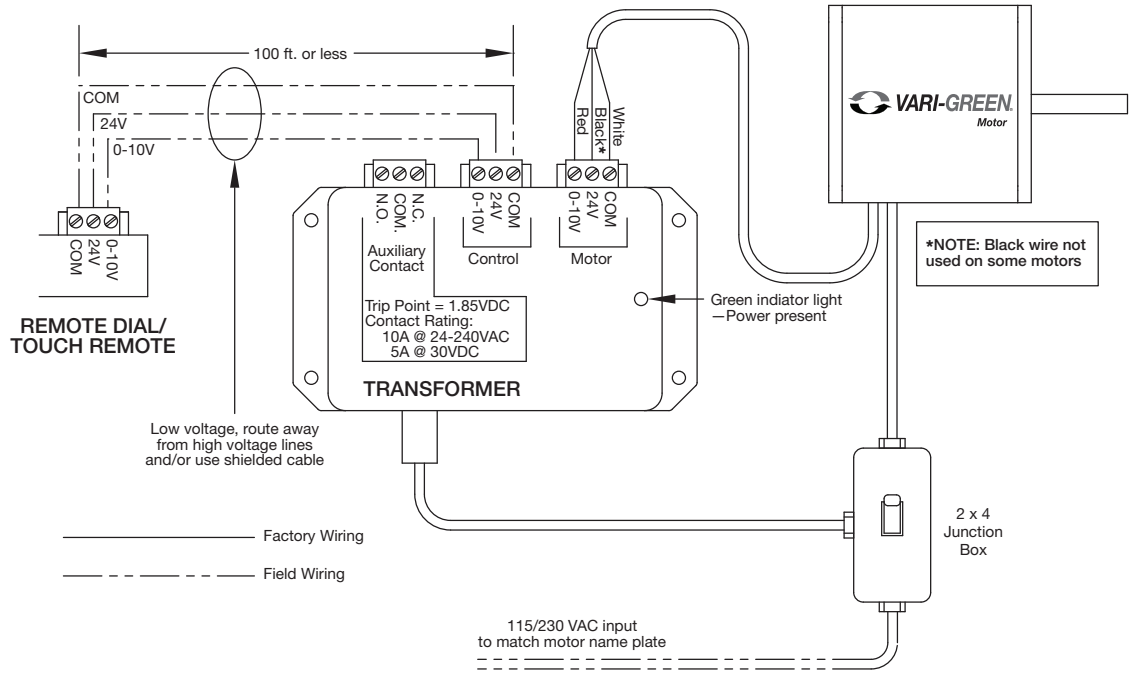
1. Touch power button to turn fan on.
2. Touch UP/DOWN arrow to increase/decrease speed.
3. Subsequent touches of the power button will start the countdown timer of 90, 60, 30 or 10 minutes.
4. LED's will turn off after a period of inactivity.
5. To lock/unlock buttons, hold the UP and DOWN arrows for 3 seconds. When locked, the power button will light up red.

Other Vari-Green® controls, such as the Constant Pressure and Air Quality families of controls, have their own manual that ship with the controller. They can also be found on Greenheck.com. See table on page 11 for document numbers.

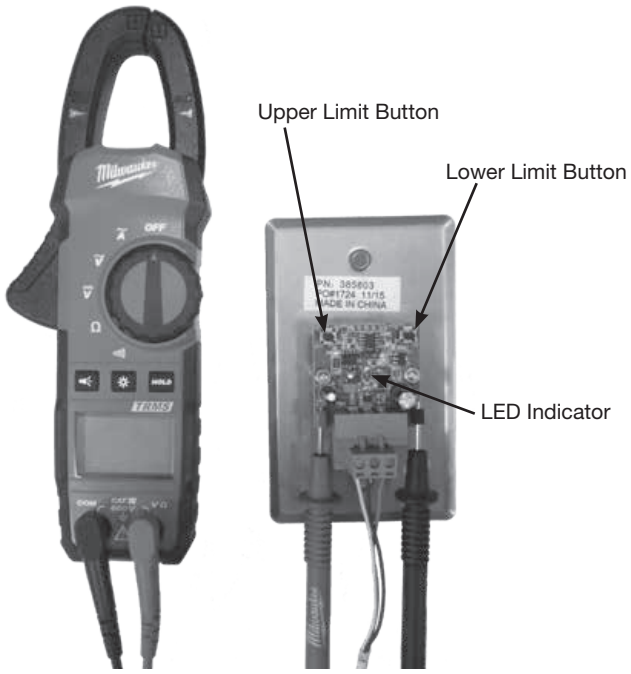
CAUTION

Even though the motor may not be operating, high voltage power may still be present at the motor. Make sure to disconnect power to the fan before servicing.

Remote Dial/Touch Remote Assembly



Remote Dial with Min/Max Setting



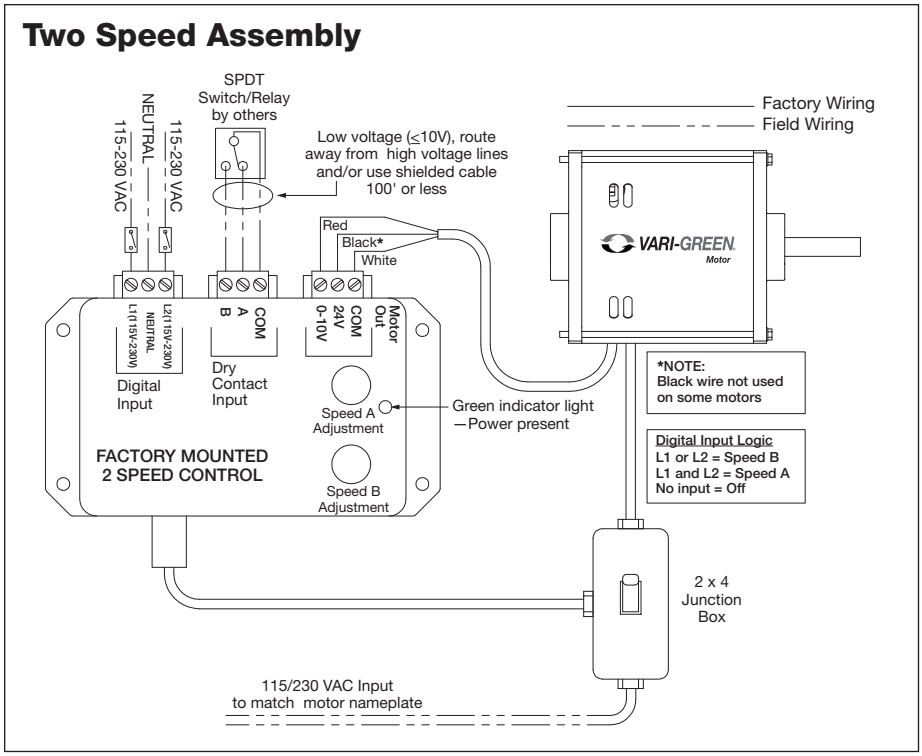
Troubleshooting - Remote Dial/Touch Remote

Remote Dial does not adjust motor RPM

1. Check voltage to ensure the motor and transformer are receiving the correct line voltage.
2. Check voltage at the remote dial. 24 VDC should be present across the 24V and COM terminals. 0-10 VDC should be present across the 0-10V and COM terminals.
3. Verify all of the connections at the transformer and make certain that they are secure.
4. Touch remote: Verify that the touch remote is unlocked.
5. To reset to default (0-10v) limits, hold both Upper and Lower limit buttons down simultaneously until the LED indicator lights up. Then release buttons and default levels will be restored.

Terminals	Desired Voltage
24V-COM	24 VDC Nominal
0-10V-COM	0-10 VDC (varies with dial position)

Two Speed Assembly



Two Speed Control

Installation Overview: The two speed control is factory mounted to the fan and may be set to provide any two speeds the application requires. It also includes a 24 VDC transformer. A green LED will be illuminated when the 2-speed control is powered.

1. There are two methods of toggling between speed A and speed B:
   a. **Dry contact input** - this utilizes an external switching device such as a relay or SPDT switch to toggle between the two speeds.
      - Connect terminal “A” to “COM” for speed A.
      - Connect terminal “B” to “COM” for speed B.

      If no contact is made between either terminal the motor will be off.
   b. **AC digital input** - this input allows an AC voltage signal to be fed directly into the 2-speed control to change speeds.
      - Send 115-230V AC to L1 **OR** L2 for speed B.
      - Send 115-230V AC to L1 **AND** L2 for speed A.

      If no voltage is applied to either terminal, the motor will be off.
   c. DO NOT CONNECT BOTH DRY CONTACT AND DIGITAL INPUTS SIMULTANEOUSLY.
2. To test fan operation before the external control devices are installed, a jumper wire can be connected between the COM and A or B terminal on the dry contact input for fan operation.

Troubleshooting - Two Speed Control

1. Check all wiring connections to ensure they are correct and secure.
2. Verify AC line voltage is present at the motor and 2-speed control.
3. Verify 24 `VDC is present at the 24V and COM terminals of the "Motor" terminal block.
4. Measure DC voltage between the 0-10V and COM terminals of the "Motor" terminal block. This voltage should match the dial position of the active dial.
   a. If using dry contact input - ensure contact closure is connecting the proper terminals.
   b. If using AC digital input - disconnect connector from 2-speed control and measure voltage between L1 and Neutral or L2 and Neutral.

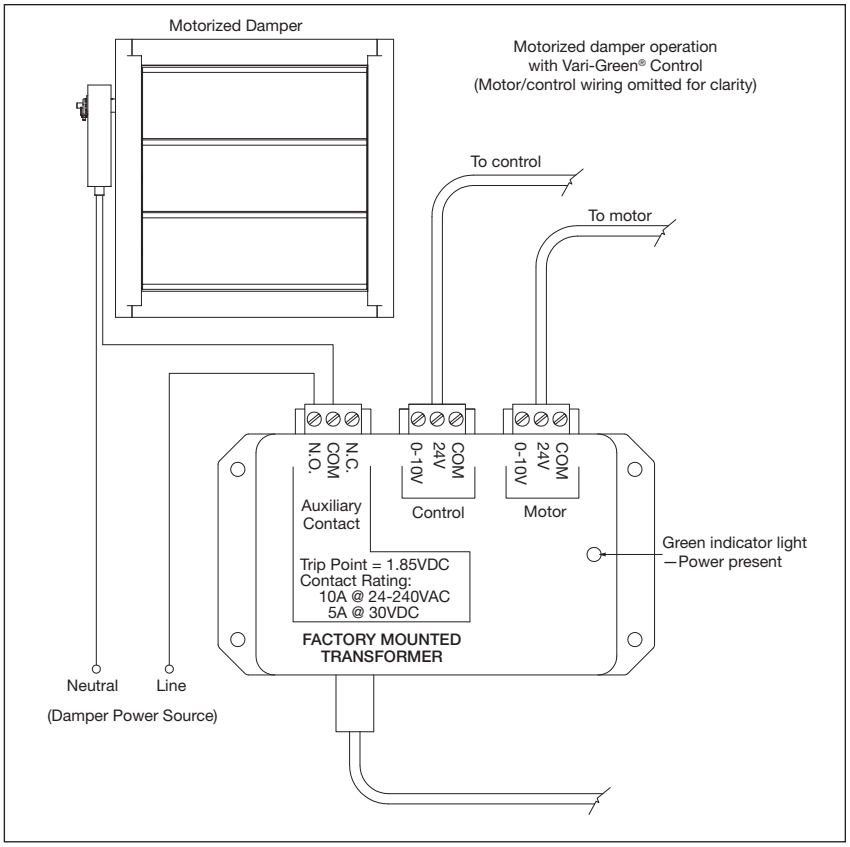
Motorized Backdraft Damper Control

The available factory mounted transformer (PN 385253) has the ability to signal a motorized back draft damper to open/close as the motor starts/stops.

A N.O./N.C. set of contacts is provided which will change state when above or below a control voltage of 1.85 VDC. See wiring diagram for example.

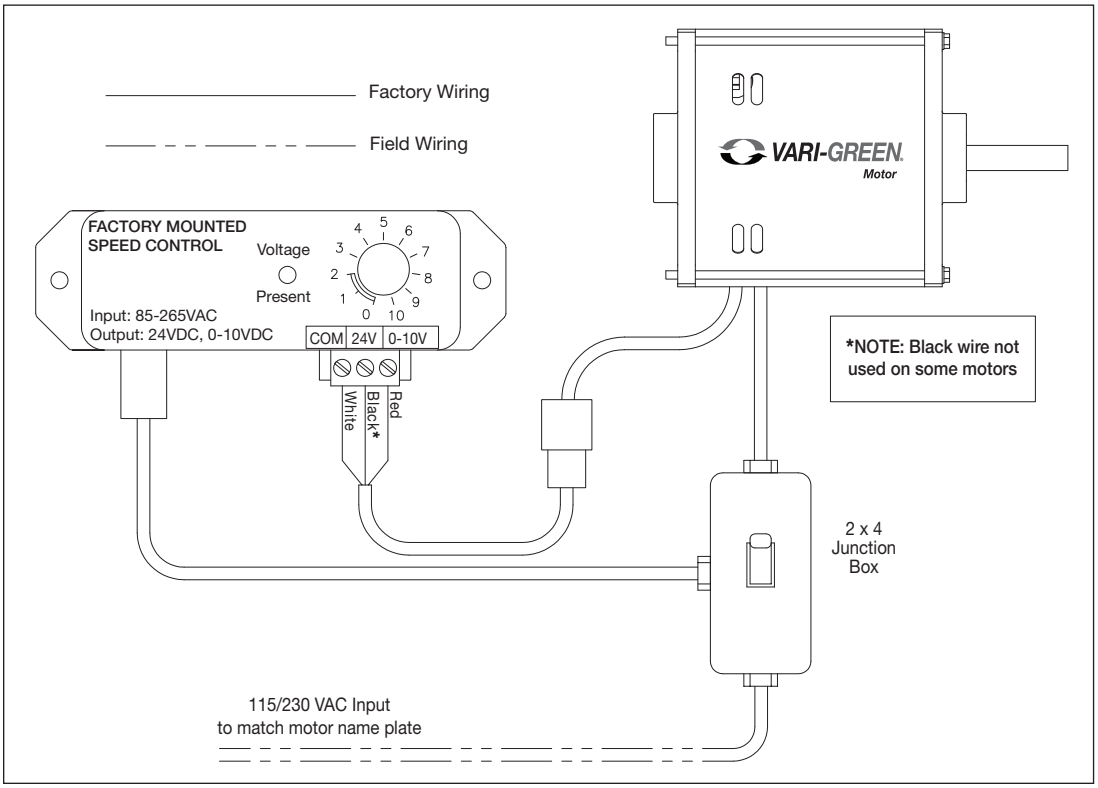
Contact Rating:

- 10A @ 24-240 VAC
- 5A @ 30 VDC



Fans Where Dial on Motor is Not Accessible

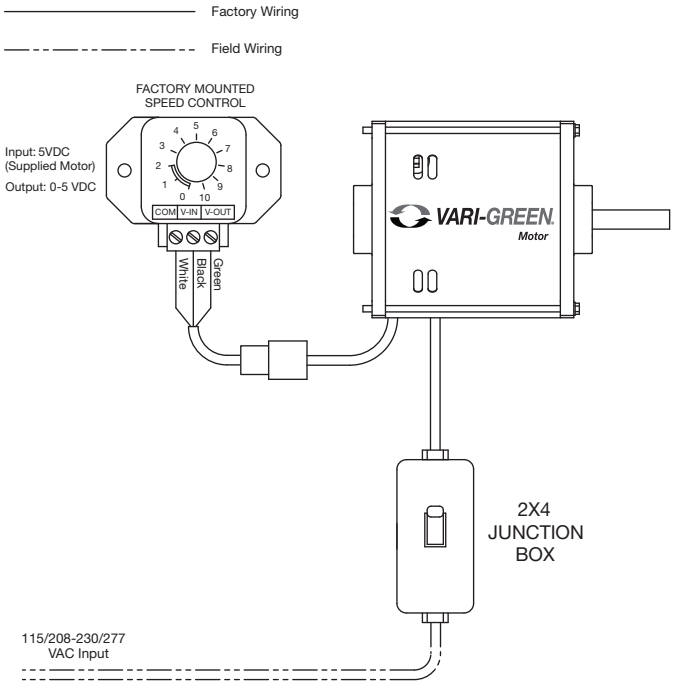
A control is available to mount on the outside of a fan where the dial on motor may be difficult to access (model SQ). This control is powered by the line voltage entering the fan and will send 24 VDC and 0-10 VDC to the motor. Control Part Number is 385611



Alternative: Fans Where Dial on Motor is Not Accessible

A control is available to mount on the outside of a fan where the dial on motor may be difficult to access (model SQ). In many cases, the tri-voltage platform of VG motors can work off either 0-5V signal or a 0-10V signal. This control is powered by 5VDC output signal wire of the motor and will send a 0-5VDC to the motor to adjust the speed. Control PN 386512.

Control	Compatible Motor P/N
386512	328447, 319356, 328128, 319357, 328129, 318013, 328130, 320587, 320588, 328131, 320589, 328132, 320590, 328133 328173, 328174



Multiple Motors on One Control

Refer to the table below for the recommended number of motors to be driven from one controller. Note that the controllers do not have the ability to distinguish between more than one motor, therefore all motors will receive the same control voltage. Control voltage must be wired in parallel to all motors.

Controls	Max. Motor Quantity
Remote Dial	4
2-speed	6
Constant Pressure/Airflow	4
Temperature/Humidity	2
VOC	2

Maintenance

Vari-Green® motors use brushless technology with sealed bearings. No routine maintenance is required other than keeping any debris from accumulating on the motor and controls.

Other Vari-Green® Control Instruction Manuals

Description	Document Number
Indoor Air Quality - VOC	475407
Indoor Air Quality - Temperature/Humidity	475573
Constant Pressure Control	474766
Generation 2 Constant Pressure/Airflow Control	479653

Maximum RPM Table

This table will show the available motor and fan combinations with the correlating maximum motor RPM for each combination.

CUE/CW	Max RPM	Motor HP
60, 70	1725	1/15
80, 90	1725	1/10
95	1725	1/6
99	1725	1/4
101	1725	1/4
101HP	1725	1/4
	2500	1/2
121	1400	1/4
	1725	1/2
131	1200	1/4
	1450	1/2
	1725	3/4
141	1000	1/4
	1300	1/2
	1550	3/4
	1725	1
141HP	1450	1/4
	1725	1/2
	2200	3/4
161	1000	1/2
	1200	3/4
	1300	1
	1725	2
161HP	1300	1/2
	1650	3/4
	1725	1
180	875	3/4
	1000	1
	1325	2

SQ	Max RPM	Motor HP
60, 70	1725	1/15
80, 90	1725	1/10
95	1725	1/6
97	1725	1/4
	2500	1/2
98	1725	1/4
	2200	3/4
99	1725	1/4
	2200	3/4
100	1725	1/4
120	1725	1/2
130	1725	3/4
130HP	1250	1/4
	1450	1/2
	1950	3/4
140	1500	3/4
	1725	1
140HP	1100	1/2
	1450	3/4
	1725	1
160	1140	3/4
	1300	1
	1725	2
160HP	850	1/2
	1000	3/4
	1600	1
	1725	2

USF	Max RPM	Motor HP
4	1660	1/4
	1725	1/2
	1725	3/4
6	1660	1/4
	1725	1/4
	1725	1/2
	1725	3/4
7	1140	1/4
	1725	1/2
8	1660	1/4
	1725	1/2
	1725	3/4
10	1660	1/4
	1725	1/2
	1725	3/4
13	1370	1/4
	1725	1/2
	1725	3/4
15	1110	1/4
	1400	1/2
	1600	3/4
16	910	1/4
	1150	1/2
	1320	3/4
18	740	1/4
	940	1/2
	1050	3/4

LD/LDP	Max RPM	Motor HP
80-90	1725	1/10
95	1725	1/6
100	1725	1/4
120	1725	1/2

SP/CSP	Max RPM	Motor HP
510	1275	1/6
710	1450	1/4
700	1750	1/3
1050	1225	1/3

G	Max RPM	Motor HP
60, 70	1725	1/15
80, 90	1725	1/10
95	1725	1/6
97-99	1725	1/4
103	1725	1/4
103HP	1725	1/4
	2500	1/2
123	1200	1/4
	1725	1/2
133	1150	1/4
	1550	1/2
	1725	3/4
143	900	1/4
	1200	1/2
	1300	3/4
	1725	1
143HP	1500	1/4
	1725	1/2
	2200	3/4
163	750	3/4
	1200	1
	1725	2
183	900	3/4
	1000	1
	1325	2

SE1/SS1	Max RPM	Motor HP
8-440*	1725	1/15
8-440*	1725	1/10
10-440*	1725	1/15
10-440*	1725	1/6
12-426	1725	1/4
12-432	1725	1/4
12-436	1725	1/4
14-432	1725	1/4
14-436	1725	1/2
14-440	1725	1/2
16-421	1725	1/2
16-426	1725	1/2
16-428	1725	3/4
16-436	1725	3/4
18-424	1725	3/4
18-429	1725	3/4
20-420	1725	1
***SE1 Model Only**		

Our Commitment

As a result of our commitment to continuous improvement, Greenheck reserves the right to change specifications without notice.

Product warranties can be found online at Greenheck.com, either on the specific product page or in the literature section of the website at Greenheck.com/Resources/Library/Literature.

AMCA Publication 410-96, Safety Practices for Users and Installers of Industrial and Commercial Fans, provides additional safety information. This publication can be obtained from AMCA International, Inc. at www.amca.org.

GREENHECK
Building Value in Air.

Phone: 715.359.6171 • Fax: 715.355.2399 • Parts: 800.355.5354 • E-mail: gfcinfo@greenheck.com • Website: www.greenheck.com

Quick Start Guide

Single/Three Phase Vari-Green® Motor

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Vari-Green Motor Quick Start Guide

When delivered, the Vari-Green Motor is pre-programed to run from either an on-board dial or a 0-10 VDC control signal. A 0-1.99 Volt control signal will be received as a "stand-by" command.

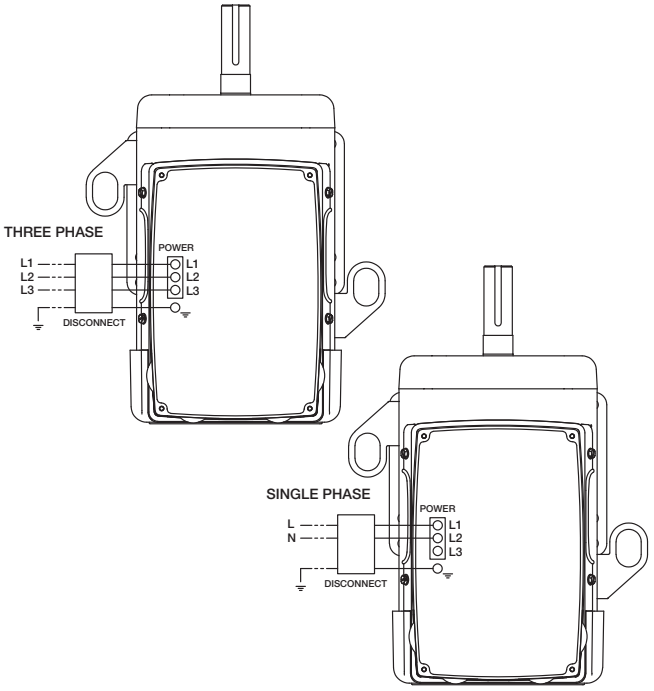
A run command is acknowledged, as well as a speed reference from 2-10 V.

For more information about this Vari-Green Motor, please review the Installation, Operation and Maintenance Manual found by following this QR code:

www.greenheck.com/vari-green/vari-green-motors

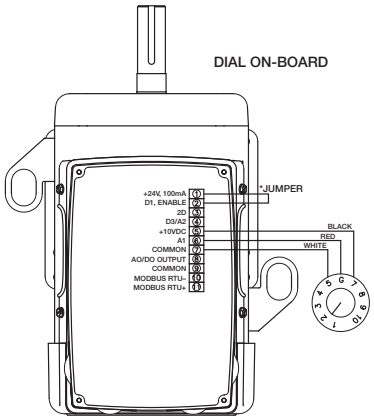
Step 1

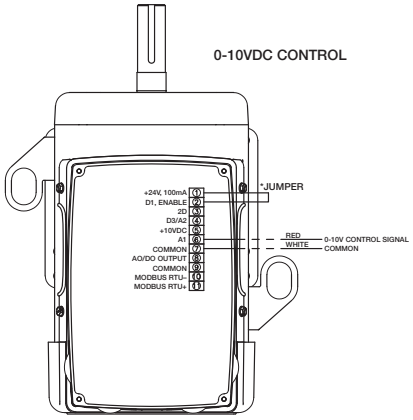
Connect the power supply. Verify Input Voltage and phase matches nameplate of motor/drive.



Step 2

Connect control wiring to the control terminal.



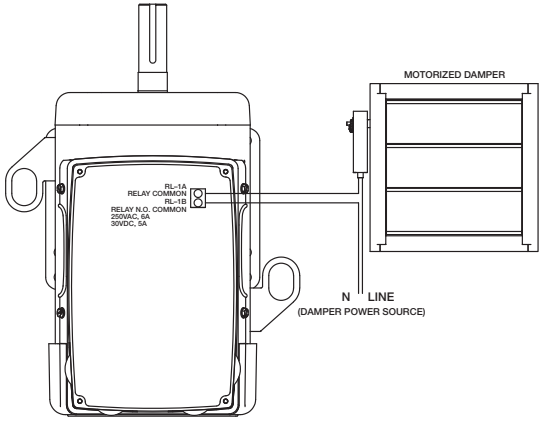


NOTE: Factory default settings:

1. Terminal 2 is set as an ENABLE command. From the factory there is a jumper from terminal 1 to 2. A START/STOP switch can be used between these terminals to ENABLE/DISABLE the drive.
2. When this Vari-Green Motor is ordered in a 0-10 VDC Control configuration, the motor is shipped with a jumper between terminal 5 and 6. This will run the motor at full speed when power is connected. Remove this jumper before landing 0-10 VDC control wires.

Step 3

Install motorized backdraft damper wiring, if applicable. The relay RL-1 is set from the factory to close when a run command is given.



Step 4

Apply power to unit. If a control signal is present, the RL-1 relay will close and the motor will ramp up to the referenced speed. If a jumper is installed between terminals 5 and 6, the motor will go to 100%.

Step 5

Balance the fan. Whether changing the position of the on-board dial or adjusting the control voltage, the fans speed can be set from the minimum to the motor's factory programmed maximum speed. Re-apply the motor cover.

VARI-GREEN® Motor

Quick Start Guide

Single/Three Phase Vari-Green® Motor

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Step 6

Review the Installation, Operation and Maintenance Manual for the fan for any specific installation questions. The manual is shipped with the fan, and can also be found at www.greenheck.com or by scanning the QR code located within the drive compartment.

Electrical Data	
Supply Voltage Range	110 Volt Units, 99-126 V
	230 Volt Units, 180-264 V
	400 Volt Units, 342-528 V
Short Circuit Capacity	5kA Without Fused Disconnect
	100kA With Fused Disconnect
Control Terminal Wiring	
Maximum Size	0.05-0.5mm2 / 20-26 AWG
RL-1 Relay	
Relay N.O. Contact	250VAC, 6A/30VDC, 5A
Motor Enclosure	
Totally Enclosed Fan Cooled, IP54	

WARNING

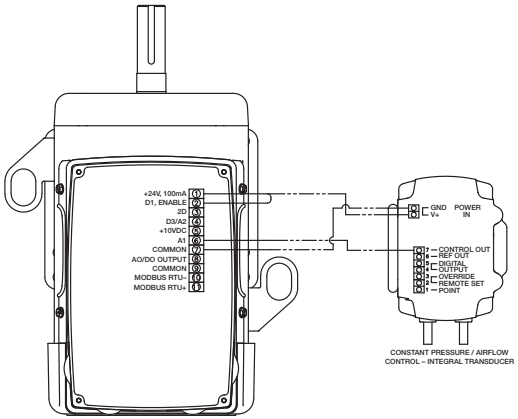
- Do not remove the drive cover for wiring or periodic inspections while power is applied or the unit is in operation. Electric shock may occur from the exposed terminals.
- Wait at least 1 minute after disconnecting the input power before performing any wiring tasks and/or periodic inspections of the drive.
- Operate the Vari-Green motor and control devices with dry hands.
- Do not use this device if power or motor cable is damaged.
- As this is a permanent magnet motor, this motor will generate voltage when the shaft is rotated. Shaft must be locked out for safe servicing.

CAUTION

- Disconnect the input power if the Vari-Green motor has been damaged. Failure to do so may result in fire and/or secondary damage or accidents.
- Do not touch the Vari-Green motor immediately after shutting down or disconnecting it. It can remain hot for a few minutes. Bodily injuries such as skin-burn or damage may occur.
- Do not apply power to a damaged Vari-Green motor or to a Vari-Green motor that is missing parts.
- Do not allow lint, paper, wood chips, dust, metallic chips or other foreign material into the drive as it may cause fire or accident.

Vari-Green Controls

Vari-Green Controls all use a 0-10 VDC control signal to provide a speed reference to Vari-Green Motors. See below for typical Vari-Green wiring. Reference the individual controls Installation, Operation and Maintenance Manual for programing, wiring and troubleshooting of that control.



VARI-GREEN®
Motor

GREENHECK
Building Value in Air.

PN 471832
Wall Housing Assembly Instructions
Sizes 8 - 54

Assembly and Installation Instructions

Please read and save these instructions for future reference. Read carefully before attempting to assemble, install, operate or maintain the product described. Protect yourself and others by observing all safety information. Failure to comply with instructions could result in personal injury and/or property damage! Upon receiving the product, check for any damage that may have occurred during transit and report it immediately to the shipper. Also verify that all accessory items are accounted for.

Wall housings are the safest, most efficient and sturdy platform for mounting sidewall propeller fans and their optional accessories. Wall housings allow for a wide range of mounting arrangements to meet specific applications. It is constructed of galvanized steel with heavy-gauge mounting flanges and prepunched mounting holes.

Item	Description	Quantity Sizes 8-48	Quantity Size 54
1	Wall Housing Mounting Angle	4	4
2	Side Panels	2	4
3	Top Panels	1	2
4	Bottom Panels	1	2
—	Fasteners	1 bag	1 bag

NOTE: Unit sizes 8-18 use spinlock fasteners in lieu of weldstuds as listed in these instructions.

NOTE: Figure 1 shows the parts for size 54. Sizes 8-48 will not require two pieces to make up the side, top and bottom panels.

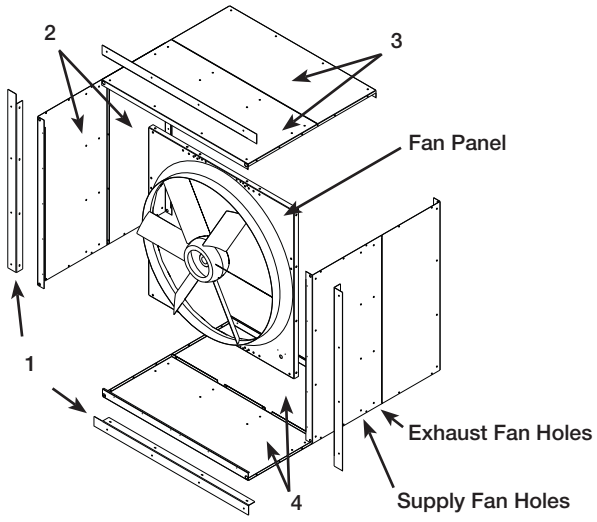


Figure 1 - Parts

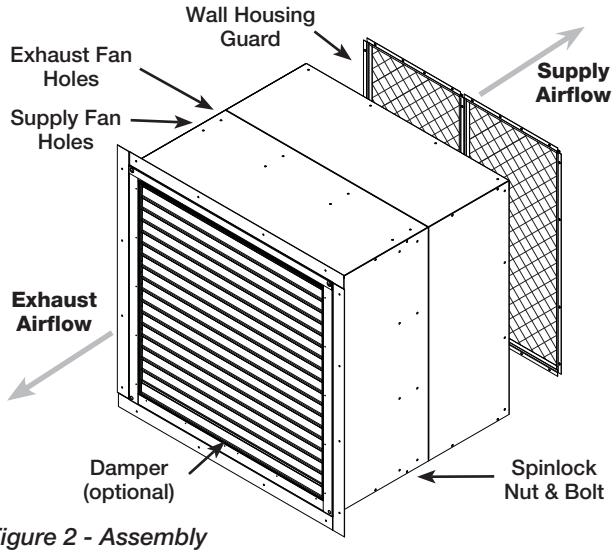


Figure 2 - Assembly

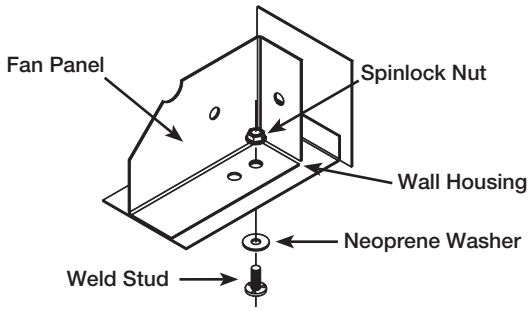


Figure 3 - Assembly

Size	Wall Housing			Damper Guard		Weatherhood			Damper	Mounting Flange	Material Gauge (ga) Thickness
	A	B*	W.O.	C	D	E	F	Width			
8	13¼ (337)	19 (483)	14¼ (362)	5½ (140)	10¼ (260)	13¼ (337)	11¼ (286)	10½ (267)	10 (254)	1½ (38)	20
10	15¼ (387)	19 (483)	16¼ (413)	6½ (165)	12¼ (311)	14⅞ (378)	13⅜ (340)	12½ (318)	12 (305)	1½ (38)	20
12	18¼ (464)	23 (584)	19¼ (489)	5⅜ (137)	14¼ (362)	16⅜ (416)	15⅝ (397)	14½ (368)	14 (356)	1½ (38)	20
14	20¼ (514)	26 (660)	21¼ (540)	6⅜ (162)	16¼ (413)	17½ (445)	17⅝ (448)	16½ (419)	16 (406)	1½ (38)	20
16	22¼ (565)	27 (686)	23¼ (591)	6¾ (171)	18¼ (464)	19⅜ (492)	19⅝ (498)	18½ (470)	18 (457)	1½ (38)	20
18	24¼ (616)	28 (711)	25¼ (641)	6 (152)	20¼ (514)	22 (559)	21⅝ (549)	20½ (521)	20 (508)	1½ (38)	20
20	26¼ (667)	32 (813)	27¼ (692)	6½ (165)	22¼ (565)	24¾ (629)	23⅝ (600)	22½ (572)	22 (559)	1½ (38)	18
24	32¼ (819)	37 (940)	33¾ (857)	6⅜ (162)	26¼ (667)	26⅞ (683)	30⅜ (772)	29⅛ (740)	26 (660)	2⅞ (73)	18
30	38¼ (972)	38 (965)	39¾ (1010)	6½ (165)	32¼ (819)	29⅛ (740)	36½ (927)	35⅛ (892)	32 (813)	2⅞ (73)	18
36	44¼ (1124)	39 (991)	45¾ (1162)	6¾ (171)	38¼ (972)	33 (838)	42½ (1080)	41⅛ (1045)	38 (965)	2⅞ (73)	18
42	50⅜ (1280)	44 (1118)	51¾ (1314)	10 (254)	44¼ (1124)	35¾ (908)	48½ (1232)	47⅛ (1197)	44 (1118)	2⅞ (73)	18
48	56⅜ (1432)	44 (1118)	57¾ (1467)	9 (229)	50¼ (1276)	40⅜ (1026)	54⅝ (1387)	53¼ (1353)	50 (1270)	2⅞ (73)	18
54	62⅜ (1584)	52 (1321)	63¾ (1619)	7½ (191)	56¼ (1429)	44¾ (1137)	60⅞ (1546)	59½ (1511)	56 (1422)	4 (102)	16

*B dimension will increase by 6 in. (152 mm) when a heavy duty motorized backdraft damper is specified. For complete dimensional information refer to submittal. All dimensions given in inches (mm).

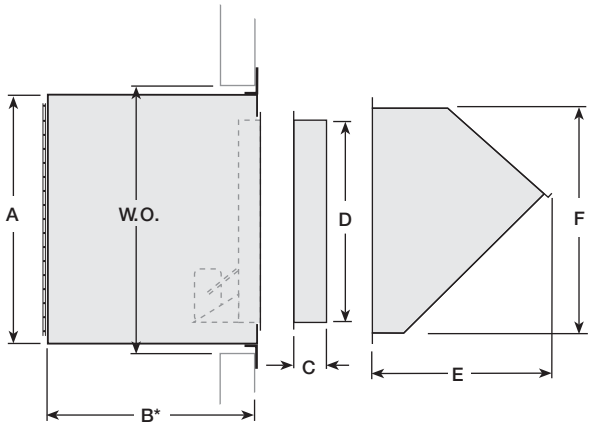


Figure 4 - Dimensional Data

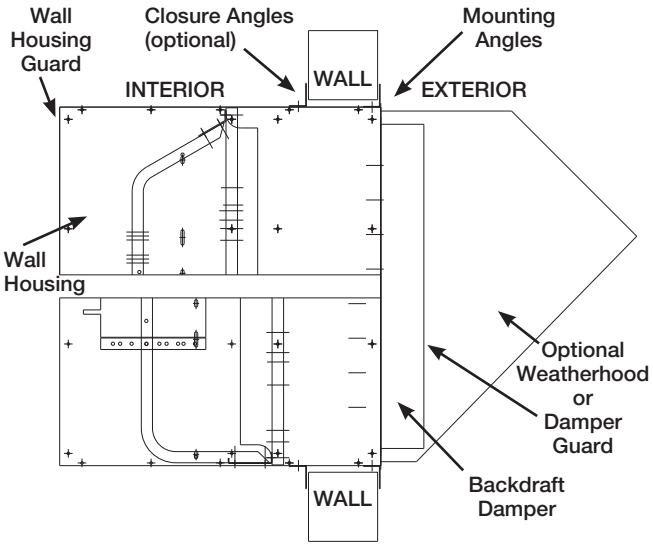


Figure 5 -
Typical Installation Configuration (Exhaust/Supply)

Assembly

1. Determine if a supply fan or exhaust fan is to be used in the wall housing (see Figure 5). Two rows of holes are provided for attaching the wall housing panels to the fan panel.

   NOTE: Exhaust fans are mounted farthest from the damper end. Supply fans are mounted nearest to the damper end (see Figure 2). Damper end has small holes in face of the wall housing. The guard end has larger extruded holes.
2. Using weldstuds and neoprene washers, attach the wall housing bottom panel (Item 4) to the bottom of the fan panel. With the weldstud heads and neoprene washers on the exterior of the housing, refer to Figure 3, place hex nuts on the spinlock bolts and finger tighten.
3. Attach side panels to the fan panel, making sure they overlap the bottom panel for weatherproofing Install weldnuts, neoprene washers and hex nuts. Finger tighten all fasteners.
4. Attach the top panels to the fan panel, assuring the formed edges overlap the side panels for weatherproofing. Install weldstuds, neoprene washers and hex nuts. Finger tighten all fasteners.
5. Install caplugs in the unused holes of the top and side panels to keep the wall housing weathertight. Unused holes in the bottom panel are used as drain holes. Tighten all fasteners securely.
6. A versatile feature of the Greenheck wall housing is a mounting flange which may be used in either a standard arrangement (Figure 5) or moved anywhere along the housing. This permits the distance the wall housing protrudes outside or inside the wall to be varied.
   5/16 inch holes must be drilled in the housing if the factory punched holes are not used.
7. Conduit holes are provided in each end of standard housings.

Damper Installation

To install an optional damper, refer to Figure 6. Using a pneumatic or electric drill, run the self-drilling screws through the holes provided in the side and bottom damper flanges into the wall housing. Check damper for freedom of movement. If an optional damper guard or weatherhood is to be installed, refer to the next section.

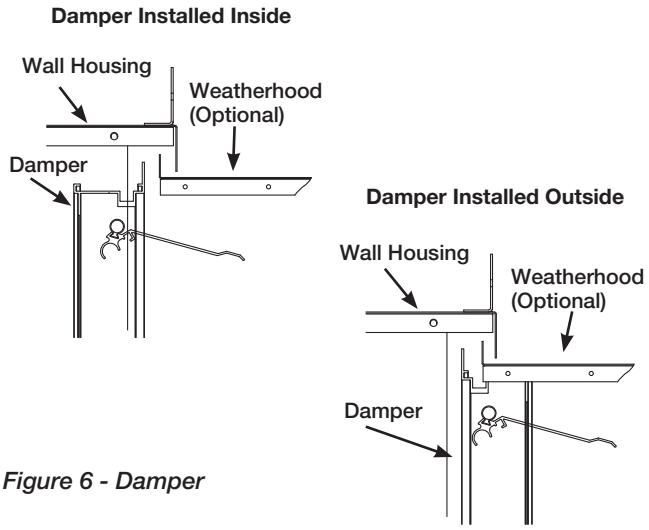


Figure 6 - Damper

Damper Guard or Weatherhood Installation

To install the damper guard, center guard over damper and fasten to wall housing using the self-drilling screws. Refer to Figure 7.

To install the weatherhood, slide the top flange of weatherhood under the flange of wall housing, see Figure 6, and fasten with self-drilling screws.

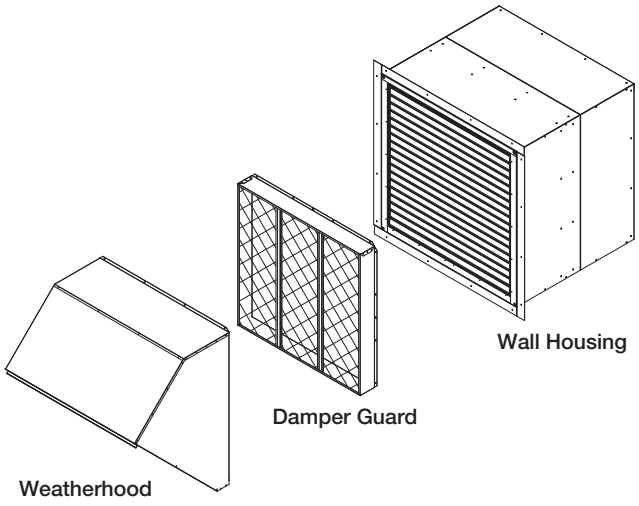


Figure 7 - Damper Guard or Weatherhood

Wall Housing Guard Installation

Attach wall housing guard to wall housing using the 1/4-20 x 3/4 thread cutting screw with washer. Refer to Figure 8.

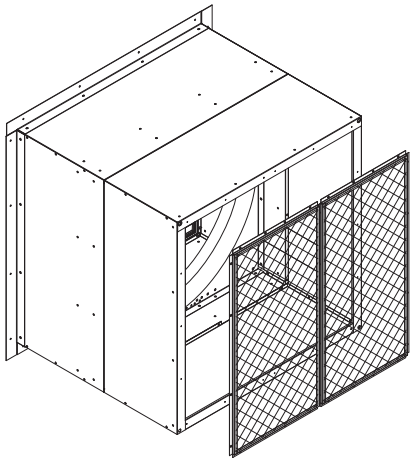


Figure 8 - Wall Housing Guard

Fit for Sidewall Propeller Fan Accessories

Figure 9 reveals the correct fit for sidewall propeller fans after all optional accessories have been assembled and installed.

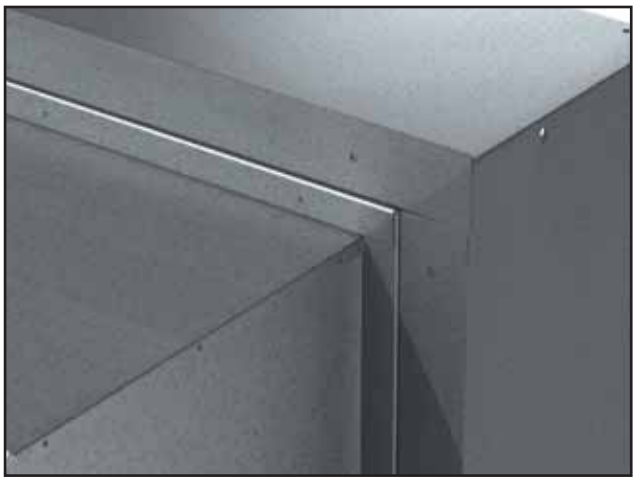


Figure 9 - Sidewall Propeller Fan Accessories

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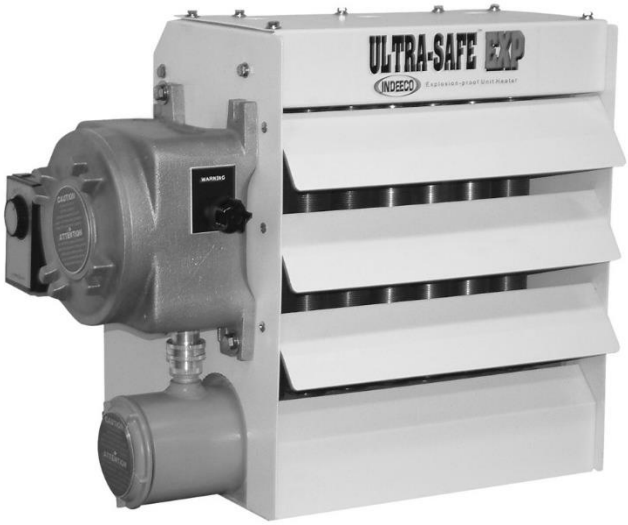
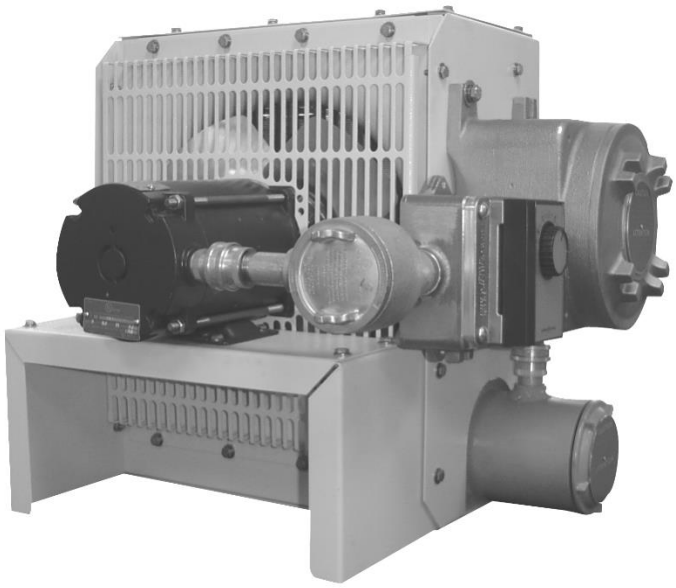
INDEECO

Owner's Manual

ULTRA-SAFE EXP Series

Electric Forced Air Heater for Hazardous Locations





This manual covers installation, maintenance and repair parts.

CSA Approved for the following classified areas:
Class I, Divisions 1 & 2, Groups C & D
Class II, Divisions 1 & 2, Groups F & G
Operating Temperature Code T3C - 320°F (160°C)
Alternate Markings: Class I, Zones 1 & 2, Group IIB, T3 or T(160)
or
Class I, Divisions 1 & 2, Groups C & D
Class II, Divisions 1 & 2, Groups E, F & G
Operating Temperature Code T3C - 320ºF (160ºC)
Alternate Markings: Class I, Zones 1 & 2, Group IIB T3 or T(160)
See Data Plate for Specific Area Classification

For details on the particular hazardous environments having the potential for explosion, refer to Articles 500 through 516 of the National Electric Code, and/or Section 18 of the Canadian Electric Code, Part I.

C US

ENM-2095-01 / 23-2199-83-3

WARNINGS

Installation and maintenance personnel should familiarize themselves with this manual and all the **WARNINGS** before installing or working on this heater to avoid potential hazardous conditions, severe property damage, personal injury or death.

1. To reduce the risk of ignition of hazardous atmospheres: Do not install where the operating temperature code limit exceeds the ignition temperature of the hazardous atmosphere.
2. Potentially lethal voltages are present. Be sure to lock the branch circuit disconnect switch in the OFF position and tag the circuit "Out for Maintenance" before working on this equipment.
3. Keep electrical enclosure covers tightly closed while in operation.
4. Hazard of Electric Shock. Heater must be grounded in accordance with the N.E.C. and/or C.E.C.
5. This heater should be installed by qualified personnel familiar with the National Electric Code and/or the Canadian Electrical Code requirements for hazardous locations. It is the responsibility of the installer to verify the safety and suitability of the installation.
6. Disassembly of the unit, for installation, is not required or authorized.
7. When connecting the room thermostat, be sure that the thermal cutouts remain connected in series with the controlling contactor. The unit must not operate without the thermal cutouts properly connected in the circuit.
8. Do not attempt to install a "Fan Only" switch on a standard unit heater and do not try to field modify a standard unit heater for this option. The heater must have been ordered for this option to have the necessary internal controls.
9. Replacement of electrical components should only be done by qualified personnel familiar with the requirements of maintaining electrical equipment in hazardous locations.
10. Replacement electrical components must be obtained from the factory in order to maintain the hazardous location rating.
11. The heat exchanger is a factory vacuum-sealed unit. Do not attempt to loosen or tighten any of the fill or drain plugs or attempt to operate the pressure relief valve. A loss of vacuum could cause nuisance tripping of the cutouts or high pressures which will cause the relief valve to actuate with an accompanying loss of liquid. Should leakage occur, remove unit from service and investigate cause.
12. The heat exchanger is filled with a mixture of water and inhibited propylene glycol. Contact with the fluid at operating temperatures may produce a burn hazard. The Material Safety Data sheets indicate that there is not a health hazard from coming in contact with the inhibited propylene glycol. Suggested first aid consists of flushing eyes with plenty of water and to wash off skin in flowing water or a shower.
13. Install and operate in an upright position only. Failure to comply will cause the overtemperature thermal cutouts to trip.
14. Installation minimum mounting clearances on nameplate must be maintained.
15. Use copper wire for supply connections according to size and rating on nameplate.
16. Do not attempt to override louver stops or operate unit with louvers fully closed.
17. "Warning Light", if supplied, will turn on if the high temperature thermal cutout opens. This could result if the heat exchanger is dirty, inlet air is obstructed, vacuum loss in heat exchanger, fan not turning or incorrect supply voltage. Disconnect power to unit before servicing.
18. Crackling noises within the heat exchanger at startup are normal.

WARRANTY WILL BE VOID IF INSTRUCTIONS ARE NOT FOLLOWED.

GENERAL

The air heaters are designed for comfort heating and should not be used in ambient temperatures exceeding 104ºF (40ºC). The units may be wall, pole or ceiling mounted. They utilize a hermetically sealed, liquid-to-air heat exchanger containing immersion type electric heating elements. A mixture of nontoxic propylene glycol and water is place in the heater core to act as a heat transfer fluid. The propylene glycol provides freeze damage protection to -49ºF (-45ºC). The unit is designed to give years of safe, trouble-free operation when properly installed and maintained.

INSTALLATION

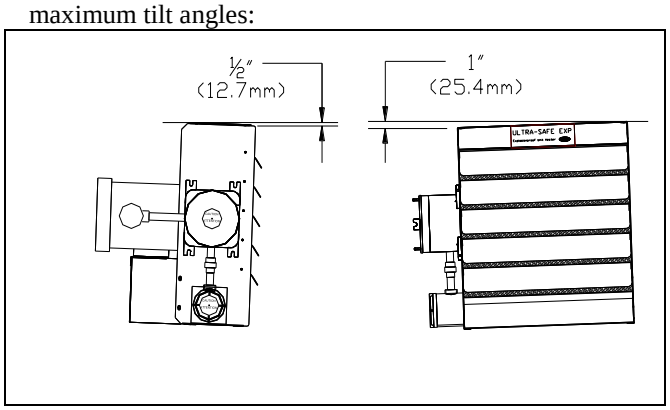
A. Site Selection:

The Heaters should not be mounted close to drapery or similar materials which could lay on the cabinet, or block the inlet or outlet of the heater. The heaters are intended for elevated mounting locations so that they blow warm air down to the floor area. A mounting height should be selected so that the heater is out of the way of possible moving equipment or personnel, yet low enough to deliver warm air to the selected area. See mechanical installation instructions for recommended installation heights.

B. Mechanical Installation:

Once an acceptable location has been determined, follow these instructions to complete the mechanical installation.

1. The Heaters are designed for use only while permanently mounted in an upright, level position. See figure below maximum tilt angles:



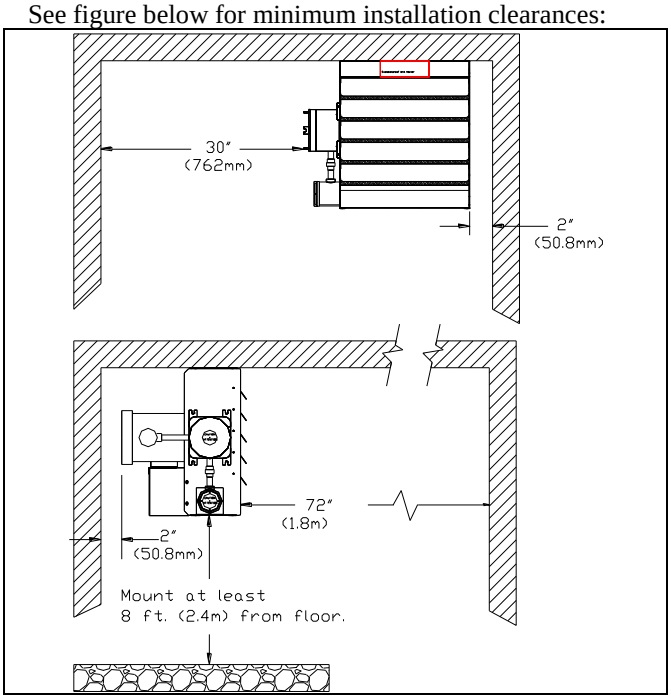
2. To ensure proper heating of floor surfaces, observe the following recommended maximum mounting heights (to bottom of heater):

Maximum Mounting Height from Floor:		
233-FA	233-FB	233-FC
9 ft.	10 ft.	13 ft.
(2.7m)	(3.0m)	(4.0m)

3. The supporting structure that the heater is attached to must have adequate strength to safely support the heater and be sufficient to keep the heater in its proper upright operating position. The maximum unit weights are:

MODEL	lbs	(kgs)
233-FA	150	68
233-FB	200	91
233-FC	250	114

4. See figure below for minimum installation clearances:



5. The heater may be suspended from overhead beams or mounted to a side wall or a 4" pipe using one of the approved mounting kits. Use of non-approved mounting kits voids all warranties, expressed or implied.
6. Wall mounting should be to structural steel. If the wall construction is plasterboard with wooden 2 X 4 framing or similar, it must be reinforced with angle iron or wooden cross braces.
7. Lock washers should be used on all mounting nuts and bolts to ensure they don't vibrate or work loose due to fan vibration or other vibration transmitted to the heater.

C. Electrical Installation:

Follow these instructions to complete the electrical installation:

1. External branch circuit protection is required. See nameplate ratings and follow Code recommendations.
2. Use only an approved explosion-proof means of wiring, such as mineral insulated cable or copper conductors in rigid conduit with conduit seals as required to make connection to the heater.
3. Follow the NEC and/or CEC and any local electrical and building codes related to the installation and intended use of the heater in an explosion-hazard area. NOTE: The heaters are suitable for installation into Division 2 areas but only when wiring and sealing per Division 1 requirements. Also, the heaters are suitable for installation into Zone 2 locations but only when wiring and sealing per Zone 1 requirements
4. When doing any work on a heater, including the initial electrical connection, disconnect the electrical current at the main branch circuit switch, and lock the switch in the off (open) position and tag the circuit "Out for Maintenance" to prevent potential lethal shock hazards.

5. Confirm that the electrical power supply matches the nameplate voltage, phase, amperage and frequency rating of the heater to be connected.
6. Ensure conductors are of appropriate gauge size. The minimum gauge is stamped on the nameplate. Size all input conductors according to accepted standards consistent with the temperature rating of the wire being used. Use minimum 75°C rated wire.
7. Proper installation of the heater requires that an adequate grounding conductor be connected to the ground terminal. This terminal is painted green or marked with the letter "G" and is located on the inside of the control enclosure next to the power input opening.
8. Check and confirm all connections are securely fastened.
9. Before application of electrical power, check all connections to ensure compliance with the wiring diagram and any code requirements. Remove any foreign objects from the control boxes. Reinstall covers tightly.
10. On all 3-phase heaters, it is necessary to verify that the fan is rotating in the proper direction. If air delivery is not from the front of the heater, exchange any 2 input wires at the main contactor terminal located in the control enclosure.
11. The explosion-proof control box is designed with threaded joints and metal-to-metal contact at the lid or cover joint to prevent an explosion. Do not attempt to install gasket material of any type at these joints. A light coating of anti-seize compound is applied to the threads to prevent seizing.
12. See section titled "operation" before energizing the heater.

D. <u>Field Installed Controls:</u>

1. <u>Power Disconnect Switch:</u>
   The NEC requires that a power disconnect switch be mounted within sight of the heater. The CEC or local codes may require a disconnect switch within sight of the heater. Refer to the electrical diagram and follow these steps:
   a.) The remote power disconnect switch must be an explosion-proof disconnect switch rated for the area classification.
   b.) The switch must be indicating and have a locked off position.
   c.) The switch must be rated for the nameplate voltage and current per the NEC, CEC and any local codes.
   d.) Follow steps 6 through 12 of the electrical installation instructions to complete the installation.

2. <u>Room Thermostat:</u>
   Refer to the electrical wiring diagram and follow these steps:
   a.) Connect the remote thermostat across the leads marked "C" and "C1". The external thermostat will then be in series with the heater thermal high-limit switches and correct operation of the heater will result.
   b.) The wiring to the remote thermostat must be copper wire, 16 gauge minimum (for Class II) or 14 gauge minimum (Class I) and run in explosion-proof conduit with appropriate conduit seals installed per the NEC, CEC and any local codes.
   c.) Any room thermostat used with this heater must be of an explosion-proof type rated for the area classification, open on temperature rise, rated minimum 120VAC, 75VA inductive capacity.
3. <u>'Fan Only' Switch:</u>
   Refer to the electrical wiring diagram and follow these steps:
   a.) Do not attempt to install a "Fan Only" switch on a standard unit heater and do not try to field modify a standard unit heater for this option. The heater must have been ordered for this option to have the necessary internal controls.
   b.) Connect the remote 'fan only' selector switch across the leads marked "C" and "F".
   c.) The wiring to the fan selector switch must be copper wire, 16 gauge minimum (for Class II) or 14 gauge minimum (for Class I) and run in explosion-proof conduit with appropriate conduit seals installed per the NEC, CEC and any local codes.
   d.) Any selector switch used with this heater must be an explosion-proof switch rated for the area classification, maintained 2 position selector switch rated minimum 120VAC, 75VA inductive.

<u>OPERATION</u>

The unit heater may be operated normally at ambient temperatures of 104°F (40°C) or less and at altitudes of 3,300 feet (1000m) or less in atmospheres containing less than 21% oxygen by volume, and as classified on the nameplate. All of these conditions must be met before attempting to operate the heater. The heater should never be operated in an oxygen-enriched atmosphere or at ambient temperatures above 104°F, (40°C). The heater may be operated at higher altitudes if the ambient temperatures are below 104°F, (40°C).

A. <u>Initial Operation:</u>

Check to make sure the mechanical and electrical installation is complete and that it is safe to operate the heater.

1.) Heater without built on or remotely mounted fan switch:
   a.) Set the temperature control thermostat to a setting above the current room temperature.
   b.) Energize the heater electrical supply circuit.
   c.) The heater and fan should come on and in 5 to 15 minutes reach a stable operating temperature. If the room temperature is high and the installation is above 3,300 feet, the unit heater may cycle on the thermal high limits of the motor or the heater.
   d.) Check out and report any unusual or questionable operating characteristics, such as noise, vibration, loss of fluid, etc. Note that crackling noises coming from the heat exchanger during warm up are normal.
   e.) Set the temperature control thermostat to the desired room temperature setting.
   f.) De-energize the heater electrical supply circuit until heater operation is required.
2.) Heater with fan switch:

a.) Place the fan switch in the fan position.
b.) Set the temperature control thermostat to a setting below the current room temperature.
c.) Energize the heater electrical supply circuit.
d.) The heater fan should come on but the heater should remain off.
e.) Place the fan switch in the auto position.
f.) The fan should go off.
g.) Set the temperature control thermostat to a setting above the current room temperature.
h.) The fan and heater should operate. If the room temperature is high and the installation is above 3,300 feet (1000m), the unit heater may cycle on the thermal high limit cutouts of the motor or the heater.
i.) Check out and report any unusual or questionable operating characteristics, such as noise, vibration, loss of fluid, etc.
Note that crackling noises coming from the heat exchanger during warm up are normal.
j.) Set the fan switch and temperature control thermostat to the desired operating positions.

B. Normal Operation:

Prior to the start of the heating season, perform the electrical and mechanical steps outlined in the section titled "maintenance".

1. Perform the Operation steps for the applicable temperature control option.
2. Place all switches in their normal operating position and place the unit heater in service.

MAINTENANCE

Maintenance and repair must be performed by qualified personnel only.

A. Electrical:

1. Inspect all terminal connections, contactor and conductor insulation for damage, looseness, fraying, etc., as applicable. Tighten any loose terminals and replace or repair wire with damaged or deteriorated insulation. If contactor contacts are badly pitted, welded together, or burned, replace the contactor. Check all explosion-proof conduit for visible damage and tightness.
2. If reduced heat output is suspected, perform the mechanical checks. If low heat output is still suspected after completing the mechanical checks, verify the condition of the heating elements by using an amperage meter to check the current draw of each input line. All input lines should draw approximately equal current which should agree with nameplate rating. If they do not, one or more of the heating elements could be burned out and the heater/core assembly should be replaced.
3. The electric motor is permanently lubricated and thermally protected. Check for smooth and quiet running at all inspections. Replace motor if excessive bearing play is detected. Contact the factory for instructions.

B. Mechanical:

1. Never attempt to fill, drain or check the liquid level of the heat exchanger or check the action of the pressure relief valve. Contact the factory for instructions.
2. The explosion-proof control box is designed with threaded joints and metal-to-metal contact at the lid or cover joints to prevent an explosion. Do not attempt to install gasket material of any type at these joints. A light coating of anti-seize compound is applied to the threads to prevent seizing.
3. Annually check the tightness of all visible bolts and nuts, in particular the support structure bolts and nuts. Similarly check the motor mounting bolts and nuts.
4. Periodically, check the motor, fan and heater core fins for cleanliness. A dirty heat exchanger can cause the unit to over heat and cycle on the thermal cutouts. If the dirt is loose dust, clean with a vacuum or by air jet. If the dirt can't be vacuumed or blown off, use a warm water spray directed to the inlet side of the heat exchanger then to the outlet side. Units may also be ordered with upgraded features to support "IP55" wet location construction. A soft bristled brush may be required to loosen stubborn deposits. Be careful not to bend the aluminum fins on the heat exchanger or the fan blade propeller. Allow unit to dry before re-energizing.
5. Check louvers for position tightness and equal angle settings. Check motor and fan for smooth running operation. Any unusual noise or vibration must be investigated and rectified.
6. Should there be any evidence of fluid leakage from the heater core, the heater should be repaired immediately. The heater will not operate properly with a low fluid level. Contact the factory for replacement core.

REPAIR AND REPLACEMENT

Maintenance and repair must be performed by qualified personnel only.

A. Replacing the Heat Exchanger Core:

The heat exchanger core is not field repairable. Contact factory for replacement.

1. Disconnect the heater electrical power supply, unwire and lower the heater from its mounting location. Set heater face down on a table or on the floor.
2. Remove the cabinet bottom, cabinet top, wiring and heater enclosure covers.
3. Disconnect all heater wires from the contactor in the wiring enclosure. Disconnect the control wiring from thermal cutout.
4. Thread conduit into wiring enclosure to disconnect the heater terminal box.
5. With an assistant supporting the weight of the heat exchanger, remove the 3 heat exchanger mounting bolts. Carefully remove the heat exchanger out of the bottom of the cabinet.
6. Locate rating tag on the heat exchanger and verify that electrical ratings of the core to be installed match the electrical ratings on the heater nameplate.

7. To reinstall, slide the core through the bottom of the cabinet while an assistant lines up and installs the 3 heat exchanger mounting bolts.
8. Guide the heater lead wires back into the wiring enclosure.
9. Reconnect the heater lead wires to the contactor and the conduit.
10. Reattach the cabinet bottom and enclosure covers before mounting heater and energizing.

B. Replacing the Temperature High-Limit Cutouts:

1. Disconnect the heater electrical power supply and remove the heater enclosure cover.
2. Remove the wire barrier to expose the high limit cutout.
3. Disconnect the wires from the high limit cutout and mark their location.
4. Remove the two nuts used to attach the temperature high limit cutout.
5. Lift and remove the sheetmetal mounting plate.
6. Carefully lift and remove the temperature high limit cutout.
7. Use only factory supply parts for safe operation.
8. Lightly coat the new manual and automatic cutout bulbs with the supplied thermal transfer compound. This is critical for proper cutout operation.
9. Carefully slide the automatic cutout bulb into the **left** thermowell and the manual cutout bulb into the **right** thermowell.
10. Reinstall the sheetmetal plate. Note that the sheetmetal plate also acts as a stop to keep the cutout bulbs from backing out of the wells.
11. Carefully install the temperature high limit control to avoid putting kinks into the capillary.
12. Reattach the wires to the cutout and reinstall the wire barrier.
13. Ensure heater enclosure cover is in place before energizing heater.

C. Resetting the Manual Cutout:

All unit heaters contain a built-in manual reset thermal cutout with or without backup contactor.

1. Disconnect the heater electrical power supply and remove the heater enclosure cover.
2. Determine the reason for the manual reset thermal cutout actuating and rectify the situation. See section titled “maintenance”.
3. Reset the manual reset thermal cutout by pressing on the red stem in the center of the control.
4. Replace the heater enclosure cover securely.
5. Energize the heater electrical supply circuit.
6. The heater and fan should come on and in 5 to 15 minutes reach a stable operating temperature.
7. Check out and report any unusual or questionable operating characteristics, such as noise, vibration, loss of fluid, etc.
8. If heater operation appears normal, place the unit into normal operation.

D. Replacing the Fan Motor and Blade:

The fan motor is permanently lubricated and does not require any maintenance. If the fan motor is defective, a replacement must be obtained from the factory.

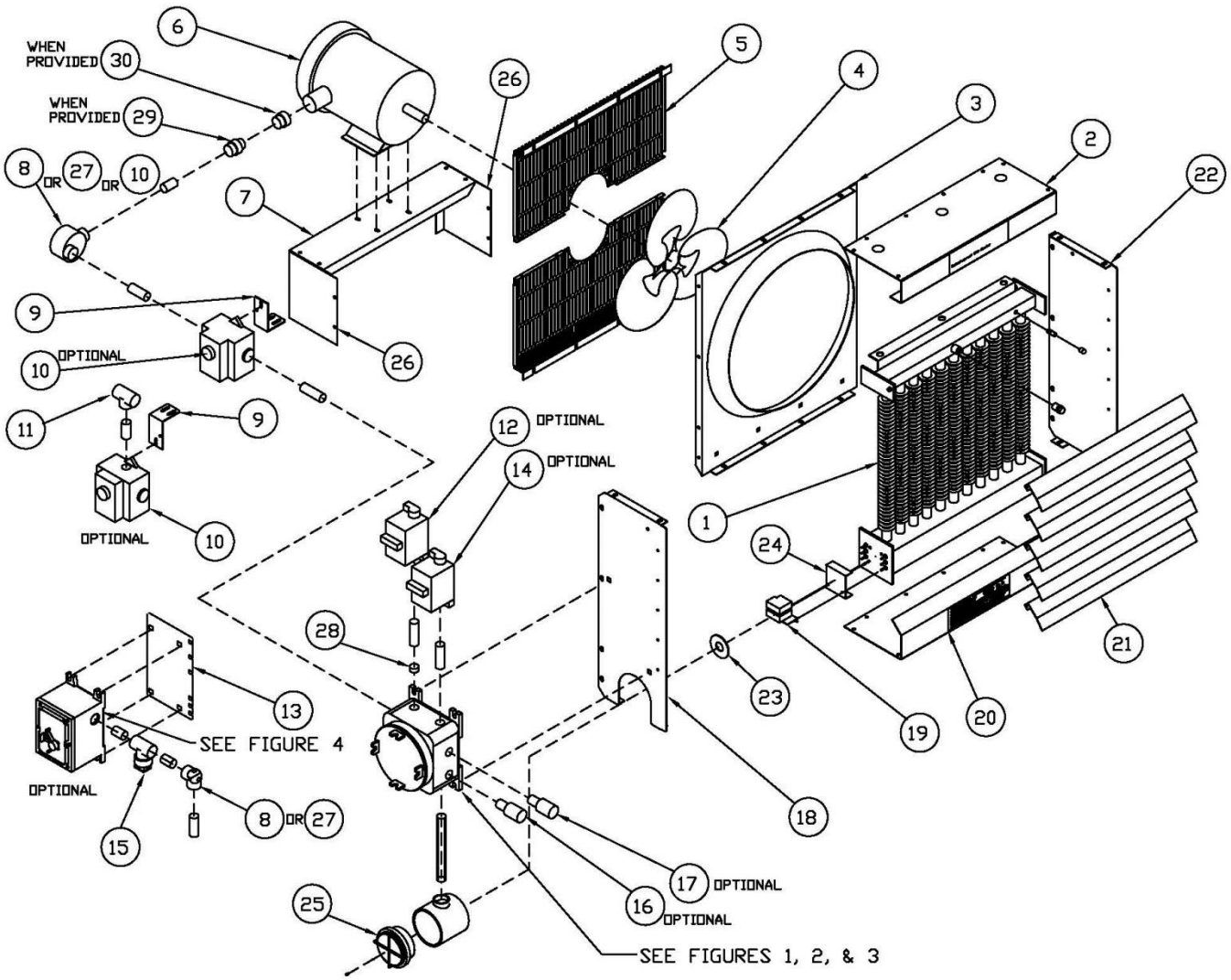
1. To replace the fan motor:
    a. Disconnect the heater electrical power supply.
    b. Disconnect the motor supply wires from the contactor in the wiring enclosure.
    c. Disassemble the conduit union located at the motor wiring hub.
    d. Remove top fan guard and motor mounting bolts.
    e. Lift motor out of heater assembly.
    f. Remove fan blade and conduit union from defective motor and install on new motor.
    g. Install new motor to heater using existing motor mounting hardware.
    h. Reinstall top fan guard and ensure that the fan blade rotates freely.
    i. Feed motor wires through conduit and into wiring enclosure.
    j. Reattach conduit union. Reconnect motor wires to contactor.
    k. Check fan rotation by momentarily energizing heater. Airflow should exit from front of heater cabinet. If rotation is incorrect, disconnect electrical power supply and reverse two of the motor lead wires at the contactor.
    l. Reattach wiring enclosure cover before placing heater back in service.

2. To replace the motor fan blade:
    a. Remove the top fan guard.
    b. Remove the four motor mounting bolts and disconnect the conduit union at the motor.
    c. Loosen the bolt that connects the fan blade to the motor shaft.
    d. Slide the motor back and tilt in order to remove the old blade & install a new one.
    e. Tighten the fan blade attachment bolt to the motor shaft.
    f. Reattach the motor conduit union and the four motor mounting bolts.
    g. Reinstall the top fan guard and ensure that the fan blade rotates freely.

REPLACEMENT PARTS

1. All replacements must be factory supplied to ensure safe heater operation.
2. Mark wires and refer to wiring diagram to ensure proper electrical connections.

Reference heater catalog number and item number in figures below when contacting factory for replacement parts. Contact factory for items not shown.



ITEM	DESCRIPTION
1	Heat Exchanger Core Assy.
2	Cabinet – Top
3	Fan Venturi
4	Fan Blade
5	Fan Guard
6	Fan Motor
7	Motor Support – Top
8	Motor Junction Box
9	Thermostat Support Bracket
10	Thermostat
11	Conduit Tee
12	Disconnect Switch – Small
13	Large Disconnect Support Bkt.
14	Fan Switch
15	Conduit Seal
ITEM	DESCRIPTION

16	Pilot Light – Bottom
17	Pilot Light – Top
18	Cabinet – Left Side
19	High Limit Cutout Assembly
20	Cabinet – Bottom
21	Cabinet - Louver
22	Cabinet – Right Side
23	High Limit Barrier
24	High Limit Mounting Bridge
25	Heater Enclosure Cover
26	Motor Support – Side
27	Conduit Pull Elbow
28	Reducer Bushing
29	Conduit Union
30	Reducer Bushing

Select the Figure that corresponds to your heater.

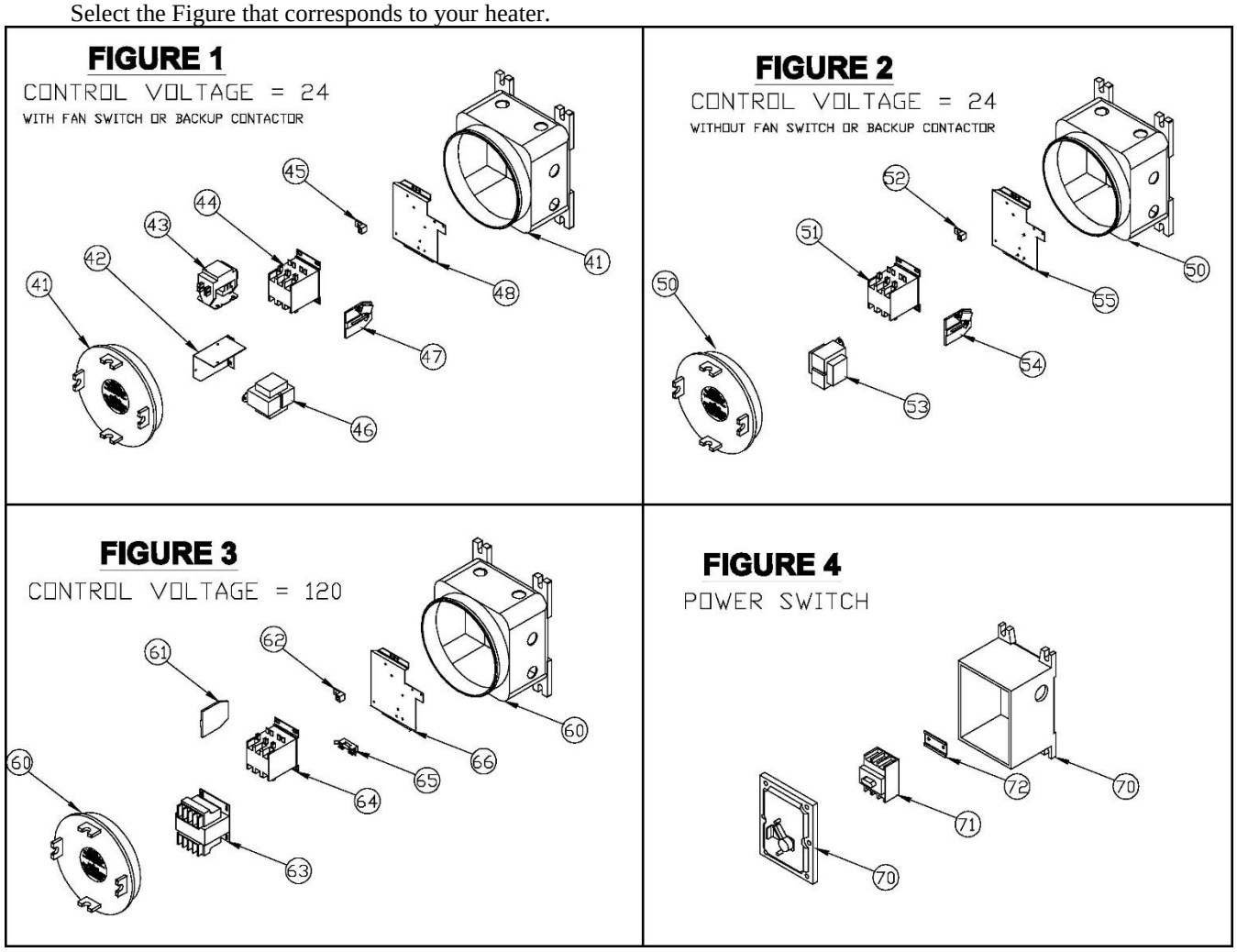


FIGURE 1:

ITEM	DESCRIPTION
41	Wiring Enclosure and Cover
42	Option Mounting Bridge
43	Option Contactor
44	Main Contactor
45	Ground Lug
46	Transformer
47	Auxiliary Contact
48	Main Mounting Bridge

FIGURE 2:

ITEM	DESCRIPTION
50	Wiring Enclosure and Cover
51	Main Contactor
52	Ground Lug
53	Transformer
54	Auxiliary Contact
55	Main Mounting Bridge

FIGURE 3:

ITEM	DESCRIPTION
60	Wiring Enclosure and Cover
61	Auxiliary Contact
62	Ground Lug
63	Transformer
64	Main Contactor
65	Transformer Fuse & Fuse Block
66	Main Mounting Bridge

FIGURE 4:

ITEM	DESCRIPTION
70	Switch Enclosure and Cover
71	Disconnect Switch
72	Disconnect Switch Track

TRIAD Series

Washdown / Corrosion Resistant
Industrial / Commercial Electric Unit Heater

Owner's Manual

This manual covers installation, operation and maintenance. Read carefully before attempting to install, operate or service the TRIAD Series Unit Heater.

IMPORTANT INSTRUCTIONS

SAVE THESE INSTRUCTIONS FOR FUTURE REFERENCE

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ENM-2052-01 / 23-2180-83-5

IMPORTANT INSTRUCTIONS

Installation and maintenance personnel should familiarize themselves with this manual and all the **IMPORTANT INSTRUCTIONS** before installing or working on this heater to avoid potential unsafe conditions, severe property damage, personal injury or death.

1. Read all instructions before installing and operating this heater.
2. Verify that the supply voltage and phase to the heater matches the nameplate rating before energizing.
3. Potentially lethal voltages are present. Be sure to lock the branch circuit disconnect switch in the OFF position and tag the circuit "Out for Maintenance" before working on this equipment.
4. Keep electrical enclosure cover tightly closed while in operation.
5. Hazard of Electric Shock. Heater must be grounded in accordance with both local and national codes.
6. This heater should be installed by a licensed electrician familiar with all applicable national and local codes having jurisdiction. It is the responsibility of the installer to verify the safety and suitability of the installation.
7. Disassembly of the unit for installation is not required or authorized.
8. Replacement electrical components must be obtained from the factory in order to maintain any applicable Agency Listings.
9. Use this heater only as described in this manual. Any other use is not recommended by the manufacturer and may result in fire, electric shock or personal injury.
10. The heater and discharge air are hot when in use. To avoid burns, do not let bare skin touch hot surfaces.
11. To prevent a possible fire, do not block or allow foreign objects to enter air intakes or exhaust in any manner.
12. Risk of fire due to high temperatures. Keep electrical cords, drapery, furnishings, insulation and other combustibles at least 3 feet (0.9m) from the front of the heater and away from the sides, rear and top.
13. Installation minimum mounting clearances specified both on heater nameplate and in this owner's manual must be maintained.
14. Use copper wire rated 90°C min. for supply connections.
15. This heater should not be used in potentially explosive atmospheres. Do not use in areas where gasoline, paint, or flammable liquids are used or stored.
16. Do not use outdoors. Heater may be washed down with water for cleaning. Do not use high pressure cleaning systems.
17. Risk of fire. Do not use as a residential or household heater.
18. Heater is designed to be controlled by a room thermostat located within the operating space that will control the room temperature below 80°F (26.7°C). Do not allow heater to cycle on the built-on limit controls.
19. The heaters are designed for permanent wall or ceiling mounting in a horizontal position only.
20. Do not operate heater after it malfunctions. Disconnect power at service panel and have heater inspected by a reputable electrician before reusing.
21. **SAVE THESE INSTRUCTIONS.**

WARRANTY WILL BE VOID IF INSTRUCTIONS ARE NOT FOLLOWED.

INSTALLATION INSTRUCTIONS

RISK OF FIRE / EXPLOSION

- This heater should not be used in potentially explosive atmospheres. Do not use in areas where gasoline, paint or flammable liquids are used or stored.
- Keep electrical cords, drapery, furnishings, insulation and other combustibles at least 3 feet (0.9m) from the front of the heater and away from the sides, rear and top.
- Installation minimum clearances specified both on the heater nameplate and in the owner's manual must be maintained.
- Do not use as a residential or household heater.

These air heaters are designed for comfort heating and should not be used in ambient temperatures exceeding 80ºF (26.7ºC). They are to be permanently mounted to the wall or ceiling for horizontal discharge. The unit is designed to give years of safe, trouble-free operation when properly installed and maintained.

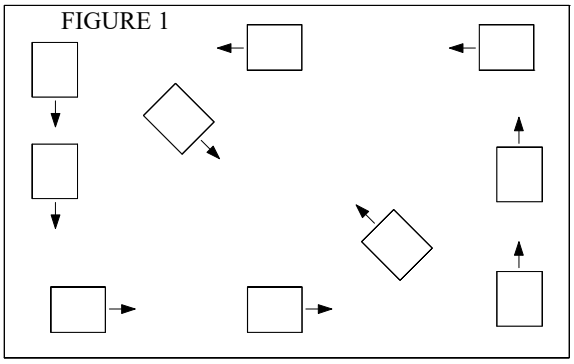
A. Site Selection:

The heaters are intended for elevated mounting locations so that they blow warm air down to the floor area. A mounting height should be selected so that the heater is out of the way of possible moving equipment or personnel, yet low enough to deliver warm air to the selected area. See the mechanical installation section for recommended installation heights.

Heater airflow should be directed to areas of greatest heat loss. In general, greater numbers of small heaters will provide more uniform and even heat distributions than a few large ones. In order to help move heated air around the room, multiple heaters should be spaced out and direct air in a circular pattern around the room perimeter such that each heater supports the next heater's airstreams. See Figures 1 & 2 for some typical airflow pattern arrangements:

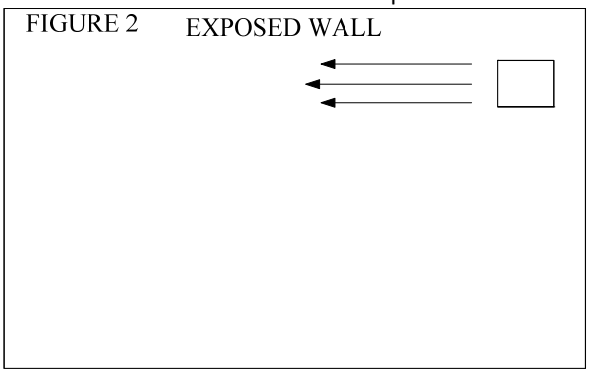
Large room with exposed walls and roof :

FIGURE 1



Small room with one exposed wall:

FIGURE 2 EXPOSED WALL



INSTALLATION INSTRUCTIONS – Continued

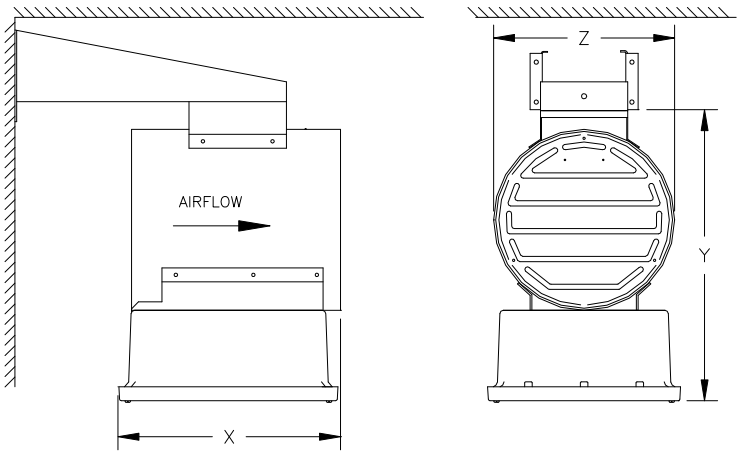
B. Mechanical Installation:

These heaters are to be mounted for horizontal discharge only. Mounting is to be accomplished by using either (4) 3/8x16 threaded rods (supplied by others) or the stainless steel swivel mounting bracket factory supplied with the heater. Lock washers should be used on all mounting nuts and bolts to ensure they don't vibrate or work loose due to fan vibration or other vibration transmitted to the heater.

The supporting structure that the heater is attached to must have adequate strength to safely support the heater. The heater dimensions and maximum unit weights are:

TABLE 1:

KW	Cabinet Size	X	Y	Z	Weight
<= 12	1	15.50" (394mm)	21.50" (546mm)	13.00" (330mm)	56 lbs (25 kg)
12.1 to 47	2	26.00" (660mm)	28.00" (711mm)	20.00" (508mm)	115 lbs (52 kg)



Select a location for installation such that the outlet air is not directed at an adjacent wall. Louvered grills can be installed to deflect the discharge air up, down or sideways.

TABLE 2:

KW	Cabinet Size	Air Volume	Air Throw	Outlet Velocity
<= 7.5	1	700 CFM (1189 cubic m/hr)	26 Ft (8 m)	760 FPM (232 m/min)
7.6 to 12	1	1450 CFM (2463 cubic m/hr)	43 Ft (13 m)	1575 FPM (481 m/min)
12.1 to 47	2	2400 CFM (4077 cubic m/hr)	50 Ft (15 m)	1200 FPM (366 m/min)

Once an acceptable location has been determined, see the following instructions to complete the mechanical installation:

1. To ensure proper heating of floor surfaces, observe the following recommended mounting height limitations (to bottom of heater):

TABLE 3: Max. Mounting Height from Floor, feet (m)			
<= 5 KW	5.1 to 10 KW	10.1 to 20 KW	20.1 to 47 KW
10' (3m)	15' (4.6m)	20' (6.1m)	25' (7.6m)

2. Install the heater at least 6 feet (1.8m) from the floor and 8" (203mm) from the wall or ceiling.
3. Mount heater using one of the following two options:

Standard ceiling or wall mount using the swivel bracket:

MOUNTING HOLE DETAIL-
REAR VIEW OF BRACKETS

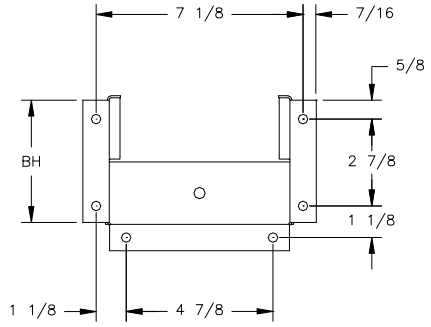


FIGURE A
(1-12KW)

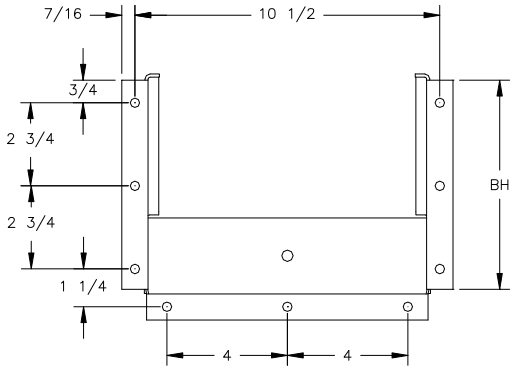


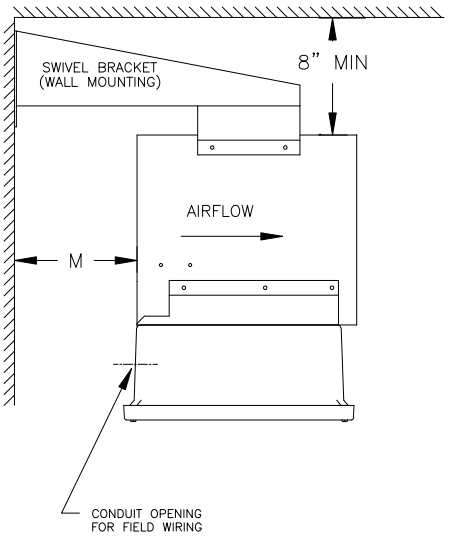
FIGURE B
(12.5-47KW)

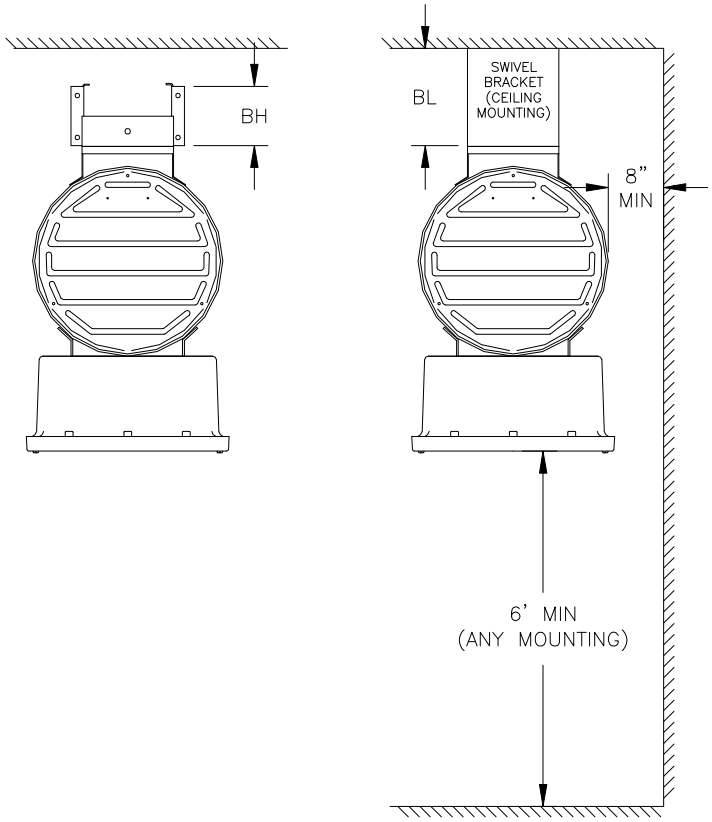
(See Table 4 on next page for tabulated dimensions)

INSTALLATION INSTRUCTIONS – Continued

12.1 to 47	7.125” (181mm)	22.25” (565mm)	3.25” (83mm)

Ceiling or wall mount using swivel bracket (cont):





Optional Ceiling Installation using 4 threaded rods:

For ceiling installation using threaded rods, secure the four rods to the ceiling using locknuts.

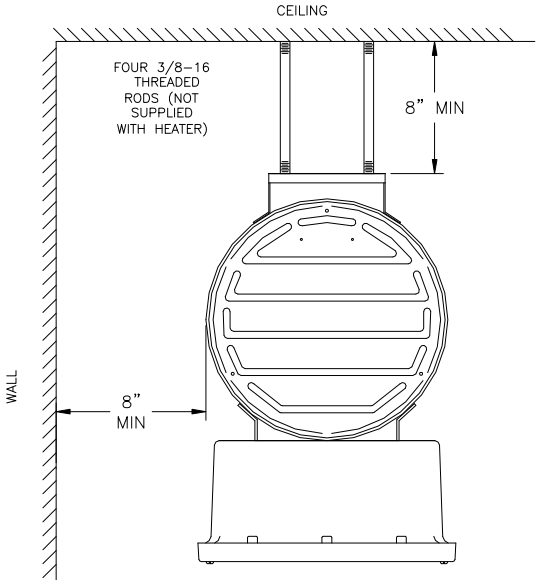


TABLE 4:

KW	BH	BL	M
<= 12	4.25” (108mm)	19.50” (495mm)	8.50” (216mm)

INSTALLATION INSTRUCTIONS - Continued

ELECTRIC SHOCK HAZARD

- Electrical installation should be made by a qualified licensed electrician. Wiring procedures, connections and grounding shall be in accordance with the national and local codes having jurisdiction.

C. Electrical Installation:

Follow these instructions to complete the electrical installation:

1. External branch circuit protection is required. See nameplate ratings and follow Code recommendations.
2. Follow the national and local electrical and building codes related to the installation and intended use of the heater.
3. When doing any work on a heater, including the initial electrical connection, disconnect the electrical supply at the main branch circuit switch, and lock the switch in the off (open) position. Tag the circuit "Out for Maintenance" to prevent potential lethal shock hazards.
4. Confirm that the electrical power supply matches the nameplate voltage, phase, amperage and frequency rating of the heater to be connected.
5. Field supply conductors must be sized for at least 125% of the circuit current. The circuit current in amps is calculated as follows:

$$\text{Single Phase Amperage} = \frac{\text{Circuit kW} \times 1000}{\text{Circuit Voltage}}$$

$$\text{Three Phase Amperage} = \frac{\text{Circuit kW} \times 1000}{1.732 \times \text{Circuit Voltage}}$$

6. Use copper conductors rated 90°C minimum with watertight conduit fittings.
7. Field wiring to the heater must comply with all branch circuit requirements of any national and local codes having jurisdiction.
8. Proper installation of the heater requires that an adequate grounding conductor be connected to the ground terminal. This terminal marked with the letter “G” and is located on the inside of the control enclosure.
9. A wiring diagram is supplied with each heater and is located on the inside surface of the control enclosure cover.
10. Check and confirm all connections are securely tightened. Remove any foreign objects from the control box and close access door.
11. See section titled “Operating Instructions” before energizing the heater.

OPERATING INSTRUCTIONS

RISK OF FIRE / EXPLOSION

- This heater should not be used in potentially explosive atmospheres. Do not use in areas where gasoline, paint or flammable liquids are used or stored.
- Keep electrical cords, drapery, furnishings, insulation and other combustibles at least 3 feet (0.9m) from the front of the heater and away from the sides, rear and top.
- To prevent a possible fire, do not block or allow foreign objects to enter air intakes or exhaust in any manner.

ELECTRIC SHOCK HAZARD

- Keep electrical enclosure cover tightly closed while in operation.
- Do not operate heater after a malfunction. Disconnect power at service panel and have heater inspected by a reputable electrician before reusing.
- Use this heater only as described in this manual. Any other use is not recommended by the manufacturer and may result in fire, electric shock or personal injury.

RISK OF INJURY / BURN

- The heater and discharge air are hot when in use. To avoid burns, do not let bare skin touch hot surfaces.
- Do not attempt to service or clean heater while unit is operating as there is a hazard from electric shock, injury from operating fan blade and burns from hot heating elements.

The unit is designed to give years of safe, trouble-free operation when properly installed and maintained. Please read the following guidelines to ensure reliable operation:

1. Confirm proper mechanical and electrical installation before operation of the heater.
2. This unit heater may be operated at ambient temperatures of 80°F (26.7°C) or less.
3. Make sure the wiring enclosure cover is closed securely.
4. Set the temperature control thermostat to a setting above the current room temperature.
5. If the heater is provided with a selector switch, it must be in the ON position.
6. Energize the heater electrical supply circuit.
7. The heater and fan should come on.
8. Check for the correct fan blade rotation. If air is not discharging through the louvers, interchange any two of the three field supplied power leads on three phase units only.
9. Since the heater is equipped with a built-in time delay relay, the fan will remain in operation for about a minute to cool the elements after the heater is switched off either by the thermostat or the selector switch. Do not turn the heater off at the main disconnect switch, as this will prevent the fan from cooling elements.

OPERATING INSTRUCTIONS - Continued

RISK OF FIRE / EXPLOSION

- This heater should not be used in potentially explosive atmospheres. Do not use in areas where gasoline, paint or flammable liquids are used or stored.
- Keep electrical cords, drapery, furnishings, insulation and other combustibles at least 3 feet (0.9m) from the front of the heater and away from the sides, rear and top.
- To prevent a possible fire, do not block or allow foreign objects to enter air intakes or exhaust in any manner.

ELECTRIC SHOCK HAZARD

- Keep electrical enclosure cover tightly closed while in operation.
- Do not operate heater after a malfunction. Disconnect power at service panel and have heater inspected by a reputable electrician before reusing.
- Use this heater only as described in this manual. Any other use is not recommended by the manufacturer and may result in fire, electric shock or personal injury.

RISK OF INJURY / BURN

- The heater and discharge air are hot when in use. To avoid burns, do not let bare skin touch hot surfaces.
- Do not attempt to service or clean heater while unit is operating as there is a hazard from electric shock, injury from operating fan blade and burns from hot heating elements.

The unit is designed to give years of safe, trouble-free operation when properly installed and maintained. Please read the following guidelines to ensure reliable operation:

10. During normal operation, the limit controls are not supposed to cycle the heater ON and OFF. If frequent cycling of the limit controls occurs, verify the minimum mounting clearances are maintained, proper operation of the room thermostat and that there is no visible obstruction to the heater inlet or outlet. If this does not eliminate the limit control cycling, the heater must be examined by qualified service personnel before further operation to determine the cause.
11. Heater may be provided with a manual reset limit control (order code M). This limit control disables the electrical function of the heater whenever excessive temperatures are present. If the manual reset limit control is suspected of causing heater non-function then the heater must be disconnected from the heater electrical supply and examined by a qualified service personnel. The personnel must determine the cause of the excessive temperatures, verify the minimum mounting clearances, verify proper orientation of the heater, verify proper orientation of the room thermostat, or if there are any obstructions or damage to the heater or heater inlet or heater outlet. The manual reset limit control may be reset, after determining the cause, by removing the electrical enclosure cover and pressing on the manual reset button. The location of the manual reset button within the electrical enclosure is shown in the Maintenance Instructions.
12. Check out and report any unusual or questionable operating characteristics, such as noise, vibration, etc.
13. Set the temperature control thermostat to the desired room temperature setting and place unit in service.

MAINTENANCE INSTRUCTIONS

ELECTRIC SHOCK HAZARD

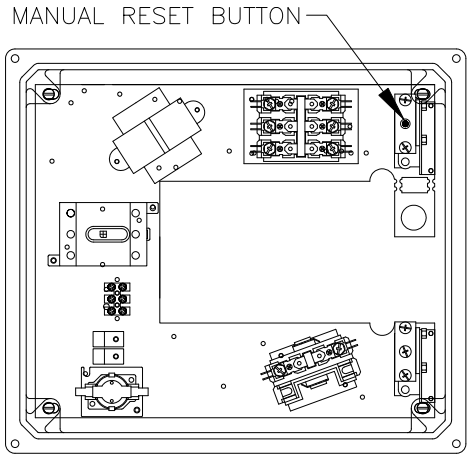
- Potentially lethal voltages are present. Be sure to lock the branch circuit disconnect switch in the OFF position and tag the circuit “Out for Maintenance” before working on this equipment.

RISK OF INJURY / BURN

- Do not attempt to service or clean heater while unit is operating as there is a hazard from electric shock, injury from operating fan blade and burns from hot heating elements.
- Maintenance and repair must be performed by qualified service personnel only.

Electrical:

1. Inspect all terminal connections, contactors and conductor insulation for damage, looseness, fraying, etc., as applicable. Tighten any loose terminals and replace or repair wire that has damaged or deteriorated insulation. Replace any contactor that has contacts that are badly pitted, welded together, or burned.
2. If reduced heat output is suspected, perform the mechanical checks. If low heat output is still suspected after completing the mechanical checks, verify the condition of the heating elements by visual inspection and by using an amperage meter to check the current draw of each input line. Adjust the room thermostat to its highest temperature to energize heater. All input lines should draw approximately equal current which should agree with the nameplate rating. If they do not, one or more of the heating elements could be burned out and should be replaced.
3. For heaters supplied with the optional manual reset limit control (order code ‘M’), the electrical enclosure cover must be opened to gain access to the reset button. See below to locate the reset button:



Mechanical:

1. Before cleaning or servicing, ensure power has been turned off at the service panel and the heating elements are cool.
2. Annually check the tightness of all visible bolts and nuts, in particular the support structure bolts and nuts.
3. Periodically, check the motor, fan, discharge openings, intake openings, heating elements and control compartment for cleanliness. If necessary, clean by using a vacuum or compressed air. Be careful not to bend or distort the fan blade propeller.
4. Check fan motor for smooth running operation. Any unusual noise or vibration must be investigated and rectified.
5. The electric motors are permanently lubricated and thermally protected. Check for smooth and quiet operation at all inspections. Replace motor if excessive bearing play is detected.
6. The heater may be washed down with water. Do not use high pressure cleaning systems.

Marley
Engineered Products

SERVICE REFERENCE

SALES REFERENCE **5200-2474-000**

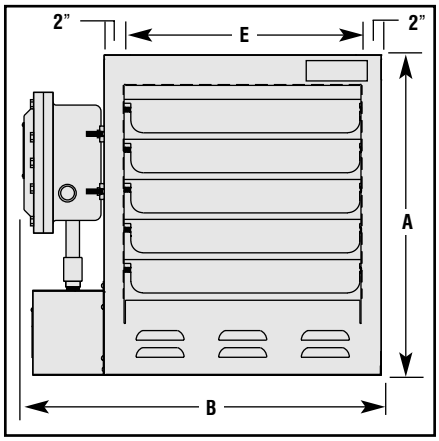
161-302421-006

DATE **MAY, 2002**

INSTALLATION, OPERATION
RENEWAL PARTS IDENTIFICATION

X Series (Model B) Explosion Proof Heater

Class I
Group C & D, Div. 1 & 2
Class II
Groups E, F & G
T3B - 165°C (329°F)



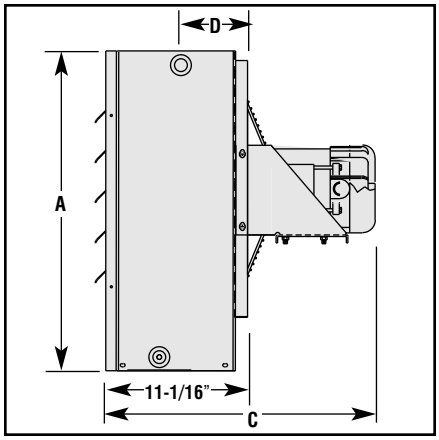


Table A – Specifications

kW	Voltage and Phase	Horiz. Air Discharge (Ft.)	BTUH	CFM	Wt. (Lbs.)	Overall Dimensions (In.)			5/8" UNC Tapped Mounting Hole Locations	
						A	B	C	D	E
3	208/240V-1 or 3Ø 480/575V-3Ø	28	10,236	700	127	19-1/8	23-7/8	21	3-1/2	13-5/8
5	208/240V-1 or 3Ø 480/575V-3Ø	28	17,060	700	127	19-1/8	23-7/8	21	3-1/2	13-5/8
7.5	208/240V-1 or 3Ø 480/575V-3Ø	32	25,590	840	133	19-1/8	23-7/8	21	3-1/2	13-5/8
10	240V-1 or 3Ø 208/480/575V-3Ø	32	34,120	840	138	19-1/8	23-7/8	21	3-1/2	13-5/8
15	208/240/480V 575V-3Ø	47	51,180	1450	150	25	27-7/8	21	4-13/32	17-5/8
18	240V-3Ø	43	61,420	1400	165	25	27-7/8	21	4-13/32	17-5/8
20	480/575V-3Ø	43	68,240	1400	165	25	27-7/8	21	4-13/32	17-5/8
25	480/575V-3Ø	54	85,300	2330	200	32-1/8	31-7/8	21-3/4	5-1/2	21-5/8
30	480/575V-3Ø	54	102,360	2330	200	32-1/8	31-7/8	21-3/4	5-1/2	21-5/8
35	480/575V-3Ø	54	119,420	2330	200	32-1/8	31-7/8	21-3/4	5-1/2	21-5/8

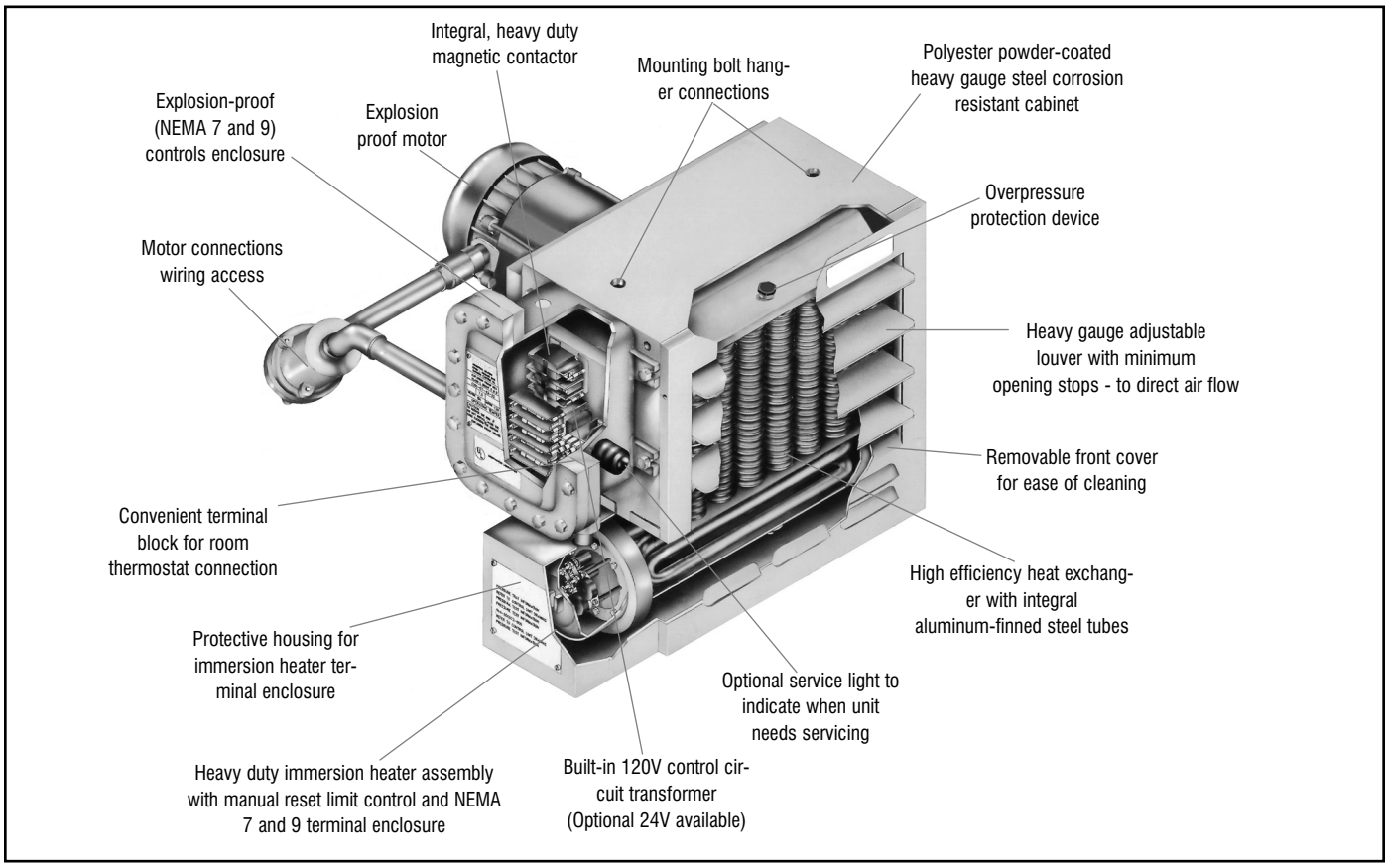
SAVE THESE INSTRUCTIONS

⚠WARNING

Read Carefully - These instructions are written to help you prevent difficulties that might arise during installation of heaters. Studying the instructions first may save you considerable time and money later. Observe the following procedures, and cut your installation time to a minimum.

TO REDUCE RISK OF FIRE AND ELECTRIC SHOCK:

1. ***To reduce the risk of ignition of hazardous atmospheres:*** In accordance with the National Electrical Code, do not install where operating temperature code exceeds the ignition temperature of the hazardous atmosphere. Use only in atmospheres having an ignition temperature higher than 165°C (329°F).
2. Disconnect from supply circuit before opening enclosures.
3. ***Hazard of Electric Shock. Heater must be effectively grounded in accordance with N.E.C. to eliminate shock hazard.***
4. Heat exchanger contains Propylene Glycol under pressure at operating temperature. A material safety data sheet (MSDS) is available from Marley upon request. Should leakage occur, remove unit from service and investigate cause.
5. Keep all electrical enclosure covers tightly closed and secured with all bolts and threads. Cover joints must be clean before replacing covers.
6. Install and operate in upright position only. Refer to Figure 3 for level requirements. Failure to comply will cause overheating of the element and shutting down the unit by tripping the high temperature cutout.
7. All unused threaded openings not used for supply wiring must be fitted with threaded plugs approved for use in hazardous locations.
8. All unit electrical installation fittings, conduit, wiring and seals must meet NEC and local codes for hazardous locations.
9. External line fusing or circuit breaker protection is required.
10. Hi limit cutouts must never be bypassed in the control circuit.
11. Alarm pilot lamp, if supplied, will turn on if the high limit control actuates. Steady on lamp indicates manual reset protector has tripped. This could result if the heat exchanger is obstructed (dirty), inlet air restricted or fan not turning. Shut off power to unit and refer to repair procedures section of instruction sheet.
12. Mounting clearances on nameplate must be observed.
13. Use copper wire for supply connections according to size and rating on nameplate.
14. Do not install any type of gasket material on any of the electrical junction box cover surfaces.
15. Do not attempt to override louver stops or operate unit with louvers fully closed.



GENERAL

The X-Series units rated 3 through 35 kW are designed for operation in Class I, Div. 1, Group C & D and Class II, Div. 1, Groups E, F and G hazardous atmospheres having an ignition temperature of 165°C (329°F) or higher. They are designed for comfort heating and should not be operated in ambient temperatures exceeding 40° (104°F). All units in Table A are UL listed. The units are easily adapted for wall, ceiling or pole mounting. Refer to Figure 4 on Page 3 for mounting information. They are supplied with either 24 or 120V internal control circuit voltage. The heater is designed for use with an external hazardous location thermostat or optional built-in thermostat.

The standard heater is designed to operate up to 7500 feet (2286 m) altitude. Consult factory for specific recommendations when using the units at higher altitudes.

INSTALLATION

⚠WARNING

Fire/Explosion Hazard. Mount only in upright position and observe nameplate mounting clearances.

Heater Location instructions:
Arrange units so their discharge air streams:

A. are subjected to a minimum of interference from columns, machinery and partitions.
B. wipe exposed walls without blowing directly at them.
C. are directed away from room occupants in comfort heating.
D. are directed along the windward side when installed in a building exposed to a prevailing wind.

Locate thermostat on interior partition walls or posts away from cold drafts, internal heat sources and away from heater discharge air streams.

Small rooms can be heated by one unit heater. Where two walls are exposed, the heater should be mounted as shown in Figure 2. Large rooms require multi-unit installations. Number and capacity of units will be determined by volume of building and square feet of floor area to be heated. Arrange units to provide perimeter air circulation where each unit supports the air stream from another.

The X-Series hazardous location heaters are designed for use only in a permanently mounted upright position. We recommend the use of a mounting kit (ceiling, wall or pole) available from Marley. (Figures 5, 6 and 7)

The ceiling or wall mounting surface and the anchoring provision must be sufficient to support the combined weights of the unit and mounting hardware.

If using mounting hardware or a supporting structure not supplied by Marley, the unit should be suspended from the supporting structure thru the two mounting points on top of the unit with 5/8 NC bolts and lockwashers. If single point mounting is desired, order the correct size Marley adapter bracket (P/N 027-302361-001 for 12" fan units, P/N 027-302361-002 for 16" fan units) and P/N 027-302361-003 for 20" fan units. This bracket is designed to hold the unit over its center of gravity with a 1 dia. bolt. The maximum tilt angles as shown in Figure 3 must not be exceeded in either direction during operation and installation. Failure to comply will cause high limit shut down.

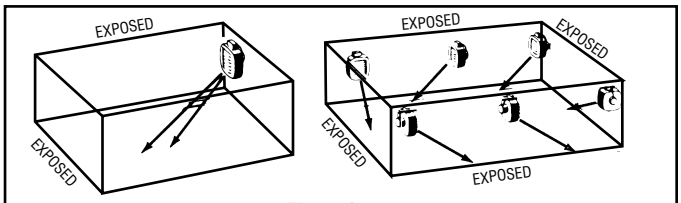


Figure 2

Maximum Out of Plane Allowance

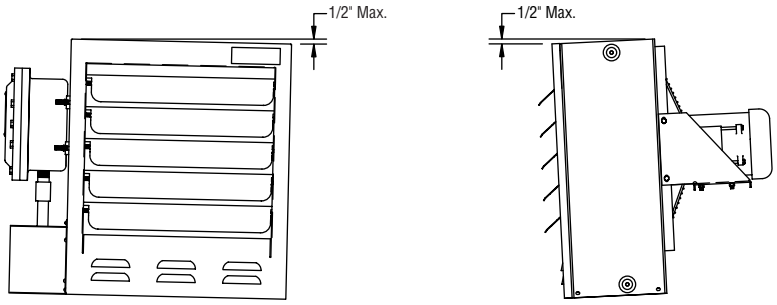


Figure 3

The heaters may be mounted at any convenient height above floor. The minimum spacings shown in Figure 4 should be maintained to adjacent walls and ceiling. If floor heat is desired, do not mount higher than 8 to 10 feet above floor.

Controlling thermostats to individual heaters should be mounted at shoulder height on inside walls or columns and clear of the discharge air stream of the unit. Allow at least 4 in front of heater for air stream to discharge freely.

Do not mount mercury type thermostat directly on unit, vibration could cause malfunction.

Heater may be mounted on a shelf or stand from the bottom. Be sure that mounting clearances are maintained and that bottom of unit has at least 1 clearance underneath it. This is necessary for good air circulation and servicing of heat exchanger. All mounting methods must allow for removal of front cover.

The mounting and anchoring provisions must take into account the unit vibration and cantilevered loading when wall or pole mounted. One of the Marley mounting kits shown in Figures 5, 6 and 7 must be used whenever possible.

Installation Clearances

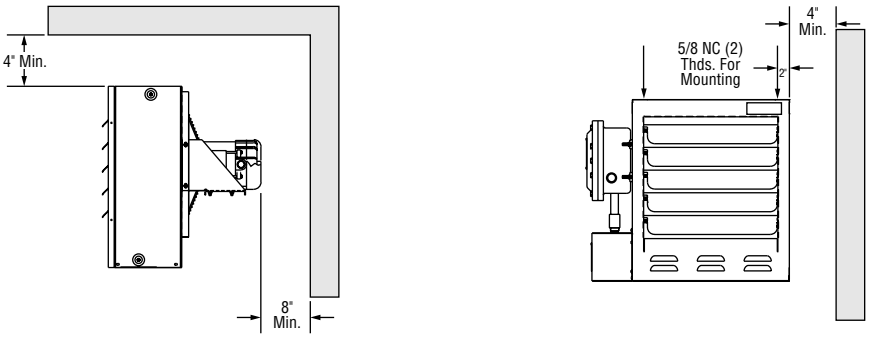
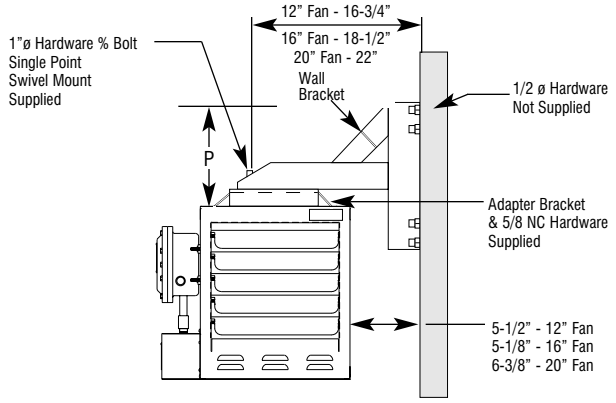


Figure 4

MOUNTING KITS

Wall Mount Kit
Model # XMB-12 12" Fan (3-10 kW)
Model # XMB-16 16" Fan (15-20 kW)
Model # XMB-20 20" Fan (25-35 kW)



3 through 10 kW	P=10"
15 through 20 kW	P=11-1/2"
25 through 35 kW	P=14-1/2"

Figure 5

Ceiling Mount Kit
Model # XCMOB

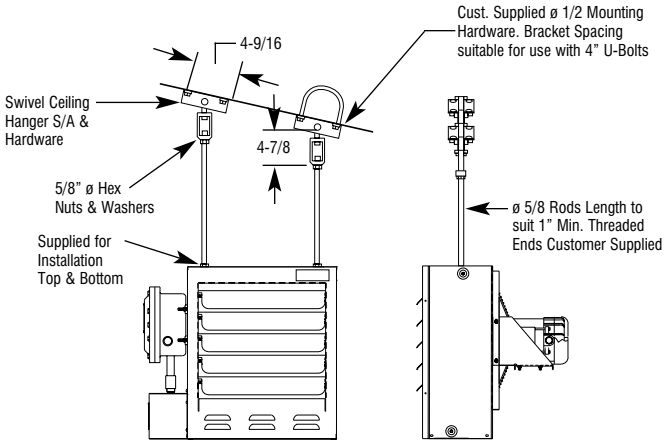
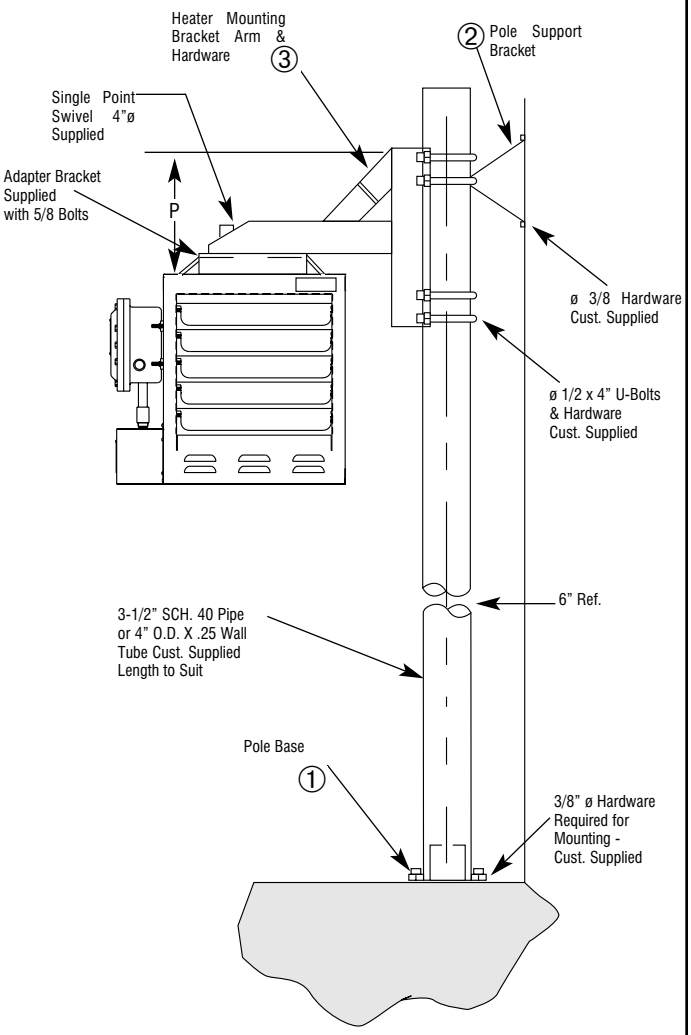


Figure 7

Pole or Wall Mount Kit
Model # XPM-12 12" Fan (3-10 kW)
Model # XPM-16 16" Fan (15-20 kW)
Model # XPM-20 20" Fan (25-35 kW)



3 through 10 kW	P=10"
15 through 20 kW	P=11-1/2"
25 through 35 kW	P=14-1/2"

Figure 6

Electrical Components

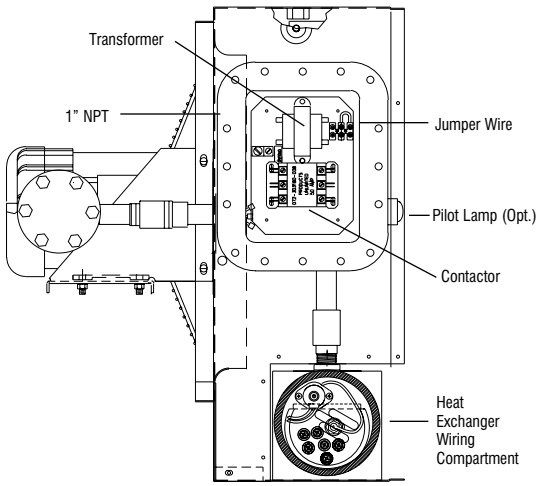


Figure 9

Unit Top View

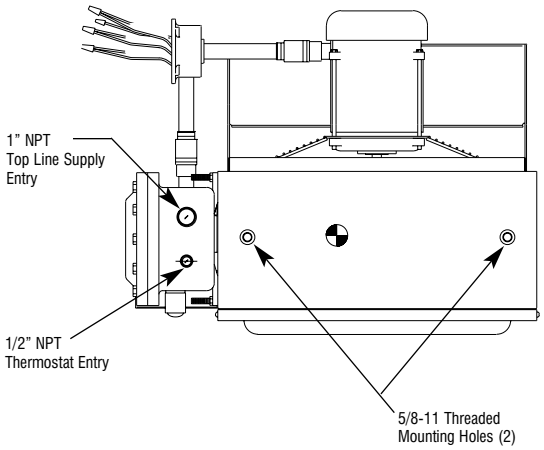


Figure 10

⚠WARNING

ELECTRIC SHOCK HAZARD. Disconnect all power before installing or servicing heater. Failure to do so could result in personal injury or property damage. Heater must be installed by a qualified person in accordance with the National Electrical Code, NFPA 70.

⚠WARNING

ELECTRIC SHOCK HAZARD. Any installation involving electric heaters must be performed by a qualified person and must be effectively grounded in accordance with the National Electrical Code to eliminate shock hazard.

1. Loosen and remove bolts securing the main terminal enclosure cover on side of unit. Connect heater to line supply wires at the box lugs located on the contactor according the voltage and frequency specified on the nameplate (see Figure 9). Refer to the appropriate wiring diagram which also appears on the inside cover of this enclosure (see Table B and diagrams on page 6).

⚠WARNING

Explosion Hazard. Cover joints must be clean before replacing cover. Do not use any gasket material on joint surfaces.

2. Use copper conductors only for supply wires. Refer to nameplate and Table B for size and rating required.
3. Connect supply line ground conductor to the box lug provided on the base plate below contactor input lugs.

Table B – Supply Wiring Requirements

kW	Phase	Volts	Supply Wire 90°C Size (ga)	Max Fuse Amps	Wiring Diagram #
3	1	208	10	25	I
	3	208	12	15	II
	1	240	10	20	I
	3	240	12	15	II
	3	480	12	15	II
	3	575	12	15	II
5	1	208	8	35	I
	3	208	10	20	II
	1	240	8	30	I
	3	240	10	20	II
	3	480	12	15	II
	3	575	12	15	II
7.5	1	208	6	50	I
	3	208	8	30	II
	1	240	6	45	I
	3	240	8	25	II
	3	480	12	15	II
	3	575	12	15	II
10	3	208	8	40	II
	1	240	4	60	I
	3	240	8	35	II
	3	480	10	20	II
	3	575	12	15	II
15	3	208	4	60	II
	3	240	6	50	II
	3	480	8	25	II
	3	575	10	20	II
18	3	240	4	60	II
20	3	480	8	35	II
	3	575	8	30	II
25	3	480	8	40	II
	3	575	8	35	II
30	3	480	6	50	II
	3	575	8	40	II
35	3	480	4	60	II
	3	575	6	50	II

4. The fan motor is factory wired at the same voltage, and phase as the heating elements. All motors are thermally protected and connected to the main supply contactor. On three phase units, **it is necessary to verify that the fan rotation is correct**. Air stream discharge must be out front of unit. After connecting unit to line and closing all covers tightly, energize unit momentarily. If air does not exit front louvers, reverse any two supply leads at the box lugs on the contactor or at the supply disconnect.
5. Either of two 1 NPT rigid conduit openings with integral stop may be used for connection to supply line. (See Figure 9 and 10 for locations) Use only NEC approval hazardous locations means of wiring such as mineral insulated cable and fittings or rigid conduit and seal fittings located as required by installation codes.

⚠WARNING

Explosion Hazard. All unused conduit openings must be fitted with plugs that are U.L. recognized for use in hazardous locations.

6. Heaters may be provided with a built-in control switch and/or thermostat. If not, they should be controlled by an externally mounted disconnect switch and/or separately mounted thermostat as shown in the appropriate wiring diagram on page 6. In case of malfunction, the personnel in the area should be aware of location of heater disconnect.
7. Installation must include appropriate over current protection devices (fusing or circuit breakers) as required by the National Electric Code in the supply line to the unit. Refer to nameplate for proper current ratings.
8. To operate heaters from an externally mounted hazardous location thermostat, a terminal block is provided for connection (Figures 9 and 10). Remove the factory installed jumper across T2 and T3 on the terminal strip. Wire the thermostat contact leads to these terminals. The built in control transformer supplies the unit with either 24V or 120V for internal unit operation. This voltage will appear across the thermostat contacts when they are open. The minimum thermostat contact rating should be 1 amp @ 120 VAC. Refer to nameplate for control voltage of unit. The 1/2 NPT conduit wiring entry on top of the terminal enclosure should be used to wire the thermostat to the heater (Figure 10).
9. Protection against overheating is provided by a manual reset limit control located within the heat exchanger wiring compartment. (Figure 9) Activation of the control will open the control circuit and energize the pilot lamp (if supplied). If normal airflow is restricted, or stopped, the unit will be cycled off by the manual reset cutout. The manual reset limit control is also designed to shut down the unit completely if the fluid level is low or other heater malfunction occurs.

⚠WARNING

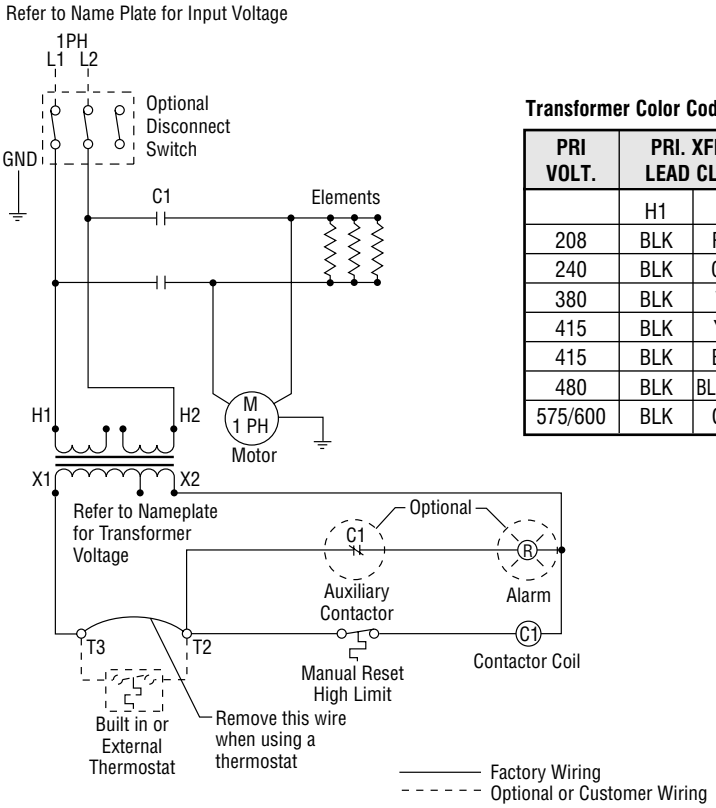
Manual reset limit control must never be bypassed in the control circuit. If the limit actuates, shut down unit and investigate cause of abnormal operation. Do not reenergize until the problem has been corrected.

⚠WARNING

The system designer is responsible for the safety of this equipment and should install adequate back-up controls and safety devices with their electric heating equipment. Where the consequences of failute could result in personal injury or property damage, back-up controls are essential.

WIRING DIAGRAMS

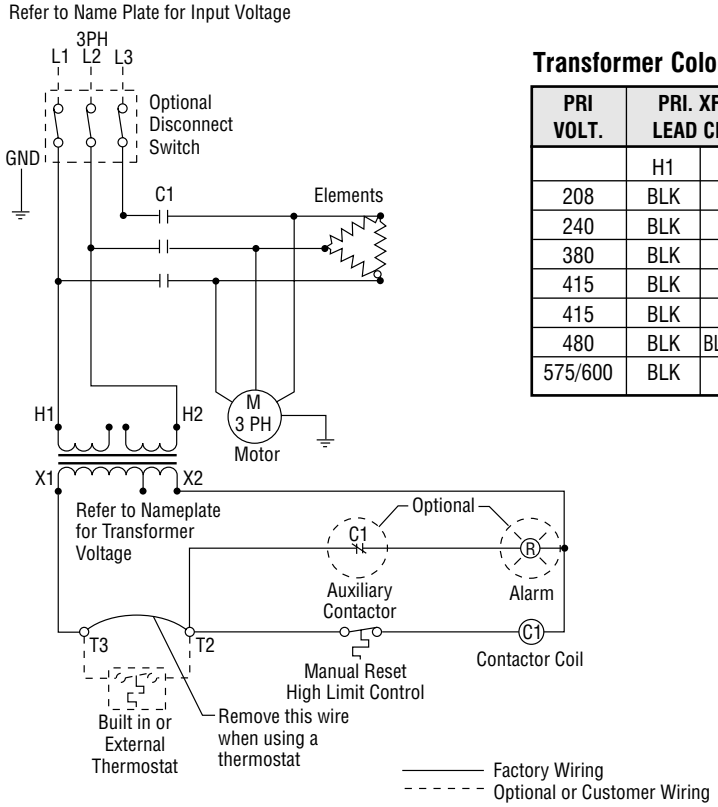
DIAGRAM I



Transformer Color Code Tabulation

PRI VOLT.	PRI. XFMR LEAD CLRS.		120V SEC LEAD CLRS.		24V SEC LEAD CLRS.	
	H1	H2	X1	X2	X1	X2
208	BLK	RED	BLK	WHT	YEL	BLU
240	BLK	ORG	BLK	WHT	YEL	BLU
380	BLK	VIO	BLK	WHT	YEL	BLU
415	BLK	YEL	BLK	WHT	-	-
415	BLK	BRN	-	-	YEL	BLU
480	BLK	BLK/RED	BLK	WHT	YEL	BLU
575/600	BLK	GRY	BLK	WHT	YEL	BLU

DIAGRAM II



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240	BLK	ORG	BLK	WHT	YEL	BLU
380	BLK	VIO	BLK	WHT	YEL	BLU
415	BLK	YEL	BLK	WHT	-	-
415	BLK	BRN	-	-	YEL	BLU
480	BLK	BLK/RED	BLK	WHT	YEL	BLU
575/600	BLK	GRY	BLK	WHT	YEL	BLU

MODEL NUMBER DESCRIPTION

X	300	8	1	2	B	T
Series	Wattage	Voltage	Phase	Control	Version	Suffix
Explosion Proof Heater for Hazardous Locations	300=3.0kW 500=5.0kW 750=7.5kW 1000=10.5kW 1500=15.0kW 1800=18.0kW 2000=20.0kW 2500=25.0kW 3000=30.0kW 3500=35.0kW	8=208Volt 4=240Volt 48=480Volt 6=575Volt	1=1 Phase 3=3 Phase	2=24Volt 1*120Volt		T=Thermostat L=Pilot Light (Heater On) K=Pilot Light (Heater Tripped) S=Selector Switch (Fan Only) D=Disconnect Switch (15 Amp 3PH) Disconnect Switch (30 Amp 1PH) Disconnect Switch (30 Amp 3PH) Disconnect Switch (60 Amp)

OPERATION

⚠WARNING

Explosion Hazard. Heater should not be operated in ambient temperature higher than 40°C (104°F) or in atmospheres corrosive to the heater itself.

1. The X-Series unit heaters use a sealed water-glycol filled heat exchanger. The electric immersion elements transfer heat energy directly to the fluid generating a fluid/vapor mixture which releases its heat energy to the finned radiator as it rises and recondenses back to the bottom reservoir to be reheated. This cycle will continue as long as fan forced air is available on the finned structure to remove the heat to the airstream.
2. The finned structure of the heat exchanger must be kept clean and free of accumulated dust and dirt. The cabinet front panel is easily removed providing access to the heater core for periodic cleaning.
3. Unit should not be operated with louvers fully closed. Mechanical stops are incorporated into the design of the cabinet to limit the degree of closure. Do not force the louvers beyond these stops.
4. If specified, units are supplied with a built in alarm pilot lamp which will energize if the manual reset control has a been activated. During unit startup, the lamp will flash on momentarily to verify its operation.

MAINTENANCE AND REPAIR

Maintenance and repair must be performed by qualified personnel only.

⚠WARNING

Explosion/Electric Shock Hazard. Disconnect all power before opening enclosure covers or servicing heaters. Failure to comply could result in personal injury or property damage.

1. Periodically inspect all electrical connections and terminals to avoid electrical wiring difficulties. Inspect all wiring for frayed or worn insulation.
2. Periodically and before each heating season, clean the finned heat exchanger and fan inlet with compresses air, vacuum, or water jet. Be sure all electrical covers are tightly closed.
3. If heat output seems to be low, check amperage draw on each element. Compare measured values to the correct currents as listed on the unit nameplate.
4. The thermally protected fan motor is permanently lubricated and sealed. No field servicing is required or should be attempted. Replace only with a factory supplied identical motor. Failure to do so will void the factory warranty and may expose the user to risk of ignition of hazardous atmospheres.
5. Check fan blade to be sure that set screws are tight and there are no cracks or looseness in the blades. Use factory supplied replacement blade only.
6. Check for any sign of leaking from the heat exchanger. Too little fluid will cause the manual high limit to trip.
7. The sealed heat exchanger contains a glycol/water solution of propylene glycol. Ethylene glycol is supplied for arctic duty conditions only. Avoid contact with skin and eyes. If ingestion should occur, seek medical attention immediately. In case of eyes or skin contact, wash affected areas with large amounts of water. **The MSDS (Material Safety Data Sheet) for these materials is available upon request.**

I. REPLACING THE HEAT EXCHANGER

⚠CAUTION

Burn Hazard. Be sure heat exchanger and fluid has been allowed to cool to 110°F before proceeding.

1. Detach the cabinet front by removing screws from all sides of unit and pulling cover forward off cabinet shell. Detach bottom panel by removing two screws on each side and two screws in the rear. Remove the electrical control enclosure lid. Disconnect the heater and high limit wires from the electrical control enclosure. Loosen electrical conduit union located between the heater housing and the electrical control enclosure. Support the lower end of the heat exchanger and loosen the three hex head bolts which hold it to the sheet metal. Lower the heat exchanger away from the sheet metal. Reverse the above procedure when installing a new heat exchanger.

II. RESETTING MANUAL RESET LIMIT CONTROL

⚠WARNING

Explosion Hazard. Be sure that all enclosure covers are replaced and tightly closed before re-energizing unit after servicing electrical components. High limit controls must never be bypassed in control circuit. The factory must perform the replacement of the immersion heater or overtemperature cutout. The heat exchanger seal must not be broken. Consult factory for service.

The occurrence of the manual reset limit control to trip is an abnormal condition. Care should be taken to determine the exact reason that the high limit control tripped. Possible problem areas could be dirty heat exchanger, blocked air inlet or outlet, fan/motor malfunction, too high operating ambient, incorrect operating voltage, or leaking heat exchanger. In the event that the heat exchanger is defective, it must be replaced.

1. The manual reset limit control is located in the heating element hazardous location enclosure on the heat exchanger which is covered by the sheet metal housing attached to the side of the unit. To gain access, remove the four sheet metal screws holding the sheet metal cover in place and unthread the cast aluminum enclosure lid. (See Figure 11.) The manual reset limit control device has a small reset button protruding from the center of its back housing. Depress this button in to reset the control. Replace the aluminum enclosure lid and sheet metal cover.

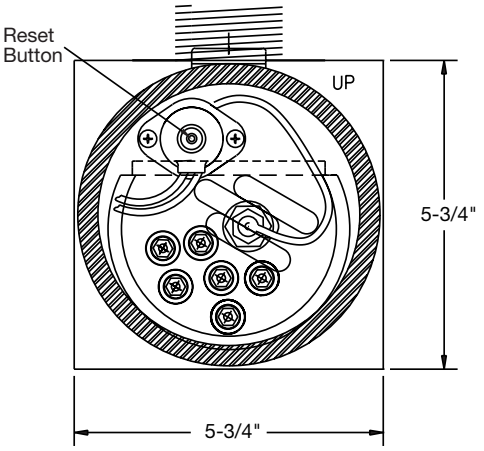


Figure 11

III. FAN MOTOR AND BLADE

1. The motor is a sealed unit that requires no lubrication. If the motor is defective, it must be replaced with an original factory supplied motor. (See renewal parts section.)

2. To replace the motor, proceed as follows:

A. Disconnect the unit from power supply.

B. (Units with motor splice box) Remove 4 bolts and cover of motor splice box (See Figure 12).

C. (Units without motor splice box) Remove 16 bolts and cover of main control enclosure.

D. Note wire connections for future reference and disconnect all wires leading to the motor. All motor wires are permanently marked according to the nameplate on the motor.

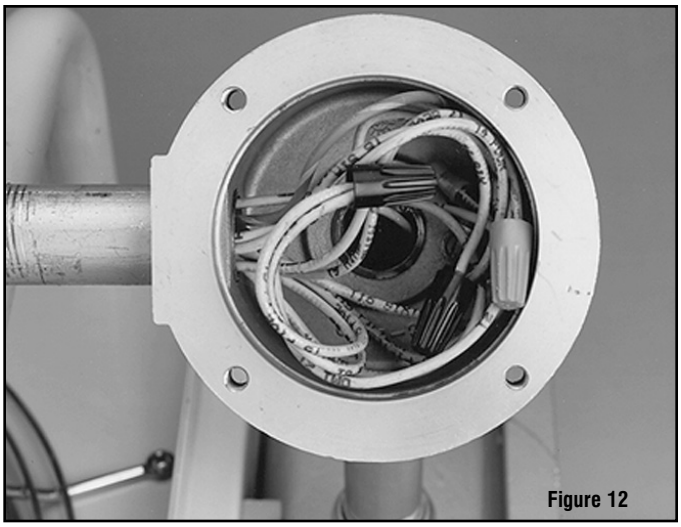


Figure 12

E. Remove 4 bolts in motor base holding it to rear cabinet shelf. See Figure 13.

F. Remove 4 screws holding fan guard to cabinet.

G. Unthread union at motor wiring outlet nipple connection. Carefully lift the motor, fan blade, and guard off of the cabinet.

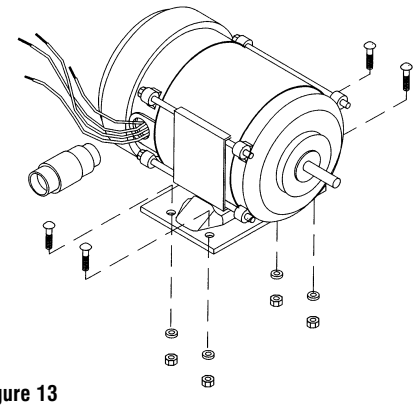


Figure 13

H. Note position of fan blade on motor shaft. Loosen the two set screws to remove the fan blade and key from shaft motor.

I. Place guard and fan blade on replacement motor shaft in same locations as original motor. Align key ways in hub and shaft. Insert key flush with fan hub and tighten the two hub set screws.

J. Feed motor wires back into conduit and reposition motor back on unit. Center fan blade in opening and rotate to be sure that it clears housing and guard.

K. Thread motor nipple connection into conduit union and tighten (5 threads minimum). Replace bolts in motor base and reattach fan guard to back of housing in four places. Recheck blade rotation and tighten all hardware.

L. Trim all motor leads extending out of the conduit to 6 lengths. Strip off 3/8 of insulation at cut ends. Using the motor nameplate, previous notes, and marked wires, reconnect the motor for the unit voltage rating as indicated on the heater nameplate. Re-attach the ground wire to the connection inside the enclosure. Replace cover and tighten securely.

M. Check fan rotation by momentarily energizing the unit. Air must exit at cabinet front. Reverse any 2 leads at contactor or line supply disconnect to reverse rotation of three phase motor.

3. Removal of fan blade does not require that the motor wiring be disturbed. To clean, service or change the fan blade proceed as follows:
   - **A.** Remove the four carriage bolts holding the motor base in place on the cabinet platform. Mark the platform to reposition at same location.
   - **B.** Loosen the four screws on the cabinet back holding the fan guard in place.
   - **C.** Pull the motor to the rear extending the conduit connection at the electrical enclosure. Fan blade and hub set screws can now be accessed by tilting the guard rearward at top or bottom back over the motor shell.

IV. ELECTRICAL COMPONENT SERVICING

⚠WARNING

EXPLOSION/ELECTRIC SHOCK HAZARD. Disconnect all power before opening enclosure covers or servicing heater. Failure to comply could result in personal injury or property damage.

When provided, the following components are located in the cast aluminum hazardous location enclosure. Remove cover and retaining bolts to gain access the following items (See Figure 16):

1. **CONTROL TRANSFORMER**
   This item is located in the electrical enclosure. It may be replaced while in the enclosure. To service or replace remove the quick connect wires and mark their locations. Remove two screws which hold the transformer in place. Note transformer orientation and voltage labels on top. Replace transformer in the same orientation and connect wires. Replace the cast aluminum cover and bolt down.
2. **CONTACTOR**
   This component can be removed from the base plate while in the enclosure. Follow the same steps as indicated for the transformer replacement.
3. **ALARM PILOT LAMP (OPTIONAL)**
   To replace the bulb, unscrew the red lens bezel while holding the lock ring until disengaged. Avoid turning the entire assembly which is held tight to the enclosure with a locking nut on the inside of the enclosure. It must be re-tightened if loosened before reuse. Replace the lamp with a 656 type bulb at the correct control voltage for the unit (120V or 24). Secure the lens cap (5 threads minimum) against the locking ring and tighten securely before re-energizing unit. Lamp should flash on momentarily when unit is energized. See renewal parts section for part number of replacement bulbs.

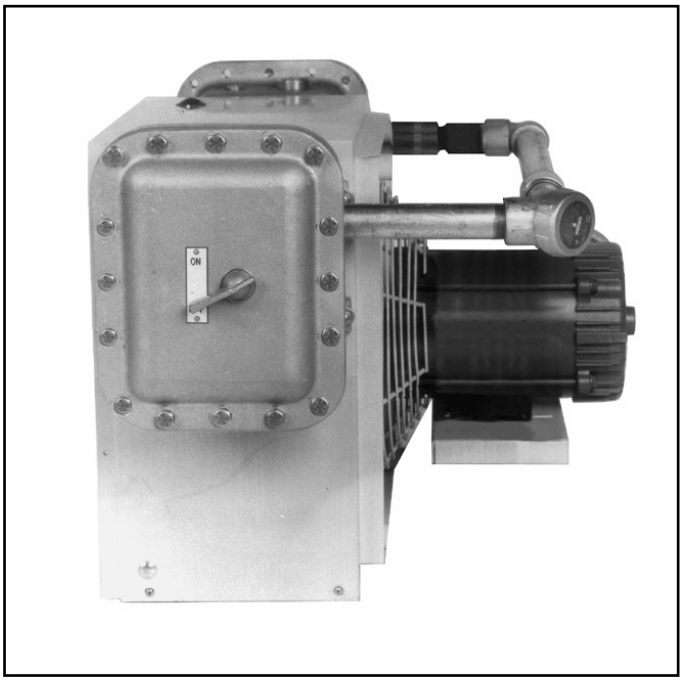


Figure 14
X-Series with Built in Disconnect Switch
(Must use XCMOB Ceiling Mounting Kit)

Figure 15
X-Series with Built in Thermostat

Electrical Control Voltage	24V	120V
Contactor	072-304551-002	072-304551-008
Transformer 208/240/480 PRI	315-304252-002	315-304252-001
Transformer 575 PRI	315-304252-005	315-304252-003
Aux. Contactor	072-304551-102	072-304551-102

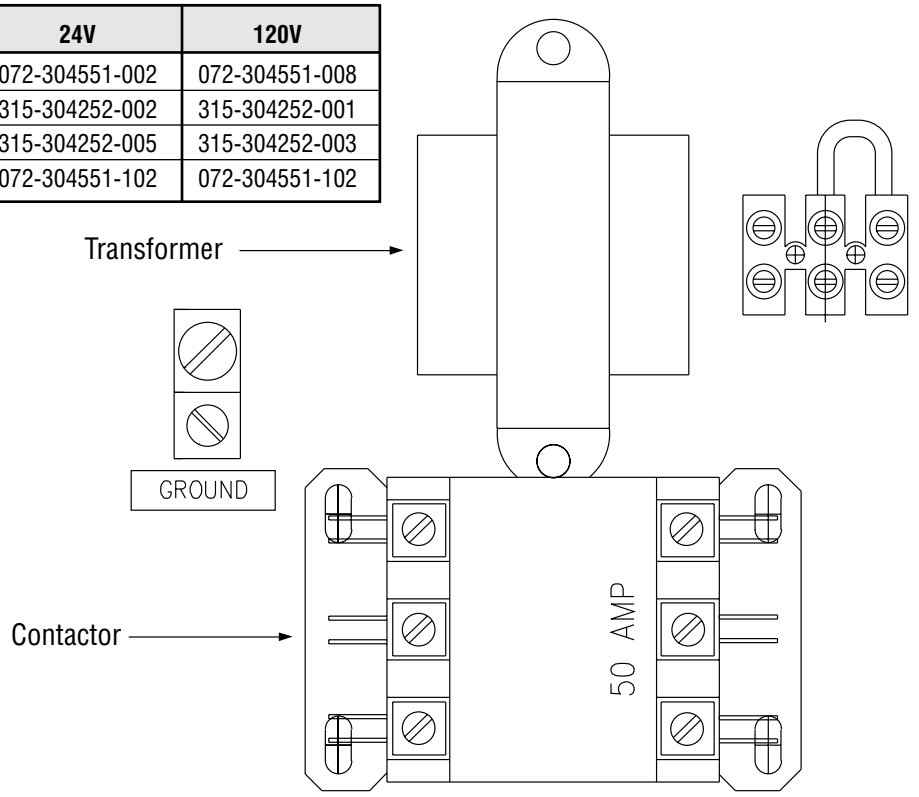


Figure 16

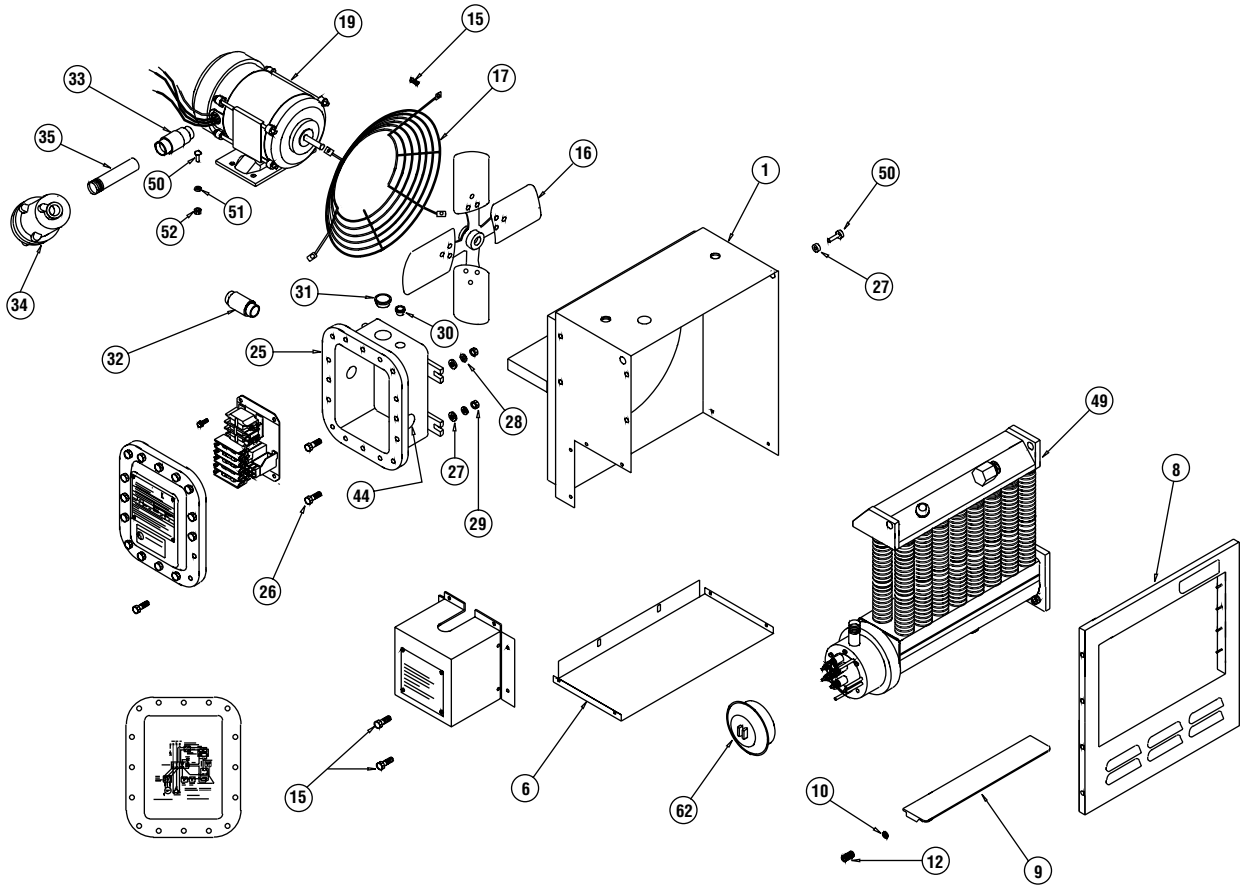


Figure 17

RENEWAL PARTS IDENTIFICATION

Common Parts Shown in Figure 17

Item#	Description	3, 5, 7.5 &10 Part No.	15 &18 Part No.	25, 30 & 35 Part No.
1	Panel wrapper	207-303891-001	207-303891-002	207-303891-003
6	Panel Bottom	207-303881-001	207-303881-002	207-303881-003
8	Panel Front	207-303883-001	207-303883-002	207-303883-003
9	Louver	182-303884-001	182-303884-002	182-303884-003
10	Washer Shoulder	328-302074-002	328-302074-002	328-302074-002
12	Spring	276-130386-001	276-130386-001	276-130386-001
14	Terminal Box Cover	080-302079-001	080-302079-001	080-302079-001
15	Screw 10-32	248-073662-002	248-073662-002	248-073662-002
16	Fan Blade	Consult Factory	Consult Factory	Consult Factory
17	Fan Guard	134-302063-004	134-302063-005	134-302063-006
25	Enclosure	347-123273-131	347-123273-131	347-123273-131
26	Bolt 3/8-16, 1.5 lg	345-075603-263	345-075603-263	345-075603-263
27	Washer flat	328-075528-085	328-075528-085	328-075528-085
28	Washer lock	328-075571-011	328-075571-011	328-075571-011
29	Hex Nut 3/8-16	200-075473-044	200-075473-044	200-075473-044
30	Plug conduit 1/2"	221-302180-001	221-302180-001	221-302180-001
31	Plug conduit 1"	221-302180-003	221-302180-003	221-302180-003
32	Union conduit 3/4"	354-302165-001	354-302165-001	354-302165-001
33	Union conduit 3/4"	354-302243-001	354-302243-001	354-302243-001
34	Conduit Box	Consult factory	069-304115-002	069-304115-002
35	Conduit 3/4"	Consult factory	Consult factory	Consult factory
44	Plug conduit 3/4"	221-302180-002	221-302180-002	221-302180-002
50	Bolt 5/16-18	345-075603-218	345-075603-218	345-075603-218
51	Washer	328-075571-010	328-075571-010	328-075571-010
52	Nut 5/16-18	200-075473-039	200-075473-039	200-075473-039
62	Cover Exp. Proof	080-042350-007	080-042350-007	080-042350-007
75	Conduit 3/4	069-115087-049	069-115087-079	069-115087-093

Optional Equipment Parts	
Description	**Part Number**
Thermostat	300-113075-003
15 Amp Disconnect - 3PH	104-304328-003
30 Amp Disconnect - 1PH	104-304328-004
30 Amp Disconnect - 3PH	104-304328-001
60 Amp Disconnect	104-304328-002
Pilot Light Ass'y 24V	213-121103-017
Pilot Light Ass'y 120V	213-121103-018
Pilot Lamp 24V	172-052561-004
Pilot Lamp 120V	172-052561-003

Mounting Kit Adapter	
3 through 10	027-302361-001
15 through 20	027-302361-002
25 through 35	027-302361-003

Motor, Element and Heat Exchanger Parts

Model	1/4 HP Motor Item 19	Heat Exchanger* Item 49
X300812B	193-302087-006	353-304167-001
X300832B	193-302087-007	353-304167-001
X300412B	193-302087-006	353-304167-002
X300432B	193-302087-007	353-304167-002
X3004832B	193-302087-007	353-304167-005
X300632B	193-302087-008	353-304167-006
X500812B	193-302087-006	353-304167-008
X500832B	193-302087-007	353-304167-008
X500412B	193-302087-006	353-304167-009
X500432B	193-302087-007	353-304167-009
X5004832B	193-302087-007	353-304167-012
X500632B	193-302087-008	353-304167-013
X750812B	193-302087-006	353-304168-001
X750832B	193-302087-007	353-304168-001
X750412B	193-302087-006	353-304168-002
X750432B	193-302087-007	353-304168-002
X7504832B	193-302087-007	353-304168-005
X750632B	193-302087-008	353-304168-006
X1000832B	193-302087-007	353-304168-008
X1000412B	193-302087-006	353-304168-009
X1000432B	193-302087-007	353-304168-009
X10004832B	193-302087-007	353-304168-012
X1000632B	193-302087-008	353-304168-013
X1500832B	193-302087-007	353-304169-001
X1500432B	193-302087-007	353-304169-002
X15004832B	193-302087-007	353-304169-005
X1500632B	193-302087-008	353-304169-006
X1800432B	193-302087-007	353-304169-008
X20004832B	193-302087-007	353-304169-012
X2000632B	193-302087-008	353-304169-013
	1/2 HP Motors	
X25004832B	193-302087-009	353-304170-003
X2500632B	193-302087-010	353-304170-004
X30004832B	193-302087-009	353-304170-008
X3000632B	193-302087-010	353-304170-009
X35004832B	193-302087-009	353-304170-012
X3500632B	193-302087-010	353-304170-013

* For arctic duty conditions, heat exchanger with ethylene glycol are required. Consult factory.

⚠WARNING

The factory must perform the replacement of the immersion heater or overtemperature cutout. The heat exchanger seal must not be broken. Consult factory for service.

LIMITED WARRANTY

All products manufactured by Marley Electric Heating are warranted against defects in workmanship and materials for one year from date of installation. This warranty does not apply to damage from accident, misuse, or alteration; nor where the connected voltage is more than 5% above the nameplate voltage; nor to equipment improperly installed or wired or maintained in violation of the product's installation instructions. All claims for warranty work must be accompanied by proof of the date of installation.

The customer shall be responsible for all costs incurred in the removal or reinstallation of products, including labor costs, and shipping costs incurred to return products to Marley Electric Heating Service Center. Within the limitations of this warranty, inoperative units should be returned to the nearest Marley authorized service center or the Marley Electric Heating Service Center, and we will repair or replace, at our option, at no charge to you with return freight paid by Marley. It is agreed that such repair or replacement is the exclusive remedy available from Marley Electric Heating.

THE ABOVE WARRANTIES ARE IN LIEU OF ALL OTHER WARRANTIES EXPRESSED OR IMPLIED. AND ALL IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE WHICH EXCEED THE AFORESAID EXPRESSED WARRANTIES ARE HEREBY DISCLAIMED AND EXCLUDED FROM THIS AGREEMENT. MARLEY ELECTRIC HEATING SHALL NOT BE LIABLE FOR CONSEQUENTIAL DAMAGES ARISING WITH RESPECT TO THE PRODUCT, WHETHER BASED UPON NEGLIGENCE, TORT, STRICT LIABILITY, OR CONTRACT.

Some states do not allow the exclusion or limitation of incidental or consequential damages, so the above exclusion or limitation may not apply to you. This warranty gives you specific legal rights, and you may also have other rights, which vary, from state to state.

For the address of your nearest authorized service center, contact Marley Electric Heating in Bennettsville, SC, at 1-800-642-4328. Merchandise returned to the factory must be accompanied by a return authorization and service identification tag, both available from Marley Electric Heating. When requesting return authorization, include all catalog numbers shown on the products.

How to order repair parts:
In order to obtain any needed repair or replacement parts, warranty service or technical information, please contact the Marley Electric Heating Service Center toll-free by calling 1-800-642-HEAT.
When ordering replacement parts, always give the information listed as follows:

1. The Part Number
2. The Model Number
3. The Part Description
4. Date of Manufacture

Marley
Engineered Products
470 Beauty Spot Road, E
Bennettsville, SC 29550 USA

PPD031
5200-2474-000

Rev. 2
TA - R2 - EF
Litho in U.S.A.

Installation, Operation and Maintenance Manuals

Job Title: **Taunton Wastewater Treat Facility Solids Handling**

Job Site: RC METALWORKS
20 INDUSTRIAL LN

JOHNSTON, RI 02919
United States

Customer PO#: 7261-BAI-11367
Engineer: SAR ENGINEERING
Contractor: AERO MECHANCIAL
Elevation: (ft) 180
Date: 2/25/2022
Submitted By: Michael Pinheiro
Agent Order#: H122104

BUCKLEY ASSOCIATES INC
385 KING ST
HANOVER, MA 02339
US
Phone: (781)878-5000
Fax: (781)871-9435
Email Address: mpinheiro@buckleyonline.com

Job Name: Taunton Wastewater Treat Facility Solids Handling

Product IOMs

Mark Name	Model Name
7MAU-1	LFC
7ERV-4, 9ERV-1, 2ERV-1, 5ERV-1, 7ERV-1, 6ERV-1, 7ERV-3, 7ERV-2, 2ERV-2	RVE
9ERV-1, 2ERV-1, 5ERV-1, 7ERV-1, 6ERV-1, 2ERV-2	GKD (No IOMs)
5EF-2	AER
5EF-1	SE
9LEF-1	VEKTOR-H
9LEF-1	GPFHL (See below)

Vari-Green Motor and Controls IOMs

Mark Name	IOM Name
5EF-1, 5EF-2	VG Motors

Accessory IOMs

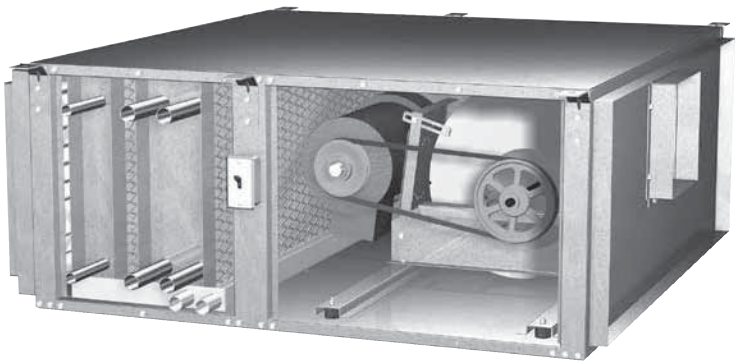
Accessory IOM Name	Mark Names
Assembly and Installation Wall Housing_471832	5EF-1
Install Operation Maint Manual DOAS v4.001	2ERV-1, 2ERV-2, 5ERV-1, 6ERV-1, 7ERV-1, 7ERV-2, 7ERV-3, 7ERV-4, 9ERV-1
Install Operation Maint Manual VG Motor and Controls	5EF-1, 5EF-2

GREENHECK
Building Value in Air.

Document 464496
Model LFC
Low-Profile Fan Coil

Installation, Operation and Maintenance Manual

Please read and save these instructions for future reference. Read carefully before attempting to assemble, install, operate or maintain the product described. Protect yourself and others by observing all safety information. Failure to comply with instructions could result in personal injury and/or property damage!



General Safety Information

Only qualified personnel should install this unit. Personnel should have a clear understanding of these instructions and should be aware of general safety precautions. Improper installation can result in electric shock, possible injury due to coming in contact with moving parts, as well as other potential hazards. Other considerations may be required if high winds or seismic activity are present. If more information is needed, contact a licensed professional engineer before moving forward.

1. Follow all local electrical and safety codes, as well as the National Electrical Code (NEC), the National Fire Protection Agency (NFPA), where applicable. Follow the Canadian Electric Code (CEC) in Canada.
2. The rotation of the wheel is critical. It must be free to rotate without striking or rubbing any stationary objects.
3. Motor must be securely and adequately grounded.
4. Do not spin fan wheel faster than the maximum cataloged fan rpm. Adjustments to fan speed significantly affects motor load. If the fan RPM is changed, the motor current should be checked to make sure it is not exceeding the motor nameplate amps.
5. Do not allow the power cable to kink or come in contact with oil, grease, hot surfaces, or chemicals. Replace cord immediately if damaged.
6. Verify that the power source is compatible with the equipment.
7. Never open blower access doors while the fan is running.

DANGER
Always disconnect power before working on or near a unit. Lock and tag the disconnect switch or breaker to prevent accidental power up.

CAUTION
When servicing the unit, motor may be hot enough to cause pain or injury. Allow motor to cool before servicing.

Receiving

Upon receiving the product, check to ensure all items are accounted for by referencing the delivery receipt or packing list. Inspect each crate or carton for shipping damage before accepting delivery. Alert the carrier of any damage detected. The customer will make a notation of damage (or shortage of items) on the delivery receipt and all copies of the bill of lading which is countersigned by the delivering carrier. If damaged, immediately contact your manufacturer's representative. Any physical damage to the unit after acceptance is not the responsibility of manufacturer.

Unpacking

Verify that all required parts and the correct quantity of each item have been received. If any items are missing, report shortages to your local representative to arrange for obtaining missing parts. Sometimes it is not possible that all items for the unit be shipped together due to availability of transportation and truck space. Confirmation of shipment(s) must be limited to only items on the bill of lading.

Handling

Units are to be rigged and moved by the lifting brackets provided or by the skid when a forklift is used. Location of brackets varies by model and size. Handle in such a manner as to keep from scratching or chipping the coating. Damaged finish may reduce ability of unit to resist corrosion.

Storage

Units are protected against damage during shipment. If the unit cannot be installed and operated immediately, precautions need to be taken to prevent deterioration of the unit during storage. The user assumes responsibility of the unit and accessories while in storage. The manufacturer will not be responsible for damage during storage. These suggestions are provided solely as a convenience to the user.

INDOOR — The ideal environment for the storage of units and accessories is indoors, above grade, in a low humidity atmosphere which is sealed to prevent the entry of blowing dust, rain, or snow. Temperatures should be evenly maintained between 30°F (*-1°C*) and 110°F (*43°C*) (wide temperature swings may cause condensation and "sweating" of metal parts). All accessories must be stored indoors in a clean, dry atmosphere.

Remove any accumulations of dirt, water, ice, or snow and wipe dry before moving to indoor storage. To avoid "sweating" of metal parts allow cold parts to reach room temperature. To dry parts and packages use a portable electric heater to get rid of any moisture build up. Leave coverings loose to permit air circulation and to allow for periodic inspection.

The unit should be stored at least 3½ in. (89 mm) off the floor on wooden blocks covered with moisture proof paper or polyethylene sheathing. Aisles between parts and along all walls should be provided to permit air circulation and space for inspection.

Inspection and Maintenance during Storage

While in storage, inspect fans once per month. Keep a record of inspection and maintenance performed.

If moisture or dirt accumulations are found on parts, the source should be located and eliminated. At each inspection, rotate the fan wheel by hand ten to fifteen revolutions to distribute lubricant on motor. Every three months, the fan motor should be energized. If paint deterioration begins, consideration should be given to touch-up or repainting. Fans with special coatings may require special techniques for touch-up or repair.

Machined parts coated with rust preventive should be restored to good condition promptly if signs of rust occur. Immediately remove the original rust preventive coating with petroleum solvent and clean with lint-free cloths. Polish any remaining rust from surface with crocus cloth or fine emery paper and oil. Do not destroy the continuity of the surfaces. Wipe thoroughly clean with Tectyl® 506 (Ashland Inc.) or the equivalent. For hard to reach internal surfaces or for occasional use, consider using Tectyl® 511M Rust Preventive or WD-40® or the equivalent.

REMOVING FROM STORAGE — As units are removed from storage to be installed in their final location, they should be protected and maintained in a similar fashion, until the equipment goes into operation.

Prior to installing the unit and system components, inspect the unit assembly to make sure it is in working order.

1. Check all fasteners, set screws on the fan, wheel, bearings, drive, motor base, and accessories for tightness.
2. Rotate the fan wheel(s) by hand and assure no parts are rubbing.

Service Clearance

Units require service clearance for:

- Filter replacement
- Coil and drain pan inspection - cleaning, and replacement
- Motor and drive inspection - maintenance and replacement

Access panels are provided for inspection and cleaning of unit components. Allow service clearance of 26 inches for removal of filters. Allow a service clearance equal to the unit width for removal of coils and drain pan.

Table of Contents

Installation
- Unit Layout 3
- Lifting / Hanging Instructions 3
- Dimensions / Weights 4
- Filter Sizes / Quantity 4
- Coil Dimensions 5-6

Start-Up
- System Start-Up 7

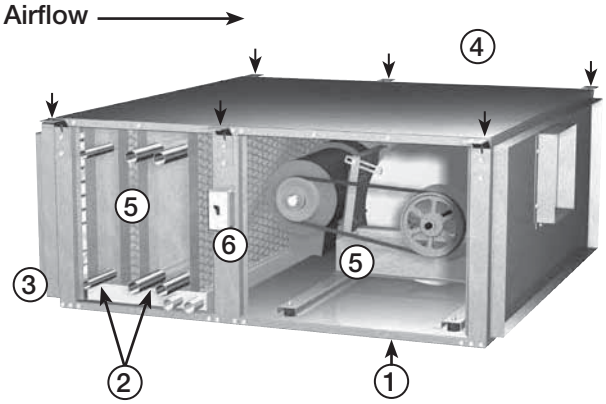
Troubleshooting
- Blower 8
- Motor Overamps 8
- Insufficient / Too Much Airflow 8
- Excessive Noise or Vibration 8

Start-Up
- Coil Module 9-10
- Drain Pan / Drain Trap 10

Maintenance
- Fan 11
- Coil 12
- Drain Pan 12

Reference
- Start-Up Documentation 12
- Optional Ladder Diagrams 13-14
- Maintenance Log 15
- Our Commitment . . . . . .Backcover

Unit Layout



1. Fan Section
2. Coil Section
   - Chilled Water
   - DX Coils
   - Hot Water
   - Steam Coils
3. Inlet Filter
   Vertical inlet filter with quarter-turn fasteners
4. Lifting Lugs/Hanging Brackets
   Six (6) lifting lugs for each unit
5. Side Access Panels
   Right and left access to each unit. (Image shows panels removed).
6. 1¼ inch knockout is provided for the recommended electrical wiring penetration or disconnect switch.

Lifting Instructions

Unit should be lifted by the factory supplied lifting lugs or frame rails and a spreader bar (by others) to prevent damage from occurring to the equipment (see Figure 1). Avoid twisting or uneven lifting of equipment. Do not lift equipment by coil connections or headers. The unit must remain upright during lifting. All access doors and panels must be closed during lifting to avoid damage.

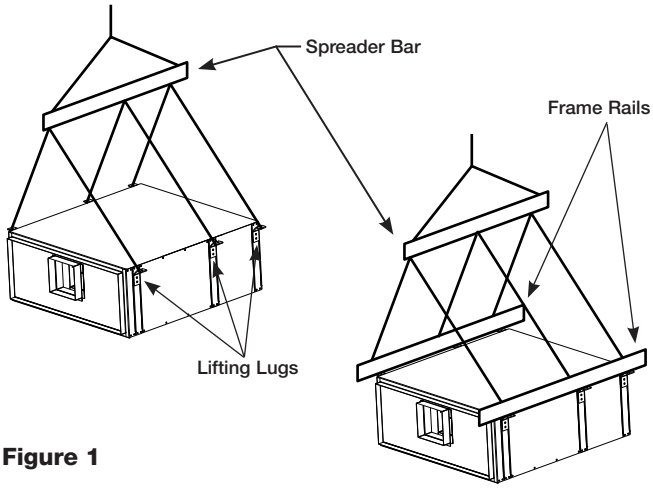


Figure 1

Hanging Instructions

The LFC should be hung by the factory supplied lifting lugs or field supplied frame rails as shown respectively in Figures 2 and 3. All hanging brackets must be used to mount the unit. The LFC is available with both external neoprene and spring isolation options.

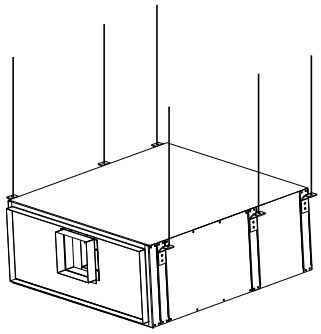


Figure 2

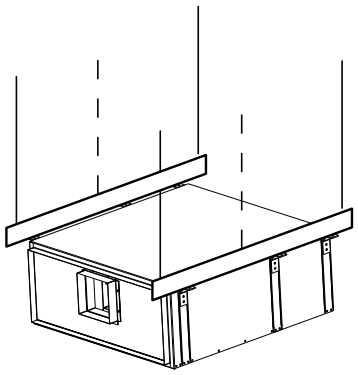
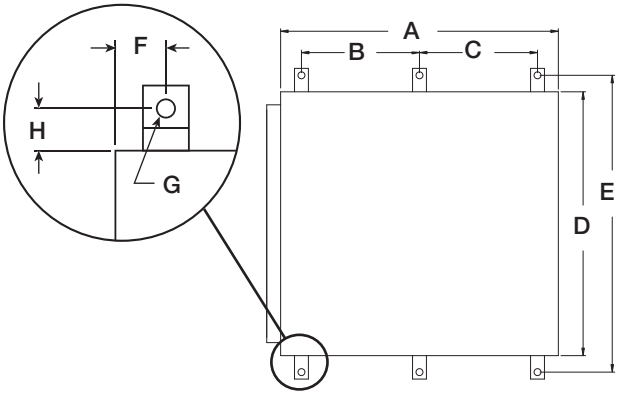
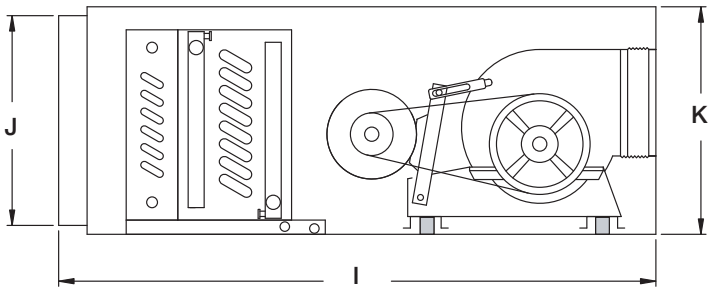


Figure 3

Unit Dimensions



Top View



Elevation View

Unit Size	I			J	K	Width	Inlet		Outlet	
	w/o Filter	w/ 2 in. Filter	w/ 4 in. Filter				Height	Width	Height	Width
15	40	42	44	8.0	11.0	38	9.0	36	4.0	6.75
20	40	42	44	11.0	14.0	38	12.0	36	6.5	6.75
25	40	42	44	13.0	16.0	38	14.0	36	8.0	8.5
30	45	47	49	15.5	18.5	38	16.5	36	9.0	9.0
45	45	47	49	14.25	18.5	50	16.5	48	9.0	10.0
50	48	50	52	16.75	21.0	50	19.0	48	10.25	10.0
65	52	54	56	21.75	26.0	50	24.0	48	12.0	12.75
85	52	54	56	21.75	26.0	62	24.0	60	12.0	15.0

All dimensions are in inches.

Weights

Unit Size	Fan w/ Drain Pan			1 Row	2 Row	4 Row	6 Row	8 Row	2 in. Vertical Filter	4 in. Vertical Filter
	Fan	Motor	Total							
15	128	50	178	25	31	44	60	75	5	8
20	151	50	201	32	41	61	83	105	6	10
25	175	60	235	38	51	77	106	135	8	13
30	199	60	259	45	61	94	129	165	9	15
45	250	75	325	51	70	110	152	195	11	17
50	316	75	391	58	80	127	175	225	12	19
65	405	75	480	64	90	143	198	255	14	22
85	450	100	550	71	100	160	221	285	15	24

All weights are shown in pounds (lbs.) Motor weights may vary depending on enclosure type and horsepower.

Mounting Dimensions

Unit Size	Horizontal Hanging							
	A	B	C	D	E	F	G	H
15	40	18.25	19.75	38	43	1	0.5	2.5
20	40	19	19	38	43	1	0.5	2.5
25	40	19	19	38	43	1	0.5	2.5
30	45	19	24	38	43	1	0.5	2.5
45	45	19	24	50	55	1	0.5	2.5
50	48	19	27	50	55	1	0.5	2.5
65	52	19	31	50	55	1	0.5	2.5
85	52	19	31	62	67	1	0.5	2.5

All dimensions are in inches.

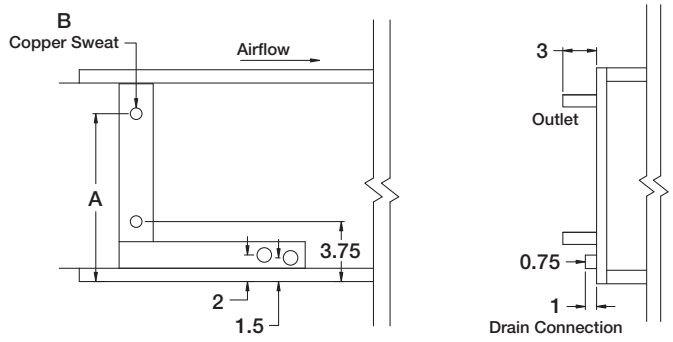
Filter Sizes and Quantity

Size	Filter Size	Qty	Face Area (ft^2)
15	9 x 18	2	1.8
20	12 x 12	1	2.5
	12 x 24		
25	14 x 18	2	3.0
30	16 x 16	1	3.4
	16 x 20		
45	16 x 24	2	4.8
50	18 x 24	2	5.4
65	24 x 24	2	7.2
85	12 x 24	1	8.9
	24 x 24	2	

All dimensions are in inches.

Coil Dimensions

Hot Water • 1 and 2 Row



Right side connection shown.

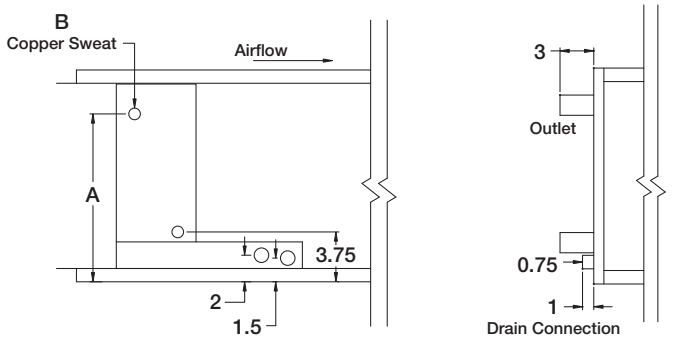
Unit Size	A	B
15	7.63	0.75
20	10.13	0.75
25	12.63	0.875
30	15.13	0.875
45	15.13	0.875
50	17.63	1.125
65	22.63	1.375
85	22.63	1.375

All dimensions are in inches.

NOTE

Fluid enters the coil from the bottom connection (Inlet) and exits from the top (Outlet).

Hot Water • 4 Row



Right side connection shown.

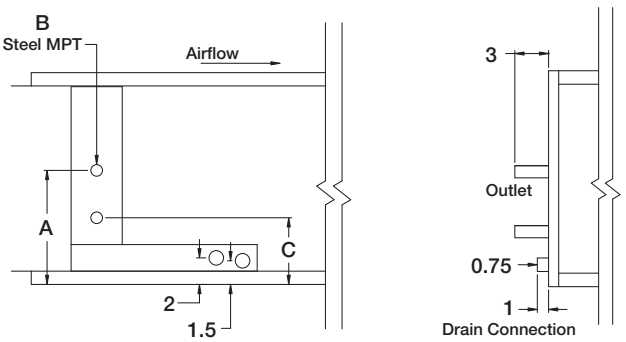
Unit Size	A	B
15	7.63	0.75
20	10.13	0.75
25	12.63	0.875
30	15.13	0.875
45	15.13	0.875
50	17.63	1.375
65	22.63	1.375
85	22.63	1.375

All dimensions are in inches.

NOTE

With airflow from left to right, the fluid enters the coil from the bottom connection (Inlet) and exits from the top (Outlet). The other two coil connections should be capped off (Cap).

Steam • 1 and 2 Row



Right side connection shown.

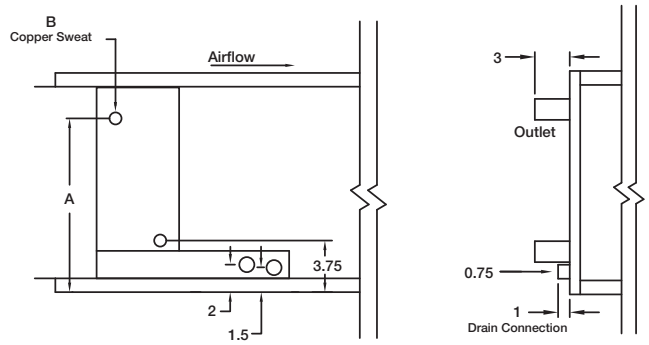
Unit Size	A	B	C
15	7.0	1.5	3.81
20	6.94	1.5	3.56
25	8.19	2.5	3.81
30	9.44	2.5	3.56
45	9.44	2.5	3.56
50	10.69	2.5	4.81
65	13.19	2.5	3.56
85	13.19	2.5	3.56

All dimensions are in inches.

NOTE

Steam enters the coil from the center connection (Inlet) and exits from the bottom (Outlet).

Chilled Water • 4, 6 or 8 Row



Right side connection shown.

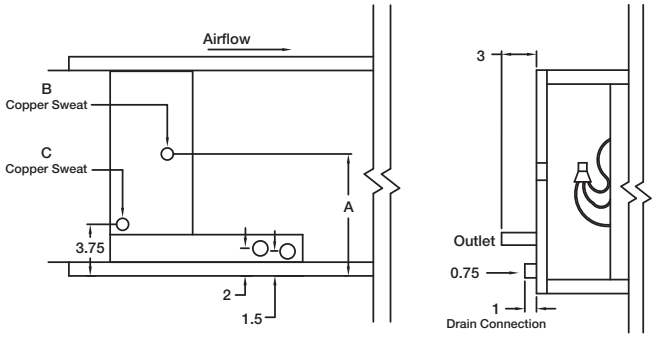
Unit Size	A	4 row	6 row	8 row
		B	B	B
15	7.63	0.75	0.75	1.375
20	10.13	0.75	0.75	1.375
25	12.63	0.875	0.875	1.375
30	15.13	0.875	0.875	1.375
45	15.13	0.875	0.875	1.375
50	17.63	1.375	1.375	1.625
65	22.63	1.375	1.375	1.625
85	22.63	1.375	1.375	1.625

All dimensions are in inches.

NOTE

With airflow from left to right, the fluid enters the coil from the bottom connection (Inlet) and exits from the top (Outlet). The other two coil connections should be capped off (Cap)

Direct Expansion (DX) • Single Circuit • 4, 6 or 8 Row



Distributor hookup is done inside module through 2-inch access hole.
Right side connection shown.

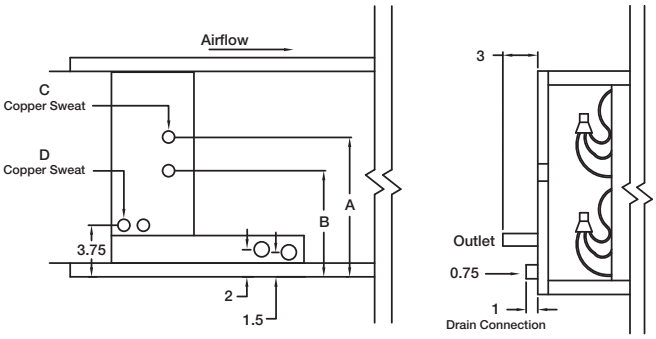
Unit Size	A	4 row		6 row		8 row	
		B	C	B	C	B	C
15	5.75	0.625	0.625	0.625	0.625	0.625	1.375
20	7.0	0.625	0.625	0.625	0.625	0.625	1.375
25	8.0	0.875	1.375	0.875	1.375	0.875	1.375
30	9.5	0.875	1.375	0.875	1.375	0.875	1.375
45	9.5	0.875	1.375	0.875	1.375	0.875	1.375
50	10.75	0.875	1.375	1.125	1.375	0.875	1.625
65	13.00	1.125	1.375	1.125	1.375	1.125	1.625
85	13.00	1.125	1.375	1.125	1.375	1.125	1.625

All dimensions are in inches.

NOTE

With airflow from left to right, the fluid enters the coil from the center connection (Inlet) and exits from the bottom (Outlet). The other coil connections should be capped off (Cap).

Direct Expansion (DXI) • Dual Circuit with 50/50 Face Interlaced Construction • 4, 6 or 8 Row



Distributor hookup is done inside module through 2-inch access hole.
Right side connection shown.

Unit Size	A	B	4 row		6 row		8 row	
			C	D	C	D	C	D
30	12.00	7.00	0.625	0.625	0.625	0.875	0.625	0.875
45	12.00	7.00	0.625	0.625	0.625	0.875	0.625	0.875
50	13.50	7.75	0.625	0.625	0.625	0.875	0.625	1.125
65	17.00	9.50	0.875	0.875	0.875	1.125	0.875	1.125
85	17.00	9.50	0.875	0.875	0.875	1.125	0.875	1.125

All dimensions are in inches.

NOTE

The first suction header on the entering air side of the coil is circuited to the top distributor. With airflow from left to right, the fluid enters the coil from the center connection (Inlet) and exits from the bottom (Outlet). The other coil connections should be capped off (Cap).

System Start-Up

For proper unit function and safety, follow everything in this start-up procedure in the order presented. This is to be done after the electrical connections are complete.

PRE-START CHECK LIST

1. Disconnect and lock-out all power switches to fan.
2. Check all fasteners, set screws and locking collars on the fan, bearings, drive, motor base and accessories for tightness.
3. Rotate the fan wheel by hand and assure no parts are rubbing.
4. Check the V-belt drive for proper alignment and tension.

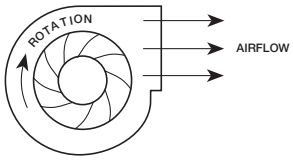
SPECIAL TOOLS REQUIRED
• Voltage Meter • Tachometer • Amperage Meter

1. Check Voltage

Before starting the unit, compare the supplied voltage with the unit's nameplate voltage and the motor voltage. Units are not provided with thermal overload protection unless a control center has been ordered with the unit or the motor has been selected with thermal overload protection.

2. Check Blower Rotation

If the blower is rotating in the wrong direction, the unit will move some air, but will not perform properly. To check the rotation, open the blower access door and run the blower momentarily to determine the rotation.



To reverse the rotation, turn the power off and use the following procedure:

- For single phase units, rewire the motor per the instructions on the motor.
- For three phase units, interchange any two power leads. This can be done at the motor starter.

3. Check for Vibration

Check for unusual noise, vibration or overheating of bearings. Excessive vibration maybe experienced during initial start-up. Left unchecked, excessive vibration can cause a multitude of problems, including structural and/or component failure. Many conditions can be discovered by careful observation. If the problem is wheel unbalance, in-place balancing can be done providing there is access to the fan wheel. Generally, fan vibration and noise is transmitted to other parts of the building by the ductwork. If noise is an issue, we recommend using heavy canvas connections on the inlet of the fan. Refer to the Troubleshooting section of this manual if a problem develops.

4. Air Volume Check and Measurement

Along with the building balance, the unit's air volume (cfm) should be measured and compared with its rated air volume. This unit is flexible for varying air volume, but the actual air volume should be known for making final adjustments. The most accurate way to measure the air volume is by using the pitot traverse method in the ductwork away from the blower. Other methods can be used, but should be proven and accurate. To adjust the air volume, change the fan rpm or the system losses. See Troubleshooting section in this guide.

5. Measure Motor Voltage, Amperage and Fan RPM

All access doors must be installed. Measure and record the input voltage and motor amperage(s).

To measure the fan RPM, the blower door will need to be removed. Minimize measurement time because the motor may over amp with the door removed.

Compare measured amps to the motor nameplate full load amps and correct if over amping. See the Troubleshooting section in this guide.

Troubleshooting

Symptom	Possible Cause	Corrective Action
Blower fails to operate	Blown fuse or open circuit breaker	Replace fuse or reset circuit breaker and check amps
	Broken fan belt	Replace
	Defective motor or capacitor	Replace
	Motor starter overloaded	Reset starter and check amps
Motor overamps	Airflow too high	Check airflow and adjust drives if needed
	Static pressures are higher or lower than design	If higher, ductwork should be improved If lower, fan RPMs should be lower
	Blower rotation is incorrect	Check rotation and correct
	Motor voltage incorrect	Check motor nameplate and supplied voltage
	Motor horsepower too low	See specifications and catalog for fan curves to determine if horsepower is sufficient
	Shorted windings in motor	Replace motor
Insufficient airflow	Mixing box damper not fully open	Adjust damper linkage or replace damper motor
	System static pressure too high	Improve ductwork to eliminate losses using good duct practices
	Blower speed too low	Check for correct drives and RPMs with catalog data
	Mixing box dampers closed	Open and adjust
	Dirty or clogged filters	Clean or replace
	Leaks in ductwork	Repair
	Elbows, or other obstructions may restrict fan outlet	Correct or improve ductwork
	Belt slippage	Adjust belt tension
Too much airflow	Blower fan speed too high	Check for correct fan RPM
	Filter(s) not in place	Install filters
	Insufficient static pressure (airflow resistance)	Induce static pressure into system ductwork
Excessive noise or vibration	Wheel rubbing on housing	Center wheel
	Loose wheel on shaft	Tighten wheel setscrew
	Loose motor or blower sheave	Tighten sheave setscrew
	Belts too loose	Adjust belt tension after 24 hours of operation
	Belts too tight	Loosen to maintain 3/8 inch deflection per ft. of span between sheaves
	Worn belt	Replace
	Motor base or blower loose	Tighten mountings bolts
	Worn bearings	Replace
	Bearing and drive alignment	Realign
	Motor out of balance	Replace
	Wheel out of balance	Replace or rebalance
	Sheaves eccentric or out-of-balance	Replace or rebalance
	Accumulation of material on wheel	Clean wheel and housing

Start-Up of Coil Module

Hot Water, Chilled Water Coils

1. Piping should be in accordance with accepted industry standards. Pipework should be supported independently of the coils. Water pipes are copper with sweat connections. USE WET TOWEL TO AVOID BURNING COIL CONNECTION GROMMETS. When installing coupling, do not apply undue stress to the connection extending through the unit. Use a back-up pipe wrench to avoid breaking the weld between coil connection and header.
2. Connect the water supply to the bottom connection on the air-leaving side and the water return to the top connection on the air-entering side. The extra bottom connection can be used for an auxiliary manual drain connection, and the extra top connection may be used for an automatic air vent or the extra connections can be capped. To ensure proper venting, an external air vent in the piping is recommended. Connecting the supply and/or return in any other manner will result in very poor performance. CAP UNUSED CONNECTIONS.
3. The air vent at the uppermost point should be temporarily opened during system start-up to release all of the air from the coil. To maintain heat transfer capacity, periodically vent any air in the coil. Vent is to be located behind the connections side access door.
4. Water coils are not normally recommended for use with entering air temperatures below 40°F. No control system can be depended on to be 100% safe against freeze-up with water coils. Glycol solutions or brines are the only safe media for operation of water coils with low entering air conditions.

WARNING

Continuous water circulation through the coil at all times is highly recommended.

5. Pipe sizes for the system must be selected on the basis of the head (pressure) available from the circulation pump. Piping should be in accordance with accepted industry standards.
6. For chilled water coils, the condensate drain pipe should be sized adequately to ensure the condensate drains properly. See Drain Pan Traps section and related drawing.

Direct Expansion (DX) Coils

1. Piping should be in accordance with accepted industry standards. Pipework should be supported independently of the coils. Undue stress should not be applied at the connection to coil headers.
2. The condensate drain pipe should be sized adequately to ensure the condensate drains properly. See Drain Pan Traps section and related drawing.
3. When connecting suction and liquid connections, make sure the coil is free from all foreign material. Make sure all joints are tight and free of leakage.
4. Dual circuits are recommended to be run by two compressors. One compressor with the appropriate valves and piping can be used but is not recommended. Manufacturer does not supply compressor or condensing units, for further instruction on DX coil installation and operation, contact your compressor and/or condenser manufacturer.

DXI coils have dual connections and should be used with two compressors.

WARNING

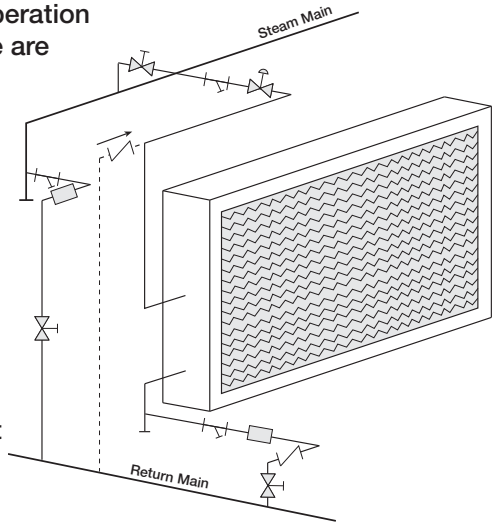
Standard unit insulation of 1.5 lbs. density has an insulation R-value of 3.7.

For applications where the unit discharge temperatures are below 55°F. and the unit is installed in a warm, humid environment, additional insulation may need to be applied to the exterior of the unit to prevent condensation.

Steam Coils

Application Recommendations

Satisfactory operation and service life are best ensured when coils are installed with proper piping, trap and support arrangement. The following notes and drawing are recommended for the coil unit installation and operation.



General

1. Provide separate supports and hangers for the unit and the piping.
2. Be certain that adequate piping flexibility is provided. Stresses resulting from expansion of closely coupled piping and coil arrangement can cause serious damage.

Steam Coils, General - *continued*

3. Standard steam coils are pitched in the casings when installed for horizontal airflow. The casing must be level after the unit is installed for proper condensate drainage. If condensate is not removed, the coil will suffer from water hammering and will have a shortened life. On vertical airflow applications, the coils must be pitched when installed.
4. Do not reduce pipe size at the coil return connection. Carry return connection size through the dirt pocket, making the reduction at the branch leading to the trap.
5. It is recommended that vacuum breakers be installed on all applications to prevent retaining condensate in the coil. Generally, the vacuum breaker is to be connected between the coil inlet and the return main. The vacuum breaker should be open to the atmosphere and the trap design should allow venting of large quantities of air.
6. Do not attempt to lift condensate when using modulating or on-off control.
7. Do not reduce the pipe size leaving the coil.

Traps

1. Size traps in accordance with the manufacturer's recommendations. Be certain that the required pressure differential will always be available. DO NOT UNDERSIZE.
2. Float and thermostatic or bucket traps are recommended for low pressure steam. On high pressure systems, bucket traps are normally recommended. The thermostatic traps should be used only for air venting.
3. Bucket traps are recommended for use with on-off control only.
4. Locate traps at least 12 inches below the coil return connection.

Controls

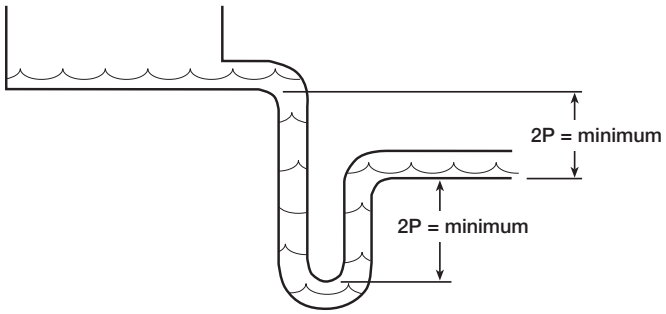
1. On high pressure installations, a two-position steam valve with a face and bypass arrangement is preferred where modulating control is required.
2. Modulating valves must be sized properly. DO NOT UNDERSIZE.

Freezing Conditions (entering air below 35°F)

1. 5 PSI steam must be supplied to the coil at all times.
2. Modulating valves are not recommended. Control should be by means of face and bypass dampers.
3. Provision should always be made to thoroughly mix fresh air and return air before it enters the coil on return air units. Also, temperature control elements must be properly located to obtain true air mixture temperatures.
4. As additional protection against freeze-up, the trap should be installed sufficiently—far below the coil to provide an adequate hydrostatic head to ensure removal of condensate during an interruption in the steam pressure. Estimate 3 feet for each 1 PSI of trap differential required.
5. On start-up, admit steam to coil ten minutes before admitting outdoor air.
6. Provision must be made to close fresh air dampers if steam supply pressure falls below minimum specified.

Drain Pan / Drain Trap

Drain lines and traps should be run full size from the drain pan connection. Drain pans should have drain lines and traps to permit the condensate from the coils to drain freely. On all units with drain pans, the trap depth and the distance between the trap outlet and the drain pan outlet should be twice the static pressure (P) in the drain pan section under normal operation to assure the trap remains sealed.



Drain Pan / Drain Trap

Fan Maintenance

Manufacturer recommends these procedures to ensure trouble free operation of this unit. It is especially important to maintain heater units for clean and efficient operation. Most unit failures can be attributed to poor setup or poor maintenance.

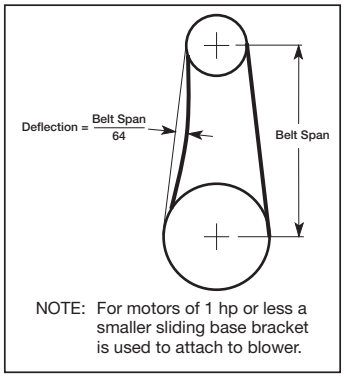
A record of maintenance performed on this unit should be kept. This information will provide essential information if problems are encountered. A section at the back of this manual is provided for recording the unit's maintenance history.

CAUTION

When performing any maintenance on this unit, be sure that the power is disconnected and cannot be accidentally turned on. The control center disconnect can be locked in the off position.

Two Weeks after Start-Up

Belts - Belts tend to stretch after a period of time. They should be periodically checked for wear and tightness. Approximately 3/8 inch of deflection per ft. of span between sheaves is standard for belt tightness. When replacing belts, use the same type as supplied with the unit. Matched belts should always be used on units with multigroove pulleys.



NOTE: For motors of 1 hp or less a smaller sliding base bracket is used to attach to blower.

Replacement of belts can be accomplished by loosening the motor to the point where the belts can be removed by hand. Do not force belts on or off as this may cause breakage of cords leading to premature belt failure. Belts should be adjusted as above.

Every Three (3) Months

Filters - The filter in the unit should be inspected at least every three (3) months. Depending on the environment, filters could require changing or cleaning more or less often. The filters can be slid out of either side of the unit.

If washable filters are installed, they can be washed in warm soapy water. An adhesive spray can be applied to increase filter efficiency.

If disposable filters are installed, check by holding up to a light source. If light cannot pass through the filter, it should be replaced. Replacement filters should be of the same manufacturer and size. When reinstalling filters, be sure to install with the airflow in the correct direction indicated on the filter.

Yearly

Bearings — Most bearings are permanently lubricated and require no further lubrication under normal use. Normal use being considered -20ºF to 120ºF and in a relatively clean environment. Some bearings are relubricatable and will need to be regreased depending on fan use. Check your bearings for grease fittings to find out what type of bearing you have. If your fan is not being operated under normal use, bearings should be checked monthly for lubrication.

Motors — Motor maintenance is generally limited to cleaning and lubrication (where applicable). Cleaning should be limited to the exterior surfaces only. Removing dust and grease buildup on motor housing assures proper motor cooling. Greasing of motors is intended only when grease fittings are provided. Many fractional motors are permanently lubricated and require no further lubrication. Motors supplied with grease fittings should be greased in accordance with manufacturer's recommendations. When motor temperature does not exceed 104ºF (40ºC), the grease should be replaced after 2000 hours of running time as a general rule.

Wheels — Wheels require very little attention when moving clean air. Occasionally, oil and dust may accumulate on the wheel causing imbalance. When this occurs the wheel and housing should be cleaned to assure smooth and safe operation. Inspect fan impeller and housing for fatigue, corrosion or wear.

Routinely check all fasteners, set screws and locking collars on the fan, bearing, drive, motor base and accessories for tightness.

Coil Maintenance

Coils must be clean to obtain maximum performance. Check once a year under normal operating conditions and, if dirty, brush or vacuum clean. Soiled fins reduce the capacity of the coil, demand more energy from the fan, and create an environment for odor and bacteria to grow and spread through the conditioned zone. High pressure water (400 psi or less) may be used to clean coils with fin thickness over 0.006 inches thick. **Test the spray pressure** over a small corner of the coil to determine if the fins will withstand the spray pressure.

For coils with fragile fins or high fin density, foaming chemical sprays and washes are available. Many coil cleaners contain harsh chemicals, so they must be used with caution by qualified personnel only. Care must be taken not to damage the coils, including fins, while cleaning.

CAUTION
Fin edges are sharp.

Winterizing Coils

Coil freeze-up can be caused by such things as air stratification and failure of outdoor air dampers and/or preheat coils. Routine draining of water cooling coils for winter shutdown cannot be depended upon as insurance against freeze-up. Severe coil damage may result. It is recommended that all coils be drained as thoroughly as possible and then treated in the following manner.

Fill each coil independently with an antifreeze solution using a small circulating pump and again thoroughly drain. Check freezing point of antifreeze before proceeding to next coil. Due to a small amount of water always remaining in each coil, there will be diluting effect. The small amount of antifreeze solution remaining in the coil must always be concentrated enough to prevent freeze-up.

NOTE: Carefully read instructions for mixing antifreeze solution used. Some products will have a higher freezing point in their natural state than when mixed with water.

Drain Pan Maintenance

Drain pans in any air conditioning unit will have some moisture in them, therefore, algae and other organisms will grow due to airborne spores and bacteria. Periodic cleaning is necessary to prevent this buildup from plugging the drain and causing the drain pan to overflow. Inspect twice a year to avoid the possibility of overflow. Also, drain pans should be kept clean to prevent the spread of disease. Cleaning should be performed by qualified personnel.

Start-Up Documentation

Job Information

Job Name _____

Address _____

City _____ State _____ Zip _____

Phone Number _____

Contact Person _____

Start-Up Company Information

Service Organization _____

Address _____

City _____ State _____ Zip _____

Phone Number _____

Fax Number _____

Start-Up Date _____

Start-Up Personnel Name _____

Nameplate Information

Unit Model Number _____

Volts _____ Hertz _____ Phase _____

Amps _____ Mark _____

Fan rpm _____

Unit Serial Number _____

Field Start-Up Documentation

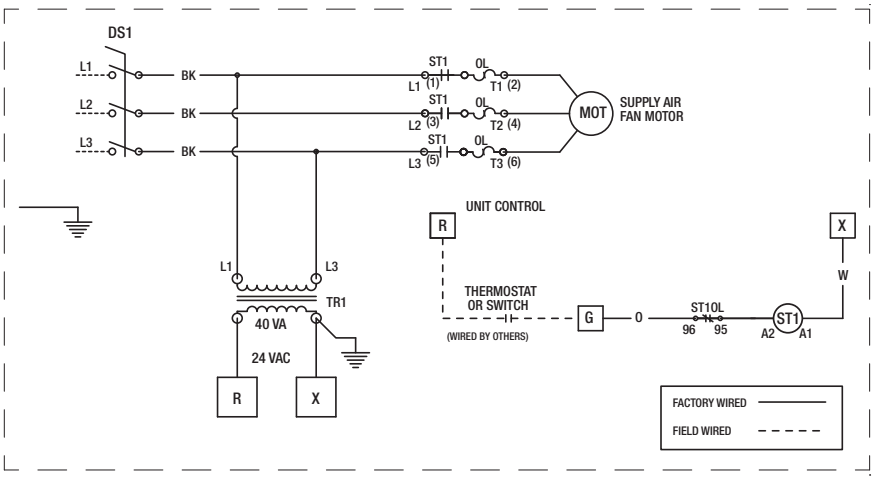
- ☐ Check blower rotation
- ☐ Check air volume (cfm)
  - _____ Design
  - _____ Actual
- ☐ Actual motor voltage _____ Volts
- ☐ Actual motor hertz _____ Hertz
- ☐ Actual motor phase _____ Phase
- ☐ Actual motor amps _____ Amps

Drive

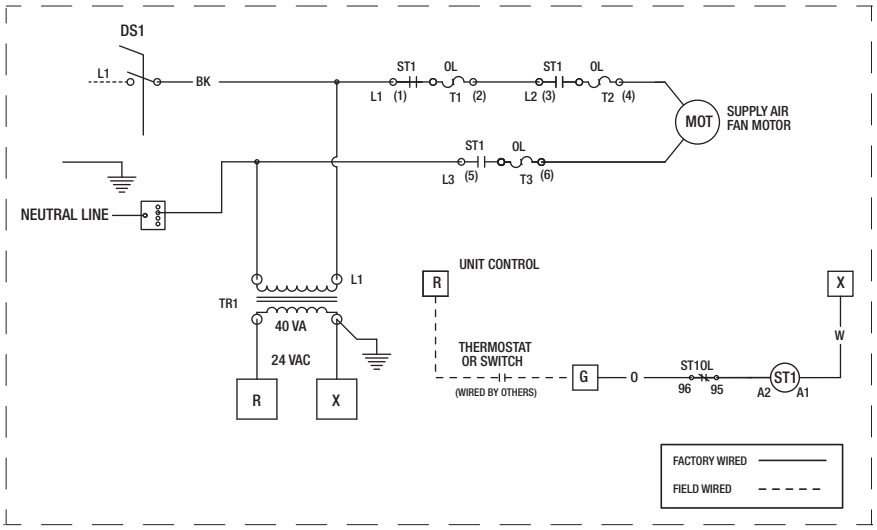
- ☐ Fan RPM Range
  - _____ Minimum
  - _____ Maximum

Optional Ladder Diagrams

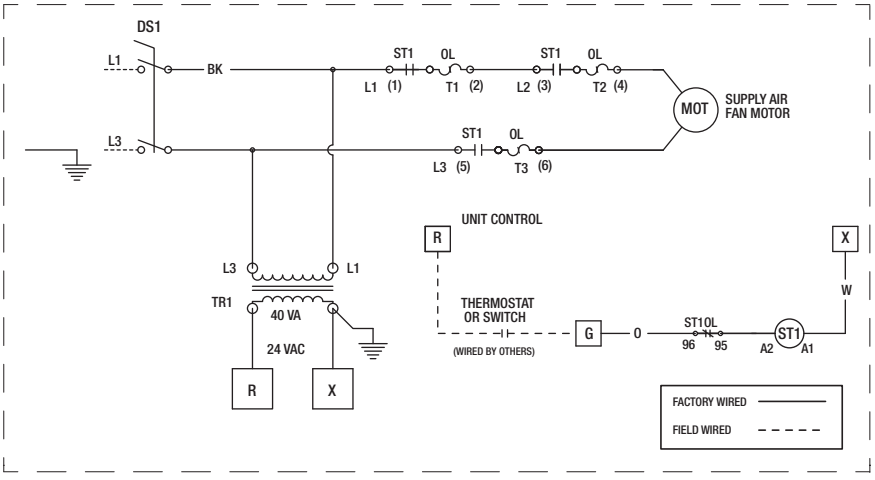
208V/230V/380V/460V/575V
3PH/50Hz/60Hz



115V/277V
1PH/60Hz



208V/230V
1PH/60Hz



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Our Commitment

As a result of our commitment to continuous improvement, Greenheck reserves the right to change specifications without notice.

Specific Greenheck product warranties are located on greenheck.com within the product area tabs and in the Library under Warranties.

Greenheck's catalog IAH Series, Models MSCF-FC • MSCF-BI • LFC-C • VFC-FC • VFCD-FC provides additional information describing the equipment, fan performance, available accessories, and specification data.

AMCA Publication 410-96, Safety Practices for Users and Installers of Industrial and Commercial Fans, provides additional safety information. This publication can be obtained from AMCA International, Inc. at www.amca.org.

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GREENHECK
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Document 474612
Model RV / RVE
Dedicated Outdoor Air Unit

Installation, Operation and Maintenance Manual

Please read and save these instructions for future reference. Read carefully before attempting to assemble, install, operate or maintain the product described. Protect yourself and others by observing all safety information. Failure to comply with these instructions will result in voiding of the product warranty and may result in personal injury and/or property damage.

Technical Support
Call: 1-866-478-2574
Email: DOAS@greenheck.com

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General Safety Information

Only qualified personnel should install and maintain this system. Personnel should have a clear understanding of these instructions and should be aware of general safety precautions. Improper installation can result in electric shock, possible injury due to coming in contact with moving parts, as well as other potential hazards. Other considerations may be required if high winds or seismic activity are present. If more information is needed, contact a licensed professional engineer before moving forward.

1. Follow all local electrical and safety codes, as well as the National Electrical Code (NEC), the National Fire Protection Agency (NFPA), where applicable. Follow the Canadian Electrical Code (CEC) in Canada.
2. All moving parts must be free to rotate without striking or rubbing any stationary objects.
3. Unit must be securely and adequately grounded.
4. Do not spin wheel faster than maximum cataloged fan RPM. Adjustments to fan speed significantly affect motor load. If the fan RPM is changed, the motor current should be checked to make sure it is not exceeding the motor nameplate amps.
5. Verify that the power source is compatible with the equipment.
6. Never open access doors to the unit while it is running.

WARNING

The roof lining contains high voltage wiring. To prevent electrocution, do not puncture the interior or exterior panels of the roof.

DANGER

- Always disconnect power before working on or near this equipment. Lock and tag the disconnect switch or breaker to prevent accidental power up.
- If this unit is equipped with optional gas accessories, turn off gas supply whenever power is disconnected.

CAUTION

This unit is equipped with a compressed refrigerant system. If a leak in the system should occur, immediately evacuate the area. An EPA Certified Technician must be engaged to make repairs or corrections. Refrigerant leaks may also cause bodily harm.

CAUTION

When servicing the unit, the internal components may be hot enough to cause pain or injury. Allow time for cooling before servicing.

Table of Contents

General Safety Information 1
Receiving, Handling, Storage 3
Product Overview 4
Subassemblies 5
Installation 6
Recommended Electrical and
Gas Supply Entry Locations 12
Piping Installation 13
Electrical Information. 14
Control Center Components. 15
Component Operation. 16
Optional Component Operation 16
Factory-Installed Refrigeration System. 20
Start-Up – Unit 24
Start-Up Components. 29
Optional Polymer Energy Wheel 32
Optional Aluminum Energy Wheel 34
Troubleshooting. 35
Routine Maintenance 41
Reference
  Venting Connection Locations 44
  Rated Airflow. 46
Our Commitment. . . . . Backcover

Receiving

This product may have been subject to road salt during transit. If so, immediately wash off all visible white reside from all exterior surfaces. Upon receiving the product, check to ensure all line items are accounted for by referencing the delivery receipt or packing list. Inspect each crate or carton for shipping damage before accepting delivery. Alert the carrier if any damage is detected, **do not refuse shipment**. The customer shall make notation of damage (or shortage of items) on the delivery receipt and all copies of the bill of lading which should be countersigned by the delivering carrier. If damaged, immediately contact your manufacturer's representative. Any physical damage to the unit after acceptance is not the responsibility of the manufacturer.

Handling

Units are to be rigged and moved by the lifting brackets provided. Location of brackets varies by model and size. Handle in such a manner as to keep from scratching or chipping the coating. Damaged finish may reduce ability of unit to resist corrosion.

Unpacking

Verify that all required parts and the correct quantity of each item have been received. If any items are missing, report shortages to your local representative to arrange for obtaining missing parts. Sometimes it is not possible that all items for the unit be shipped together due to availability of transportation and truck space. Confirmation of shipment(s) must be limited to only items on the bill of lading.

Storage

Units are protected against damage during shipment. If the unit cannot be installed and operated immediately, precautions need to be taken to prevent deterioration of the unit during storage. The user assumes responsibility of the unit and accessories while in storage. The manufacturer will not be responsible for damage during storage. These suggestions are provided solely as a convenience to the user.

The ideal environment for the storage of units and accessories is indoors, above grade, in a low humidity atmosphere which is sealed to prevent the entry of blowing dust, rain, or snow. Units designed for outdoor applications may be stored outdoors. All accessories must be stored indoors in a clean, dry atmosphere.

Indoor

Maintain temperatures evenly to prevent condensation. Remove any accumulations of dirt, water, ice, or snow and wipe dry before moving to indoor storage. To avoid condensation, allow cold parts to reach room temperature. Leave coverings loose to permit air circulation and to allow for periodic inspection.

The unit should be stored at least 3½ in. (89 mm) off the floor. Clearance should be provided to permit air circulation and space for inspection.

Outdoor

The unit should be placed on a level surface to prevent water from leaking into the unit. The unit should be elevated so that it is above water and snow levels. Ensure sufficient support to prevent unit from settling into soft ground. Locate parts far enough apart to permit air circulation, sunlight, and space for periodic inspection. To minimize water accumulation, place all unit parts on blocking supports so that rain water will run off.

Do not cover parts with plastic film or tarps as these cause condensation of moisture from the air passing through heating and cooling cycles.

Inspection and Maintenance

While in storage, inspect units once per month. Keep a record of inspection and maintenance performed.

If moisture or dirt accumulations are found on parts, the source should be located and eliminated. At each inspection, rotate the fan wheel by hand ten to fifteen revolutions to distribute lubricant on motor. If paint deterioration begins, consideration should be given to touch-up or repainting. Units with special coatings may require special techniques for touch-up or repair.

Machined parts coated with rust preventive should be restored to good condition promptly if signs of rust occur. Immediately remove the original rust preventive coating with petroleum solvent and clean with lint-free cloths. Polish any remaining rust from surface with crocus cloth or fine emery paper and oil. Do not destroy the continuity of the surfaces. Wipe thoroughly clean with Tectyl® 506 (Ashland Inc.) or the equivalent. For hard to reach internal surfaces or for occasional use, consider using Tectyl® 511M Rust Preventive, WD-40® or the equivalent.

Removing from Storage

As units are removed from storage to be installed in their final location, they should be protected and maintained in a similar fashion until the equipment goes into operation.

Prior to installing the unit and system components, inspect the unit assembly to make sure it is in working order.

1. Check all fasteners, set screws on the fan, wheel, bearings, drive, motor base, and accessories for tightness.
2. Rotate the fan wheel(s) by hand and assure no parts are rubbing.

Product Overview

A horizontally configured High Percentage Outdoor Air unit designed for installation either indoors or outdoors. Each unit has multiple options for cooling and/or heating. The unit is designed to replace air that is exhausted from the building and also heat and cool, as needed. The air volume produced by the unit is constant, but can be optionally modulated to provide a variable air volume (VAV) and recirculation is also offered as an option.

Cooling

Units have the following cooling options available:

- Packaged DX
- Split DX (thermal expansion valve is field-provided)
  Not available on housing sizes 10, 75/150, 110/118.
- Chilled water coil
- Air-source heat pump (ASHP)
  Not available on housing sizes 10, 75/150, 110/118.

Packaged DX and air-source heat pumps are shipped fully charged with refrigerant and are ready for operation upon arrival.

Heating

There are four different optional heat sources that can be ordered for this unit:

- Indirect gas-fired furnace with one or two sets of heat exchangers
- Electric heat with infinitely variable SCR control
- Hot water coil
- Air-source heat pump (ASHP)
  Not available on housing sizes 10, 75/150, 110/118.

Airflow Arrangement

The unit is capable of Constant Air Volume (CAV), Variable Air Volume (VAV), 100% Outdoor Air and have recirculating air options.

Safety Listing

Models are listed per ANSI/UL 1995, Heating and Cooling Equipment and are ETL Certified.

Models and Capacities

Model	Cooling Capacity
RV-10	3 to 7 tons
RV-25	5 to 15 tons
RV-45	15 to 30 tons
RV-75	25 to 50 tons
RV-110	30 to 70 tons
RVE-40	5 to 15 tons
RVE-85	15 to 30 tons
RVE-150	25 to 50 tons
RVE-180	30 to 70 tons

Subassemblies

Blower - Either one, two, or three plenum-type fans. All units are equipped with a plenum fan for Supply Air and a second may be selected for Exhaust (Relief) Air.

Coils - Evaporator coil (optional)
Condenser coil (optional, packaged DX only)
Indoor coil (optional, air-source heat pump only)
Outdoor coil (optional, air-source heat pump only)
Water coil (optional)
Reheat coil (optional)

Compressors - Each unit having packaged DX will have either one, two or four refrigerant compressors. Optionally, one of the compressors may be a digital or inverter scroll type compressor. Air-source heat pump units will have one inverter scroll compressor and may contain a second staged compressor.

Dampers - Motorized intake air damper, optional motorized recirculating damper. Optional return air damper. Optional gravity-type exhaust damper.

Optional Barometric Relief Damper - Used during economizer mode of the unit when building pressure increases, relief damper will open due to over pressurization.

Electric Heater - An SCR controlled electric heater (not shown) is available on the units. It has its own control panel and may require a separate power supply. See unit-specific wiring diagram.

Supply Filters - Housing size 110/180 is available with a filter bank depth of either 2,4 or 6-inch. All other housings are available with a filter bank depth of either 2 or 4-inch.

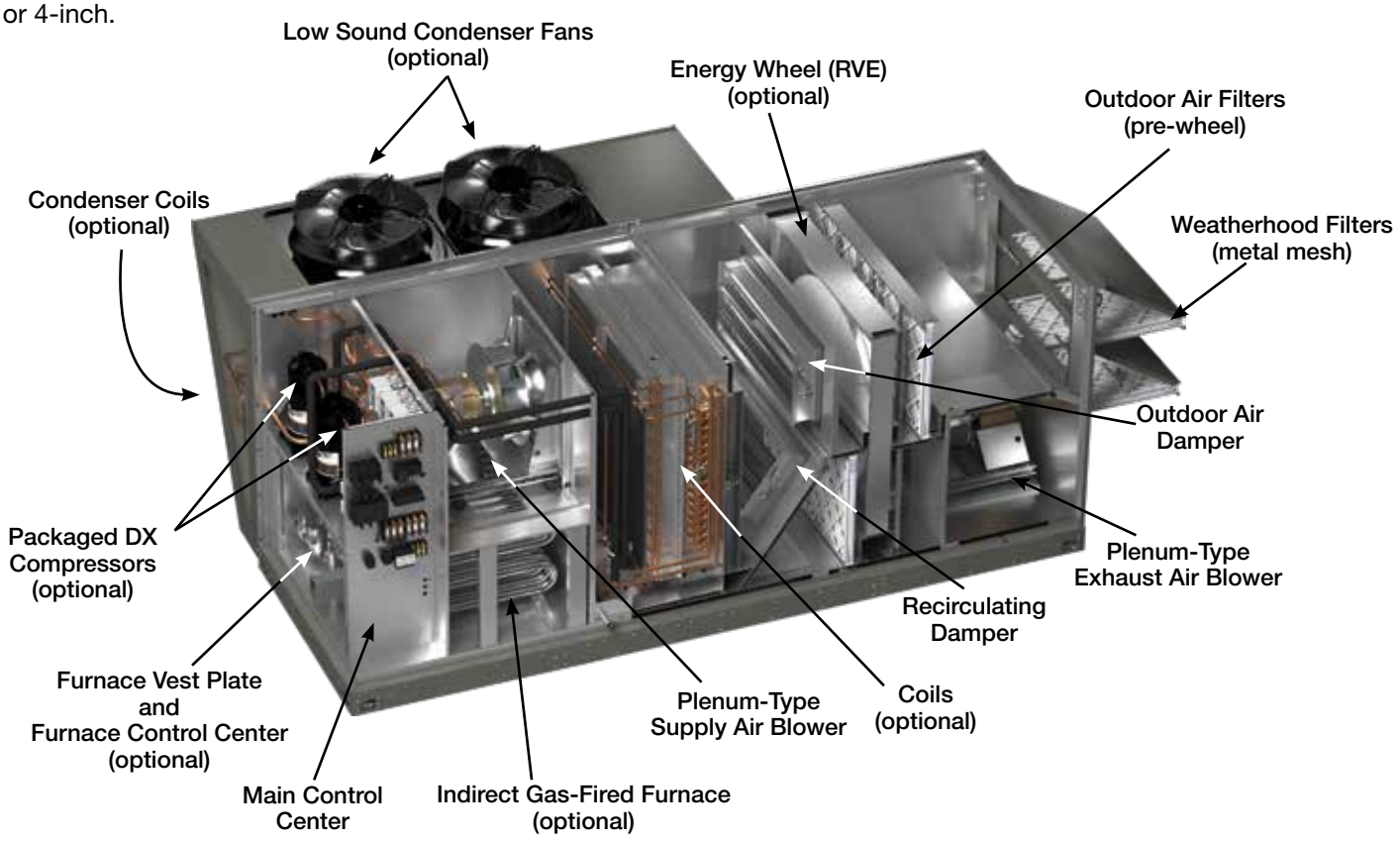
Indirect Gas-Fired Furnace - Housing sizes 10, 25/40 and 45/85, use furnace model PVG. Housing sizes 75/150 use furnace models PVG 600-800 or HMA 1000-1200. Housing sizes 110/180 use furnace model HMA 600-1200.

Packaged DX System - Any unit may be ordered with a packaged DX system. Housing size 10 will use one compressor; housing size 25/40 will include either one or two compressors; housing size 45/85 will include two compressors; housing size 75/150 will include three compressors; housing size 110/180 will include four compressors; a condenser coil(s) and evaporator coil(s) and all required components. Units that have packaged DX are charged with R410A refrigerant. Do not use tools or parts designed for other refrigerants on these units.

Air-Source Heat Pump - Units having an air-source heat pump will include either one or two compressors, an indoor and outdoor coil, and all required components. Air-source heat pump units are charged with R410A refrigerant. Do not use tools or parts designed for other refrigerants on these units. Not available on housing sizes 10, 75/150, 110/118.

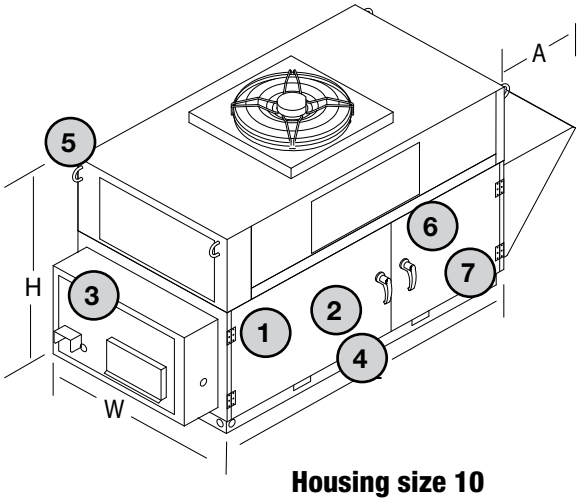
Split DX - The unit may be ordered with a split DX system for connection to a building cooling system. Thermal expansion valve (TXV) is field-provided. Not available on housing sizes 10, 75/150, 110/118.

Vestibule - Some units may be ordered with a factory-assembled vestibule that is to be field-attached to the side of the unit. See lifting instructions.

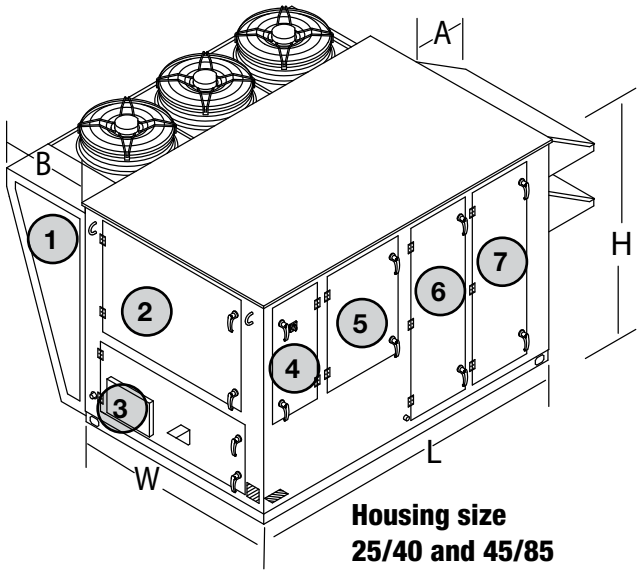


Installation

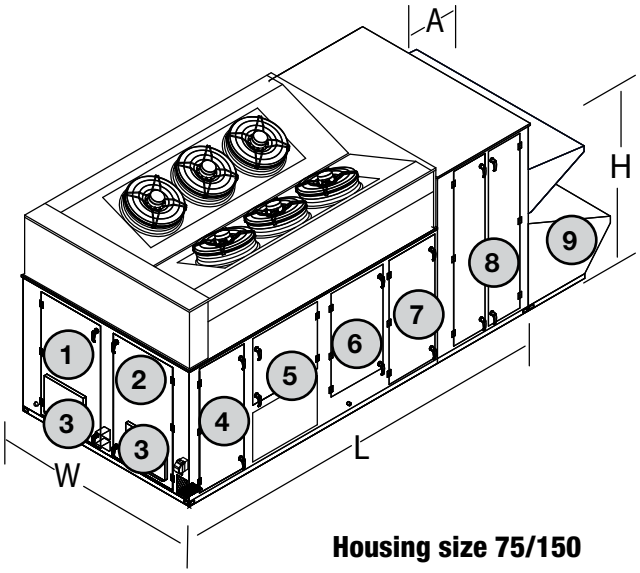
Typical Unit Weights and Dimensions



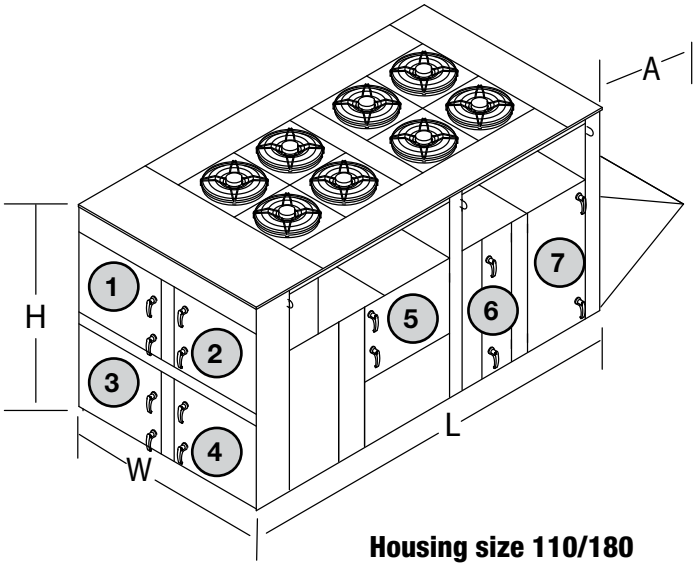
Housing size 10



Housing size 25/40 and 45/85



Housing size 75/150



Housing size 110/180

Component Access	
1	Optional Inverter Compressor
2	Optional Compressor/Electrical
3	Optional Gas Furnace/Optional Electric Heater
4	Electrical
5	Supply Blower
6	Coil
7	Filters
8*	Exhaust Blower/Optional Electric Preheat
9	Powered Exhaust Blower Section
* When a powered exhaust fan (or RVE) is selected, door 8 will be to the immediate right of door 7.	

Installation

Typical Unit Weights and Dimensions

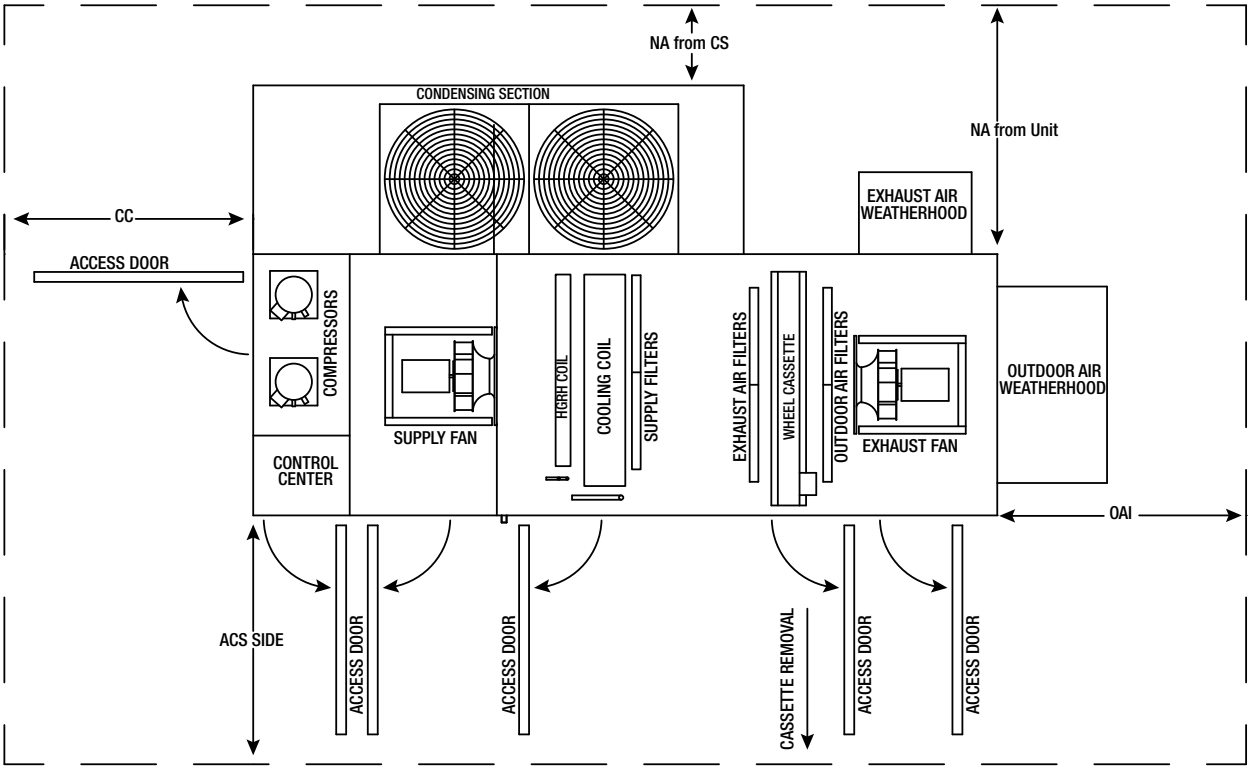
Model	Nominal tonnage (tons)	Height (H)	Width (W)	Length (L)	Intake (A)	Condensing Section (B)	Nominal weight (lbs)	Outdoor Intake	Supply Discharge	Return Intake	Exhaust Discharge
RV-10	3-7	58.1	44.0	82.2[9]	22.3	NA	1,180	End	Bottom or Side	Bottom or End[2]	NA
RV-25	5-15	59.3	52.5	98.6[6]/149.5[7]	22.1	30.1	2,700			Bottom, End[2] or Side[1]	End[3] or Side[1]
RV-45	15-30	72.5	68.2	109[6]/163.2[7]	27.7	30.1	4,500				
RV-75	25-50	101.3	98	155.2[6]/188[4]	39/47.5[8]	NA	6,500			Bottom, End[11] or Side[1]	End
RV-110	30-70	99.5	96	185	45.3	NA	7,950			Bottom or End[10]	Side
RVE-40	5-15	59.3	52.5	149.5/180.5[4]	22.1	30.1	3,400	End	Bottom or Side	Bottom, End[2] or Side[1]	End[3] or Side[1]
RVE-85	15-30	72.5	68.2	163.2/197.2[4]	27.1	30.1	5,100				
RVE-150	25-50	101.3	98	199.6[5]/233.8[4]	47.5	NA	8,000			Bottom or Side	End
RVE-180	30-70	99.5	96	263[5]/307[4]	45.3	NA	10,450				Side

All dimensions are shown in inches. Weight is shown in pounds and includes largest supply and exhaust fans, PDX with reheat, largest indirect-gas fired furnace, and all dampers. Actual weights will vary based on the unit configuration.

[1] Only available with powered exhaust
[2] Only available without barometric relief
[3] Only available with barometric relief
[4] Length with side return
[5] Length with bottom return
[6] Length with bottom or end return
[7] Length with powered exhaust
[8] Length with powered exhaust bumpout
[9] Optional indirect gas-fired furnace bumpout length is additional 13.3 inches
[10] Only available without powered exhaust
[11] Only available without powered exhaust and without barometric relief

Installation

Service Clearances



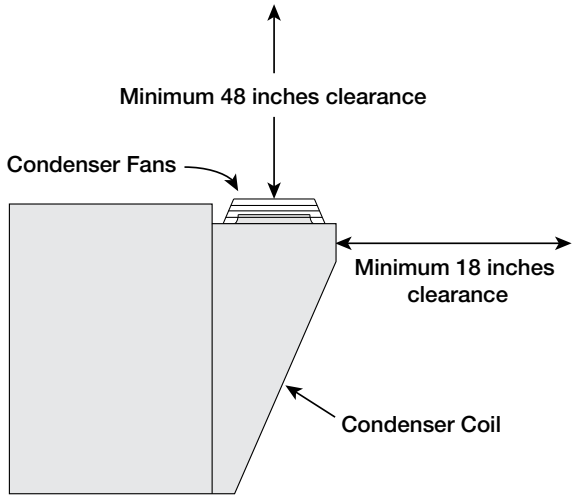
Model	ACS Access Side	CC Control Cabinet End		OAI Outdoor Air Intake		*NA from Unit	NA from Condensing Section	NA from Piping Vestibule (not shown)
		Other	Indoor Mounted with IG Furnace	Outdoor Mounted	Indoor Mounted			
RV-10	50	42	NA	36	NA	24	NA	NA
RV-25	40	42	72	42	18	24	18	30
RV-45	36	58	72	42	18	24	18	30
RV-75	48	48	NA	87	NA	48	NA	NA
RV-110	48	48	NA	60	NA	48	NA	NA
RVE-40	40	42	72	42	18	24	18	30
RVE-85	36	58	72	42	18	24	18	30
RVE-150	48	48	NA	87	NA	48	NA	NA
RVE-180	48	48	NA	60	NA	48	NA	NA

All dimensions are shown in inches.

*No condensing section or piping vestibule, or unit has top condensing section.

Additional Clearances for Packaged DX Units

Packaged DX units require additional clearance because they must have unrestricted air movement around the condenser coil and condenser fans. Hot air is being discharged from the condenser fans during operation. Enough clearance must be provided to avoid recirculation or coil starvation. When equipped with condenser coils, the unit should never be placed under an overhang or inside a building. A minimum of 48 inches above the condenser fans is acceptable, but unobstructed is strongly recommended.



End view of rooftop unit with Packaged DX

Additional Clearances for Air Source Heat Pump

IMPORTANT

Air-source heat pumps are equipped with a defrost cycle to remove ice from the outdoor coil. During defrost cycles, melted water may drip from the bottom of the refrigeration section under the outdoor coil. In cold climates, proper drainage/heat tape must be installed under the outdoor coil to prevent the buildup of ice on the roof.

Air-source heat pump units require additional clearance because they must have unrestricted air movement around the outdoor coil and outdoor fans. Enough clearance must be provided to avoid recirculation or coil starvation. Air-source heat pump units should never be placed under an overhang or inside a building. A minimum of 48-inches above the outdoor fans is acceptable, but unobstructed is strongly recommended.

Handling Concerns for Packaged DX or Air-Source Heat Pump

Units with PDX or ASHP have a system that is pressurized with refrigerant. If damage occurs, the refrigerant could leak into the atmosphere or cause bodily harm due to the extreme cold nature of expanding refrigerant. Use protective equipment such as gloves and safety glasses to minimize or prevent injury in case of a system leak during installation.

Before Lifting

Before lifting, be sure that all shipping materials have been removed from the unit.

Vestibule

Determine whether or not the unit has a vestibule that must be field-attached to the side of the unit. Vestibules are shipped assembled but detached from the unit. They have lifting lugs on them so they can also be lifted by crane, but the installed location of the unit may make it preferable to install the vestibule on the unit prior to lifting.

Field Power Access

Determine where high voltage and low voltage wiring is to be brought into the cabinet. If wiring is to be brought into the cabinet through the floor, see Alternate Supply Entry Locations in this manual. If unit is to be installed on a roof, cut access openings in the roof deck as needed.

Installation

Lifting

1. Ensure that all shipping materials have been removed from unit.
2. To assist in determining rigging requirements, weights are provided in the Unit Weights & Dimensions section of this manual.
3. Unit must be lifted by all lifting lugs provided at top of unit.
4. Spreader bars must span the unit to prevent damage to the cabinet by the lift cables.
5. Never rest the spreader bar on the unit.

WARNING

Spreader bars are required to prevent damage to the cabinet, failure to do so can result in damage that is the installer's responsibility.

6. Always test-lift the unit to check for proper balance and rigging before hoisting to desired location.
7. Never lift unit by weatherhood.
8. Never lift units in windy conditions.
9. Preparation of curb and roof openings should be completed prior to lifting unit to the roof.
10. Check to be sure that gasketing (supplied by others) has been applied to the top of the curb prior to lifting the unit and setting on the curb.
11. Do not use forklifts for handling unit on housing sizes 25/40, 45/85, 75/150, or 110/180.
12. If using forklift on housing 10, use forks with 48-inch length and ensure forks extend to opposite side of unit using factory-installed forklift pockets at unit base.

Roof Curb Mounting

Roof curb details, including duct locations and dimensions, are to be found in the roof curb assembly instructions.

Rooftop units require curbs to be mounted first. The duct connections must be located so they will be clear of structural members of the building.

1. Factory-supplied roof curbs. Roof curbs are model GKD which are shipped in a knockdown kit (includes duct adapters) and require field assembly (by others) on all units except RV-110 and RVE-180, which are shipped assembled. Assembly instructions are included with the curb kit.

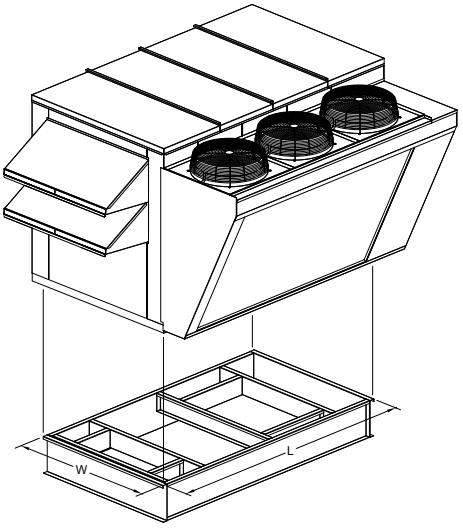
2. Install curb. Locate curb over roof opening and fasten in place. Check that the diagonal dimensions are within ±1/8 inch of each other and adjust as necessary. For proper coil drainage and unit operation, it is important that the installation be level. Shim the curb as required to level. Install gasketing on top surface of curb (provided by others).

3. Install ductwork. Installation of all ducts should be done in accordance with SMACNA and AMCA guidelines. Duct adapters are provided to support ducts prior to setting the unit.

4. Set the unit. Lift unit to a point directly above the curb and duct openings. Guide unit while lowering to align with duct openings. Roof curbs fit inside the unit base. Make sure the unit is properly seated on the curb and level.

5. Fasten the unit, Fasten the unit to the curb/ equipment support(s) using appropriate methods. The installer is responsible for determining appropriate support and fastening methods to ensure compliance with all applicable codes.

6. Install vestibule. If unit was ordered with a vestibule and it has not yet been attached to the unit, caulk and attach the vestibule at this time.

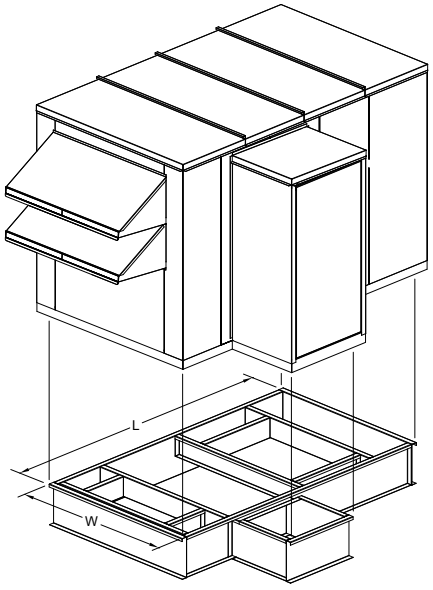


Typical Unit with Condensing Section and Factory-Supplied Curb Kit

Installation

Optional Piping Vestibule

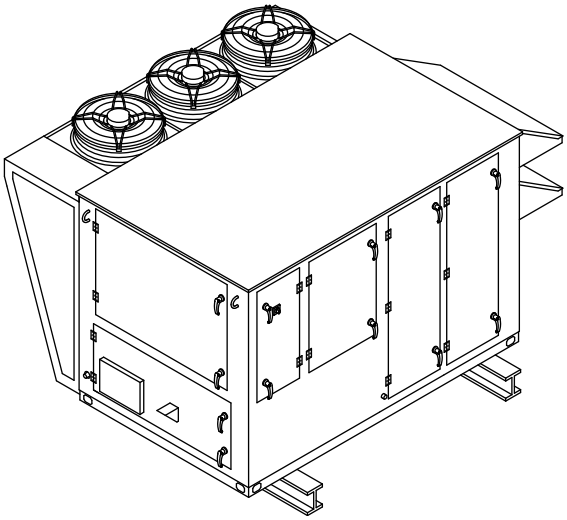
If the unit was ordered with the vestibule, the NA (Non-Access side) clearance dimension must be measured from the vestibule.



Typical Unit with Piping Vestibule and Factory-Supplied Curb Kit

Rail Mounting and Layout

- The units may be installed on rails provided and installed by others. Ensure that rails are designed to handle the weight of the unit and provide proper load distribution on building supports.
- Make sure that rail positioning does not interfere with the openings on the unit.
- Rails should run the width of the unit and extend beyond the unit a minimum of 12 inches on each side.
- Set unit on rails.

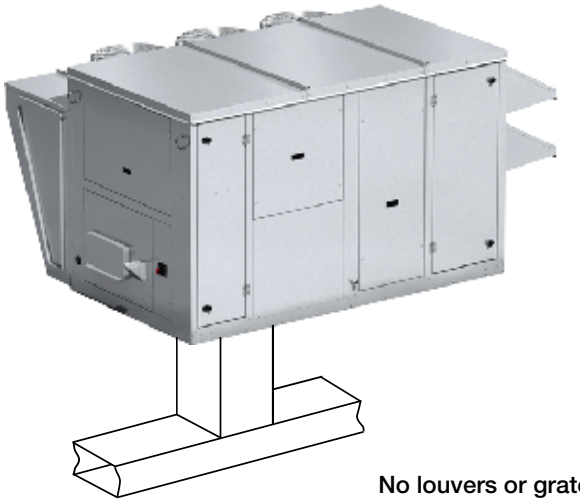


Typical Unit Installed on Rails Supplied by Others

Ductwork Configurations

NOTE

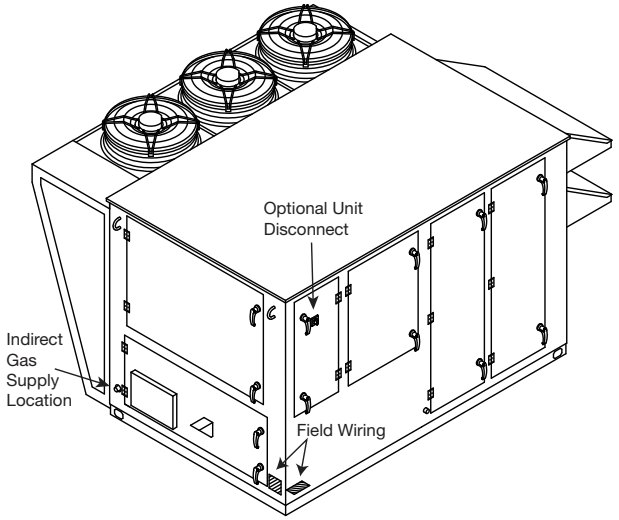
Downblast Discharge Ductwork - whenever downblast discharge is used, the ductwork directly beneath the unit must be connected with either a “T” or an “L” configuration and the area directly beneath the heat source **must not have any openings** such as louvers or grates.



No louvers or grates

Recommended Electrical and Gas Supply Entry Locations

Manufacturer recommends that electrical service and gas supply be brought into the cabinet through the end wall, as shown below. There are three penetrations into the cabinet that are required; one for high voltage supply wiring, one for low voltage control wiring and one for either gas supply or high voltage supply wiring for an electric heater.



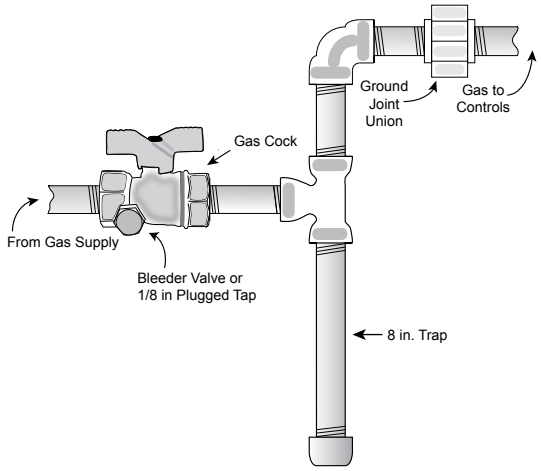
Recommended Gas and Electric Supply Entry Locations

Alternate Supply Entry Locations

Each installation is unique and as a result, alternate entry locations may be field-located. Before using any alternate entry location, verify the suitability of the location and ensure the use of an alternate location does not interfere with unit wiring, components or functionality.

Gas Connections

If this unit is equipped with an indirect gas-fired furnace, connection to an appropriate gas supply line will be required. For complete information on installation procedures for the optional gas furnace, refer the PVF/PVG Indirect Gas-Fired Heat Module Installation, Operation, and Maintenance Manual.



Typical Gas Supply Piping Connection

Optional Gas Piping

Units with indirect gas-fired furnaces require field-supplied and installed gas supply piping.

Housing Size	Total Heating Capacity (Input in MBH)	Gas Connection Size	Max Gas Pressure
10	75	¾" NPT	14 in. wg.
	100		
	150		
	200		
25/40	100	¾" NPT	14 in. wg.
	150		
	200		
	250		
	300		
45/85	300	¾" NPT	14 in. wg.
	400		
	500		
75/150	600	¾" NPT	14 in. wg.
	800		
	100	1" NPT	
	1200		
110/180	600	1" NPT	13.5 in. wg.
	800	2" NPT	
	1000		
	1200		

WARNING

Never drill holes in the roof of the unit! There is high voltage wiring located between the inner and outer roof panels. Damage to the wiring could cause severe bodily harm or death.

NOTE

110/180 gas furnaces are designed for gas pressure of 5-13.5 in. wg for natural gas (6-inch minimum on single 500 and 600 MBH furnaces) and 11-13.5 in. wg for LP. If the gas pressure at the job location is greater than 13.5 in. wg, an additional regulator is required to reduce pressure. For other RV and RVE models, reference the ***Model PVF and PVG IOM.***

Piping Installation

Optional Coil Piping

Factory-installed cooling and heating components are mounted in the coil section of the unit. The coil section is downstream of the energy wheel on the supply air side of the unit. Note the coil connection locations on the picture. Coil connections are located external to the unit.

Note: DX coil liquid connection is internal to units.

Water Coils

1. Piping should be in accordance with accepted industry standards. Pipework should be supported independently of the coils. When installing couplings, do not apply undue stress to the connection extending through the unit. Use a backup pipe wrench to avoid breaking the weld between coil connection and header.
2. Connect the water supply to the bottom connection on the air leaving side and the water return to the top connection on the air entering side. Connecting the supply and/or return in any other manner will result in very poor performance. Be sure to replace factory-installed grommets around coil connections if removed for piping. Failure to replace grommets will result in water leakage into the unit and altered performance.
3. Water coils are not normally recommended for use with entering air temperatures below 40°F. No control system can be depended on to be 100% safe against freeze-up with water coils. Glycol solutions or brines are the only safe media for operation of water coils with low entering air conditions. If glycol or brine solutions are not used, coils must be drained when freezing conditions are expected. **If required, vent and drain connections must be field-piped, external to the unit.**
4. Pipe sizes for the system must be selected on the basis of the head (pressure) available from the circulation pump. The velocity should not exceed 6 feet per second and the friction loss should be approximately 3 feet of water column per 100 feet of pipe.
5. For chilled water coils, the condensate drain pipe should be sized adequately to ensure the condensate drains properly. Refer to Drain Trap section.

Direct Expansion (DX) Coils (Split DX)

1. Piping should be in accordance with accepted industry standards. Pipework should be supported independently of the coils. Undue stress should not be applied at the connection to coil headers.
2. The condensate drain pipe should be sized adequately to ensure the condensate drains properly. Refer to Condensate Drain Trap section.
3. When connecting suction and liquid connections make sure the coil is free from all foreign material. Make sure all joints are tight and free of leakage. Be sure to replace factory-installed grommets around coil connections if removed for piping.
4. Manufacturer does not supply compressor, condensing units, or thermal expansion valve (TXV) with standard models. For further instruction on DX coil installation and operation contact your compressor and/or condenser manufacturer.

Condensate Drain Trap

This unit is equipped with a stainless steel condensate pan with a stainless steel connection. It is important that the drain connection be fitted with a P trap to ensure proper drainage of condensate while maintaining internal static pressures and to prevent migration of sewer gas back into the unit.

A P trap assembly (kit) is supplied with each unit, except for housing 110/180, and is to be assembled and installed as local conditions require and according to the assembly instructions provided with the P trap. If local and area codes permit, the condensate may be drained back onto the roof, but a drip pad should be provided beneath the outlet. If local and area codes require a permanent drain line, it should be fabricated and installed in accordance with Best Practices and all codes.

In some climates, it will be necessary to provide freeze protection for the P trap and drain line. The P trap should be kept filled with water or glycol solution at all times and it should be protected from freezing to protect the P trap from damage. If severe weather conditions occur, it may be necessary to fabricate a P trap and drain line of metal and install a heat tape to prevent freezing.

Condensate Overflow Switch

This unit is equipped with an optional factory-mounted condensate overflow switch. In the event that a high level of condensate is detected, the microprocessor controller will trigger an alarm and shutdown the unit.

WARNING

The roof lining contains high voltage wiring. To prevent electrocution, do not puncture the interior or exterior panels of the roof.

WARNING

To prevent injury or death due to electrocution or contact with moving parts, lock disconnect switch open.
For units with a gas furnace, if you turn off the power supply, turn off the gas.

IMPORTANT

Before connecting power to the unit, read and understand the following instructions and wiring diagrams. Complete wiring diagrams are attached on the inside of the control center door(s).

IMPORTANT

All wiring should be done in accordance with the latest edition of the National Electric Code ANSI/NFPA 70 and any local codes that may apply. In Canada, wiring should be done in accordance with the Canadian Electrical Code.

IMPORTANT

The equipment must be properly grounded and bonded. Any wiring running through the unit in the airstream must be protected by metal conduit, metal clad cable or raceways.

CAUTION

If replacement wire is required, it must have a temperature rating of at least 105ºC, except for an energy cut-off or sensor lead wire which must be rated to 150ºC.

DANGER

High voltage electrical input is needed for this equipment. This work should be performed by a qualified electrician.

CAUTION

Any wiring deviations may result in personal injury or property damage. Manufacturer is not responsible for any damage to, or failure of the unit caused by incorrect final wiring.

Determine the Size of the Main Power Lines

The unit's nameplate states the voltage and the unit's MCA. The main power lines to the unit should be sized accordingly. The nameplate is located on the outside of the unit on the control panel side.

Determine the Size of Electric Heater Wiring

An optional electric heater may require a separate power supply. The power connection should be made to the factory-provided electric heater disconnect and must be compatible with the ratings on the nameplate, supply power voltage, phase and amperage. Consult ANSI/NFPA 70 and CSA C22.1 for proper conductor sizing.

Provide the Opening(s) for the Electrical Connections

Electrical openings vary by unit size and arrangement and are field-supplied.

Connect the Power Supplies

Connect the main power lines and electric heater power lines to the disconnect switches or terminal blocks and main grounding lug(s). Torque field connections to manufacturer's recommendations.

Wire the Optional Convenience Outlet

The convenience outlet requires a separate 115V power supply circuit. The circuit must include short circuit protection which may need to be supplied by others.

Connect Field-Wired Low Voltage Components

Most factory-supplied electrical components are prewired. To determine what electrical accessories require additional field-wiring, refer to the unit-specific wiring diagram located on the inside of the control center access door.

The low voltage control circuit is 24 VAC and control wiring should not exceed 0.75 ohms.

Control wires should not be run inside the same conduit as that carrying the supply power. Make sure that field-supplied conduit does not interfere with access panel operation. All low voltage wiring should be run in conduit wherever it may be exposed to the weather.

If wire resistance exceeds 0.75 ohms, an industrial-style, plug-in relay should be added to the unit control center and wired in place of the remote switch (typically between terminal blocks R and G on the terminal strip. The relay must be rated for at least 5 amps and have a 24 VAC coil. Failure to comply with these guidelines may cause motor starters to "chatter" or not pull in which can cause contactor failures and/or motor failures.

Field-Provided Disconnect

If field-installing an additional disconnect switch, it is recommended that there is at least four feet of service room between the switch and system access panels. When providing or replacing fuses in a fusible disconnect, use dual element time delay fuses and size according to the rating plate.

Control Center Components

Main Control Center Components

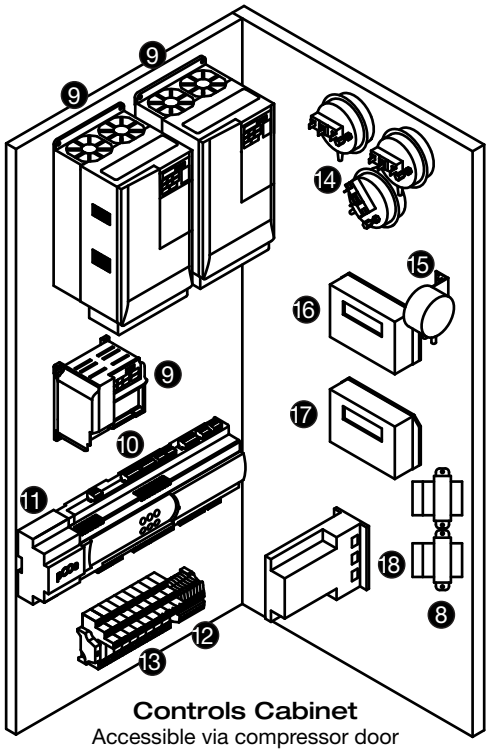
Image represents a typical installation for RVE-40 or RVE-85. Components and locations will vary on other models.

Electrical Cabinet

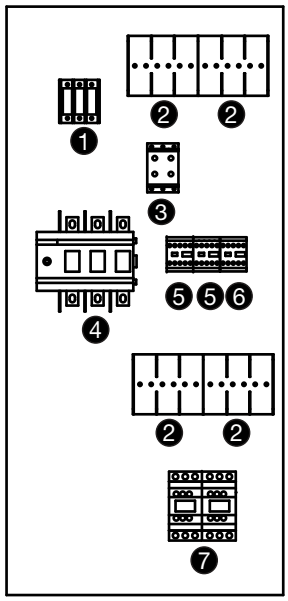
1. Power distribution block; high voltage supply is terminated here
2. Fuse holders
3. Phase monitor
4. Unit Disconnect
5. Condensing fan motor contactors
6. Wheel motor contactor
7. Compressor motor contactors

Controls Cabinet

8. Transformer
9. VFDs
10. Microprocessor controller
11. Monitoring points
12. Low voltage terminal strip
13. Relays
14. Dirty filter switches
15. Wheel pressure switch
16. Outdoor airflow monitor
17. Exhaust airflow monitor
18. Digital scroll controller



Controls Cabinet
Accessible via compressor door

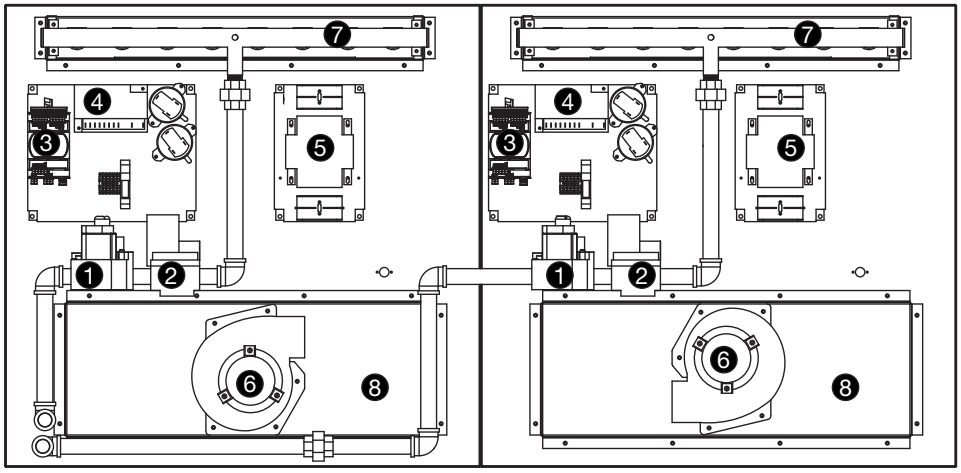


Electrical Cabinet
Accessible via control center door

Optional Indirect Gas-Fired Furnace

Note: In some models, two furnaces are installed to provide greater output. When two furnaces are installed, they are in parallel and both will operate at the same time and the same output. Both furnaces will have identical controls.

1. Single-stage valve
2. Modulating valve
3. PCOE expansion board
4. Ignition controller
5. Transformer
6. Combustion blower
7. Burner manifold
8. Collector box



For further information on the optional furnace and its control center, see the Indirect Gas-Fired Heat IOM shipped with the unit.

Component Operation

Phase Monitor

The unit control circuitry includes a phase monitor that constantly checks for phase reversal, phase imbalance, loss of phase or a power brownout. When it detects a fault, it cuts off the 24 VAC that goes to the low voltage terminal strip, thereby shutting off all motors.

Variable Frequency Drive (VFD)

If a VFD was provided and installed at the factory, it has been pre-set to control the speed of the blower motor for optimum performance. The motor speed needs to be verified during test and balance of the unit.

If the system was configured for Constant Air Volume (CAV), the VFD will operate in an ON/OFF fashion and the speed of the motor will not change. If the system was configured for Variable Air Volume (VAV), the microprocessor will constantly monitor operating conditions and provide a signal to the VFD, changing the VFD output as needed.

The VFD may alternatively be connected to an external signal such as provided by a BMS and be operated by a 0-10 VDC input.

Supply Fan VFD Sequence

Optional Room CO_2 Sensor: The microprocessor will modulate the supply fan based on a comparison of the CO_2 set point to the actual CO_2 levels reported from the sensor. Mechanical high static protection cutoffs must be installed by others to protect the system and equipment from over-pressurization.

Optional Duct Static Pressure Sensor: The microprocessor will modulate the supply fan based on a comparison of the duct static pressure set point to the actual duct static pressure level reported from the sensor. Mechanical high static protection cutoffs must be installed by others to protect the system and equipment from over-pressurization. The manufacturer does not assume responsibility for this.

Optional Building Static Pressure Sensor: The supply fan is modulated based upon the signal from a building static pressure sensor. The microprocessor will modulate the supply fan based on a comparison of the building static pressure set point to the actual building static pressure level reported from the sensor.

Optional Single Zone VAV: The microprocessor will use a space mounted temp sensor to vary heating and cooling capacity and the airflow delivered by the fan to maintain room-air temp at a desired set point.

Optional 0-10 VDC by others to VFD: Supply fan is modulated by a 0-10 VDC, field-provided by others.

Optional Component Operation

Exhaust Fan VFD Sequence

Optional Building Static Pressure Sensor: The exhaust fan is modulated based upon the signal from a building static pressure sensor. The microprocessor will modulate the exhaust fan based upon a comparison of the building static pressure level reported from the sensor.

Optional Outdoor Air Damper Tracking: The microprocessor will proportionally modulate the exhaust fan based upon the outdoor air damper position.

Optional Supply Tracking: The microprocessor will proportionally modulate the exhaust fan based upon the supply fan.

Optional 0-10 VDC by Others to VFD: The supply fan is modulated by a 0-10 VDC provided by others in the field.

Outdoor Air and Recirculated (Recirc) Air Damper Sequence

Optional Room CO_2 Sensor: The microprocessor will proportionally modulate the OA/RA dampers based upon a comparison of the CO_2 set point to the actual CO_2 level reported from the sensor. As the CO_2 level rises, the controller will proportionally modulate the outdoor air damper open, between the minimum and maximum OA position.

Optional Building Pressure: The OA/RA dampers will modulate based upon the signal from a building static pressure sensor. The controller will modulate the dampers, between the minimum and maximum OA positions, based upon a comparison of the building static pressure set point to the actual building static pressure level reported from the sensor.

Exhaust Fan Only Power

The exhaust fan will have a dedicated power circuit where in the case of a power outage, the exhaust fan will still run. A phase monitor will detect an outage or power loss and open the contact, disconnecting all power to the unit and controller. An external signal will need to be sent to a relay to power the exhaust fan, enabling the fan to run at a maximum speed. This sequence is NOT to be used for high temperature exhaust applications.

Service Lights

Service lights provide light to each of the compartments in the energy recovery unit. The lights are wired to a junction box mounted on the outside of the unit. The switch to turn the lights on is located in the unit control center. The switch requires a separate power source to allow for power to the lights when the unit main disconnect is off for servicing.

Optional Component Operation

Electronically Commutated (EC) Condenser Fans with Standard Scroll or Digital Scroll Compressors

The EC condenser fan(s) will modulate up and down to maintain the optimal liquid line pressure using built in control sequences within the factory controller. One pressure transducer is provided with each refrigeration circuit for monitoring and the factory controller will ramp condenser fan(s) up or down based on the condenser set point.

Economizer Fault Detection Diagnostics

Provides the status and faults of the air economizer to indicate proper economizer sequence operation. This assures the benefits of free cooling when outdoor conditions are suitable for economizer functions. The fault detection diagnostics system will indicate when free cooling is available and if the outside air damper and recirculation damper are reacting properly. If the dampers are not functioning correctly an alarm will be generated.

Air-Source Heat Pump

Operating Conditions and Limitations

To operate in Cooling mode, the following conditions must be true:

1. Supply air temperature above minimum low supply temperature limit (35°F)
2. Outside air temperature above the cooling ambient lockout (55°F, adj.)

To operate in Heating mode, the following conditions must be true:

1. Supply air temperature below maximum high supply temperature limit (120°F)
2. Supply air temperature above 35°F
3. Outside air temperature above the low ambient lockout (10°F, adj.)

For more information on air-source heat pump operation, reference the supplemental ***Reference Guide for Microprocessor Controller.***

IMPORTANT

Air-source heat pumps are equipped with a defrost cycle to remove ice from the outdoor coil. During defrost cycles, melted water may drip from the bottom of the refrigeration section under the outdoor coil. In cold climates, proper drainage/heat tape must be installed under the outdoor coil to prevent the buildup of ice on the roof.

IMPORTANT

Melted water from snow accumulation on the unit roof can be sucked into outdoor fans, resulting in ice formation on fan blades under certain conditions. Remove snow accumulation from the unit roof and outdoor coil section after snow storms.

Airflow Monitor

IMPORTANT

For the outdoor airflow monitoring device to perform as intended, field calibration is required. Calibration of the airflow monitoring device requires an independent measurement of airflow and should be performed when the system undergoes test and balance.

A factory-wired, mounted, and powered airflow monitoring system is provided in the outdoor, supply, and/or exhaust air streams. The airflow control system displays outdoor, supply, and/or exhaust air in actual cubic feet per minute (CFM) at factory controller or can be read by a building management system if communication is established.

Operation

Outdoor airflow monitoring is accomplished using two thermal dispersion sensors that accurately measure airflow velocity down to zero feet per minute (fpm). The airflow controller takes the average measurement for two sensor configurations, and determines the outdoor airflow rate based on the effective intake area. Field calibration of the outdoor airflow monitoring device determines the effective intake area of the unit. For additional information on how to navigate through the outdoor airflow controller menus, refer to technical manuals from GreenTrol® Automation Inc. at www.greentrol.com.

Supply and/or exhaust airflow monitoring is accomplished by measuring the pressure drop across the fan inlet venture. The airflow is then calculated by the factory controller based on the measured pressure drop and a K-Factor specific for each fan size.

Hot Gas Reheat Valve

Units equipped with a reheat coil use a three-way valve with actuator to control the supply air discharge temperature of the unit during dehumidification mode. The unit controller provides a 0-10 VDC signal to control the amount of reheat to meet the supply temperature set point.

Controls by Others

The reheat coil needs to be purged to ensure adequate oil return. It is recommended that every six hours of reheat compressor run time should initiate a six minute purge cycle. During the purge cycle, the reheat valve should be modulated to 100% open to the reheat coil.

Optional Component Operation

VFD Compressor

If the VFD compressor option is included, the compressor VFD is mounted in the end of the condensing section. Condensing section internal components are accessible via the access panel on the side of the condenser coil.

Envelope Control

The unit controller tracks the operating point of the VFD compressor within the operating envelope at all times. If the operating point is out of the envelope, the controller will take action to bring it back in. If unsuccessful, the controller will shut down the compressor. DO NOT operate the compressor VFD in hand mode because the envelope control safeties will not be in place. Refer to the controls IOM for more information on envelope control.

Electronic Expansion Valve

An electronic expansion valve is provided on the VFD compressor circuit to ensure tight superheat control throughout the compressor modulation band. The EXV acts as a liquid line solenoid valve when the compressor is off to prevent refrigerant migration.

Crankcase Heat

The VFD compressor will be heated by the compressor stator. To ensure optimal performance and reliability, do not disable stator heat. All other compressors will be provided with a crankcase heater.

Oil Return Management

The compressor VFD has an oil return purge cycle such that if the compressor has been operating below a set RPM for a set period of time, the VFD will accelerate the compressor to ensure sufficient lubrication.

DO NOT disable the oil return management function.

DO NOT operate the compressor VFD in hand mode because the oil return management will not be operational.

Ultraviolet Germicidal Irradiation (UVGI)

UV-C lights are mounted in the supply blower cabinet and provide air disinfection. The lights are factory-powered and are on when the supply blower is running. A kill switch on the supply blower access door turns the lights off when that door is open.

Housing 110/180 Only

UV-C lights are mounted downstream of the cooling coil, providing coil surface and drain pan disinfection. The lights are factory-powered and are on when there is power to the unit disconnect. A kill switch on the coil access door turns the lights off when that door is open.

Needlepoint Bipolar Ionization (NPBI®)

Needlepoint bipolar ionizers are mounted on the fan inlet cone(s) and provide air disinfection. The ionizers are factory-powered and are on when there is power to the unit disconnect.

Frost Control

Extremely cold outdoor air temperatures can cause moisture condensation and frosting on the energy recovery wheel. Frost control is an optional feature that will prevent/control wheel frosting. Three options are available:

Polymer Energy Wheel

Available options are:

1. Timed exhaust frost control
2. Electric preheat frost control
3. Modulating wheel frost control

These options are provided with a thermodisc mounted in the outdoor air intake compartment and a pressure sensor to monitor pressure drop across the energy wheel. An outdoor air temperature of below 5°F and an increase in pressure drop indicate that frost is occurring. Both the pressure sensor and the outdoor air thermodisc must trigger to initiate frost control. The two sensors together ensure that frost control is only initiated during a real frost condition.

Timed exhaust frost control includes a timer in addition to the thermodisc and wheel pressure sensor. When frost control is initiated, the timer will turn the supply blower off. The default timer setting will shut down the supply fan for 5 minutes every 30 minutes, allowing warm exhaust to defrost the energy wheel. Use the test procedure in the Optional Start-Up Accessories section for troubleshooting.

Electric preheat frost control includes an electric heater (at outdoor air intake) in addition to the thermodisc and wheel pressure sensor. When frost control is initiated, the electric preheater will turn on and warm the air entering the energy wheel. Use the test procedure in the Optional Start-Up Accessories section for troubleshooting.

Modulating wheel frost control includes a variable frequency drive (VFD) in addition to the thermodisc and wheel pressure sensor. When frost control is initiated, the VFD will reduce the wheel speed, reducing effectiveness and preventing condensation and frosting. If the outdoor air temperature is greater than the frost threshold temperature **OR** the pressure differential is less than the set point, the wheel will run at full speed. If the outdoor air temperature is less than 5°F **AND** the pressure differential is greater than the set point, the wheel will run at reduced speed until the pressure differential falls below the set point. The VFD will be fully programmed at the factory.

Optional Component Operation

Aluminum Energy Wheel

Available options are:

1. Modulating wheel frost control
2. Modulating wheel with electric preheat frost control

These options are provided with a temperature sensor mounted in the exhaust air discharge compartment. Frost control will initiate when the exhaust air temperature is below 36°F.

Modulating wheel frost control includes a variable frequency drive (VFD) in addition to the exhaust air temperature sensor. When frost control is initiated, the VFD will modulate the wheel speed to maintain 36°F exhaust air temperature. The VFD will be fully programmed at the factory.

Modulating wheel with electric preheat frost control includes a variable frequency drive (VFD) and electric heater (at outdoor air intake) in addition to the exhaust air temperature sensor. When frost control is initiated, the VFD will modulate the wheel speed to maintain 36°F exhaust air temperature. The electric heater will turn on when the outdoor air temperature is below 10°F. The VFD will be fully programmed at the factory.

Rotation Sensor

The rotation sensor monitors energy wheel rotation. If the wheel should stop rotating, the sensor will close a set of contacts in the unit control center. Field-wiring of a light (or other alarm) between terminals R and 12 in the unit control center will notify maintenance personnel when a failure has occurred.

Dirty Filter Sensor

Dirty filter sensors monitor pressure drop across the outdoor air filters, exhaust air filters, or both. If the pressure drop across the filters exceeds the set point, the sensor will close a set of contacts in the unit control center. Field-wiring of a light (or other alarm) to these contacts will notify maintenance personnel when filters need to be replaced. The switch has not been set at the factory due to external system losses that will affect the switch. This switch will need minor field adjustments after the unit has been installed with all ductwork complete. The dirty filter switch is mounted in the exhaust inlet compartment next to the unit control center or in unit control center.

Microprocessor Control

The microprocessor controller is specifically designed and programmed to optimize the performance of the unit with supplemental heating and cooling. This option ensures that the outdoor air is conditioned to the desired discharge conditions. The controller and accompanying sensors are factory-mounted, wired and programmed. Default settings are pre-programmed, but are easily field-adjustable.

The microprocessor controller can be interfaced with a Building Management System through LonWorks®, BACnet®, or ModBus.

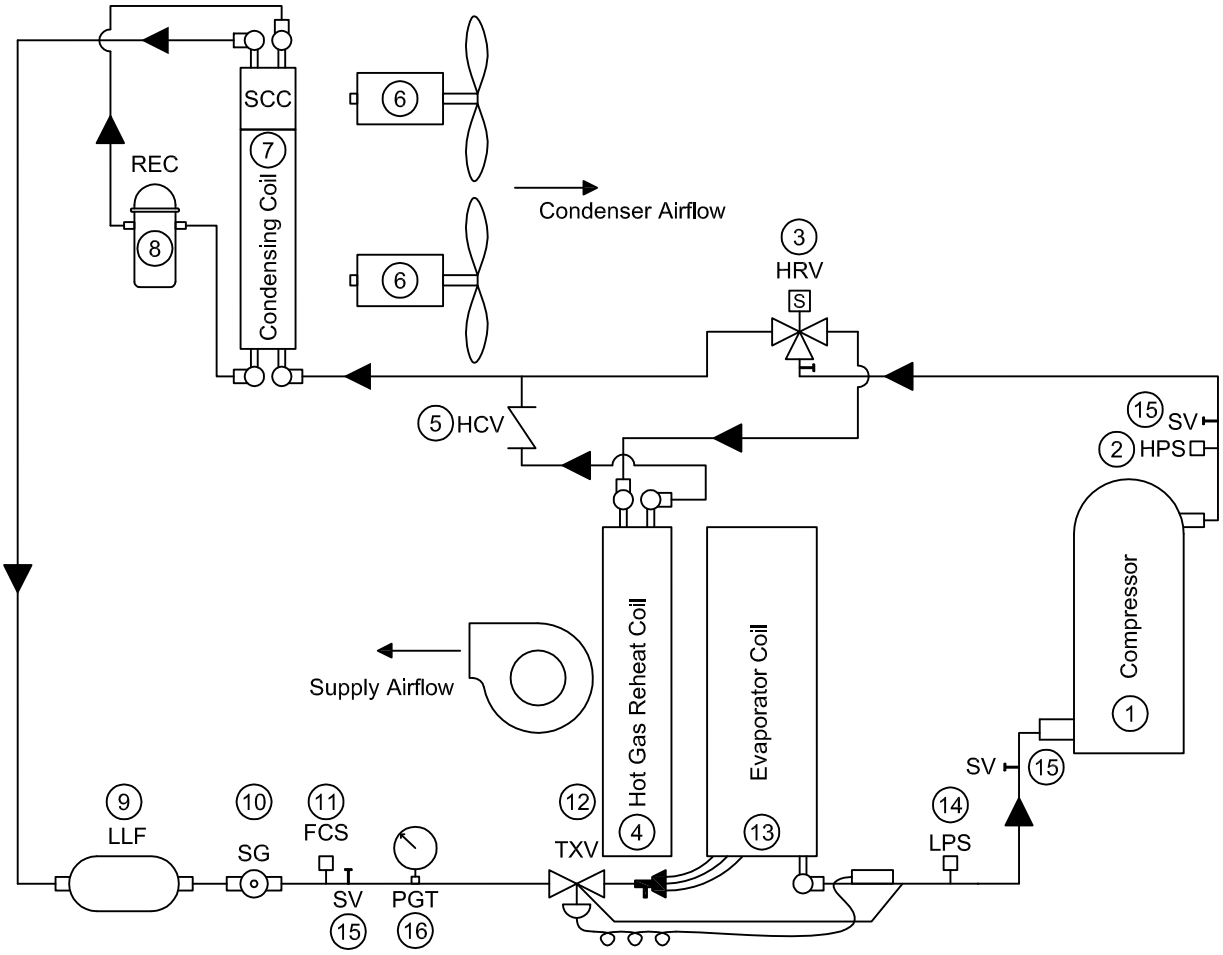
Please refer to the Installation, Operation and Maintenance manual for detailed information.

Unoccupied Recirculation Damper

The unoccupied recirculation option provides a recirculation damper from the return air intake to the supply airstream. If equipped with a room temperature and/or relative humidity sensor, the unit can cycle on to maintain unoccupied room set points if there is a call for unoccupied heating, cooling, or dehumidification. During the unoccupied mode, the supply and exhaust (if equipped) fans will be off unless there is a call for cooling, heating, or dehumidification in the space.

Factory-Installed Refrigeration System Components

Packaged DX Cooling with Three Way Hot Gas Reheat



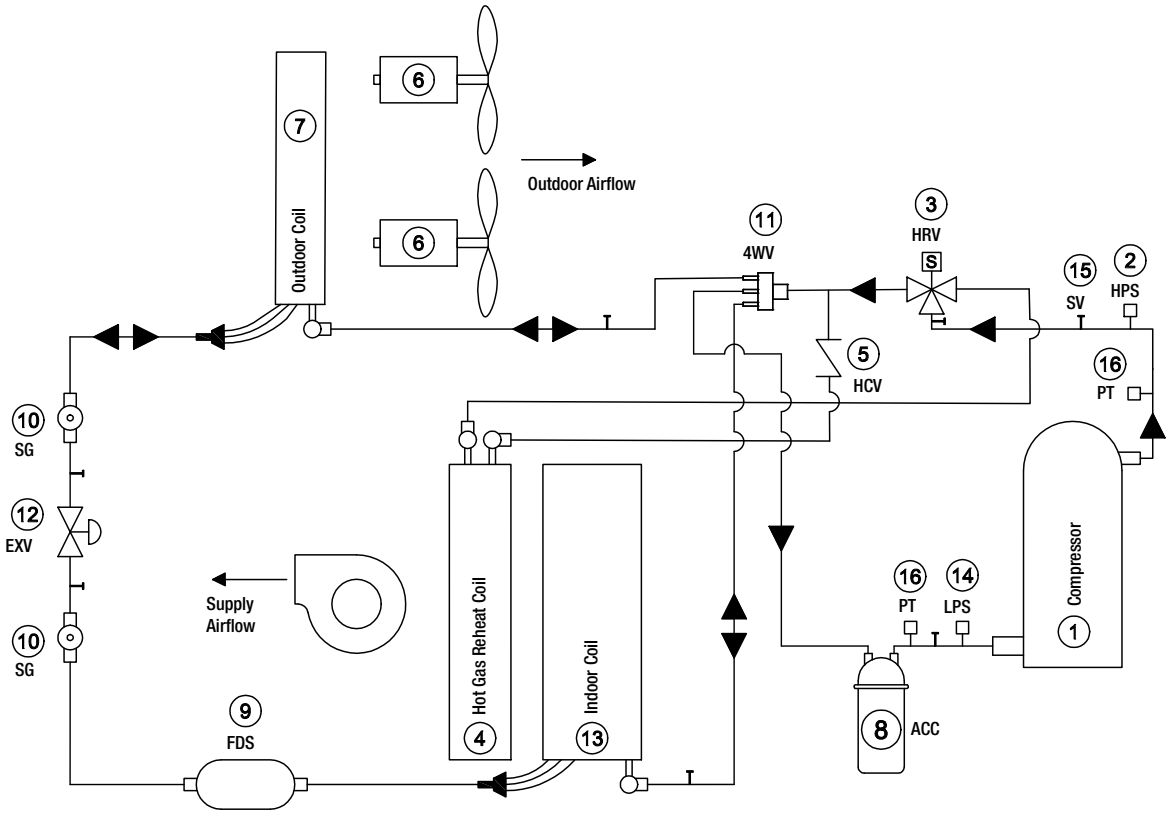
Factory-Installed Refrigeration System Components

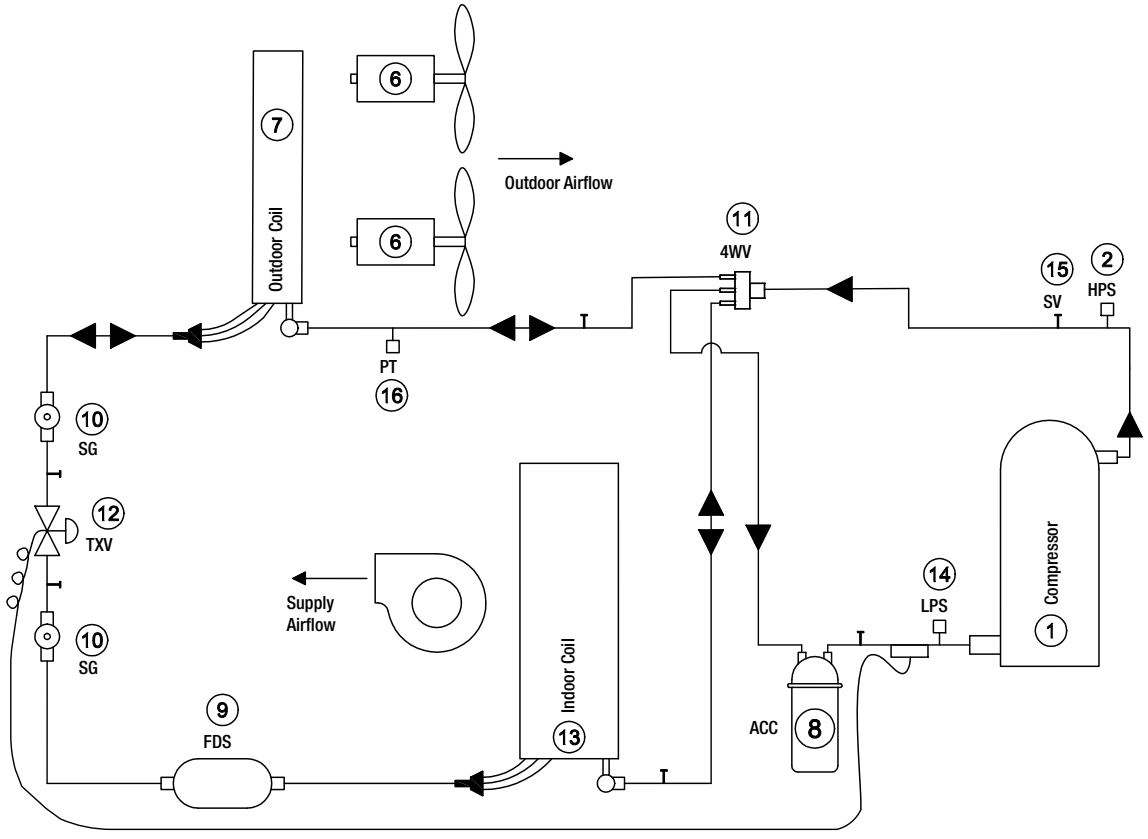
Packaged DX Cooling with Three Way Hot Gas Reheat

1. **Compressor**
2. **High Limit Pressure Switch**
   The switch opens when refrigerant pressure increases above the set point in the discharge line. A manual reset is then required.
3. **Hot Gas Reheat Valve (optional)**
   Units equipped with a reheat coil use a three-way valve with actuator to control the supply air discharge temperature of the unit during dehumidification mode. The unit controller provides a 0-10 VDC signal to control the amount of reheat to meet the supply temperature set point
4. **Hot Gas Reheat Coil (Optional)**
5. **Hot Gas Reheat Check Valve (Optional)**
6. **Condenser Fans**
7. **Condensing Coil**
8. **Liquid Receiver (Optional)**
9. **Liquid Line Filter Drier**
10. **Sight Glass**
11. **Fan Cycle Switch(es)**
    The switch(es) open or close based on liquid refrigerant pressure to control the condensing fans to maintain liquid pressure.
12. **Thermostatic Expansion Valve (TXV)**
    Each unit is equipped with a TXV on each refrigerant circuit. The valve controls the flow of liquid refrigerant entering the evaporator coil by maintaining a constant, factory-set superheat of 10°F. The valve is adjustable and is located on the side of the evaporator coil and can be accessed through the coil access panel.
13. **Evaporative Coil**
14. **Low Limit Pressure Switch**
    The switch is installed on the suction line and disables the DX system when the suction pressure drops below the set point. The switch will auto reset when the pressure rises above the auto-reset set point.
15. **Service Access Ports**
16. **Pressure Gauge & Transducer (Optional EC condenser fans only)**
    See Optional Electronically Commutated (EC) Condenser Fans under the component operation.

Factory-Installed Refrigeration System Components

Air-Source Heat Pump with Three Way Hot Gas Reheat





Factory-Installed Refrigeration System Components

1. **Compressor**
2. **High Limit Pressure Switch**
   The switch opens when refrigerant pressure increases above the set point in the discharge line. A manual reset is then required.
3. **Hot Gas Reheat Valve (optional)**
   Units equipped with a reheat coil use a three-way valve with actuator to control the supply air discharge temperature of the unit during dehumidification mode. The unit controller provides a 0-10 VDC signal to control the amount of reheat to meet the supply temperature set point
4. **Hot Gas Reheat Coil (Optional)**
5. **Hot Gas Reheat Check Valve (Optional)**
6. **Outdoor Fans**
7. **Outdoor Coil**
8. **Refrigeration Accumulator**
9. **Liquid Line Filter Drier**
10. **Sight Glass**
11. **Four Way Reversing Valve**
    Each compressor circuit is equipped with a reversing valve to reverse the direction of refrigerant flow, switching the unit between heating and cooling mode.
12. **Electronic Expansion Valve (EXV) or Thermostatic Expansion Valve (TXV)**
    An expansion valve is provided on each refrigerant circuit. This valve controls the flow of liquid refrigerant entering the indoor and outdoor coils by maintaining a constant superheat. The TXV is adjustable. Both the EXV and TXV are located on the side of the outdoor coil and can be accessed through the refrigeration system access panel.
13. **Indoor Coil**
14. **Low Limit Pressure Switch**
    The switch is installed on the suction line and disables the DX system when the suction pressure drops below the set point. The switch will auto reset when the pressure rises above the auto-reset set point.
15. **Service Access Ports**
    Typical port locations are shown. Additional valves may be present in the system.
16. **Refrigerant Pressure Transducers**

Start-Up Unit

DANGER

Electric shock hazard. Can cause injury or death. Before attempting to perform any service or maintenance, turn the electrical power to unit to OFF at disconnect switch(es). Unit may have multiple power supplies.

CAUTION

Use caution when removing access panels or other unit components, especially while standing on a ladder or other potentially unsteady base. Access panels and unit components can be heavy and serious injury may occur.

CAUTION

Do not operate without the filters and birdscreens installed. They prevent the entry of foreign objects such as leaves, birds, etc.

CAUTION

Do not run unit during construction phase. Damage to internal components may result and void warranty.

WARNING

- Unit was factory tested. All blowers, fans, and compressors are set-up to run correctly when supplied power. If any one fan is running backwards or the compressor is making loud noises, immediately turn off the power. Switch two leads on the incoming power to the disconnect. This will ensure proper operation of the unit. Failure to comply may damage the compressors and void the warranty.
- Do not jumper any safety devices when operating the unit. This may damage components within or cause serious injury or death.
- Do not operate compressor when the outdoor temperature is below 40ºF.
- Do not short-cycle the compressor. Allow 5 minutes between “on” cycles to prevent compressor damage.
- DX system is charged with refrigerant. Start-up must be performed by EPA Certified Technician.

WARNING

Prior to starting up the unit, power must be energized for 24 hours without a call for cool to allow the compressor crankcase heaters time to boil off any liquid refrigerant present in the compressor.

Every installation requires a comprehensive start-up to ensure proper operation of the unit. As part of that process, the following checklist must be completed and information recorded. Starting up the unit in accordance with this checklist will not only ensure proper operation, but will also provide valuable information to personnel performing future maintenance. Should an issue arise which requires factory assistance, this completed document will allow unit experts to provide quicker resolve. Qualified personnel should perform start-up to ensure safe and proper practices are followed.

Unit Model No. _____

Unit Serial No. _____

Energy Wheel Date Code _____

Compressor 1 Model No. _____

Compressor 2 Model No. _____

Compressor 3 Model No. _____

Compressor 4 Model No. _____

Start-Up Date _____

Start-Up Personnel Name _____

Start-Up Company _____

Phone Number _____

Start-Up Unit

Pre-Start-Up Checklist

- ☐ Remove any foreign objects that are located in the unit.
- ☐ Check all fasteners, set-screws, and locking collars on the fans, bearings, drives, motor bases and accessories for tightness.
- ☐ Rotate the fan wheels and energy recovery wheels by hand and ensure no parts are rubbing.
- ☐ Verify diameter seal settings on the energy recovery wheel.
- ☐ Filters can load up with dirt during building construction. Replace any dirty pleated filters and clean the aluminum mesh filters in the intake hood.
- ☐ Verify that non-motorized dampers open and close properly.
- ☐ Check the tightness of all factory wiring connections.
- ☐ Verify proper drain trap installation.
- ☐ Check condensing fans for any damage or misalignment. Spin the blades and make sure they don't contact any parts and are free turning without any resistance.
- ☐ Look over the piping system.
- ☐ Inspect all coils within the unit. Fins may get damaged in transit or during construction. Carefully straighten fins with a fin comb.

Electrical

- ☐ Disconnect and lock-out all power switches.
- ☐ Verify control wire gauge.
- ☐ All field-mounted sensors and instruments are installed and wired.
- ☐ Unit controls are off.
- ☐ Electrical service matches unit voltage.
- ☐ Electrical field wiring is complete.
- ☐ All electrical connections are tightened.
- ☐ Compressor and motor breakers or fuses are open (disabled).
- ☐ Main power is wired to the disconnect.
- ☐ Discharge air sensor is installed per wiring instructions.
- ☐ Space temperature and humidity sensors are installed per if selected with unit.

Compressors

- ☐ This unit contains an external crankcase heater for each standard or digital scroll compressor. The variable speed compressor uses internal stator heating. Each compressor needs power supplied to it 24 hours prior to start-up. If start-up is scheduled in 24 hours, unlock the disconnect power and energize unit.
- ☐ Compressor shipping brackets are removed if provided.

IG Furnace

- ☐ If there is an indirect gas-fired furnace in this unit, refer to the manual provided with this unit for Pre-Start-Up information.
- ☐ Gas piping is complete and gas lines are purged.
- ☐ Gas venting is in place.

Hot Water/Chilled Water Coils

- ☐ Chilled water piping system is complete.
- ☐ Hot water piping system is complete.
- ☐ Control valves are installed, wired, and operating properly.
- ☐ Water coils are balanced to design GPM.
- ☐ Water system is free of air.

SPECIAL TOOLS REQUIRED

- **Voltage Meter (with wire probes)**
- **Amperage Meter**
- **Pressure Gauges – (refrigerant)**
- **Tachometer**
- **Thermometer**
- **Incline manometer or equivalent**

Start-Up Procedure

The unit will be in operational mode during start-up. Use necessary precautions to avoid injury. All data must be collected while the unit is running.

- ☐ Make sure Pre-Start-Up checklist is complete.
- ☐ Jumper R to G, R to Y1, and R to Y2 (if applicable) on the control board.
- ☐ Turn the disconnect on. After 3 minutes compressors will come on. Make sure all fans and compressors are rotating the correct direction.
- ☐ Allow the unit to run until the refrigerant system stabilizes. Approximately 1-2 minutes.

Voltage Imbalance

In a 3-phase system, excessive voltage imbalance between phases will cause motors to overheat and eventually fail. Maximum allowable imbalance is 2%. To determine voltage imbalance, use recorded voltage measurements in this formula.

Key: V1, V2, V3 = line voltages as measured
VA (average) = (V1 + V2 + V3) / 3
VD = Line voltage (V1, V2 or V3) that deviates farthest from average (VA)

Formula: % Voltage Imbalance = [100 x (VA-VD)] /VA

Start-Up Checklist - General

Line Voltage. Check at unit disconnect.

	L1-L2	_____	Volts	L2-L3	_____	Volts	L1-L3	_____ Volts

Motor Amp Draw

Supply Motor 1 Amps	L1	_____	Amps	L2	_____	Amps	L3	_____ Amps
Supply Motor 2 Amps	L1	_____	Amps	L2	_____	Amps	L3	_____ Amps
Supply Motor 3 Amps	L1	_____	Amps	L2	_____	Amps	L3	_____ Amps
Exhaust Motor 1 Amps	L1	_____	Amps	L2	_____	Amps	L3	_____ Amps
Exhaust Motor 2 Amps	L1	_____	Amps	L2	_____	Amps	L3	_____ Amps
Exhaust Motor 3 Amps	L1	_____	Amps	L2	_____	Amps	L3	_____ Amps

Fan RPM		**Correct fan rotation direction?**	
Supply Fan RPM	_____	Supply Fan	Yes / No
Exhaust Fan RPM	_____	Exhaust Fan	Yes / No

Energy Wheel Motor *(if equipped)*

	L1	_____	Amps	L2	_____	Amps	L3	_____ Amps

Condensing Fans *(PDX only)*

Condensing Fan 1	L1	_____	Amps	L2	_____	Amps	L3	_____ Amps
Condensing Fan 2	L1	_____	Amps	L2	_____	Amps	L3	_____ Amps
Condensing Fan 3	L1	_____	Amps	L2	_____	Amps	L3	_____ Amps
Condensing Fan 4	L1	_____	Amps	L2	_____	Amps	L3	_____ Amps
Condensing Fan 5	L1	_____	Amps	L2	_____	Amps	L3	_____ Amps
Condensing Fan 6	L1	_____	Amps	L2	_____	Amps	L3	_____ Amps
Condensing Fan 7	L1	_____	Amps	L2	_____	Amps	L3	_____ Amps
Condensing Fan 8	L1	_____	Amps	L2	_____	Amps	L3	_____ Amps

Outdoor Fans *(ASHP only)*

Outdoor Fan 1	L1	_____	Amps	L2	_____	Amps	L3	_____ Amps
Outdoor Fan 2	L1	_____	Amps	L2	_____	Amps	L3	_____ Amps
Outdoor Fan 3	L1		Amps	L2		Amps	L3	Amps

Compressors *(if equipped)*

Outdoor Air Temperature	_____ Deg F	Outdoor Air Relative Humidity	_____ % RH
Return Air Temperature	_____ Deg F	Return Air Relative Humidity	_____ % RH

Start-Up Checklist - Packaged Direct Expansion (DX)

	Compressor 1	Compressor 2	Compressor 3	Compressor 4
L1	Amps	Amps	Amps	Amps
L2	Amps	Amps	Amps	Amps
L3	Amps	Amps	Amps	Amps
Crankcase Heater Not present on inverter compressor	Amps	Amps	Amps	Amps
Superheat (Housings 10, 25/40, 45/85, 75/150) Should be between 8º and 12ºF	Deg. F	Deg. F	Deg. F	Deg. F
Subcooling (Housings 10, 25/40, 45/85, 75/150) Should be between 8º and 12ºF	Deg. F	Deg. F	Deg. F	Deg. F
Superheat (Housings 110/180) Should be between 10º and 20ºF (0% reheat) or should be between 10º and 30ºF (100% reheat)	Deg. F	Deg. F	Deg. F	Deg. F
Subcooling (Housings 110/180) Should be between 10º and 15ºF (0% reheat) or should be between 2º and 10ºF (100% reheat)	Deg. F	Deg. F	Deg. F	Deg. F
Discharge Pressure Should be between 300 and 500 PSIG	PSIG	PSIG	PSIG	PSIG
Suction Line Pressure Should be between 100 and 135 PSIG	PSIG	PSIG	PSIG	PSIG
Liquid Line Temp.	Deg. F	Deg. F	Deg. F	Deg. F
Suction Line Temp.	Deg. F	Deg. F	Deg. F	Deg. F
Moisture Indicating Sight Glass				
Liquid Visible	Yes / No	Yes / No	Yes / No	Yes / No
Color of Center Dot	Purple / Pink	Purple / Pink	Purple / Pink	Purple / Pink
Hot Gas Bypass Operational	Yes / No / NA	NA	NA	NA

Start-Up Checklist - Air-Source Heat Pump (ASHP)

	Compressor 1	Compressor 2
Compressors		
L1	Amps	Amps
L2	Amps	Amps
L3	Amps	Amps
Crankcase Heater	NA	Amps
Cooling		
Superheat Should be between 10º and 20ºF (0% reheat) or should be between 10º and 30ºF (100% reheat)	Deg. F	Deg. F
Subcooling Should be between 10º and 15ºF (0% reheat) or should be between 2º and 10ºF (100% reheat)	Deg. F	Deg. F
Discharge Pressure Should be between 250 and 500 PSIG	PSIG	PSIG
Suction Line Pressure Should be between 96 and 155 PSIG	PSIG	PSIG
Liquid Line Temp	Deg. F	Deg. F
Suction Line Temp	Deg. F	Deg. F
Moisture Indicating Sight Glass		
Liquid Visible	Yes / No	Yes / No
Color of Center Dot	Purple / Pink	Purple / Pink
Heating		
Superheat Should be between 10º and 20ºF	Deg. F	Deg. F
Subcooling Should be between 10º and 20ºF	Deg. F	Deg. F
Discharge Pressure Should be between 250 and 500 PSIG	PSIG	PSIG
Suction Line Pressure Should be between 96 and 155 PSIG	PSIG	PSIG
Liquid Line Temp	Deg. F	Deg. F
Suction Line Temp	Deg. F	Deg. F
Moisture Indicating Sight Glass		
Liquid Visible	Yes / No	Yes / No
Color of Center Dot	Purple / Pink	Purple / Pink

Note: Unit may not run at 100% heating mode in ambient temperatures over 70°F (21°C). Modulate compressor as necessary to keep unit running.

Start-Up Components

Fan

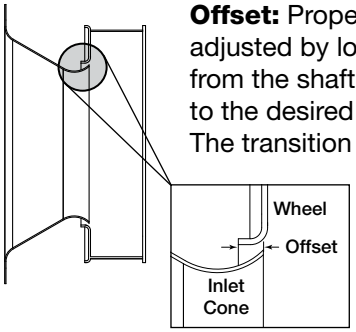
The fan should be checked for free rotation. If any binding occurs, check for concealed damage and foreign objects in the fan housing.

CAUTION

When operating conditions of the fan are to be changed (speed, pressure, temperature, etc.), consult manufacturer to determine if the unit can operate safely at the new conditions.

Supply Fan (Plenum Type)

The unit contains one or two plenum supply fans located on the end of the unit opposite the outdoor air intake and may optionally have a relief air blower which is referred to as an exhaust blower in this document. Efficient fan performance can be maintained by having the correct offset.



Offset: Proper offset, or overlap, is adjusted by loosening the wheel hub from the shaft and moving the wheel to the desired position along the shaft. The transition between the inlet cone and the wheel should be as shown; there is a smooth feel to the profile when moving one component to the other.

Fan Size	Offset (inches)	Tolerance (inches)
ER35C	5/32	± 1/32
ER45C	3/16	± 1/32
ER50C	13/64	± 1/32
ER56C	1/4	± 1/32
PDL-355	5/32	± 1/32
PRM-450	3/16	± 1/32
PRM-560	15/64	± 1/32

Refer to the respective Installation, Operation and Maintenance Manual shipped with this unit for additional start-up and maintenance information regarding the plenum fan.

Fan Wheel Rotation Direction

Check for proper wheel rotation by momentarily energizing the fan. Rotation is determined by viewing the wheel from the drive side and should match the rotation decal affixed to the fan housing.

If the wheel is rotating the wrong way, direction can be reversed by interchanging any two of the three electrical leads. Check for unusual noise, vibration or overheating of the bearings. Refer to the Troubleshooting portion of this manual if a problem develops.

Supply/Exhaust Fan

The optional exhaust fan is a direct-drive plenum type. Fan speed is controlled by a VFD which, in turn, is controlled by the microprocessor controller or by an external signal. Motor speed will be set on the VFD during the unit Test and Balance, but after that, the VFD will not normally be changed. Always check the motor amperage rating shown on the motor nameplate when changing the fan RPM. All access doors must be installed except the control center door.

Vibration

Vibration Causes

Off axis or loose components
Drive component unbalance
Poor inlet / outlet conditions
Foundation stiffness

Excessive vibration may be experienced during initial start-up. Left unchecked, excessive vibration can cause a multitude of problems, including structural and/or component failure. The most common sources of vibration are listed.

Many of these conditions can be discovered by careful observation. Refer to the Troubleshooting section of this manual for corrective actions. If observation cannot locate the source of vibration, a qualified technician using vibration analysis equipment should be consulted.

Generally, fan vibration and noise is transmitted to other parts of the building by the ductwork. To eliminate this undesirable effect, the use of flexible connectors is recommended.

Discharge Air Temperature Sensor

Units are supplied with a Discharge Air Temperature Sensor that is to be field-installed prior to unit start-up. The sensor is to be installed at least three duct diameters downstream of the heat exchanger. The sensor must be connected directly to the microprocessor controller. All other sensors and low voltage devices are to be connected to the low voltage terminal strip in the control center. The discharge air sensor is shipped loose and can be found in the unit's control center. See the unit-specific wiring diagram for connection locations.

Typical Discharge Air Temperature Sensor

Start-Up Components

Airflow Monitoring

For additional information on how to navigate through the airflow controller menus, refer to technical manuals from GreenTrol® Automation Inc. at www.greentrol.com. Also refer to the Greenheck Reference Guide for Microprocessor Controller.

Display and Navigation

The LCD screen will by default show the current airflow that is being measured. To enter the menu to set up the monitoring station the user must remove the front cover of the GreenTrol to uncover the navigation buttons. Press and hold the UP and DOWN keys at the same time for 3 seconds to enter the menu.

Enter Button Function - The ENTER button allows the user to go into the selected menu or function, as well as save the selected value.

Up/Down Button Function - The UP/DOWN buttons are used to navigate the menu and to change values in the menu.

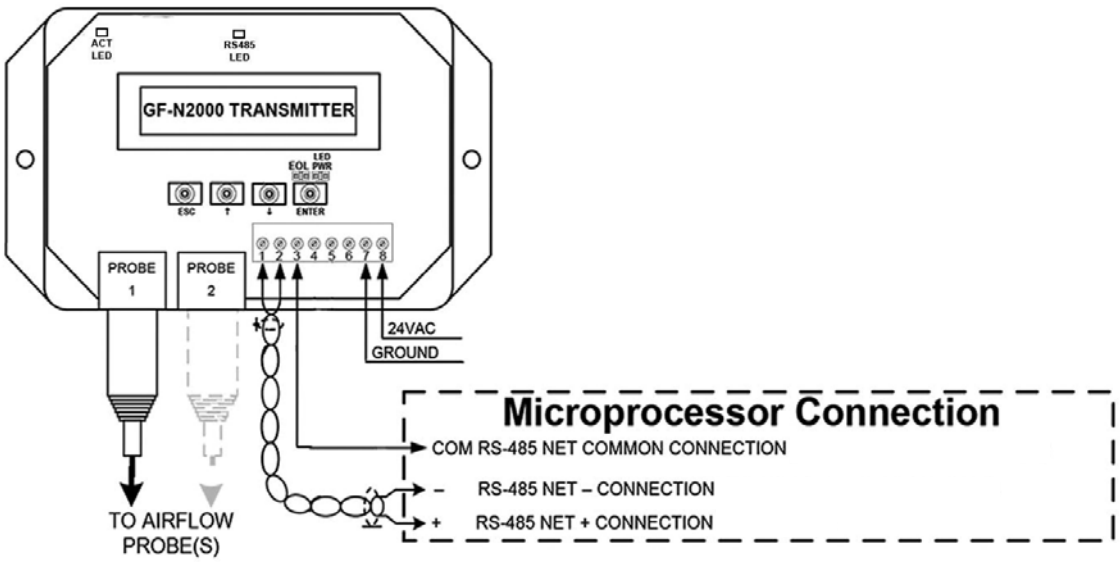
Esc Button Function - The ESC button allows the user to exit the current menu or function.

Field Calibration

1. Press UP/DOWN = Setup
2. Press DOWN/ENTER = Setup Wizard
3. Scroll Down to Field Adjust and press ENTER
4. Run FAK wizard and press ENTER
5. Set FAW Int and press ENTER
6. FAW INT = 300 and press ENTER
7. Set number of flows and press ENTER
8. Set flow and press ENTER
9. Set flow to actual CFM measured by Test and Balance and press ENTER
10. Wait for calibration before cycling power
11. Proceed to Communication Setup

Communication Setup

1. Press the UP and DOWN keys at the same time for 3 seconds
2. When SETUP appears on the screen press ENTER
3. Scroll DOWN (twice) to the NETWORK menu and press ENTER
4. When NETOUT appears on the screen, press ENTER; when SET NETOUT appears on the screen, press ENTER again
5. Scroll UP or DOWN to set the NETOUT = MODBUS and then press ENTER
6. Scroll DOWN to NETADDR and press ENTER, when SET NETADDR appears on the screen press ENTER again
7. Scroll UP or DOWN to set the NETADDR to the same address that was listed for the airflow monitor in the microprocessor. For instance, the Outdoor Airflow Monitor screen above has an address of 31. Then press ENTER.
8. Scroll DOWN to NETBAUD and press ENTER, when SET NETBAUD appears on the screen, press ENTER again
9. Scroll UP or DOWN until NETBAUD = 19200, then press ENTER
10. Scroll down to PARITY and press ENTER, when SET PARITY appears on the screen press ENTER again
11. Scroll UP or DOWN until PARITY = NONE2, then press ENTER
12. Once the address is set and the communication wires are connected, “Status” LED should be a steady green and the “RS485” LED should be a quick blinking green LED.

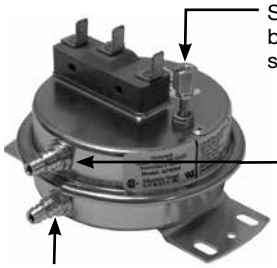


Start-Up Components

Optional Dirty Filter Switch

To adjust the switch, the unit must be running with all of the access doors in place, except for the compartment where the switch is located (exhaust intake compartment). The adjusting screw is located on the top of the switch.

1. Open the filter compartment and place a sheet of plastic or cardboard over 50% of the filter media.



2. Replace the filter compartment door.
3. Check to see if there is power at the alert signal leads (refer to electrical diagram).
4. Whether there is power or not, turn the adjustment screw on the dirty filter gauge (clockwise if you did not have power, counterclockwise if you did have power) until the power comes on or just before the power goes off.
5. Open the filter compartment and remove the obstructing material.
6. Replace the door and check to make sure that you do **not** have power at the alert signal leads. The unit is now ready for operation.

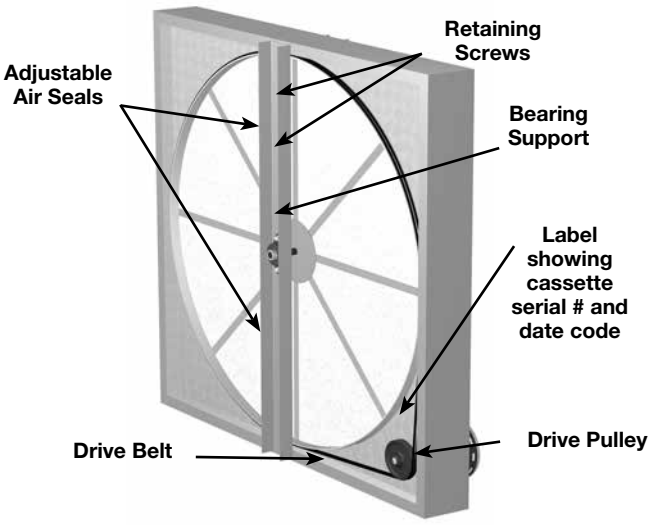
Troubleshooting

Symptom	Possible Cause	Corrective Action
Energy wheel does NOT turn	Air seals are too tight.	Refer to Adjust the Air Seals in the Optional Energy Wheel Start-Up section.
	Broken belt.	Replace.
	No power to wheel motor.	Make sure wheel drive is plugged in. Verify power is available.
Energy wheel runs intermittently	Wheel motor overloads are tripping due to rubbing between wheel and air seals.	Recheck air seals, make sure they are not too tight. See Adjust the Air Seals in the Optional Energy Wheel Start-Up section.

Optional Polymer Energy Wheel

Start-Up

If selected, the energy wheel is installed in the unit with one half of the wheel in the outdoor airstream and one half in the exhaust airstream. The energy wheel includes air seals to minimize leakage between airstreams.



Drive Belt

Inspect the drive belt. Make sure the belt rides smoothly in the pulley and around the outside of the wheel. Note the directional arrow and data information shown in the image.

Adjust the Air Seals (Polymer wheels only)

The information below only applies to polymer wheels, which require air seal adjustment at the time of start-up for proper performance. Aluminum wheel air seals are factory-set and do not require field adjustment.

Make sure the unit power supply is locked out. Disconnect the wiring to the wheel module and pull the wheel cassette out of the cabinet on its tracks. Large cassettes are not removable. Then slowly rotate the wheel by hand to make sure there is no binding or misalignment.

There is a perimeter seal located around the outside of the wheel and a diameter seal across the face of the wheel on both sides. Check to make sure that all air seals are secure and in good condition.

Adjust the air seals by loosening all the air seal retaining screws on the bearing support. Using a piece of paper as a feeler gauge, adjust the seals so they almost touch the face of the wheel while tugging slightly on the paper. When the wheel is rotated, there should be a slight tug on the paper. Tighten the screws, repeat the steps on the other set of seals.

Push the wheel cassette back into the unit and plug in the power connector. Turn the main power supply back on and then observe the operation of the wheel by opening the wheel access door slightly. Remove filters if necessary to observe the wheel.

Sequence of Operation

Optional Economizer - The economizer will be locked out when: the outside air is below economizer lockout; the unit is operating in dehumidification mode; or there is a call for heating.

- **Stop Wheel:** When economizer mode is enabled and there is a signal for cooling, the wheel will stop rotating to allow free cooling.
- **Modulate Wheel:** When economizer mode is enabled and there is a signal for cooling, the wheel VFD modulates wheel speed to maintain the discharge temperature set point.

Optional Frost Control - Polymer Wheel
The microprocessor controller will output a signal when wheel frosting is occurring which is determined by a temperature set point (OA <5°F – 2°F hysteresis, adjustable) and wheel pressure drop increase.

- **Preheat:** When frosting is occurring, the preheater is energized to defrost the wheel. Once the pressure drop decreases below the set point, the preheater is de-energized.
- **Timed Exhaust:** When frosting is occurring, the supply blower is cycled off. The exhaust blower shall continue to run, allowing the warm exhaust air to defrost the wheel. After the 5 minute cycle, the supply fan is re-energized to continue normal operation.
- **Modulating Wheel:** When frosting is occurring, the wheel VFD will reduce wheel speed to prevent condensation and frosting. If the outdoor air temperature is greater than the frost threshold temperature OR the pressure differential is less than the set point, the wheel will run at full speed. If the outdoor air temperature is less than the frost threshold temperature AND the pressure differential is greater than the set point, the wheel will run at reduced speed until the pressure differential falls below the set point. The temperature and pressure differential set points are set at the factory, but are field-adjustable. The VFD will be fully programmed at the factory.

Optional Polymer Energy Wheel

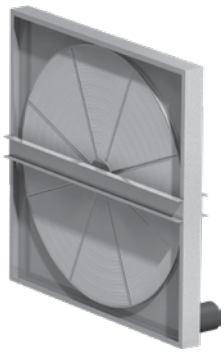
Maintenance

WARNING

Whenever performing maintenance or inspections, always disconnect the power source.

Inspection

The wheel should be inspected semiannually in accordance with the maintenance schedule. Maintenance of the wheel consists mainly of inspecting the wheel for cleanliness and then checking the drive motor, belt, and pulley for wear. If the wheel appears dirty, the wheel should be disassembled and cleaned.



Energy Wheel Cassette

The wheel rotates through two airstreams moving in opposite directions, which means the wheel is self-cleaning, up to a point. If the wheel media becomes blocked by dirt or dust, or if the media collects a layer of smoke residue or an oily film, the energy transfer efficiency drops.

The main factor in the frequency of cleaning is the cleanliness of the air. If air filters are not changed frequently, the wheel will collect contaminants and will then have to be cleaned.

Wheel Disassembly

Wheels are part of a cassette that may be pulled from the unit for easy access. There may be a small damper assembly or other component that blocks removal of the cassette. Before sliding out the cassette or any other component, disconnect any power supply cord and secure it so it cannot jam or otherwise get damaged.

Each wheel has removable segments that hold the coated layers of media and each segment is held in place with two retaining clips located on the outer rim of the wheel. When removing more than one segment, remove them in sequence from opposite sides of the wheel (180 degrees apart) to reduce the imbalance. Secure the wheel against rotation. Carefully release the two retaining clips and swing them fully open. The segment can now be removed by pushing the face of the segment close to the outer rim of the wheel. Wheel segments are built to close tolerances and the segment may have to be jiggled to remove it. Do not use a hammer or otherwise force the segment because these are high value items and are not built to withstand abuse.

Segment Retaining Clip

Whenever retaining clips are opened, they should be closed as soon as possible. If the wheel should rotate when a clip is open, the clip will jam against the bearing support bar and could cause damage.

Cleaning

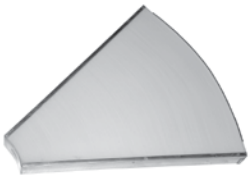
Maintenance or cleaning of the wheel segments should be done with the segments removed from the wheel cassette to avoid splashing liquids or cleaning agents inside the cabinet. If the energy wheel appears excessively dirty, it should be cleaned to ensure maximum operating efficiency. Only excessive buildup of foreign materials needs to be removed. **DISCOLORATION AND STAINING OF ENERGY RECOVERY WHEEL DOES NOT AFFECT ITS PERFORMANCE.**

Thoroughly spray the wheel matrix with a household cleaner such as Fantastik™ or the equivalent. Gently rinse with warm water and use a soft brush to remove any heavy accumulations. A detergent/water solution can also be used. Avoid aggressive organic solvents, such as acetone. Wheel segments can be soaked in the above solution overnight for removal of stubborn dirt or accumulations.

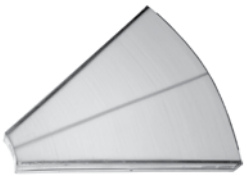
After cleaning is complete, shake excess water from the wheel or segments. Dry the wheel or segments before putting them back into the cassette.

Reassembly

When reinstalling the segments, be sure to install them with the correct face toward the motor side of the cassette. Note that one face of each segment is smooth and the other face has a reinforcing channel or support cut into the surface.



Wheel Segment (Pulley Side)



Wheel Segment (Motor Side)

Wheel Belt

Inspect belts each time filters are replaced. Belts that look chewed up or are leaving belt dust near the motor pulley may indicate a problem with the wheel. Be sure to inspect wheel for smooth and unrestricted rotation. If a belt requires replacement, contact the local manufacturer representative. Instructions for replacement will ship with the new belt.

Wheel Bearing

In the unlikely event that a wheel bearing fails, the bearing is behind a removable plate on the wheel support beam (slide cassette halfway out of cabinet to access). Contact the local manufacturer's representative for detailed instructions on how to replace the bearing.

Optional Aluminum Energy Wheel

Start-Up

Optional Frost Control

The microprocessor controller will output a signal when wheel frosting is occurring which is determined by a temperature set point (EA < 36°F, adjustable).

- **Modulating wheel frost control:** When frosting is occurring, the wheel VFD will modulate the wheel speed to maintain 36°F exhaust air temperature. The VFD will be fully programmed at the factory.
- **Modulating wheel with electric preheat frost control:** When frosting is occurring, the wheel VFD will modulate the wheel speed to maintain 36°F exhaust air temperature. The electric preheater will energize when the outdoor air temperature is below 10°F. The VFD will be fully programmed at the factory.

Maintenance

WARNING

Whenever performing maintenance or inspections, always disconnect the power source.

Inspection

The wheel should be inspected in accordance with the maintenance schedule. Maintenance of the wheel consists mainly of inspecting the wheel for cleanliness and then checking the drive motor, belt, and pulley for wear. If the wheel appears dirty, the wheel should be cleaned.

The wheel rotates through two airstreams moving in opposite directions, which means the wheel is self-cleaning up to a point. If the wheel media collects a layer of smoke residue or an oil film, the energy transfer efficiency drops.

The main factor in the frequency of cleaning is the cleanliness of the air. If air filters are not changed frequently, the wheel will collect contaminants and will then have to be cleaned.

Cleaning

Accumulation of dust or particles on the surface of the wheel can typically be vacuumed, purged with compressed air, or wiped from the surface. In cases when a more thorough cleaning is required, use the following procedure.

Liberally spray 409 cleaner onto a small section of the dirty side of the energy wheel, letting it foam to soften debris and residue. Blow approximately 90 psi of compressed air and from the opposite side of the wheel, catching the blown-off material on pre-placed drop cloths. Lightly sweep a soft sash paint brush across the face of the wheel to remove any leftover residue. A SLIGHT CLEANER SMELL MAY BE PRESENT FOR A SHORT TIME AFTER THE UNIT IS TURNED BACK ON. THIS SMELL WILL DISSIPATE QUICKLY.

Wheel Belt

Inspect belts each time filters are replaced. Belts that look chewed up or are leaving belt dust near the motor pulley may indicate a problem with the wheel. Be sure to inspect wheel for smooth and unrestricted rotation. If a belt requires replacement, contact the local manufacturer representative. Instructions for replacement will ship with the new belt.

Wheel Bearing

In the unlikely event that a wheel bearing fails, contact the local manufacturer's representative for detailed instructions.

Troubleshooting – Alarms

Several of the electronic controls in the unit monitor the system for faults and will go into alarm, shutting down the unit or a single function within the unit.

Microprocessor Controller

The microprocessor is located in the main control center. If the microprocessor is in alarm condition, the Alarm button will blink red. Press the Alarm button to see the specific condition or to reset the microprocessor. Refer to the microprocessor IOM for detailed information on fault codes and see the unit-specific wiring diagram.

Phase Monitor

The phase monitor has two LED indicator lights, one red and one green. Green indicates proper operational status, red indicates the unit has detected a fault and is in alarm condition. The alarm LED will blink to show the specific fault and there is a chart printed on the monitor that shows the code for the blinking light. The phase monitor is self-resetting once the alarm condition is corrected. It is located in the main control center.

Variable Frequency Drive (VFD)

Variable frequency drives have a display screen that will show an alarm condition. If a fault such as a voltage spike occurs, the VFD will go into alarm and will not reset until a hard restart is performed. See the unit-specific manufacturer's manual supplied with the unit. VFDs are located in the main control center.

Optional Digital Scroll Compressor Controller

Present only if packaged DX with digital scroll option is selected. The controller has three LED indicator lights. One is green, indicating that it has power, one is an alarm indicator that will flash a code for various alarm conditions and the third indicates whether the compressor is operating in a loaded or unloaded condition. See the manufacturer's unit-specific manual for further information.

See the Fault Code chart below. The Fault Code chart is also printed on the back of the controller. Note that if the controller generates either a Code 2 or a Code 4 Lockout, a manual reset must be performed. Manual Reset is accomplished by shutting off main power to the unit and then turning it back on.

Digital Scroll Compressor Controller Fault Codes

Alert Code	System Condition	Diagnostic Alert Light	Action
Code 2*	High Discharge Temperature Trip	Blinks 2 Times	Lockout
Code 3	Compressor Protector Trip	Blinks 3 Times	Lockout
Code 4*	Locked Rotor	Blinks 4 Times	Lockout
Code 5	Demand Signal Loss	Blinks 5 Times	Lockout
Code 6	Discharge Thermistor Fault	Blinks 6 Times	Reduce Capacity
Code 7	Future	N/A	N/A
Code 8	Welded Contactor	Blinks 8 Times	Unload Compressor
Code 9	Low Voltage	Blinks 9 Times	Trip Compressor

*Protective faults that require manual reset.

Troubleshooting – Unit

Symptom	Possible Cause	Corrective Action
Blower fails to operate	Blown fuse or open circuit breaker.	Replace fuse or reset circuit breaker and check amps.
	Defective motor or capacitor.	Replace.
	Motor overloaded.	Reset VFD and check amps.
	Electrical.	Check for On/Off switches. Check for correct supply voltage. Check Control wiring.
Motor starters “chatter” or do not pull in	Control power (24 VAC) wiring run is too long. (Resistance should not exceed 0.75 ohms).	Shorten wiring run to mechanical room or install a relay to turn unit on/off. Consult factory for relay information. Increase wire gauge size so that resistance is 0.75 ohms or less.
	Incoming supply power is less than anticipated. Voltage supplied to starter coil must be within +10% / -15% of nominal voltage stated on the coil.	Need to increase supply power or use a special control transformer which is sized for the actual supply power.
Motor over amps	Static pressures are higher than design.	Check for dirty filters. Improve ductwork.
	Motor voltage incorrect.	Check motor wiring. Check motor nameplate versus supplied voltage.
	Motor horsepower too low.	See specifications and catalog for fan curves to determine if horsepower is sufficient.
	Shorted windings in motor.	Replace motor.
Low airflow (cfm)	Unit damper not fully open.	Adjust damper linkage or replace damper motor.
	System static pressure too high.	Improve ductwork to eliminate losses using good duct practices.
	Blower speed too low.	Check maximum motor RPM and compare with catalog data. Verify that external control wiring is in place if required.
	Fan wheels are operating backwards.	For 3-phase, see Direction of Fan Wheel Rotation Direction in Start-Up, Components section.
	Dirty filter.	Replace filters or follow cleaning procedures in Routine Maintenance section of this manual.
	Leaks in ductwork.	Repair.
	Elbows or other obstructions may be obstructing fan outlet.	Correct or improve ductwork.
High airflow (cfm)	Blower fan speed too high.	Check for correct maximum fan RPM. Decrease maximum fan speed if necessary in the VFD.
	Filter(s) not in place.	Install filters.
	Insufficient static pressure (Ps). (airflow resistance)	Induce Ps into system ductwork. Make sure grilles and access doors are installed. Decrease fan speed if necessary.
Excessive noise or vibration	Fan wheel rubbing on inlet.	Adjust wheel and/or inlet cone. Tighten wheel hub or bearing collars on shaft.
	Bearings.	Replace defective bearing(s). Lubricate bearings. Tighten collars and fasteners.
	Loose wheel on shaft.	Tighten wheel hub.
	Motor base or blower loose.	Tighten mounting bolts.
	Noise being transmitted by duct.	Make sure ductwork is supported properly. Make sure ductwork metal thickness is sized for proper stiffness. Check duct size at discharge to ensure that air velocities are not too high.

Always have a completed Pre-Start-Up Checklist and Start-Up Checklist prior to requesting parts or service information.

Troubleshooting – Refrigeration Circuit

TROUBLESHOOTING NOTE
Before any components are changed on the refrigeration system, the cause of the failure must be identified. Further problems will exist unless the true cause or problem is identified and corrected.

IMPORTANT
Do not release refrigerant to the atmosphere! If required service procedures include the adding or removing of refrigerant, the service technician must comply with all federal, state and local laws. The procedures discussed in this manual should only be performed by a qualified EPA Certified Technician.

NOTE: Unit is equipped with a phase loss/phase reversal control. If system does not start, check phase of electrical supply.

The first step in troubleshooting a refrigeration circuit is to examine the microprocessor controller and digital scroll compressor controller (if present) and see if there is a fault code. The next step is to check airflow conditions (e.g. improper ductwork, atypical wet bulb / dry bulb, etc.). After these steps have been eliminated, proceed with troubleshooting by following this guide.

Symptom	Possible Cause	Corrective Action
Compressor will not run or does not start	Open disconnect switch or circuit breaker.	Close switch and/or breaker.
	Compressor contactor not closing.	Check voltage to contactor coil, transformer, slave relay, system. Replace parts as necessary.
	Blown fuse or tripped breaker.	Check for reason and repair. Replace fuse after correcting problem.
	Low line voltage.	Check line voltage. If more than 10% from compressor marking, correcting is necessary.
	Compressor motor protector open.	Motor thermal protector automatically resets. Allow time (2 hours) for compressor to cool down so protector will reset. Restart and check for reason overheat occurred.
	Compressor defective.	Check motor for open circuit, short circuit, grounded windings, or burn out. Compressor may be seized; check refrigerant. If necessary, replace compressor.
	High pressure switch open or defective.	If manual reset (high pressure), reset switch. (Switch opens at 610 psi and will not reset above 420 psi for R-410A). Replace if defective.
	Low pressure switch open or defective.	See switch label for setpoint.
	Open room thermostat or control. (No cooling required).	Check room temperature. If temperature is proper, wait for thermostat to close.
	Loose wiring.	Check all wire terminals and tighten as necessary.
Compressor starts but cuts out on low pressure *Low pressure switch cuts out at 50 PSIG (PDX) or 25 PSIG (ASHP)*	Low or loss of refrigerant charge.	Check refrigerant pressures and temperatures (subcooling.)
	Airflow restricted.	Check for dirty evaporator coil, dirty filters, dampers closed, iced evaporator coil, improper belt, check motor amps, check duct design.
	Restriction in refrigerant line.	Check refrigerant pressures, look for frosted tubing and components indicating a restriction. Check pressure drop across the filter drier.
	Defective low pressure switch.	Replace.

Always have a completed Pre-Start-Up Checklist and Start-Up Checklist prior to requesting parts or service information.

Troubleshooting – Refrigeration Circuit

Symptom	Possible Cause	Corrective Action
Compressor starts but cuts out on high pressure switch *High pressure switch cuts out at 610 PSIG*	Refrigerant overcharge.	Check pressures, charge by subcooling.
	Condenser fan motor defective.	Check fan motor.
	Condenser coil inlet obstructed or dirty.	Check coil and clearances. Clean coil if necessary.
	Air or non-condensables in system.	Check high side equalized pressures, check expansion valves.
	Defective high pressure switch.	Replace.
	Restriction in discharge or liquid line.	Check refrigerant line pressures, check expansion valves, replace any defective component.
	Condensing fan relay not pulling in.	Replace.
Compressor cuts out on thermal overload	Low voltage.	Check voltage.
	Sustained high discharge pressure.	Check running amperage and conditions described under “low suction pressure” symptoms.
	High suction and discharge pressures.	Check thermal expansion valve setting, check for air in system. Check air conditions and cfm.
	Defective compressor overload.	If compressor is hot, allow compressor to cool for two hours. Recheck for open circuit.
	Improper refrigerant charge.	Check subcooling.
	Improperly wired.	Review wiring schematics.
	Loose wiring.	Check all connections.
	Defective start relay.	Replace relay.
	Motor windings damaged.	Verify amp draw.
Compressor hums, but will not start	Improperly wired.	Review wiring schematics.
	Low line voltage.	Check voltage.
	Loose wiring.	Check all connections.
	Defective start relay.	Replace relay.
	Motor winding damaged.	Verify amp draws. Replace compressor if necessary.
	Internal compressor mechanical damage.	Replace.
Compressor noisy or vibrating	Refrigerant overcharge.	Check pressures and subcooling.
	Liquid floodback.	Check thermal expansion valve setting. Check for refrigerant overcharge.
	Tubing rattle.	Dampen tubing vibration by taping or clamping. Carefully bend tubing away from contact where possible.
	Scroll compressor rotating in reverse. (3-phase)	Check high and low side pressures during operation to confirm. Rewire for opposite rotation.
	Damaged compressor.	Replace the compressor.
	Improper mounting on unit base.	Check that compressor is properly isolated and mounting bolts are tight.

Always have a completed Pre-Start-Up Checklist and Start-Up Checklist prior to requesting parts or service information.

Troubleshooting – Refrigeration Circuit

Symptom	Possible Cause	Corrective Action
High suction pressure	Excessive load on evaporator coil.	Check for high entering wet bulb temperature, check for excessive air flow.
	Compressor is unloaded. (digital scroll)	Check digital scroll controller signal and solenoid valve.
	Expansion valve sensing bulb not secured to suction line.	Check the thermal expansion valve, ensure bulb is insulated. Check superheat. If superheat is high, then valve is choking refrigerant flow. • Check bulb for contact. • Adjust valve for superheat ~10°F. • Replace valve powerhead or valve.
	Thermostatic expansion valve. Overfeeding.	Check bulb location and clamping. Adjust superheat. Replace expansion valve power head.
	Room load too large.	Reduce the load or add more equipment.
	Overcharged.	Check pressures and subcooling.
High discharge pressure	Thermal expansion valve setting.	Check thermal expansion setting and calibrate superheat / subcooling.
	Air inlet to condenser coil dirty or obstructed.	Check for proper clearances and possible air recirculating. Clean coil.
	Condenser fan motor defective.	Check condenser fan motor.
	Too much refrigerant.	Check subcooling. Remove excess refrigerant.
	Non-condensable in system.	Remove non-condensable from system.
	Dirty condenser coil.	Clean condenser coil.
	Condenser fan not running or running backwards.	Check electrical circuit and fuse. Check fan cycling controls.
	High load conditions.	Add more equipment or reduce load.
Low suction pressure	Refrigerant undercharge/loss of refrigerant charge.	Check pressures and subcooling.
	Blower running backward.	Confirm blower rotation. If reversed, interchange any two wires from 3-phase disconnect.
	Low entering air temperature. (Low load conditions).	Check entering air wet bulb conditions.
	Refrigerant leak.	Check system for leaks. Repair leaks and add refrigerant.
	Evaporator dirty or iced-up, or airflow restricted.	Clean the coil. Check fan operation. Check airflow.
	Plugged liquid line filter-drier.	Replace filter-drier, check psi across filter.
	Improper hot gas bypass setting (if equipped).	Check setting and correct as required.
	Expansion valve defective, superheat too high or valve too small.	Adjust valve for proper superheat or replace the expansion valve if too small or defective.
	Moisture in system, check sight glass.	Reclaim refrigerant, check for leaks, recharge.

Always have a completed Pre-Start-Up Checklist and Start-Up Checklist prior to requesting parts or service information.

Troubleshooting – Refrigeration Circuit

Symptom	Possible Cause	Corrective Action
Low discharge pressure	Insufficient refrigerant charge.	Check subcooling, check for leak. Repair leak and add refrigerant.
	Defective or improperly adjusted expansion valve.	Check superheating and adjust thermal expansion valve.
	Low suction pressure.	See “low suction pressure”.
	Faulty condenser temperature controls. (Condensing fan cycle switch).	Check condenser controls and reset to obtain desired condensing temperature.
Compressor short cycles	Thermostat location or controls malfunction.	Check thermostat, check heat anticipator setting.
	Improper refrigerant charge.	Check subcooling, verify superheat.
	Defective high or low pressure control.	Check high or low pressure switch.
	Poor air distribution.	Check ductwork for recirculating.
	Low airflow at evaporator coil.	Check blower operation and airstream restrictions.
	Incorrect unit selection (oversized).	Contact factory.
Compressor loses oil	Refrigerant leak.	Check system for leaks. Repair leaks and add refrigerant.
	Short cycling.	Check low pressure control settings.
	Refrigerant flood back.	Check thermal expansion valve setting. Check for refrigerant overcharge. Check crankcase heater operation.
	Reheat flush cycle inadequate.	Contact factory.
Not enough capacity or lack of performance	Refrigeration undercharged.	Check subcooling. Adjust charge, if necessary.
	Dirty filter or evaporating coil.	Check filter, coil and airflow.
	Dirty or clogged condensing coil.	Check coil and airflow.
	Air or other non-condensables in system.	Check equalized high side pressure with equivalent outdoor temperature.
	Restriction in suction and liquid line.	Check for restrictions in refrigerant circuit.
	Control contacts stuck.	Check wiring.
	Excessive load.	Add more equipment or reduce room load.
Liquid line is frosted or wet	Restriction in liquid line.	Clear restriction upstream of point of frosting. (Note: liquid line frosting in normal on ASHP units).
Suction line is frosting	Insufficient evaporating coil airflow.	Check airflow, check filters, check VFD control signal for proper operation.
	Malfunctioning or defective expansion valve.	Check bulb of thermal expansion valve.
Frost on evaporating coil (Note: Normal on ASHP units in heating mode).	Hot gas bypass valve not functioning properly (if equipped).	Check valve. If defective, replace.
	Manual hot gas bypass valve closed (if equipped).	Open valve.
	Low load or airflow.	Increase airflow, check filters.

Always have a completed Pre-Start-Up Checklist and Start-Up Checklist prior to requesting parts or service information.

Routine Maintenance

DANGER

Electric shock hazard. Can cause injury or death. Before attempting to perform any service or maintenance, turn the electrical power to the unit to OFF at disconnect switch(es). Unit may have multiple power supplies.

CAUTION

Use caution when removing access panels or other unit components, especially while standing on a ladder or other potentially unsteady base. Access panels and unit components can be heavy and serious injury may occur.

This unit requires minimal maintenance to operate properly. Maintenance requirements for this model vary for each installation and depend greatly on how much the system is used and the cleanliness of the air. Proper maintenance will both increase the life of the system and maintain its efficiency. Maintenance must be performed by experienced technicians and in the case of refrigeration systems, must be done by an EPA certified technician.

Maintenance frequency is based on a presumed nominal use of the system. If the system is being run constantly, the frequency should be adjusted accordingly. If there is seasonal debris in the air which can be drawn into the filters and the coils, they should be checked more frequently. If the system is being used for only a few hours per day, the frequency may be reduced. Use the maintenance log at the end of this manual to record each maintenance session and observations and then establish a maintenance schedule that is appropriate for the installation. The following is provided as a guideline.

Maintenance Frequency:

Monthly

1. External Filter
   Clean metal mesh filters
2. Internal Filters
   Replace MERV 8 filters monthly.
   Adjust replacement schedule for MERV 13 and MERV 14 or other filters as inspection requires.

Semiannually

1. Check motor and motor bearings
   Check for excessive heat, vibration or noise.
   Lubricate bearings in accordance with the motor manufacturer's recommendations.
2. Condensate Drain (if applicable)
   Inspect and clean – refill with water
3. Heat Transfer Coils (if applicable)
   Inspect for cleanliness – clean as required
4. Outdoor Fan Blades and Motor (if applicable)
   Check for cleanliness
   Check all fasteners for tightness
   Check for fatigue, corrosion, wear

Annually

It is recommended that the annual inspection and maintenance occur at the start of the cooling season. After completing the checklist, follow the unit start-up checklist provided in the manual to ensure the refrigeration system operates in the intended matter.

1. Lubrication
   Apply lubricant where required
2. Dampers
   Check for unobstructed operation
3. Blower Wheel and Fasteners
   Check for cleanliness
   Check all fasteners for tightness
   Check for fatigue, corrosion, wear
4. Door Seal
   Check if intact and pliable
5. Wiring Connections
   Check all connections for tightness
6. Cabinet
   Check entire cabinet, inside and out, for dirt buildup or corrosion. Remove accumulated dirt, remove any surface corrosion and coat the area with appropriate finish.

Routine Maintenance

Maintenance Procedures:

Lubrication - Check all moving components for proper lubrication. Apply lubricant where required. Any components showing excessive wear should be replaced to maintain the integrity of the unit and ensure proper operation.

Dampers - Check all dampers to ensure they open and close properly and without binding. Backdraft dampers can be checked by hand to determine if blades open and close freely. Apply power to motorized dampers to ensure the actuator opens and closes the damper as designed.

Gas Furnace - Maintain furnace in accordance with instructions in the Indirect Gas-Fired Heat IOM shipped with this unit.

Fan Motors - Motor maintenance is generally limited to cleaning and lubrication. Cleaning should be limited to exterior surfaces only. Removing dust and grease buildup on the motor housing assists proper cooling. Never wash-down the motor with high pressure spray. Greasing of motors is only intended when fittings are provided. Fan motors typically have two grease fittings. Each motor manufacturer has different lubrication schedules for different models. Go to the motor manufacturer's website and download their maintenance requirements. **Do not over-lubricate motors or use an incompatible grease.** Many fractional motors are permanently lubricated for life and require no further lubrication.

Fan Wheel and Fasteners - Wheels require very little attention when moving clean air. Occasionally oil and dust may accumulate on the wheel causing imbalance. When this occurs, the wheel and housing should be cleaned to assure smooth and safe operation. Inspect fan impeller and housing for fatigue, corrosion, or wear.

Routinely check all fasteners, set screws and locking collars on the fan, bearings, drive, motor base and accessories for tightness. A proper maintenance program will help preserve the performance and reliability designed into the fan.

Coil Maintenance - Coils must be cleaned to maintain maximum performance. Check coils once per year under normal operating conditions and if dirty, brush or vacuum clean. Soiled fins reduce the capacity of the coil, demand more energy from the fan and create an environment for odor and bacteria to grow and spread through the conditioned zone. High pressure water (700 psi or less) may be used to clean coils with a fin thickness over 0.0095 inches thick. **TEST THE SPRAY PRESSURE** over a small corner of the coil to determine if the fins will withstand the spray pressure.

For coils with fragile fins or high fin density, foaming chemical sprays and washes are available. Many coil cleaners use harsh chemicals, so they must be used with caution by qualified personnel only. Care must be taken not to damage the coils, including the fins, while cleaning. **Caution: Fin edges are sharp!**

WARNING

REFER TO GENERAL SAFETY INFORMATION

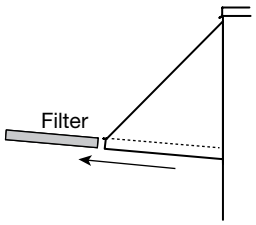
Do not operate this unit without the filters and birdscreen installed. They prevent the entry of foreign objects such as leaves, birds, etc.

Do not remove access panels or other unit components while standing on a ladder or other unsteady base. Access panels and unit components are heavy and serious injury may occur.

Internal Filter Maintenance - The unit will typically be provided with 2-inch thick pleated paper filters in the airstream. These filters should be checked according to a routine maintenance schedule and replaced as necessary to ensure proper airflow through the unit. Replacement filters shall be of same performance and quality as factory installed filters. Filter must be pleated design with integral metal grid. Two acceptable filter replacements are Aerostat Series 400 or Farr 30/30®.

Filters upstream of the coil should be checked regularly. If the filters are dirty, they should be cleaned or replaced. It is important the filters stay clean to maintain desired airflow.

External Filter Maintenance - Aluminum mesh, 2-inch thick filters are located in the supply weatherhood (if the weatherhood option was purchased). These filters should be checked and cleaned on a regular basis for best efficiency. The frequency of cleaning depends upon the cleanliness of the incoming air. These filters should be cleaned by rinsing with a mild detergent in warm water prior to start-up.



Outdoor Air Intake Hood Mesh Filter Access

WARNING

Biological hazard. May cause disease. Cleaning should be performed by qualified personnel.

Drain pans in any air conditioning unit will have some moisture in them, therefore, algae and other organisms will grow due to airborne spores and bacteria. Periodic cleaning is necessary to prevent this buildup from plugging the drain and causing the drain pan to overflow. Inspect twice a year to avoid the possibility of overflow. Also, drain pans should be kept clean to prevent the spread of disease. Cleaning should be performed by qualified personnel.

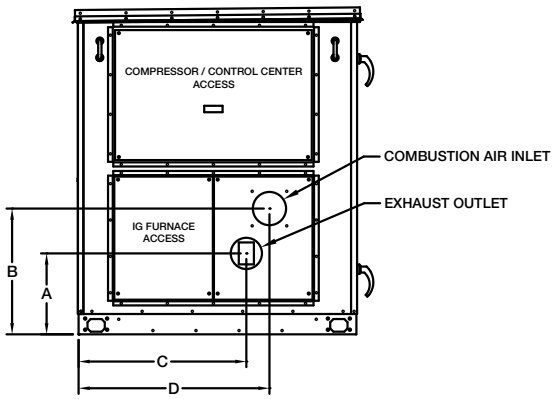
Routine Maintenance

Model	Outdoor Air Weatherhood (Aluminum Mesh)	Pre-Wheel Outdoor	Exhaust Filters	Supply Final Filters (Pre-coil)
RV-10	(1) 16x20x1	NA	NA	(1) 12x24 + (1) 24x24
RV-25	(4) 20x20x2	NA	NA	(4) 20x20
RV-45	(4) 25x25x2	NA	NA	(6) 16x25
RV-75	(12) 16x20x2	NA	NA	(8) 20x20 + (4) 16x20
RV-110 (30, 40 tons)	(8) 20x25x1	NA	NA	**6-row DX coil:** (4) 20x24 + (4) 20x20 **4-row DX coil:** (6) 20x24 + (6) 20x20
RV-110 (50, 60, 70 tons)	(8) 20x25x1	NA	NA	(6) 20x24 + (6) 20x20
RVE-40	(4) 20x20x2	(2*) 20x25x2	(2*) 20x25x2	(4) 20x20
RVE-85	(4) 25x25x2	(4**) 16x25x2	(4**) 16x25x2	(8) 16x25
RVE-150	(12) 16x20x2	(8) 20x24	(8) 20x24	(8) 20x20 + (4) 16x20
RVE-180 (30, 40 tons)	(8) 20x25x1	(9) 20x24x2 + (3) 20x20x2	(6) 20x24x2 + (2) 20x20x2	**6-row DX coil:** (4) 20x24 + (4) 20x20x **4-row DX coil:** (6) 20x24 + (6) 20x20
RVE-180 (50, 60, 70 tons)	(8) 20x25x1	(9) 20x24x2 + (3) 20x20x2	(6) 20x24x2 + (2) 20x20x2	(6) 20x24 + (6) 20x20

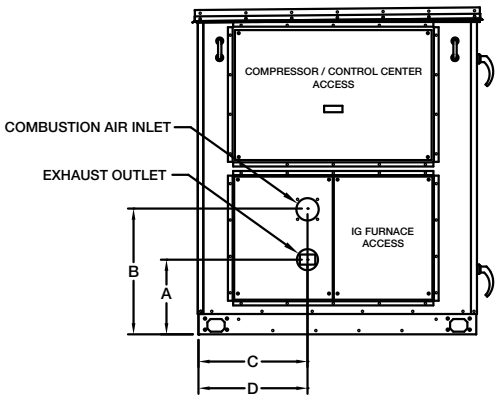
* Based upon a 30 / 36 in. energy wheel (16x25x2, quantity of 3 for 41 in. energy wheel)
** Based upon a 52 in. energy wheel (16x16x2, quantity of 8 for 58 in. energy wheel)

Reference - Venting Connection Locations (Models RV-25, -45, RVE-40, -85)

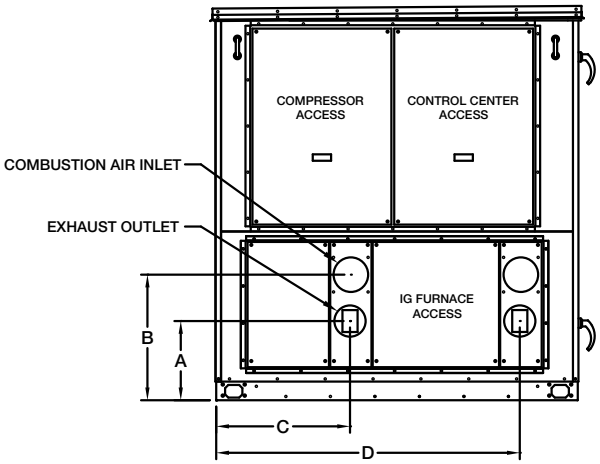
200-300MBH



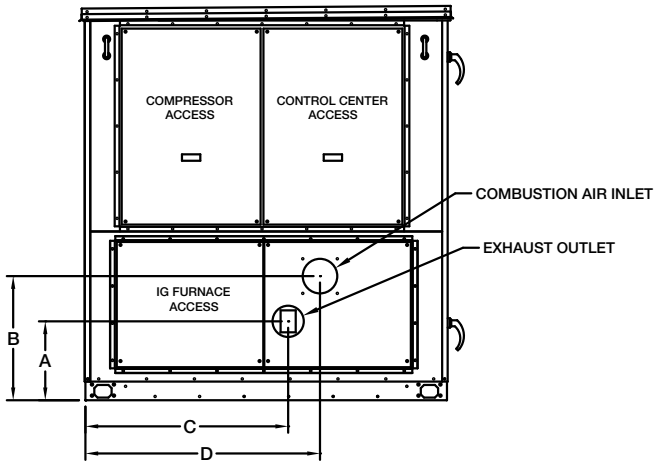
100-150MBH



500MBH

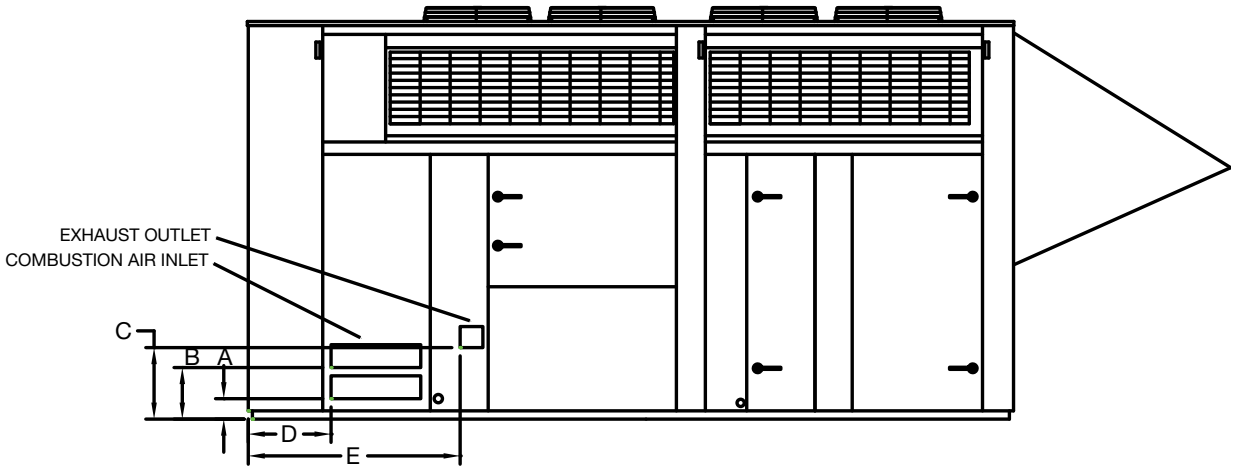


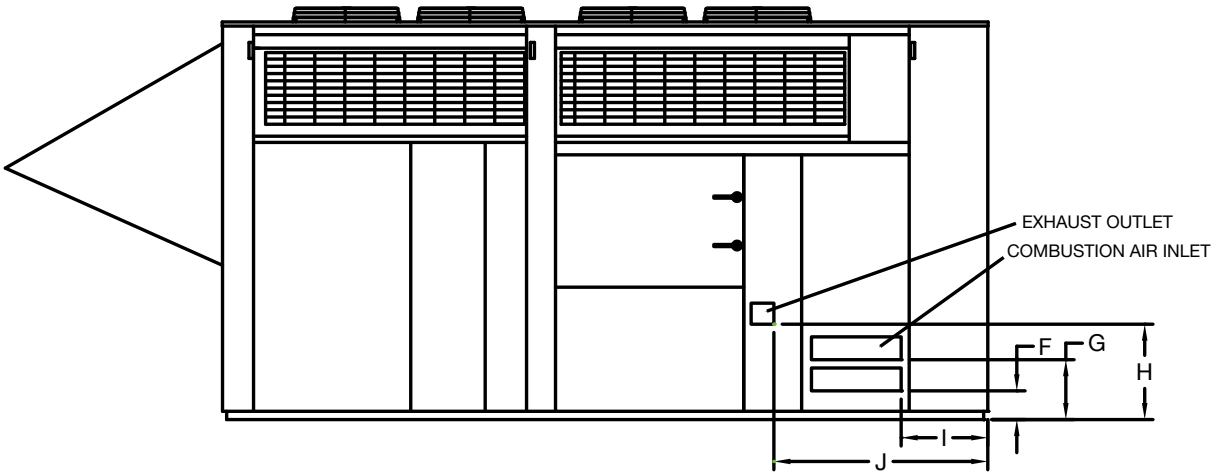
300-400MBH



IG Venting Location								
Housing Size	Furnace Size (MBH)	A	B	C	D	Flue Connection Size (diameter in inches)		
						Standard	2-Pipe/Concentric	
						Exhaust	Exhaust	Intake
25/40	100	14	23.5	20.5	20.5	4	4	4
	150					4	4	4
	200	15.2	23.7	31.5	35.9	6	6	6
	250					6	6	6
	300					6	6	6
45/85	300	14.8	23.3	38.1	44.1	6	6	6
	400					6	6	6
	500	14.9	23.6	25.2	57.1	6	6	6

Reference - Venting Connection Locations Cont. (Models RV-110, RVE-180)





IG Venting Location																
Housing Size	Furnace Size (MBH)	A	B	C	D	E	F	G	H	I	J	Inlet Dimensions		Outlet Dimensions		
												Length	Height	Edge Thickness	Length	Height
110/180	600	6	13.8	17.2	20.5	50	NA	NA	NA	NA	NA	21.5	6	1	6.5	5.5
	800	6	13.8	24.7	20.5	49.8	6	13.7	18.5	20.5	49.7	20.5	6	1	6.5	5.5
	1000	6	13.8	17.2	20.5	50	6	13.7	24.2	20.5	49.9	21.5	6	1	6.5	5.5
	1200	6	13.8	17.2	20.5	50	6	13.7	24.2	20.5	49.9	21.5	6	1	6.5	5.5

Reference - Rated Airflow

Model	Airflow (SCFM)
RV-10-3I	1100
RV-10-4I	1450
RV-10-5I	1700
RV-10-6I	1900
RV-10-7I	1900
RV-25-5I	2325
RV-25-5D	2325
RV-25-5S	2325
RV-25-5A	3400
RV-25-7.5I	2300
RV-25-7.5D	2300
RV-25-7.5S	2300
RV-25-7.5A	3000
RV-25-10I	2700
RV-25-10D	2800
RV-25-10S	2800
RV-25-10A	4400
RV-25-12.5I	3400
RV-25-12.5D	3550
RV-25-12.5S	3550
RV-25-12.5A	4400
RV-25-15I	3775
RV-25-15D	3775
RV-25-15S	3775
RV-25-15A	4300
RV-45-15I	4100
RV-45-15D	4100
RV-45-15S	4100
RV-45-15A	4800
RV-45-17.5I	4650
RV-45-17.5D	4650
RV-45-17.5S	4650

Model	Airflow (SCFM)
RV-45-17.5A	5500
RV-45-20I	4900
RV-45-20D	5100
RV-45-20S	5100
RV-45-20A	6400
RV-45-25I	5750
RV-45-25D	5600
RV-45-25S	5600
RV-45-25A	7200
RV-45-30I	6000
RV-45-30D	6000
RV-45-30S	5750
RV-45-30A	7000
RV-75-25I	8300
RV-75-25D	8300
RV-75-30I	9400
RV-75-30D	9500
RV-75-40I	10000
RV-75-40D	10000
RV-75-50I	10800
RV-75-50D	10800
RV-110-30I	9000
RV-110-30D	9000
RV-110-40I	10500
RV-110-40D	10500
RV-110-50I	10500
RV-110-50D	10500
RV-110-60I	14000
RV-110-60D	14000
RV-110-70I	16000
RV-110-70D	16000

Full load rating airflow per AHRI 340/360

Our Commitment

As a result of our commitment to continuous improvement, Greenheck reserves the right to change specifications without notice.

Product warranties can be found online at Greenheck.com, either on the specific product page or in the literature section of the website at Greenheck.com/Resources/Library/Literature.

Greenheck's Model RV and RVE catalog provides additional information describing the equipment, fan performance, available accessories, and specification data.

AMCA Publication 410-96, Safety Practices for Users and Installers of Industrial and Commercial Fans, provides additional safety information. This publication can be obtained from AMCA International, Inc. at www.amca.org.

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Building Value in Air.

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Building Value in Air.

Document 471755
Sidewall Propeller Fans
Belt Drive and Direct Drive
Exhaust, Supply, Filtered Supply and Reversible

Installation, Operation and Maintenance Manual

Please read and save these instructions for future reference. Read carefully before attempting to assemble, install, operate or maintain the product described. Protect yourself and others by observing all safety information. Failure to comply with these instructions will result in voiding of the product warranty and may result in personal injury and/or property damage.

Models AER, SE1, SS1, SE2, SS2, SCR3, SBE-1, SBS-1, SBE-2, SBS-2, SBE-3, SBS-3, SBCE, SBCS, SBCR
Models SCE3, SCS3 (Mexico Only)

Axial Propeller Wall Fans

Axial propeller wall fans are ideal for factory and warehouse applications where high volumes of air and low pressures are required. From general ventilation to industrial duty, the range of construction and performance capabilities offered represent the most comprehensive sidewall propeller fan line in the industry.

Wall mounted fans include both direct- and belt-driven fans with various impeller styles for exhaust, supply, filtered supply, and reversible applications.

Filtered Supply

Optional filtered supply wall housings are designed with the draw-thru concept to achieve the highest filter and fan efficiencies. Permanent 2-inch (51 mm) washable filters are accessed through a bolted panel and can be easily removed for cleaning.

General Safety Information

Only qualified personnel should install this fan. Personnel should have a clear understanding of these instructions and should be aware of general safety precautions. Improper installation can result in electric shock, possible injury due to coming in contact with moving parts, as well as other potential hazards. Other considerations may be required if high winds or seismic activity are present. If more information is needed, contact a licensed professional engineer before moving forward.

1. Follow all local electrical and safety codes, as well as the National Electrical Code (NEC) and the National Fire Protection Agency (NFPA), where applicable. Follow the Canadian Electric Code (CEC) in Canada.
2. The rotation of the propeller is critical. It must be free to rotate without striking or rubbing any stationary objects.
3. Motor must be securely and adequately grounded.
4. Do not spin fan propeller faster than max cataloged fan RPM. Adjustments to fan speed significantly affects motor load. If the fan RPM is changed, the motor current should be checked to make sure it is not exceeding the motor nameplate amps.
5. Do not allow the power cable to kink or come in contact with oil, grease, hot surfaces or chemicals. Replace cord immediately if damaged.
6. Verify that the power source is compatible with the equipment.
7. Never open access doors to a duct while the fan is running.

DANGER
Always disconnect, lock and tag power source before installing or servicing. Failure to disconnect power source can result in fire, shock or serious injury.
CAUTION
When servicing the fan, motor may be hot enough to cause pain or injury. Allow motor to cool before servicing.
CAUTION
Precaution should be taken in explosive atmospheres.

DANGER
Pour écarter les risques d'incendie, de choc électrique ou de blessure grave, veiller à toujours débrancher, verrouiller et étiqueter la source de courant avant l'installation ou l'entretien.
ATTENTION
Lors de toute intervention sur la soufflante, le moteur peut être suffisamment chaud pour provoquer une douleur voire une blessure. Laisser le moteur refroidir avant toute maintenance.
ATTENTION
Faire preuve de précaution dans les atmosphères explosives.

Receiving

Upon receiving the product, check to ensure all items are accounted for by referencing the delivery receipt or packing list. Inspect each crate or carton for shipping damage before accepting delivery. Alert the carrier of any damage detected. The customer will make notification of damage (or shortage of items) on the delivery receipt and all copies of the bill of lading which is countersigned by the delivering carrier. If damaged, immediately contact your Representative. Any physical damage to the unit after acceptance is not the responsibility of the Manufacturer.

Unpacking

Verify that all required parts and the correct quantity of each item have been received. If any items are missing, report shortages to your local representative to arrange for obtaining missing parts. Sometimes it is not possible that all items for the unit be shipped together due to availability of transportation and truck space. Confirmation of shipment(s) must be limited to only items on the bill of lading.

Note: The filtered supply unit ships with all ordered components completely factory-assembled. The optional weatherhood ships knocked down for field assembly and installation.

Storage

Fans are protected against damage during shipment. If the unit cannot be installed and operated immediately, precautions need to be taken to prevent deterioration of the unit during storage. The user assumes responsibility of the fan and accessories while in storage. The manufacturer will not be responsible for damage during storage. These suggestions are provided solely as a convenience to the user.

Indoor - The ideal environment for the storage of fans and accessories is indoors, above grade, in a low humidity atmosphere which is sealed to prevent the entry of blowing dust, rain or snow. Temperatures should be evenly maintained between 30° to 110°F (-1° to 43°C). Wide temperature swings may cause condensation and "sweating" of metal parts. All accessories must be stored indoors in a clean, dry atmosphere.

Remove any accumulations of dirt, water, ice or snow and wipe dry before moving to indoor storage. To avoid "sweating" of metal parts allow cold parts to reach room temperature. To dry parts and packages use a portable electric heater to get rid of any moisture build up. Leave coverings loose to permit air circulation and to allow for periodic inspection. The unit should be stored at least 3-1/2 inch (89 mm) off the floor on wooden blocks covered with moisture proof paper or polyethylene sheathing. Aisles between parts and along all walls should be provided to permit air circulation and space for inspection.

Outdoor - Fans designed for outdoor applications may be stored outdoors, if absolutely necessary. Roads or aisles for portable cranes and hauling equipment are needed.

The fan should be placed on a level surface to prevent water from leaking into the fan. The fan should be elevated on an adequate number of wooden blocks so that it is above water and snow levels and has enough blocking to prevent it from settling into soft ground. Locate parts far enough apart to permit air circulation, sunlight and space for periodic inspection. To minimize water accumulation, place all fan parts on blocking supports so that rain water will run off. Do not cover parts with plastic film or tarps as these cause condensation of moisture from the air passing through heating and cooling cycles. Fan propellers should be blocked to prevent spinning caused by strong winds.

Inspection & Maintenance During Storage

While in storage, inspect fans once per month. Keep a record of inspection and maintenance performed.

If moisture or dirt accumulations are found on parts, the source should be located and eliminated. At each inspection, rotate the wheel by hand ten to fifteen revolutions to distribute lubricant on motor. If paint deterioration begins, consideration should be given to touch-up or repainting. Fans with special coatings may require special techniques for touch-up or repair.

Machined parts coated with rust preventive should be restored to good condition promptly if signs of rust occur. Immediately remove the original rust preventive coating with petroleum solvent and clean with lint-free cloths. Polish any remaining rust from surface with crocus cloth or fine emery paper and oil. Do not destroy the continuity of the surfaces. Thoroughly wipe clean with Tectyl® 506 (Ashland Inc.) or the equivalent. For hard to reach internal surfaces or for occasional use, consider using Tectyl® 511M Rust Preventive, WD-40® or the equivalent.

Removing from Storage

As fans are removed from storage to be installed in their final location, they should be protected and maintained in a similar fashion until the fan equipment goes into operation.

Pre-Installation Checks

- Check chart below for correct wall opening dimensions.
- Check motor voltage and amperage rating for compatibility with electrical supply. Supply wiring must be properly fused and conform to local and national codes.
- Motor load amperage must be checked and compared to nameplate rating to avoid serious damage to motor when speed is increased.

Wall Opening Requirements

Wall opening size and propeller-to-damper distance are two important dimensions for fan installation. Fans mounted to the wall require a different wall opening (W.O.) size than those mounted in collars or wall housings. Propeller-to-damper distance (M) is important to reduce turbulence and damper flutter which may lead to premature damper failure.

Figure 1 and 2 show the wall opening (W.O.) required for installations with either a wall housing or collar.

Figure 3 shows the recommended wall opening (W.O.) and the minimum distance (M) suggested between the fan and damper for direct to wall installations.

Figure 4 shows the dimensions and wall opening (W.O.) required for installations with a filtered supply wall housing.

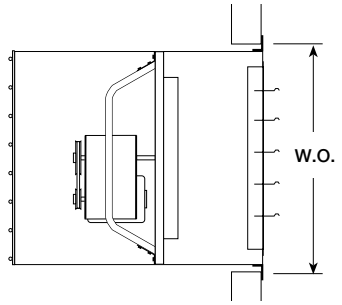


Figure 1 - Wall Housing Installation

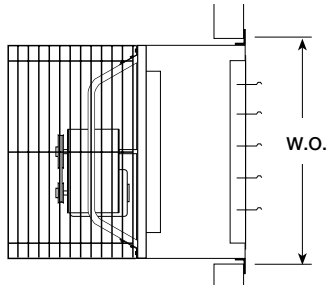


Figure 2 - Wall Collar Installation

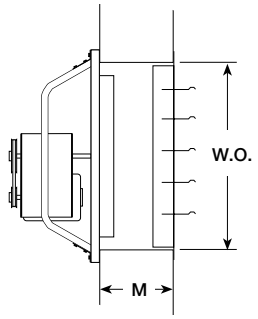


Figure 3 - Direct to Wall Installation

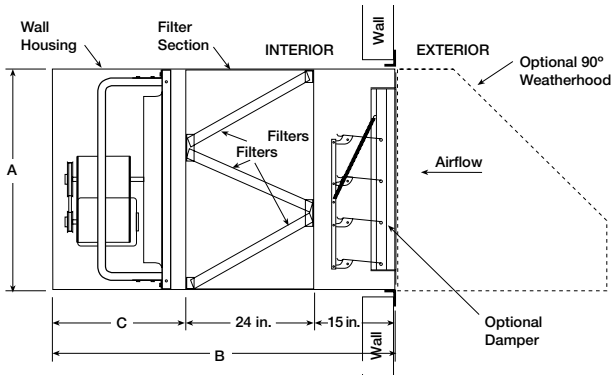


Figure 4 - Filtered Supply Wall Housing Installation

Fan Size	Damper Size Square	Recommended Wall Opening (W.O.) Square			M Minimum	Filtered Supply Wall Housing Only				
		Figures 1 & 2	Figure 3	Figure 4		A	B	C	Filter Quantity & Size	
8	10 *(254)*	14-1/4 *(362)*	10-1/2 *(267)*	-	6 *(152)*	-	-	-	-	-
10	12 *(305)*	16-1/4 *(413)*	12-1/2 *(318)*	-	6 *(152)*	-	-	-	-	-
12	14 *(356)*	19-1/4 *(489)*	14-1/2 *(368)*	-	7 *(178)*	-	-	-	-	-
14	16 *(406)*	21-1/4 *(540)*	16-1/2 *(419)*	-	8 *(203)*	-	-	-	-	-
16	18 *(457)*	23-1/4 *(591)*	18-1/2 *(470)*	-	9 *(229)*	-	-	-	-	-
18	20 *(508)*	25-1/4 *(641)*	20-1/2 *(521)*	-	10 *(254)*	-	-	-	-	-
20	22 *(559)*	27-1/4 *(692)*	22-1/2 *(572)*	-	12 *(305)*	-	-	-	-	-
24	26 *(660)*	33-3/4 *(857)*	26-1/2 *(673)*	33-3/4 *(857)*	13 *(330)*	32-1/4 *(819)*	63 *(1600)*	24 *(610)*	4	23-1/4 x 16-1/4 *(591 x 413)*
30	32 *(813)*	39-3/4 *(1010)*	32-1/2 *(826)*	39-3/4 *(1010)*	13 *(330)*	38-1/4 *(972)*	65 *(1651)*	26 *(660)*	4	24-5/8 x 19-1/4 *(625 x 489)*
36	38 *(965)*	45-3/4 *(1162)*	38-1/2 *(978)*	45-3/4 *(1162)*	14 *(356)*	44-1/4 *(1124)*	67-1/4 *(1708)*	28-1/4 *(718)*	6	23-1/4 x 22-1/8 *(591 x 562)*
42	44 *(1118)*	51-3/4 *(1314)*	44-1/2 *(1130)*	51-3/4 *(1314)*	15 *(381)*	50-1/8 *(1273)*	72-7/8 *(1851)*	34 *(864)*	6	24-1/8 x 25-1/8 *(613 x 638)*
48	50 *(1270)*	57-3/4 *(1467)*	50-1/2 *(1283)*	57-3/4 *(1467)*	16 *(406)*	56-1/8 *(1426)*	72-7/8 *(1851)*	34 *(864)*	12	23-1/4 x 18-3/4 *(591 x 476)*
54	56 *(1422)*	63-3/4 *(1619)*	56-1/2 *(1435)*	63-3/4 *(1619)*	17 *(432)*	62-3/8 *(1584)*	79-11/16 *(2024)*	40-11/16 *(1033)*	12	23-1/4 x 20-3/4 *(591 x 527)*
60	62 *(1575)*	69-3/4 *(1772)*	62-1/2 *(1588)*	-	19 *(483)*	-	-	-	-	-
72	74 *(1880)*	84-3/4 *(2153)*	74-1/2 *(1892)*	-	19 *(483)*	-	-	-	-	-

All dimensions given in inches *(millimeters)*. Filters are 2 inch *(51 mm)* nominal thickness. Above filter sizes are actual dimensions.

Typical Installation

DANGER

Always disconnect, lock and tag power source before installing or servicing. Failure to disconnect power source can result in fire, shock or serious injury.

DANGER

Pour écarter les risques d'incendie, de choc électrique ou de blessure grave, veiller à toujours débrancher, verrouiller et étiqueter la source de courant avant l'installation ou l'entretien.

Move fan to the desired location and determine the method by which the fan is to be mounted as shown in Figures 1-4 shown on page 3. Optional wall mount housings (Figure 1) and wall mount collars (Figure 2) provide a convenient means of mounting sidewall propeller fans while maintaining the proper distance between propeller and damper.

Attach the fan by inserting a suitable fastener through each of the prepunched mounting holes in the fan panel. Care should be taken not to bend or distort the fan panel or drive components during installation.

Support Braces

Wall Housing sizes 42 and larger with heavy motors and all Filtered Supply Wall Housings need additional bracing.

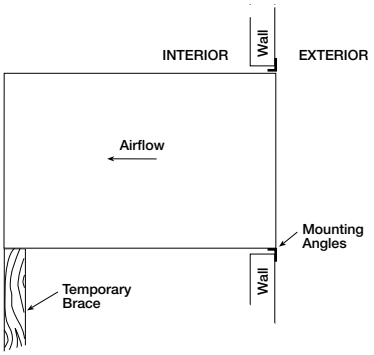
Filtered Supply Wall Housing Installation

Step 1 Install Housing

Install housing through wall opening from outside.

Temporarily brace end of unit until permanent support braces are installed.

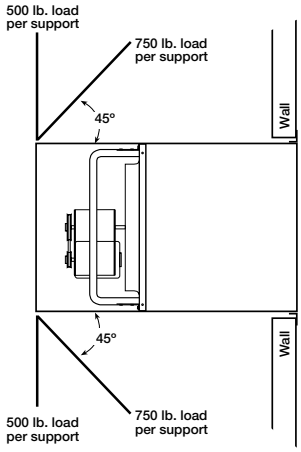
Secure through prepunched holes in angles with suitable fasteners.



Step 2 Install Support Braces

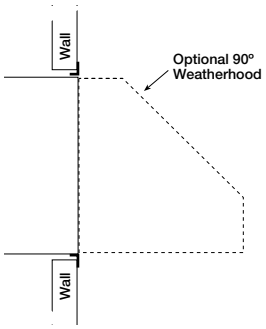
Choose method of support. Attach support to end of unit (above or below housing) with rods, cable, angle, etc. (supplied by others) as shown.

Vertical braces must carry a minimum load of 500 pounds per support, and angled (45°) braces a minimum of 750 pounds per support based on two supports.



Step 3 Install Weatherhood

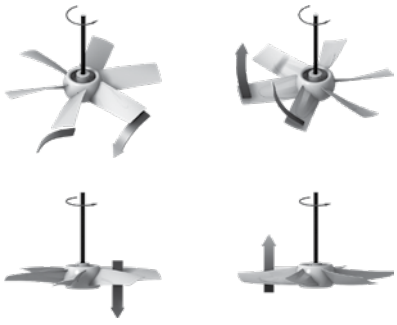
Position weatherhood over end of wall housing and fasten through mounting holes with self-tapping screws. Caulk, flash and complete electrical hook-up to finish installation.



Pre-Start-Up Checks

Check all fasteners and setscrews for tightness. This is especially important for bearing setscrews.

The propeller should rotate freely and not rub on the fan panel venturi. Rotation direction of the propeller should be checked by momentarily turning the unit on. Propeller blade should cup and throw the air when rotating in the correct rotation as shown in the figure. Rotation should be in the same direction as the rotation decal affixed to the unit.



For 3-phase installations, fan rotation can be reversed by simply interchanging any two of the three electrical leads. For single-phase installations follow the wiring diagram located on the motor.

For belt drive fans, the adjustable motor pulley is preset at the factory for the specified fan RPM. Fan speed can be increased by closing or decreased by opening the adjustable pulley. Two or three groove variable pitch pulleys must be adjusted an equal number of turns open. Any increase in fan speed represents a substantial increase in horsepower required from the motor. Always check motor load amperage and compare to nameplate rating when changing fan speed.

Maintenance

DANGER

Always disconnect, lock and tag power source before installing or servicing. Failure to disconnect power source can result in fire, shock or serious injury.

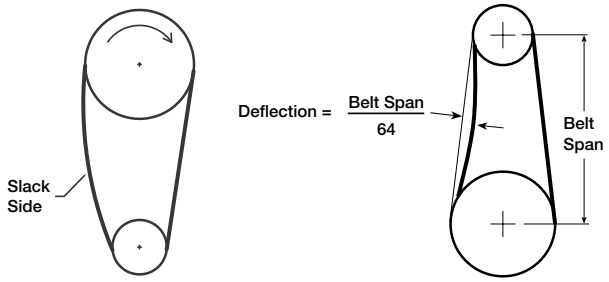
DANGER

Pour écarter les risques d'incendie, de choc électrique ou de blessure grave, veiller à toujours débrancher, verrouiller et étiqueter la source de courant avant l'installation ou l'entretien.

Once the fan has been put into operation, a periodic maintenance program should be set up to preserve the reliability and performance of the fan. Items to be included in this program are belts, bearings, fasteners and setscrews, lubrication, and removal of dust and dirt.

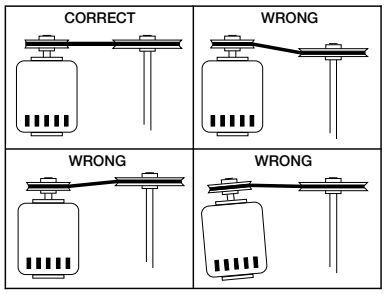
Belts

Premature belt failures are frequently caused by improper belt tension (either too tight or too loose) or misaligned pulleys. The proper tension for operating a V-belt is the lowest tension at which the belts will not slip at peak load conditions. For initial tensioning, the proper belt deflection halfway between pulley centers is 1/64 inch (0.4 mm) for each inch of belt span. For example, if the belt span is 64 inches (1626 mm), the belt deflection should be one inch (25 mm) using moderate thumb pressure at midpoint of the drive. See figure shown below.



Check belt tension two times during the first 24 hours of operation and periodically thereafter. To adjust belt tension, simply loosen four fasteners (two on each side of the motor plate) and slide the motor plate away from the fan shaft until proper belt tension is attained. On some fans, fasteners attaching the motor to the motor plate must be loosened in order to adjust the belt.

It is very important that the drive pulleys remain in proper alignment after adjustments are made. Misalignment of pulleys will result in premature belt wear noise, vibration and power loss.



Bearings (for belt drive fans only)

Bearings are the most critical moving part of the fan and should be inspected at periodic intervals. Locking collars and setscrews, in addition to fasteners attaching the bearings to the bearing plate, must be checked for tightness. In a clean environment and temperatures above 32ºF (0ºC) and below 200ºF (93ºC), fan shaft bearings with grease fittings should be lubricated semi-annually using a high-quality lithium based grease. If unusual environmental conditions exist, temperatures below 32ºF (0ºC) and above 200ºF (93ºC), moisture or contaminants, more frequent lubrication is required.

With the unit running, add grease very slowly with a manual grease gun until a slight bead of grease forms at the seal. Be careful not to unseat the seal by over lubricating or using excessive pressure. Bearings without grease fittings are lubricated for life.

Fasteners and Setscrews

Any fan vibration has a tendency to loosen mechanical fasteners. A periodic inspection should include checking all fasteners and setscrews for tightness. Particular attention should be paid to setscrews or taper-lock bushings attaching the propeller to the motor shaft and the motor shaft to the bearings. Loose bearing setscrews will lead to premature failure of the fan shaft. In addition, check all fasteners attaching the motor to the motor plate.

Lubrication

Refer to the paragraph on bearings for bearing lubrication. Many fractional horsepower motors installed on the smaller fans are lubricated for life and require no further attention. Motors equipped with oil holes should be oiled in accordance with the manufacturer's instructions printed on the motor. Use a high grade SAE 20 machine oil and use caution not to over lubricate. Motors supplied with grease fittings should be greased according to directions printed on the motor.

Removal of Dust and Dirt

Dirt clogs cooling openings on the motor housing, contaminates bearing lubricant and collects on propeller blades causing severe imbalance if left unchecked. The exterior surface of the motor, fan panel and entire propeller should be thoroughly cleaned periodically. Use caution and do not allow water or solvents to enter the motor or bearings. Motors or bearings must not be sprayed with steam or water.

The filters also require periodic cleaning. The 2 inch (51 mm) washable aluminum filters are accessed through the bolted access panel.

Troubleshooting

WARNING

Before taking any corrective action, make certain unit is not capable of operation during repairs.

AVERTISSEMENT

Avant d'entreprendre toute action corrective, s'assurer que l'appareil ne pourra pas fonctionner durant les réparations.

PROBLEM	CAUSE	CORRECTIVE ACTION
Too much airflow	Resistance lower than designed	Decrease fan speed.
Reduced airflow	System resistance too high	Check backdraft dampers for proper operation. Remove obstructions in ductwork. Clean dirty filters. Check for adequate supply air for exhaust fans or exhaust air for supply fans.
	Fan too close to damper	Increase distance between fan and damper.
	Fan speed too low	Increase fan speed.
	Excessive dirt buildup on propeller	Clean propeller.
Excessive noise	Bearings	Tighten collars and fasteners. Lubricate bearings. Replace defective bearings.
	V-belt drive	Tighten pulleys on motor and fan shaft. Adjust belt tension. Align pulleys properly. Replace worn belts or pulleys. See Maintenance.
	Excessive vibration	Clean dirt buildup from propeller. Check all setscrews and fasteners for tightness. Check for worn bearing. Correct propeller imbalance. Check for loose dampers, guards or ductwork.
	Defective motor	Replace motor.
	Variable frequency drive (VFD)	Check VFD for drive setting, some controllers are able to be adjusted to lower the harmonic noises sometimes heard during operation by adjusting a simple setting on the controller.
	Debris	Remove all debris from the fan.
Fan does not operate	Electrical supply	Check fuses/circuit breakers. Check for switches turned off or disconnected. Check for correct supply voltage.
	Drive	Check for broken or worn belts. Tighten loose pulleys.
	Motor	Assure motor is correct horsepower and not tripping overload protector.

Maintenance Documentation

Job Information

Job Name:_____
Address:_____
City: _____
State: _____ Zip:_____
Phone: _____
Contact Person: _____

Service Organization:_____
Address: _____
City:_____
State: _____ Zip: _____
Phone: _____
Work Done By: _____

Nameplate Information

Model: _____
Volts:_____ Hertz: _____ Phase: _____
Amps:_____ Mark: _____
Supply hp: _____ Exhaust hp:_____
Serial Number: _____
Model Voltage: _____
Motor Amperage: _____
Fan RPM:_____

Field Start-Up Documentation

Actual Voltage: _____ Hertz: _____ Phase:_____
Actual Amperage:_____
Blower Rotation:_____
Air Volume: Design cfm: _____
Actual cfm: _____
Level of fan (L or H):_____
Fan RPM Range (min.)_____ (max.) _____

Parts List

Each fan bears a manufacturer's nameplate with model number and serial number embossed. This information will assist the local representative and the factory in providing service and replacement parts. Before taking any corrective action, make certain unit is not capable of operation during repairs.

CAUTION

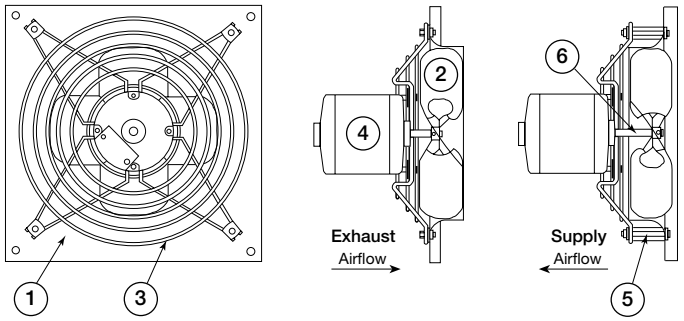
A fan manufactured with an explosion resistant motor does not certify the entire unit to be explosion proof. Refer to UL Listing Mark for the fans approved usage.

CAUTION

La présence d'un moteur antidéflagrant sur un ventilateur ne garantit pas que tout l'appareil est antidéflagrant. Pour connaître les emplois autorisés de l'appareil, voir son marquage de conformité UL.

Direct Drive

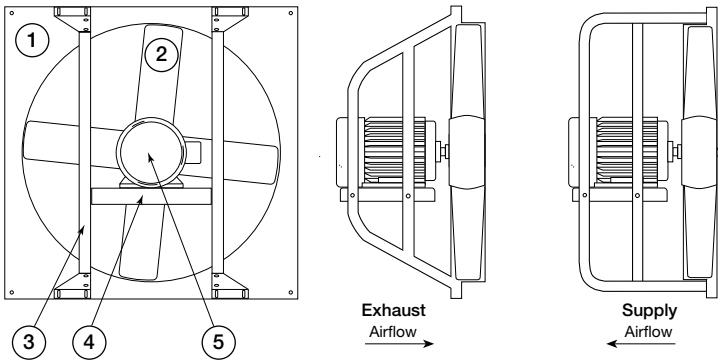
SE1 and SS1 (Sizes 8 thru 12 - D, G and E Motor Speeds)



1. Fan Panel
2. Propeller
3. Drive Frame/Motor Support
4. Motor
5. Riser Blocks (4) - supply fan only
6. Shaft Extension - supply fan only

Direct Drive

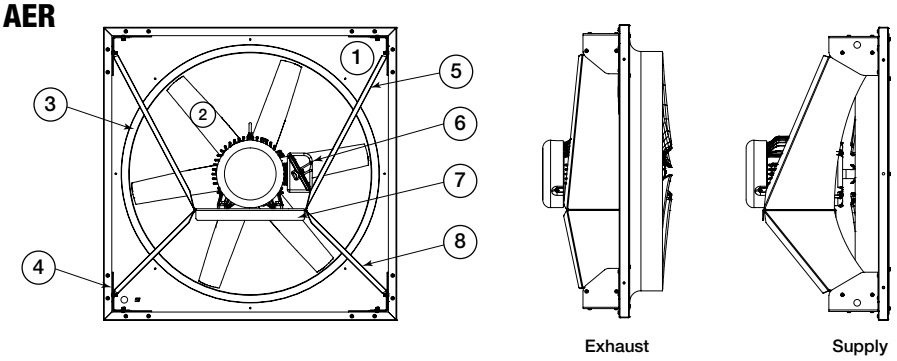
SE1 and SS1 (Sizes 12 thru 24 - A, B and C Motor Speeds)
SE2, SS2 and SCR3
SCE3 and SCS3 (Mexico Only)



1. Fan Panel
2. Propeller
3. Drive Frame Channels (2)
4. Motor Plate
5. Motor

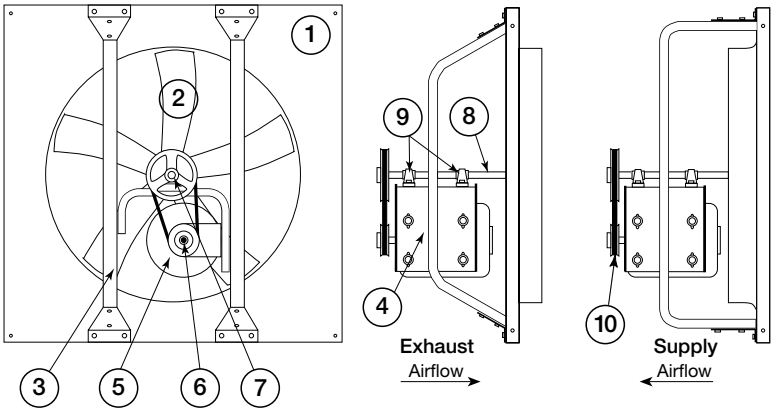
Direct Drive

AER



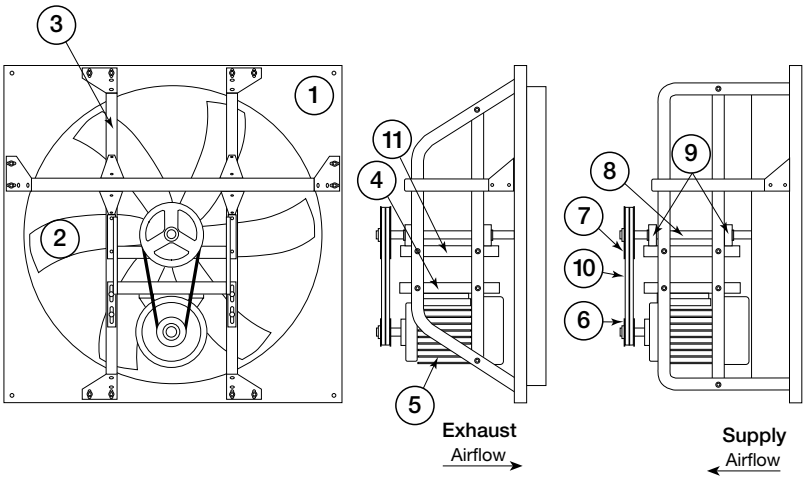
1. Fan Panel
2. Propeller
3. Venturi Insert
4. Corner Brackets (4)
5. Drive Frame Upper Arm (2)
6. Motor
7. Motor Plate
8. Drive Frame Lower Arm (2)

Belt Drive
SBE-1, SBS-1, SBE-2 and SBS-2 (L and H propellers)



1. Fan Panel
2. Propeller
3. Drive Frame Channel (2)
4. Motor /Bearing Plate
5. Motor
6. Motor Pulley
7. Shaft Pulley
8. Fan Shaft
9. Bearings (2)
10. Belt

Belt Drive
SBE-3, SBS-3, SBCE, SBCS and SBCR (L and H propellers)



1. Fan Panel
2. Propeller
3. Drive Frame Channel (2)
4. Motor Plate
5. Motor
6. Motor Pulley
7. Shaft Pulley
8. Fan Shaft
9. Bearings (2)
10. Belt
11. Bearing Plate

Our Commitment

As a result of our commitment to continuous improvement, Greenheck reserves the right to change specifications without notice.

Product warranties can be found online at Greenheck.com, either on the specific product page or in the literature section of the website at Greenheck.com/Resources/Library/Literature.

Greenheck's Sidewall Propeller Fans catalog provides additional information describing the equipment, fan performance, available accessories, and specification data.

AMCA Publication 410-96, Safety Practices for Users and Installers of Industrial and Commercial Fans, provides additional safety information. This publication can be obtained from AMCA International, Inc. at www.amca.org.

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Document 469003
Model Vektor®-H and Vektor®-HS
Laboratory Exhaust System

Installation, Operation and Maintenance Manual

Please read and save these instructions for future reference. Read carefully before attempting to assemble, install, operate or maintain the product described. Protect yourself and others by observing all safety information. Failure to comply with these instructions will result in voiding of the product warranty and may result in personal injury and/or property damage.

Vektor®-H Belt Drive

Vektor®-H Direct Drive

Vektor®-HS Belt Drive

General Safety Information

Only qualified personnel should install this fan system. Personnel should have a clear understanding of these instructions and should be aware of general safety precautions. Improper installation can result in electric shock, possible injury due to coming in contact with moving parts, as well as other potential hazards. Other considerations may be required if high winds or seismic activity are present. If more information is needed, contact a licensed professional engineer before moving forward.

1. Follow all local electrical and safety codes, as well as the National Electrical Code (NEC), the National Fire Protection Agency (NFPA), where applicable. Follow the Canadian Electrical Code (CEC) in Canada.
2. The rotation of the wheel is critical. It must be free to rotate without striking or rubbing any stationary objects.
3. Motor must be securely and adequately grounded.
4. Do not spin fan wheel faster than maximum cataloged fan RPM. Adjustments to fan speed significantly effects motor load. If the fan RPM is changed, the motor current should be checked to make sure it is not exceeding the motor nameplate amps.
5. Do not allow the power cable to kink or come in contact with oil, grease, hot surfaces or chemicals. Replace cord immediately if damaged.
6. Verify that the power source is compatible with the equipment.
7. Never open access doors to a duct while the fan is running.

DANGER
Always disconnect, lock and tag power source before installing or servicing. Failure to disconnect power source can result in fire, shock or serious injury.
CAUTION
When servicing the fan, motor may be hot enough to cause pain or injury. Allow motor to cool before servicing.
CAUTION
Precaution should be taken in explosive atmospheres.

Receiving

Greenheck models Vektor-H and Vektor-HS fans are thoroughly inspected, test run at the factory, and shipped on a skid or packaged to minimize damage during shipment. The transportation carrier has the responsibility of delivering all items in their original condition as received from the manufacturer. The individual receiving the equipment is responsible for inspecting the unit for obvious or hidden damage and recording any damage on the bill of lading before acceptance of the equipment. All claims (if necessary) shall be filed with the final carrier.

Unpacking

Verify that all required parts and the correct quantity of each item have been received, including accessory kit containing gasketing, etc. If any items are missing, report shortages to your local representative to arrange for obtaining missing parts. Sometimes it is not possible that all items for the unit be shipped together due to availability of transportation and truck space. Confirmation of shipment(s) must be limited to only items on the bill of lading.

Handling

The Vektor-H and Vektor-HS laboratory exhaust system is shipped in subassembly sections for easy rigging and installation. Depending on the fan size, the sections can include: Blower Assembly, Stack Extension, and Discharge Nozzle.

The Vektor-H and Vektor-HS are designed to be self-supporting and standing (without the use of guy wires) when assembled per the instructions provided within this manual. All subassembly sections have lifting lugs as shown.

Storage

Fans are protected against damage during shipment. If the unit cannot be installed and operated immediately, precautions need to be taken to prevent deterioration of the unit during storage. The user assumes responsibility of the fan and accessories while in storage. The manufacturer will not be responsible for damage during storage. These suggestions are provided solely as a convenience to the user.

INDOOR

The ideal environment for the storage of fans and accessories is indoors, above grade, in a low humidity atmosphere which is sealed to prevent the entry of blowing dust, rain, or snow. Temperatures should be evenly maintained between 30°F and 110°F. (*-1°C and 43°C*). Wide temperature swings may cause condensation and “sweating” of metal parts. All accessories must be stored indoors in a clean, dry atmosphere.

Remove any accumulations of dirt, water, ice or snow and wipe dry before moving to indoor storage. To avoid “sweating” of metal parts allow cold parts to reach room temperature. To dry parts and packages use a portable electric heater to get rid of any moisture build up. Leave coverings loose to permit air circulation and to allow for periodic inspection.

The unit should be stored at least 3-1/2 in. (*89 mm*) off the floor on wooden blocks covered with moisture proof paper or polyethylene sheathing. Aisles between parts and along all walls should be provided to permit air circulation and space for inspection.

OUTDOOR

Fans designed for outdoor applications may be stored outdoors, if absolutely necessary. Roads or aisles for portable cranes and hauling equipment are needed.

The fan should be placed on a level surface to prevent water from leaking into the fan. The fan should be elevated on an adequate number of wooden blocks so that it is above water and snow levels and has enough blocking to prevent it from settling into soft ground. Locate parts far enough apart to permit air circulation, sunlight, and space for periodic inspection. To minimize water accumulation, place all fan parts on blocking supports so that rain water will run off.

Do not cover parts with plastic film or tarps as these cause condensation of moisture from the air passing through heating and cooling cycles.

Fan wheels should be blocked to prevent spinning caused by strong winds.

Inspection and Maintenance during Storage

While in storage, inspect fans once per month. Keep a record of inspection and maintenance performed; see backcover.

If moisture or dirt accumulations are found on parts, the source should be located and eliminated. At each inspection, rotate the wheel by hand ten to fifteen revolutions to distribute lubricant on motor and bearings. If paint deterioration begins, consideration should be given to touch-up or repainting. Fans with special coatings may require special techniques for touch-up or repair.

Machined parts coated with rust preventive coating should be restored to good condition promptly if signs of rust

occur. Immediately remove the original rust preventive coating with petroleum solvent and clean with lint-free cloths. Polish any remaining rust from surface with crocus cloth or fine emery paper and oil. Do not destroy the continuity of the surfaces. Wipe clean thoroughly with Tectyl® 506 (Ashland Inc.) or the equivalent. For hard to reach internal surfaces or for occasional use, consider using Tectyl® 511M Rust Preventive or WD-40® or the equivalent.

REMOVING FROM STORAGE

As fans are removed from storage to be installed in their final location, they should be protected and maintained in a similar fashion, until the fan equipment goes into operation.

Prior to assembly and installation of the Vektor fan and system components, inspect the fan assembly to make sure it is in working order.

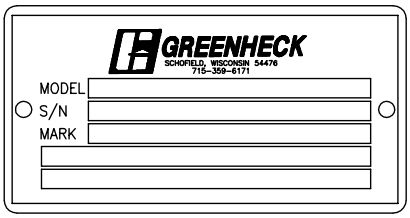
1. Check all fasteners, set screws on the fan, wheel, bearings, drive, motor base and accessories for tightness.
2. Rotate the fan wheel(s) by hand and assure no parts are rubbing. Access to the wheel is obtained through a bolted panel located on the side of the fan housing.

General Information

To ensure a successful installation, the instructions in this manual should be read and adhered to. Failure to comply with proper installation procedures may void the warranty.

Unit and System Identification Tags

Each fan has a permanently affixed manufacturer's engraved metal nameplate containing the model number and individual serial number.



The tag shown is an example of an identification nameplate on the fan. The information provides general details about the fan, as well as containing specific information unique to the unit. When contacting your local manufacturer's representative with future needs or questions, please have the information on this label available. Tags are mounted in an area which is clearly visible, usually on the side of the fan cabinet.

Vektor fan systems may arrive in component pieces due to shipping restrictions. Individual components of a system have matching identification tags which should be used to identify and assemble the complete system. Assembling systems with different identification tags can cause reductions in the fan(s) performance.

Prior to fully assembling and installing the Vektor-H or Vektor-HS fans, inspect bypass air plenums and the fan assembly to make sure they are in working order.

Pre-Installation Information

Before installation, it is important to be certain the mounting surface will bear the operating weight of the unit. For proper unit operation, it is also important that it be operated in a completely level position.

For further details on safety practices involving industrial and commercial fans, please refer to AMCA Publication 410.

Electrical Disconnects

All fan motors should have disconnects located in close visual proximity to turn off electrical service. Service disconnects shall be locked-out when maintenance is being performed.

Moving Parts

All moving parts must have guards to protect personnel. Refer to local codes for requirements as to the number, type and design. Fully secure fan wheel before performing any maintenance. The fan wheel may start "free wheeling" even if all electrical power has been disconnected. Before the initial start-up or any restart, check the following items to make sure that they are installed and secure.

- Do not spin fan wheel faster than the maximum cataloged fan rpm.
- Adjustments to fan speed significantly affects motor load. If the fan RPM is changed, the motor current should be checked to make sure it is not exceeding the motor nameplate amps.

Guards (Motor Cover, Weatherhoods)

Do not operate fans without proper protective devices in place. Failure to do so may result in serious bodily injury and property damage. Check local codes to ensure compliance for all protective devices.

Air Pressure and Suction

In addition to the usual hazards associated with rotating machinery, fans also create a dangerous suction at the inlet. Special caution needs to be used when moving around a fan, whether it is in operation or not. Before start-up, make sure the inlet area is clear of personnel and loose objects.

Rigging and Lifting

The steel cone is to be lifted by the points at the top, separately and individually from the fan assembly. **Polyethylene nozzles do not have lifting points.** If needed, attach polyethylene nozzle to fan or stack prior to lifting and use component lifting points.

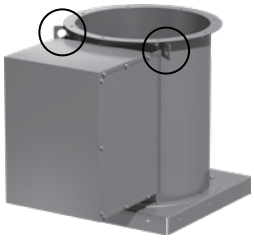
Fans and bypass air plenums (BAP) should be disassembled prior to lifting and lifted individually. Fans and BAP are to be rigged and moved by the lifting points provided or by the skid when a forklift is used. Location of the brackets varies by model and size. Handle in such a manner as to keep from scratching or chipping the coating. Damaged finish may reduce the ability of the fan to resist corrosion. Spreader bars are recommended to prevent damage to the unit. Failure to use spreader bars may result in damage which becomes the installer's responsibility.

1. Before lifting, be sure that all shipping materials have been removed from the unit.
2. Use standard lifting and rigging practices.
3. All lifting brackets on each unit must be utilized at the same time.
4. Fan to be kept level during lifting and installation.
5. Spreader bars must span the unit to prevent damage to the unit by the lifting cables.
6. Always test-lift the unit to check for proper balance and rigging before hoisting to desired location.
7. Never lift unit in windy conditions.
8. Preparation of roof opening should be completed prior to lifting the unit onto the roof.
9. Use well-padded chains to protect the unit from damage.

Vektor-H

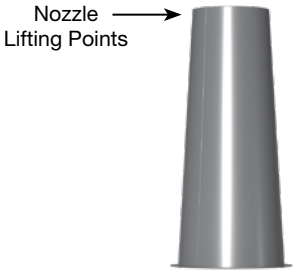
Unit Assembly Lifting Lugs

Belt Drive
Sizes 9-12



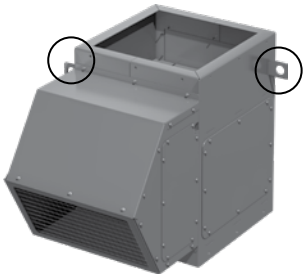
Belt Drive
Sizes 13-36

Direct Drive
Lift as an assembly with all four (4) lifting lugs.
Image shows if motor and wheel assembly needs to be removed.

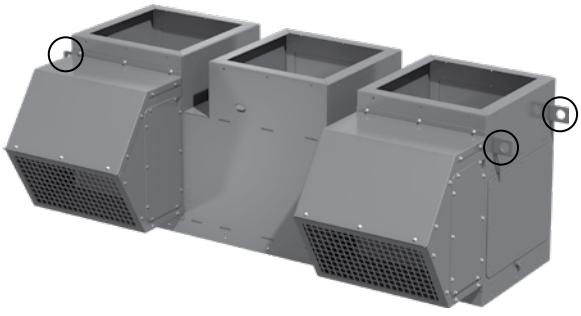


Nozzle sizes 13-36

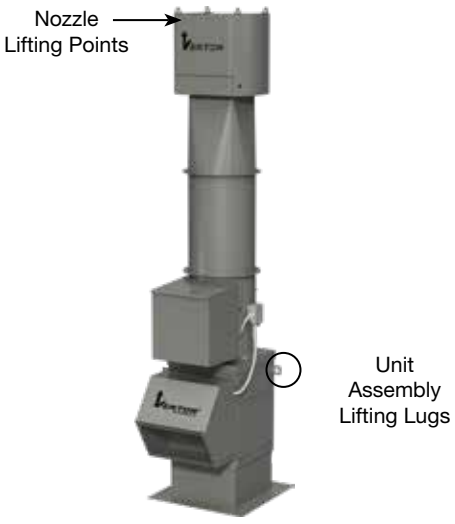
Vektor-HS with VGN Technology



Bypass Air Plenum
Sizes 9-22



3x1 Fan System with Bypass Air Plenum
Sizes 9-13, 18-36



Rigging and Lifting (continued)

Unit Lifting Points		
Fan		
Size	**Quantity**	**Placement**
Belt – 9-12	2	Inside fan body, on top of belt tube
Belt – 13-36	2	Exterior of fan body
Direct – All	4	Outside of core and outside of fan body, All (4) to be used to “balance” the lift.
Bypass Air Plenum (BAP)		
Size	**Quantity**	**Placement**
1x1 – 9-22	2	Opposite sides of plenum
1x1 – 24-36	4	Two on each end of plenum
2x1 – 9-16	2	Opposite sides of plenum
2x1 – 18-36	4	Two on each end of plenum
3x1 – 16	2	Opposite sides of plenum
3x1 – 9-13, 18-36	4	Two on each end of plenum

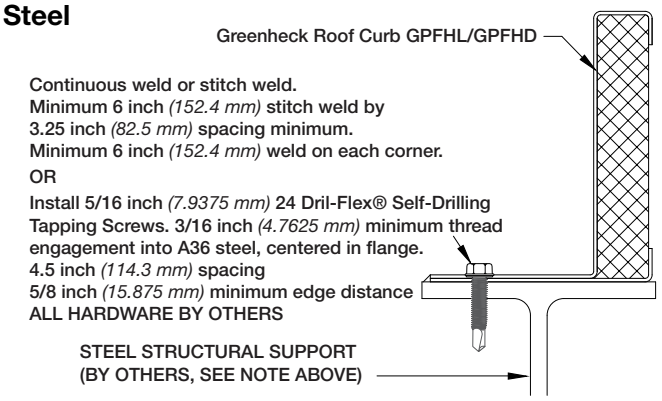
Roof Curb and Mounting Details

NOTE

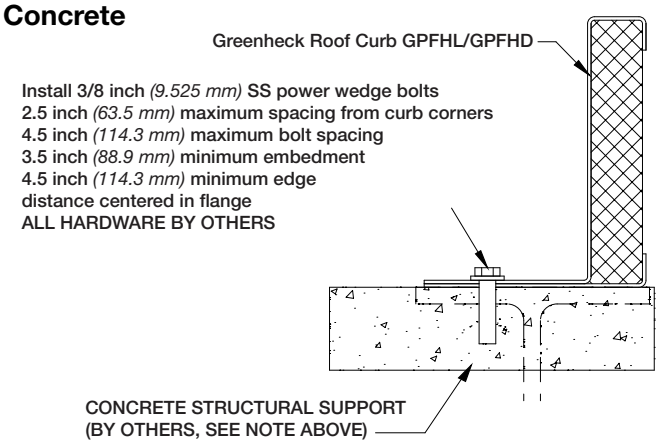
Steel, concrete or wood roof support is per structural engineer and in accordance with load requirements and applicable building codes.

The figures below illustrates three common methods used to install Vektor systems. Methods used to attach a Vektor unit are dependent on local codes, roof construction design and roof construction materials. Consult an architect or structural engineer for proper means of attachment.

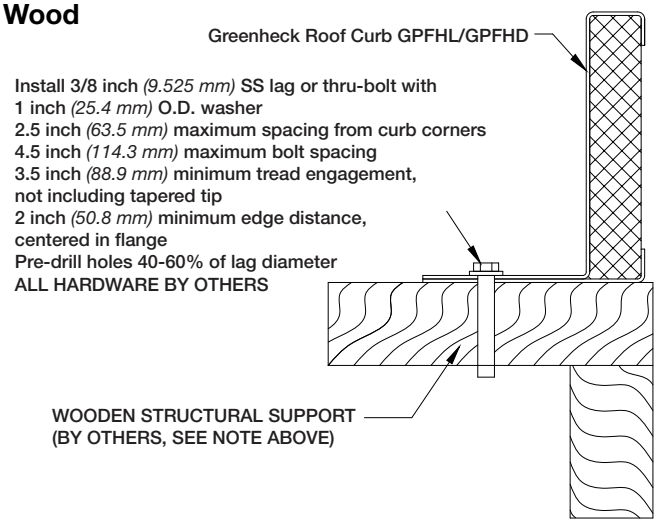
Steel



Concrete



Wood

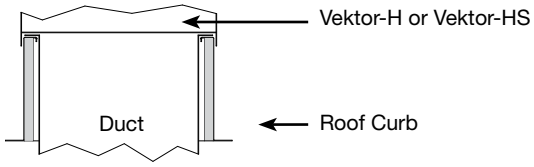


Duct Installation

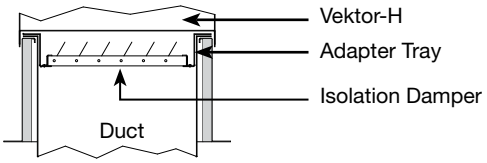
Bottom Inlet Duct Connection

The end of the duct (customer-supplied) is secured between the roof curb's top edge and the curb cap of either the Vektor-H or bypass air plenum. If an isolation damper is present in the roof curb, the duct is located between the roof curb and the damper adapter tray.

Option 1:
- No isolation damper in roof curb
- Bottom inlet on bypass air plenum



Option 2:
- With isolation damper in roof curb



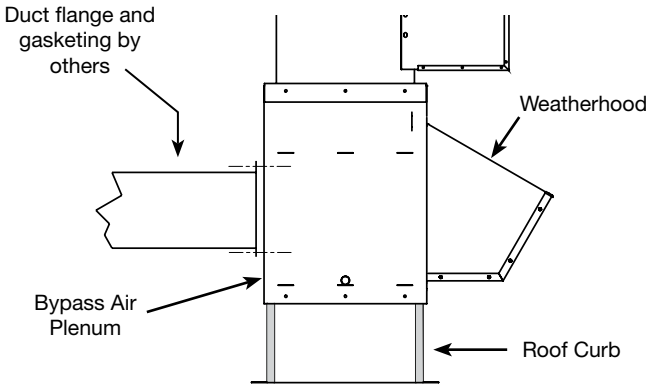
Duct Connection to Curb

Side or End Duct Connection

- Vektor-H or Vektor-HS
- With bypass air plenum

NOTE

Plenum is provided with removable side or end panels, allowing the proper duct connection.



Duct to Bypass Air Plenum

Stack Extensions

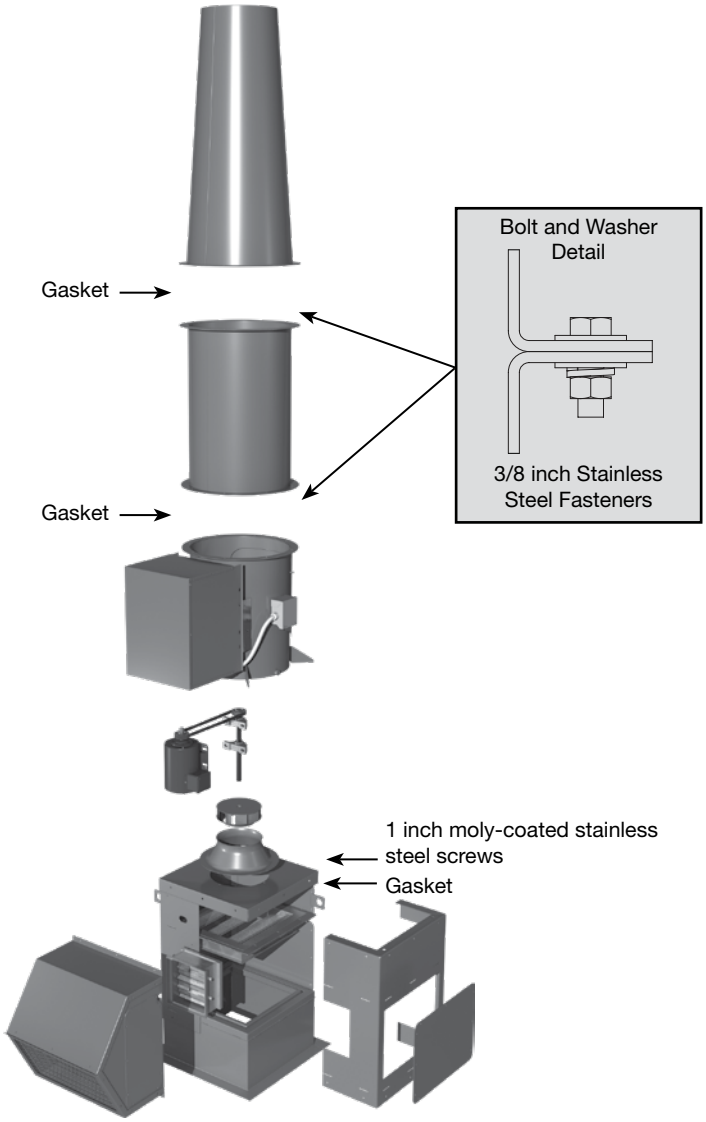
Systems with multiple stack extensions require all sections assembled and installed on site between the main fan body and the discharge cone. Each section has guy wire attachment brackets located on the upper end of each section. The order sections are installed in are universal. Gasketing (3/16 x 1/2 inch with sticky back) is provided and is to be installed between each joining section.

Guy wires are required on system with multiple stack extensions. Location of connections, wiring and anchorage is determined by a structural engineer.

System Assembly

NOTE

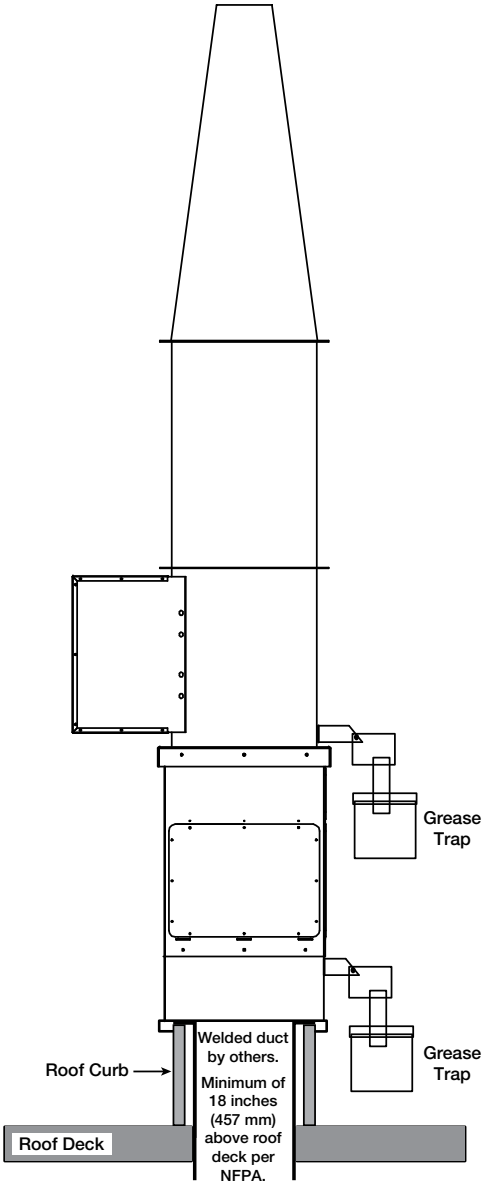
When installing each section, be certain to rig each section separately using the lifting lugs provided.



1. Mount roof curb to roof deck in accordance with local codes.
2. Place the bypass air plenum (BAP) onto the secured roof curb. Pre-drill pilot holes into the roof curb using pre-existing holes in plenum as a guide. Use thread cutters to add threads to holes in roof curb. Attach the BAP to the roof curb with mounting hardware (by others).

   If a BAP is not provided for the unit, skip to Step 4.
3. Install 3/16-inch thick x 1/2-inch wide, closed-cell gasket on the top edge of BAP, adhesive side down (gasket provided). Leave no gaps between gasket sections to ensure a tight seal.
4. Place the panel of the fan housing onto the gasket and BAP or onto roof curb if BAP is not provided. Use thread cutters to add threads to holes, securing with 1-inch moly-coated stainless steel screws. Must use every hole for proper coverage.
5. Install the final nozzle subassemblies as shown in the submittal drawing. Align flange bolt holes and fasten sections using the 3/8-inch 316 stainless steel bolts, washers, and lock washers provided.
6. Follow electrical connection and pre-start-up checks as listed on pages 10 and 11.

Kitchen Roof Mounting Installation



Typical Commercial Kitchen Installation

WARNING

In a kitchen exhaust application, do not use a speed control or isolation damper.

NOTE

In a kitchen fan and high temperature applications exhaust upblast fans must have external wiring.

UL/cUL 762 installation for restaurant applications

1. The size of the duct must be equal to the inlet opening.
2. Secure the fan to curb at all four corners using a minimum eight anchor bolts, lag screws or other suitable fasteners.
3. Use optional grease trap and external junction box.
4. Area codes may require a continuous weld between duct and inlet.
5. To comply with NFPA 96, the discharge is required to be a minimum of 40 inches *(1016 mm)* above the roof deck and a minimum of 10 ft. from any building air intake. The minimum velocity in the duct should be 500 ft/min. or greater.
6. Ductwork to an upblast discharge exhaust fan is constructed of carbon steel not less than 16 MSG *(1.6 mm)* and extends a minimum of 18 inches *(457 mm)* above the roof surface.
7. Ensure that a minimum of 500 ft/min. of air velocity through the fan is maintained per NFPA 96, clause 8.2.1.1, 2008 edition and UL 762, Issue #5, December 19, 2003, clause 6.2.

Grease Trap

A grease trap is an aluminum trap designed to collect grease residue to avoid drainage onto roof surface. It contains a built-in water separating baffle.

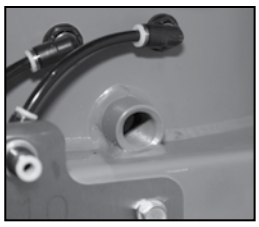
Instructions

1. Apply cover to grease trap. Install clip nuts to trap over holes provided. Attach cover with two #10 - 24 x 1/2 fasteners.
2. Position the container under the grease drain so the drain spout enters the cover approximately 1-1/2 to 2 in. *(38-51 mm)*.
3. Locate and mark the container mounting holes on the extended base or roof curb.
4. Drill 3/16 in. (*5 mm*) diameter holes in marked locations.
5. Apply container with #10 - 24 x 3/4 fasteners.
6. For most climates, fill container with water (at installation and after each cleaning) until it flows out the drain hole. The unit is now ready for use.

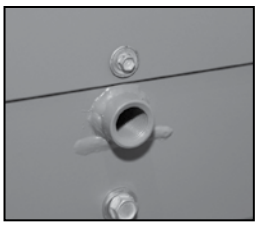
Maintenance

Regular inspection of grease trap is recommended. Depending on the amount of grease discharged through the fan, the grease trap should be changed accordingly to ensure proper operation.

Fan and Plenum Drainage Piping / Trap Detail (By Others)



Fan Drain Connection



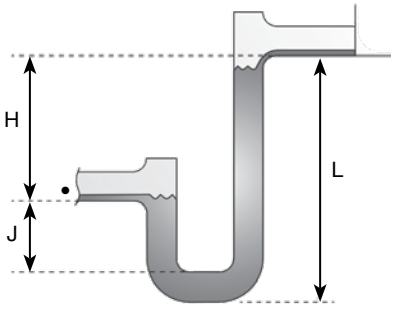
Plenum Drain Connection

There is a location for a pipe connection on each tubular fan housing and bypass air plenum. Each drain may need to be connected to a drainage system to ensure proper disposal of any water or condensate that may occur.

- Drain connections are 1/2-inch NPT
- Installed piping to have a downward angle to allow for drainage
- Fill traps to recommended level before start-up

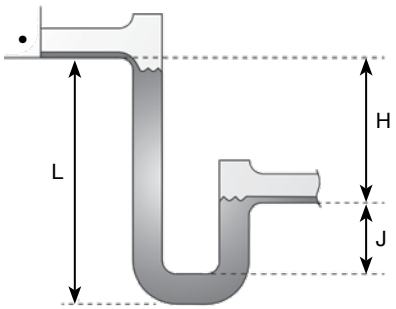
Note: A conservative method of trap design is to set N = total static pressure.

• Connect this end to the fan drain



* A trap is needed for each fan

• Connect this end to the optional BAP drain



H = 1 in. for each inch of maximum negative static pressure plus 1 in.

J = 1/2 of H

L = H + J + Pipe diameter

Electrical Connections

NOTE

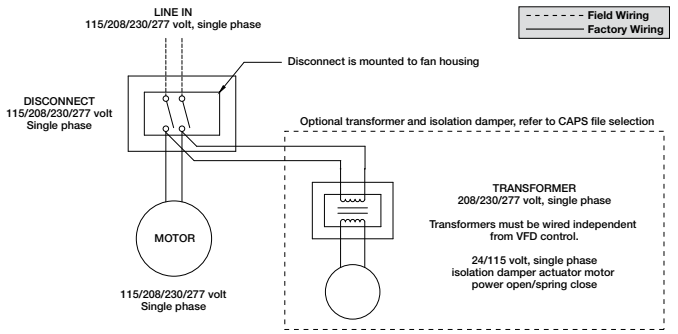
Refer to the Vektor Laboratory Exhaust with Variable Geometry Nozzle (VGN) Technology Electrical Controls Installation, Operation and Maintenance Manual for electrical wiring and connection information.

Before electrical connections are made, the supply voltage, phase and ampere capacity must be checked for compatibility with the fan motor. In addition, the supply wiring must be properly fused and conform to local and national electrical codes. If unit is supplied with a safety disconnect switch, ensure proper wiring to the fan motor. Be sure the disconnect is switched to the "OFF" position before connecting supply wires. If no disconnect is supplied, ensure the supply wire is not live before connection. Supply wires are then connected to the optional safety disconnect switch (if supplied) or motor.

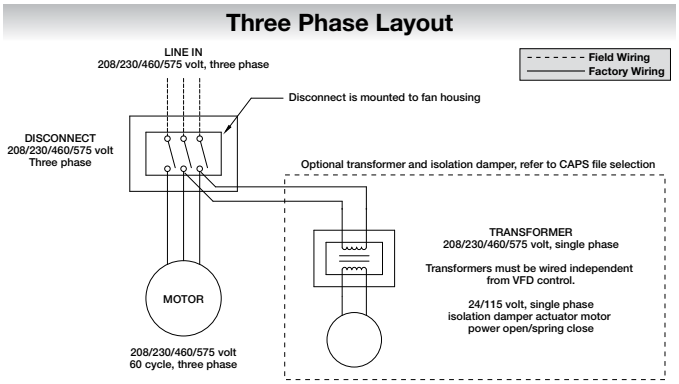
Vektor-H Motor Disconnect and Isolation Damper Wiring Diagram

Disconnect is mounted to fan housing. Transformers are mounted to bypass air plenum with damper actuator motors. For systems that ship unassembled because of physical size, this connection at disconnect from transformers must be field-installed. Wires with conduit and fittings are provided pre-connected to transformers.

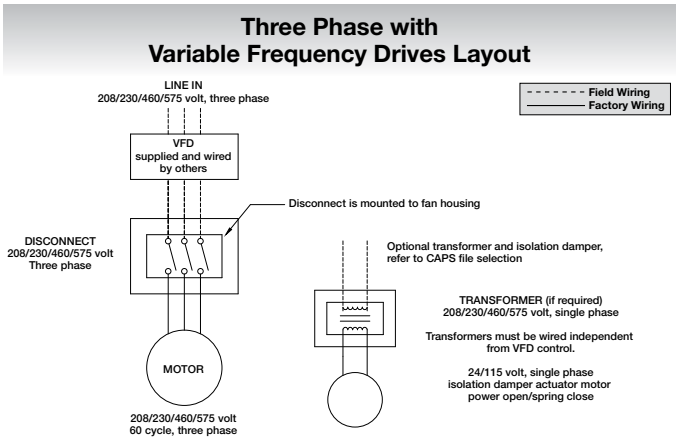
Single Phase Layout



Three Phase Layout



Three Phase with Variable Frequency Drives Layout



Vektor-H Applications with Variable Frequency Drive (VFD)

For Vektor systems with single-point, three-phase wiring per blower, the isolation damper actuator will be powered via a step-down transformer, which is wired to the fan disconnect, as shown in the wiring diagrams on page 10.

If fan flow (motor speed) is to be controlled using a variable frequency drive with this wiring, the reduced voltage and frequency supplied to the fan will cause control problems with the isolation damper actuator.

When a project's Vektor control sequence requires the use of a VFD, it is suggested that the control contractor supply the isolation damper actuator voltage, independent of the power supplied to the Vektor fan motor.

NOTE

For Vektor-HS fans provided from the factory with a VFD, refer to the Vektor Laboratory Exhaust with Variable Geometry Nozzle (VGN) Technology Electrical Controls Installation, Operation and Maintenance Manual for electrical wiring and connection information.

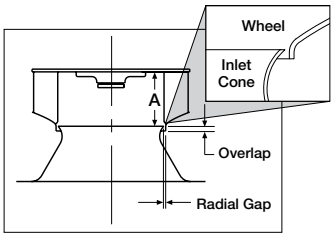
Pre-Start-Up Checks

Check all fasteners for tightness.

Check radial gap, overlap and wheel alignment. The wheel should be aligned as shown. Although the wheel position is preset and the unit is test run at the factory, movement may occur during shipment.

The radial gap should be consistent at all locations between the centrifugal wheel and the inlet cone. Centering may be accomplished by loosening the inlet cone bolts and repositioning the inlet cone.

To obtain the optimum performance, the centrifugal wheel must overlap the inlet cone. Adjustments can be made by loosening the set screws in the wheel and moving the wheel to the desired position.



Wheel rotation should be in the same direction as the rotation decal affixed to the unit. (Counterclockwise rotation is correct as viewed from fan inlet). For 3-phase installations, fan rotation can be reversed by simply interchanging any two of the three electrical leads. For single phase installations, follow the wiring diagram located on the motor.

NOTE

Any increase in fan speed represents a substantial increase in horsepower required from the motor. Always check motor load amperage and compare to nameplate rating when changing fan speed.

	Belt Drive			
	Inlet Cone to Backplate			
Unit Size	A Dimension ± Tolerance		A Dimension ± Tolerance	
	Inches		millimeter	
9	3-3/16	± 1/8	81	± 3
10	3-7/16	± 1/8	87	± 3
12	4	± 1/8	102	± 3
13	4-7/16	± 1/8	113	± 3
16	5-7/16	± 1/8	138	± 3
18	6-3/8	± 1/8	162	± 3
22	7-13/16	± 3/16	198	± 5
24	8-5/8	± 1/4	219	± 6
30	10-9/16	± 3/8	268	± 10
36	12-3/4	± 3/8	324	± 10

	Direct Drive			
	Inlet Cone to Backplate			
Unit Size	A Dimension ± Tolerance		A Dimension ± Tolerance	
	Inches		millimeter	
10	3-1/2	± 1/8	89	± 3
12	4-5/16	± 1/8	125	± 3
13	4-7/8	± 1/8	124	± 3
14	5-7/16	± 1/8	138	± 3
16	6-1/16	± 1/8	154	± 3
18	6-7/8	± 1/8	175	± 3
20	7-11/16	± 1/8	195	± 3

Radial Gap is adjusted by loosening the inlet cone bolts and centering the cone on the wheel. If additional adjustment is required to maintain a constant radial gap, loosening the bearing bolts and centering the wheel is acceptable as a secondary option.

Overlap or offset, is adjusted by loosening the wheel hub from the shaft and moving the wheel to the desired position along the shaft. The transition between the inlet cone and wheel should be as shown above; there is a smooth feel to the profile when moving from one component to the other.

Maintenance

WARNING

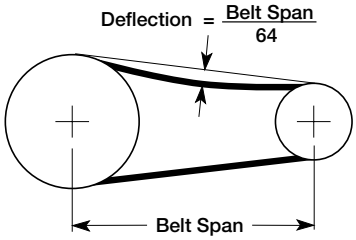
Disconnect all electrical power to the fan and secure to the 'OFF' position prior to inspection or servicing. Failure to comply with this safety precaution could result in serious injury or death.

Once the fan has been put into operation, a periodic maintenance program should be set up to preserve the reliability and performance of the fan. Items to be included in this program are:

- Belts
- Fasteners
- Set Screws
- Motors
- Removal of dust and dirt
- Fan shaft bearings
- Vektor-HS nozzle bearings
- Relubrication schedule

Belts

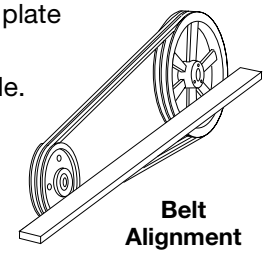
Premature belt failures are frequently caused by improper belt tension (either too tight or too loose) or misaligned pulleys. The proper tension for operating a V-belt is the lowest tension at which the belts will not slip at peak load conditions. For initial tensioning, the proper belt deflection half-way between pulley centers is 1/64-inch for each inch of belt span. For example, if the belt span is 64 inches, the belt deflection should be one inch using moderate thumb pressure at midpoint of the drive.



Belt Tension

Check belt tension two times during the first 24 hours of operation and periodically thereafter. To adjust belt tension, simply loosen four fasteners (two on each side of the motor plate) and slide the motor plate away from the fan shaft until proper belt tension is attained. On some fans, fasteners attaching the motor to the motor plate must be loosened in order to adjust the belt.

It is very important that the drive pulleys remain in proper alignment after adjustments are made. Misalignment of pulleys will result in premature belt wear, noise, vibration and power loss.



Belt Alignment

Fasteners and Set Screws

A periodic inspection should include checking all fasteners and set screws for tightness. Particular attention should be paid to set screws attaching the wheel to the shaft.

Motors

Belt Drive:
Many fractional horsepower motors installed on the smaller fans are lubricated for life and require no further attention. Motors supplied with grease fittings should be greased according to directions printed on the motor.

Direct Drive:
Motor bearings are lubed for life, with no maintenance required.

If motor or wheel needs to be serviced or replaced, use the lifting lugs to pull assembly cartridge out.

Removal of Dust and Dirt

Dirt clogs cooling openings on the motor housing, contaminates bearing lubricant, and collects on the impeller causing severe imbalance if left unchecked. The exterior surface of the motor and impeller should be thoroughly cleaned periodically. Use caution and do not allow water or solvents to enter the motor or bearings. Under no circumstances should motors or bearings be sprayed with steam or water.

Fan Shaft Bearings

The bearings for Greenheck fans are carefully selected to match the maximum load and operating conditions of the specific class, arrangement, and fan size. The instructions provided in this manual and those provided by the bearing manufacturer will minimize any bearing problems. Bearings are the most critical moving part of the fan; therefore, special care is required when mounting them on the unit and maintaining them. Locking collars and set screws, in addition to fasteners attaching the bearing to the bearing plate must be checked for tightness. Greenheck Fan Corporation recommends bearings to be relubricated quarterly at a minimum. All Vektor-H and Vektor-HS fans use Mobil Mobilith SHC 100 synthetic grease conforming to NCGI Grade 2. Never mix greases made with different bases as this will cause a breakdown of the grease and possible failure of the bearing. For specific information, contact the factory representative or the fan system submittals.

- For conditions including temperatures, moisture, dirt or excessive vibration, consult the factory for a specific lubrication interval for your application.
- Lubricant should be a high quality lithium complex synthetic grease conforming to NLGI Grade 2.

- The use of non-synthetic grease will decrease lubrication intervals by approximately 3 times.
- Storage periods of 3 months or longer require monthly rotation of the shaft and purging grease prior to storage and start-up.

Recommended Bearing Lubrication Schedule Relubrication Schedule in Months*				
Fan Size	9 - 13	16 - 22	24	30 - 36
Fan RPM	Bearing Bore (inches)			
	½ - 1	1⅛ - 1½	1⅝ - 1⅞	1 15/16 - 2 3/16
to 250	12	12	12	12
500	12	12	12	12
750	12	12	12	12
1000	12	12	12	12
1250	12	12	12	12
1500	12	12	12	10
2000	12	10	8	6
2500	12	7	5	4
3000	12	5	3	2
3500	12	3	2	0.75
4000	12	2	0.5	
5000	12	1		
Number of shots of grease**	4	8	8	10

* Lubrication interval is based on 12 hour per day operation and maximum 160°F. housing temperature. For 24 hour per day operation, the interval should be cut in half.

** Lubricant should be added with the shaft rotating and until clean grease is seen purging from the bearing. The lubrication interval may be modified based on the condition of the purged grease. If bearing is not visible to observe purged grease, lubricate with number of shots indicated for bore size.

Damper and Damper Actuators

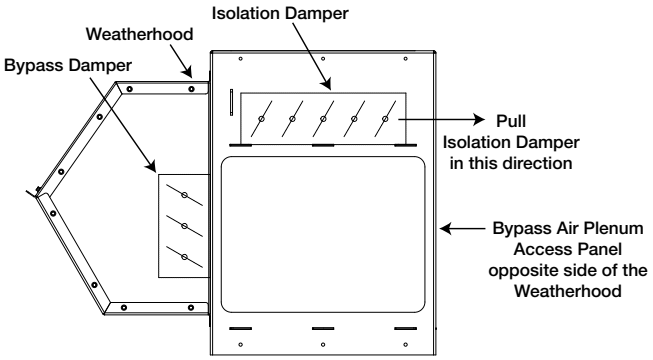
CAUTION

If performing maintenance on the dampers or replacing actuators, disconnect power to damper actuators.

If access is required to a gravity isolation damper, remove the panel opposite the weatherhood on the bypass air plenum section and slide the damper straight out toward you.

When performing maintenance on an isolation damper **with** an actuator, remove the bolted weatherhood, and disconnect the actuator from damper. Then remove the panel opposite the weatherhood on the bypass air plenum section and slide the isolation damper out.

Damper actuators, when supplied by Greenheck, are designed to be maintenance free. No lubrication is required.



Vektor-HS Nozzle Bearings

The bearings for the HS nozzle assembly are permanently lubricated and do not require additional grease.

Field Coating Touch-Up for Scratched Areas

Standard coating and color is LabCoat™ RAL 7023 Concrete Grey.

Failure to perform touch-ups may result in rust or corrosion which can accelerate color fade. This not covered under warranty.

TOUCH-UP PAINT REPAIR KIT CONTENTS

- One Zinc Clad Aerosol Can
- One pint (recoat epoxy primer grey) with one pint (recoat epoxy primer catalyst)
- One quart H.S. Polyurethane
- One Scotch-Brite scratch pad
- Two 1-1/2 inch wide paint brushes
- Four pint-sized empty cans for mixing
- One quart-sized empty can for mixing
- Zinc repair instructions
- MSDS sheets

NOTE

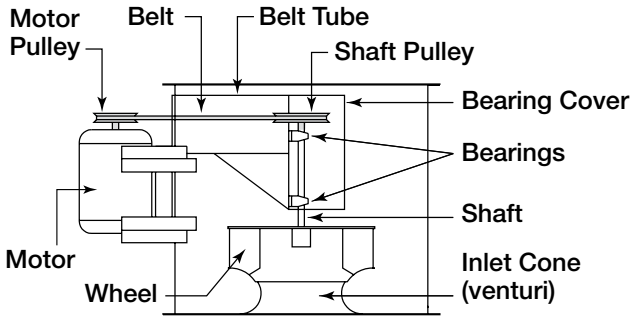
While the manufacturer provides heavy-duty, quality products for marine environments, routine paint touch-ups may be required in coastal regions where salt or marine air could damage the coating. The severe environment will accelerate the damage from any scratches or chips and it is recommended that those be repaired immediately.

To order a coating repair kit, please reference part number **HAZ2597 PNT FIELD REPAIR KIT, RAL7023 CONCRETE GREY**. Please contact factory with your fan's serial number for colors other than our standard.

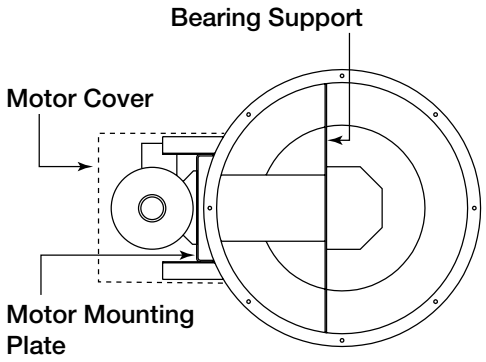
Vektor-H and Vektor-HS Exhaust Fan Parts List and Assembly

Each fan bears a manufacturer's nameplate with model number and serial number embossed. This information in addition to the parts list shown, will assist the local sales representative and the factory in providing service and replacement parts.

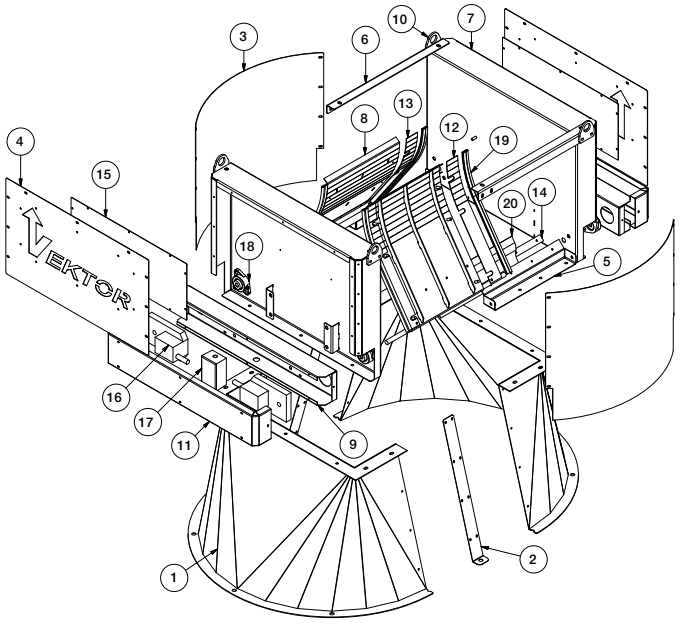
Side View

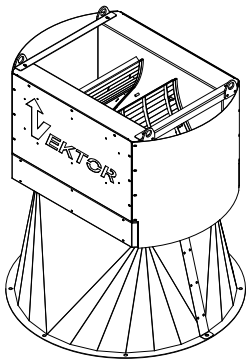


Top View



Vektor-HS Nozzle Parts List and Assembly





Item	Quantity	Description
1	2	Transition Weld
2	2	Transition side cover
3	2	Wind wrap round
4	2	Wind wrap flat
5	2	Frame bottom bar
6	2	Frame top bar
7	2	Frame weld
8	2	Blade weld
9	1 or 2*	Actuator mount
10	4	Lifting point
11	1 or 2*	Actuator cover
12	2	Blade seal, right
13	6	Blade seal, left
14	4	Flex backing
15	2	Vektor backing
16	1 or 2*	Actuator
17	1	Electrical box
18	4	Bearing
19	4	Blade seal
20	2	Flex seal

*Quantity 1 for sizes 9 thru 13
Quantity 2 for sizes 16 thru 36

Maintenance Log

Date _____Time _____ AM/PM

Notes:_____

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Date _____Time _____ AM/PM

Notes:_____

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Date _____Time _____ AM/PM

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Date _____Time _____ AM/PM

Notes:_____

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Our Commitment

As a result of our commitment to continuous improvement, Greenheck reserves the right to change specifications without notice.

Product warranties can be found online at Greenheck.com, either on the specific product page or in the literature section of the website at Greenheck.com/Resources/Library/Literature.

Greenheck's Vektor-H and Vektor-HS,Vektor-MS and Vektor-CS catalogs provides additional information describing the equipment, fan performance, available accessories, and specification data.

AMCA Publication 410-96, Safety Practices for Users and Installers of Industrial and Commercial Fans, provides additional safety information. This publication can be obtained from AMCA International, Inc. at www.amca.org.

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Installation, Operation and Maintenance Manual

Please read and save these instructions for future reference. Read carefully before attempting to assemble, install, operate or maintain the product described. Protect yourself and others by observing all safety information. Failure to comply with these instructions will result in voiding of the product warranty and may result in personal injury and/or property damage.

Sure-Aire™ Electronics Features:

- LCD display with user-friendly touch panel interface
- NEMA-4/IP56 enclosure rating
- Factory calibrated
- Programmable elevation
- English or metric readings
- 24 VAC/DC or 100-240 VAC 50/60 Hz input voltage
- Part numbers and pressure ranges:
  386719 – 0-4.15 in. wg
  386720 – 0-8.30 in. wg
  386721 – 0-22.14 in. wg
  386722 – 0-41.52 in. wg
  386723 – 0-83.14 in. wg
  386724 – 0-138.40 in. wg
  Pressure ranges reflect differential pressures between the fan inlet and inlet cone, not system static pressure.
- Isolated output, linear to differential pressure or volume
  4-20 mA
  2-10 VDC
- Communication protocols
  BACnet MSTP
  Modbus
- Temperature compensation for air density

Tools Required

- Four (4) #8-32 screws
- 1/4-inch nylon tubing (length dependent on distance between fan and Sure-Aire electronics, maximum 75 feet *(23 m)* each line)
- Sensor wiring for temperature sensor (if temperature sensor is being used)

Flow Accuracy – +/- 3.0% of actual flow

Transducer in Electronics

- Accuracy +/- 0.5% of full scale at 77°F (*25°C*)
- Pressure limit: 70 psi (1938 in. wg)
- Thermal effects: 0.015%/°F (*0.027%/°C*) from -13° thru 185°F (*25° thru 85°C*)

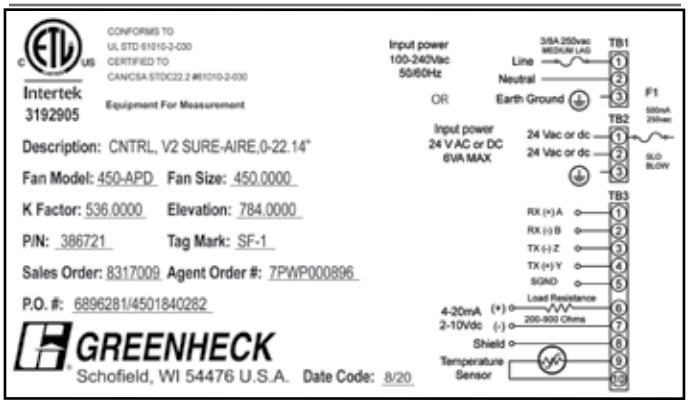
WARNING

Improper installation, adjustment, alterations, service or maintenance may cause injury and/or property damage, as well as possibly void the factory warranty. No person may install, operate, or maintain a Sure-Aire™ electronics without first being fully trained and qualified in the installation, operation and maintenance, and carefully reading and understanding the contents of this manual. If you have any questions about these instructions, contact your local representative.

CAUTION

Risk of electrical shock! More than one disconnect switch may be required to de-energize the equipment before servicing.

Label Information



General Information

This instruction manual provides installation, operating, maintenance, and other information for the Sure-Aire™ electronics.

Receiving

Upon receiving the electronics, check to ensure all items are accounted for by referencing the packing list. Inspect each crate or carton for shipping damage before accepting delivery. Alert the carrier of any damage detected. The customer will make notification of damage (or shortage of items) on the packing list and all copies of the bill of lading which is countersigned by the delivering carrier. If damaged, immediately contact your local sales representative. Any physical damage to the unit after acceptance is not the responsibility of the manufacturer.

Unpacking

Verify that all required parts and the correct quantity of each item have been received. If any items are missing, report shortages to your local representative to arrange for obtaining missing parts.

Storage

Electronics are protected against damage during shipment. If the electronics cannot be installed and operated immediately, precautions need to be taken to prevent deterioration during storage. The user assumes responsibility of the electronics and any accessories while in storage. The manufacturer will not be responsible for damage during storage. These suggestions are provided solely as a convenience to the user.

The ideal environment for the storage of electronics is indoors, above grade, in a low humidity atmosphere which is sealed to prevent the entry of blowing dust, rain or snow. Temperatures should be evenly maintained between 30° to 110°F (*-1° to 43°C*). Wide temperature swings may cause condensation and “sweating” of metal parts. All accessories must be stored indoors in a clean, dry atmosphere.

Removing from Storage

As electronics are removed from storage to be installed in their final location, they should be protected and maintained in a similar fashion until the control goes into operation. Environmental Operation Range: -4° to 140°F (*-20° to 60°C*).

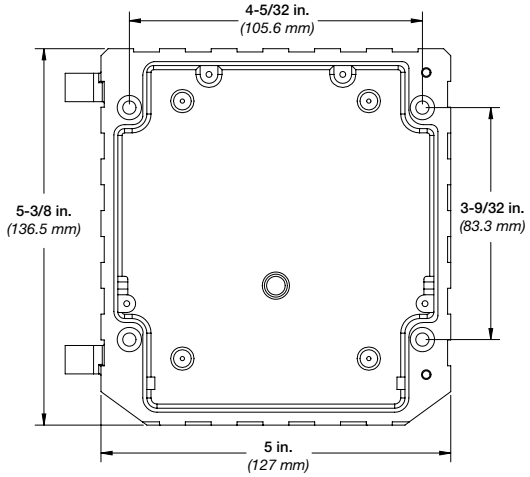
Installation

WARNING

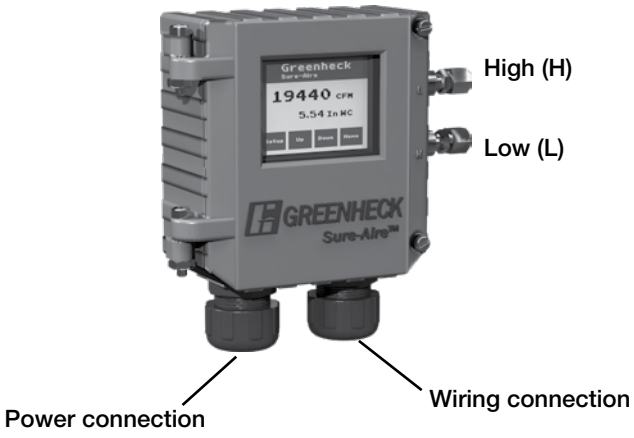
When wiring the electronics, you must follow industry standard practices for controls and protect against electrostatic discharge (ESD). Failure to exercise good ESD practices may cause damage to the electronics.

1. Mount the electronics in the vertical plane using four (4) #8-32 screws, field supplied. Open the front cover by unscrewing the two captive thumb screws to gain access to the four mounting locations.

   Note: Mount the Sure-Aire™ electronics within 75 feet of the fan.



2. Use 1/4-inch nylon tubing to connect the corresponding High (H) and Low (L), 1/4-inch quick connect, pressure ports of the Sure-Aire™ electronics to the high and low pressure ports on the fan.



3. **Connect supply power:**
   Two input power options are available: 24 VAC/DC or 100-240 VAC. The wiring for each can be seen on page 4. Use 1/2-inch liquid tight conduit to meet full IP rating.

Installation (continued)

4. **Optional Wiring Connections:**

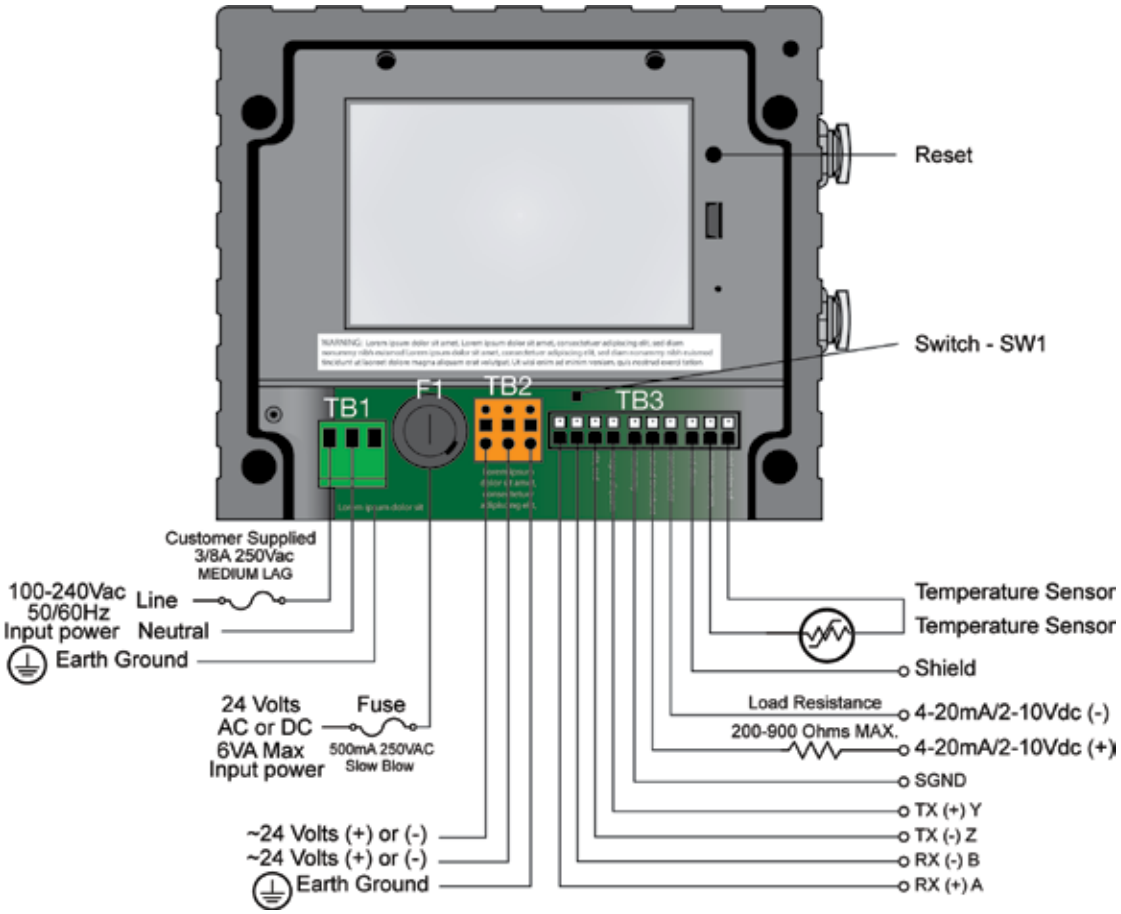
   4.1 **Analog Output Signal:**
   Both 4-20mA and 2-10VDC are available. Connect signal wire into corresponding terminals on block TB3. If using 4-20 mA, a load resistor between 200 and 900 ohms is required, field supplied. If two or more outputs share a common connection, a signal isolator may be required.
   Update settings within electronics (see page 7): Use the touch screen to select the 4-20 mA or 2-10 VDC output signal via the setup menu.

   4.2. **Network Protocol:**
   Both BACnet MSTP and Modbus RTU are enabled. Connect appropriate wiring to block TB3. Adjust switch, SW1, to 2-wire (left) or 4-wire (right) as required. Reference network protocol section for more information.
   Update settings within electronics (page 7):
   Switch SW1: 2-Wire/4-Wire
   Select:
   - Left Position = 2-Wire
   - Right Position = 4-Wire

   4.3. **Temperature Density Compensation:**
   Temperature compensation can adjust airflow calculation based on changing airstream temperatures. If temperature compensation is not used, the air density value will be a function of standard air (70°F/*21°C*).
   The supplied sensor measures the exterior temperature of the ductwork, only screw holes are required. Mount the sensor in contact with the ductwork.
   Wire the temperature sensor into corresponding terminals on block TB3 (wiring supplied by others).
   Update settings within electronics (page 5): In the setup menu change Temperature Compensation to “Yes”. Confirm that this is set to “Yes”.

5. **Close and tighten screws on cover:**
   When the required preceding steps are complete, make sure the front cover is properly aligned to the housing and the two captive thumb screws are securely tightened.

Wiring Diagram

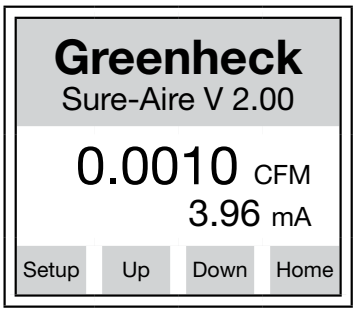


Display Setting Options and Setup

Navigation Buttons

The electronics is equipped with a touchscreen LCD display. There are 4 navigation buttons on the bottom of the screen. Button names will change based on the parameter you are in (i.e. “Setup” will change to “Home” and “Home” will change to “Edit”).

Home Screen



To view settings use the “Up” and “Down” buttons to scroll through the list. To adjust settings, press “Setup” and scroll through the settings. Below is information on the adjustable settings.

Settings Menu

Home Screen: Top/Bottom View: Press “Edit“ to change Main Display Value. Press “Prev“ or “Next“ to adjust what reading displays on the Home screen, then press “Enter“ to store the value.

- Flow (default top display)
- Pressure
- Temperature
- Air density
- Output signal (default bottom display)
- Velocity
- None

Measurement System: Press “Edit“ to change the measurement system units. Press “Prev“ or “Next“ to adjust, then press “Enter“ to store the value.

- English (default)
- Metric

K-Factor: Press “Edit“ to change K-Factor. Press “Inc“ or “Dec“ to adjust, then press “Enter“ to store the value.

- 200 to 30,000
  (Factory set to fan model and size)

Elevation: Press “Edit“ to change elevation. Press “Inc“ or “Dec“ to adjust, then press “Enter“ to store the value.

- 0 - 10,000 ft
  (0 ft default)

Outlet Area: Press “Edit“ to change the stack outlet area. Press “Inc“ or “Dec“ to increase or decrease the area, respectively. Then press “Enter“ to store the value.

- 0-10 Ft^2

Display Brightness: Press “Edit“ to change brightness. Press “Inc“ or “Dec“ to adjust, then press “Enter“ to store the value.

- 10 - 100%
  (80% default)

Air Flow Units: Press “Edit” to change Air Flow Units. Press “Prev” or “Next” to adjust, then press Enter to store the value.

- CFM (default)
- m^3/hr
- m^3/min

Pressure Units: Press “Edit“ to change pressure units. Press “Prev“ or “Next“ to adjust, then press “Enter“ to store the value.

- In. wg (default)
- Ft wg
- mm wg
- cm wg
- PSI
- In. Hg
- mm Hg
- mBar
- Pa
- kPa - kilopascals (1kPa = 1000 Pa)
- hPa - hectopascals (1hPA = 100 Pa)
- Oz. In.

Temperature Compensation: Press “Edit“ to change Temperature Compensation. Press “Prev“ or “Next“ to adjust, then press “Enter“ to store the value.

- Yes (default)
- No

Note: If temperature compensation is set to “No“, the air density will be a function of standard temperature (70°F/*21°C*).

Analog Output Signal: Press “Edit“ to change Output Signal type. Press “Prev“ or “Next“ to adjust, then press “Enter“ to store the value.

- 4-20 mA (default)
- 2-10 VDC

Linearize By: Press “Edit“ to change the linearization settings. The electronics will linearize the electronics output with respect to this setting.

- Flow (default)
- Pressure

Note: The maximum measurable flow rate will automatically calculate based on the electronics settings. The maximum flow rate is displayed on the screen.

WARNING

Due to load resistance change from product to product, it may be necessary to recalibrate the 4-20 mA electronics. See 4-20 mA transducer calibration procedure.

Display Setting Options and Setup (continued)

Network Protocol: See page 7. Select the appropriate protocol, baud rate and network address.

Defaults

Load Factory Defaults: Press “Edit“ to load factory defaults. Press “Prev“ or “Next“ to select “Yes“, then press “Enter“**.**

- No (default)
- Yes (changes all settings to factory default)

Load Customer Defaults: Press “Edit“ to load customer defaults. Press “Prev“ or “Next“ to select “Yes“, then press “Enter“.

- No (default)
- Yes (loads all customer default settings)

Save Customer Defaults: Press “Edit“ to save current electronics settings as the customer default. Press “Prev“ or “Next“ to select “Yes“, then press “Enter“.

- No (default)
- Yes (saves current settings as the customer default)

Network Protocol - Optional

Greenheck’s Sure-Aire™ electronics has the ability to connect to a Building Automation System (BAS) through the on-board RS-485 port. The electronics can be configured as either BACnet MS/TP or Modbus RTU Slave. When in the display menu, scroll through the options until the Network Protocol screen. Pressing edit will permit changing the network protocol type and associated data. This information should be set to match the BAS.

BACnet MS/TP Server

When the electronics is configured for BACnet, it will expose a total of eight (8) objects on the network.

BACnet MS/TP Server Device Settings	
Setting	Value
Baud Rate	Set to match BMS
Parity	No Parity (1 Stop Bit)
APDU Timeout (ms)	1000
Number of APDU Retries	3
Max Master Address	127
Max Info Frames	1

BACnet MS/TP Server Objects			
Object Name	Object Type	Data Type	Units
Sure-Aire™	Device Object	N/A	N/A
K-Factor	Analog Input	16-Bit Unsigned	None
Elevation	Analog Input	16-Bit Unsigned	None
Outlet Area	Analog Input	32-Bit Floating Point	None
Flow Temperature	Analog Input	16-Bit Signed	None
Pressure	Analog Input	32-Bit Floating Point	None
Volume	Analog Input	32-Bit Floating Point	None
Velocity	Analog Input	32-Bit Floating Point	None

Modbus RTU Slave

When the electronics is configured for Modbus, it will expose a total of seven (7) registers on the network. The Modbus RTU Slave settings and list of registers can be seen below.

Modbus RTU Slave Device Settings	
Setting	Value
Baud Rate	Set to match BMS
Parity	No Parity (1 Stop Bit)
Timeout (ms)	0
Response Delay (ms)	0

Modbus RTU Slave Registers			
Register Name	Register Type	Data Type	Units
K-Factor	Input Register	16-Bit Unsigned	None
Elevation	Input Register	16-Bit Unsigned	None
Outlet Area	Input Register	16-Bit Unsigned	None
Flow Temperature	Input Register	16-Bit Unsigned	None
Pressure	Input Register	16-Bit Unsigned	None
Volume	Input Register	16-Bit Unsigned	None
Velocity	Input Register	16-Bit Unsigned	None

NOTE

All of the objects/registers that are exposed on the network do not have a unit associated with them. The units of the values exposed on the network will be based on the units that are selected on the Sure-Aire™ electronics.

Analog Output Signal - Optional

Greenheck's Sure-Aire™ differential pressure electronics provides either a 2-10 VDC or 4-20 mA analog output signal. The output signal can be configured linearly proportional to either the pressure range or the flow within the setup. The ranges for Greenheck's Sure-Aire™ electronics are listed by model on cover.

Voltage and Amperage Signal

If using the analog signal linear to flow, the max flow is automatically calculated based on the pressure range and K-factor input into the electronics. The max value is displayed in the setup menu.

If output signal is linear to pressure, the corresponding equations are used to calculate the flow.

Calculating flow for 2-10 VDC output signal:

$$CFM = K\sqrt{\frac{(V - 2)\,P_{max}}{8\rho}}$$

K	Constant dependent on fan model and size (see page 9)
Pmax	Maximum pressure of electronics (in. wg)
ρ	Air density (lb/ft³ °F) [0.075 at 70°F and 0 ft elevation]
V	Output voltage of 2-10 VDC signal
mA	Output current of 4-20 mA signal

Calculating flow for 4-20 mA output signal:

$$CFM = K\sqrt{\frac{(mA - 4)\,P_{max}}{16\rho}}$$

Calculation Using Manual Pressure Gauge or Third Party Transducer

Flow Rate Equation

The volumetric flow through the fan (cfm) can be calculated from the equation:

$$CFM = K\sqrt{\frac{\Delta P}{\rho}}$$

where K is the K-Factor for the specific fan model and size, ΔP is the measured differential pressure across the inlet cone (in. wg), and ρ is the density of air (lb/ft³ °F).

Transducer Recalibration Procedure

The electronics are calibrated per order at the factory. Under certain circumstances, there may be a discrepancy of calibration once installed on site. The following procedure is used to re-calibrate the pressure trandsucer within the electronics. In the event an error occurs trying to re-calibrate, the transducer parameters can be re-set to factory settings using “Load Factory Settings” within the setup menu.

Equipment

Digital multimeter.

Vacuum pressure device with gauge (only needed if calibrating upper range).

200-900 ohm resistor (only needed if calibrating using 4-20 mA).

NOTE

Setup can be changed to 2-10 volts for calibration and then back to 4-20mA.

Procedure

1. Remove power to the electronics.
2. Remove any wires connected on the analog outputs.
3. Remove tubing from Sure-Aire™ electronics box, box uses push-to connect fittings. Push in on plastic ring and pull on tubing to remove.
4. Connect multimeter to analog points on terminal strip. If calibrating using 4-20 mA, a series load resistor between 200 and 900 ohms is required.
5. Set multimeter to the correct measurement units, VDC or mA.
6. Apply power to the Sure-Aire™ electronics.
7. Press the “Setup“ button on the LCD panel.
8. Verify the analog signal is setup for your measurement and that the signal is linear to Differential Pressure.
9. Go to the “Trans Min/Trans Max” screen. Record the values for each. It is correct that the trans min value is higher than the trans max value.
10. Press “Enter/Edit”.
11. With all tubing removed, adjust the trans min value up/down until the multimeter reads either 2 VDC or 4 mA.
12. Press “Next”. If only calibrating low value, press “Enter” to complete.
13. To calibrate upper range, apply the pressure device to the high port and pull vacuum to maximum pressure on Sure-Aire™ label.
14. Adjust the trans max value up/down until the multimeter reads either 10 VDC or 20 mA.
15. Press “Enter” to store the new value.
16. Press “Exit” to return to the main screen.
17. Go to “Save Customer Defaults” and save for future resetting to the changes.

K-Factors

Size	APD	Size	APH / APM HPA	AFDW / BIDW	FJI	QEI / QEID	USF-500 & Vektor-C series	Vektor-H Belt Drive	Vektor-M series
315	257	7	not applicable	not applicable	179	not applicable	179	not applicable	not applicable
355	329	8	not applicable	not applicable	179	not applicable	179	not applicable	not applicable
400	406	9	not applicable	not applicable	179	408	179	248	not applicable
450	536	10	not applicable	not applicable	179	not applicable	179	202	not applicable
500	652	12	355	592	244	408	244	296	not applicable
560	847	13	not applicable	701	not applicable	not applicable	296	351	not applicable
630	1053	15	355	861	366	603	366	not applicable	526
		16	421	1062	not applicable	724	443	531	634
		18	517	1083	542	897	542		787
		20	617	1301	651	1088	651	not applicable	955
		22	759	1610	805	1321	805		1161
		24	913	1964	976	1631	976		1436
		27	1105	2369	not applicable	1962	1186	not applicable	1729
		30	1355	2928	not applicable	2400	1464		2116
		33	1625	3540	not applicable	2923	1771	not applicable	2581
		36	1967	4336	not applicable	3576	2167		3154
		40	2361	5259	not applicable	4331	2635	not applicable	3825
		44	2854	6440	not applicable	5318	3220	not applicable	4698
		49	3411	7808	not applicable	6525	3905	not applicable	5766
		54	4121	9571	not applicable	7891	4786	not applicable	6975
		60	4972	11707	not applicable	9648	5855	not applicable	not applicable
		66	5960	14166	not applicable	not applicable	7084	not applicable	not applicable
		73	7276	17330	not applicable	not applicable	8667	not applicable	not applicable

Vektor-H Direct Drive

Fan Size	Nozzle Size															
	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
10	487	511	540	547	554	563	573	–	–	–	–	–	–	–	–	–
12	577	616	664	674	685	697	700	704	708	–	–	–	–	–	–	–
13	–	–	–	839	851	861	868	872	876	880	–	–	–	–	–	–
14	–	–	–	–	1223	1239	1257	1260	1263	1267	1272	–	–	–	–	–
16	–	–	–	–	1290	1409	1542	1563	1586	1587	1588	1597	1607	–	–	–
18	–	–	–	–	–	1923	1937	1952	1965	1979	1990	2003	1994	1983	1995	2007
20	–	–	–	–	–	2248	2296	2348	2367	2387	2408	2431	2432	2432	2429	2426

Our Commitment

As a result of our commitment to continuous improvement, Greenheck reserves the right to change specifications without notice.

Product warranties can be found online at Greenheck.com, either on the specific product page or in the literature section of the website at Greenheck.com/Resources/Library/Literature.

Greenheck's Sure-Aire™ Flow Monitoring System catalog provides additional information describing the equipment, fan performance, available accessories, and specification data.

AMCA Publication 410-96, Safety Practices for Users and Installers of Industrial and Commercial Fans, provides additional safety information. This publication can be obtained from AMCA International, Inc. at www.amca.org.

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Installation, Operation and Maintenance Manual

Please read and save these instructions for future reference. Read carefully before attempting to assemble, install, operate or maintain the product described. Protect yourself and others by observing all safety information. Failure to comply with these instructions will result in voiding of the product warranty and may result in personal injury and/or property damage.

Table of Contents

Reference part number listed in chart to locate specific motor information page number.

HP	Voltage	* RPM Range	Encl.	FLA	Control Method	Motor Part No.	Pg.
1/15	115-120/ 208-230	300-1750	TENV	1.3/0.65	0-5V Only	328447	5
					Pot Only	328448	5
1/10	115	300-1725	TENV	1.5	Pot/0-10V	318003	4
	115/208-230/277	300-1750	ODP	1.38/ 0.84/0.73	Pot/0-10V	319356	4
	115/208-230/277	350-1750	TENV	1.5/1.1/ 0.9	Pot/0-10V	328128	4
1/6	115/208-230/277	300-1750	ODP	2.2/1.3/ 1.1	Pot/0-10V	319357	4
	115/208-230/277	350-1750	TENV	2.3/1.5/ 1.2	Pot/0-10V	328129	4
	115	300-1750	TENV	2.6	Pot/0-10V	318004	4
				3.1	0-10V Only	311352	3
				3.1	Pot Only	311353	
				3.1	Pot/0-10V	311731	3
				2.45		312359	
						313712	
						317886	
	208-240	300-1750	TENV	1.6	Pot/0-10V	313233	3
						313713	
	277	350-1750	TENV	1.15	Pot/0-10V	316495	3
1/4	115/208-230/277	300-1750	ODP	2.85/ 1.7/1.5	Pot/0-10V	318013	4
	115/208-230/277	350-1750	ODP	4.2/2.6/ 2.4	Pot/0-10V	328130	4
	115	300-1725	ODP	3.9	0-10V Only	310107	3
					Pot Only	310108	
				3.5	Pot/0-10V	311377	3
						313714	
						317887	
	208-240	300-1725	ODP	2.3	Pot/0-10V	313234	3
						313715	
	277	300-1725	ODP	1.8	Pot/0-10V	316496	3
1/3	115/208-230/277	300-1750	ODP	4.4/2.6- 2.4/2.2	Pot/0-10V	320587	4
	115/208-230/277	350-1200	TENV	4.75/ 2.95/2.4	Pot/0-10V	328173	4
	115/208-230/277	350-1550	TENV	4.1/2.4 2.2	Pot/0-10V	328174	4
1/2	115	300-1725	ODP	6.2	0-10V Only	309025	3
				5.5	Pot Only	309028	
				6.2	Pot/0-10V	311812	3
	208-240	300-1725	ODP	4.2	Pot/0-10V	313235	3
	277	350-1725	ODP	3.3	Pot/0-10V	316497	3

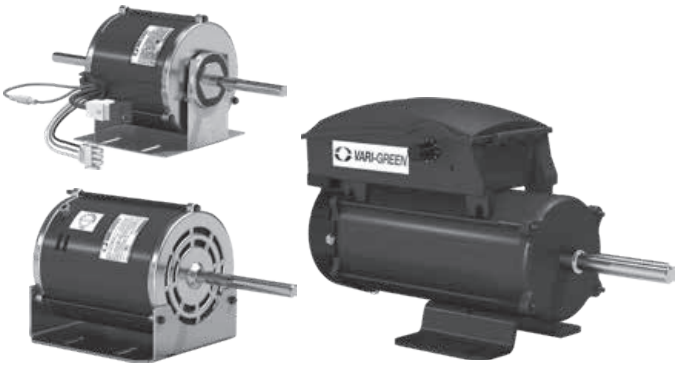
HP	Voltage	* RPM Range	Encl.	FLA	Control Method	Motor Part No.	Pg.
1/2	115	300-2500	ODP	4.0	0-10V Only	310307	3
				6.5	Pot Only	310476	
				6.9	Pot/0-10V	312360	3
	208-240	350-2500	ODP	4.9	Pot/0-10V	317706	3
	277	350-2500	ODP	3.27	Pot/0-10V	317707	3
	115/208-230/277	300-1750	ODP	6.4/3.8- 3.6/3.2	Pot/0-10V	320588	4
	115/208-230/277	350-1750	ODP	6.2/4.0/ 3.2	Pot/0-10V	328131	4
	115/208-230/277	350-2500	ODP	6.6/4.0/ 3.25	Pot/0-10V	328178	4
3/4	115	300-1725	ODP	10.1	0-10V Only	309026	3
				10.1	Pot Only	309029	
				10.6	Pot/0-10V	311388	3
						312619	
	208-240	300-1725	ODP	6.6	Pot/0-10V	314534	3
	277	350-1725	ODP	5.4	Pot/0-10V	316498	3
	115	300-2200	ODP	11.3	0-10V Only	310306	3
				11.3	Pot Only	310475	
				11.3	Pot/0-10V	312361	3
	208-240	350-2200	ODP	5.6	Pot/0-10V	317708	3
	277	350-2200	ODP	4.7	Pot/0-10V	317709	3
	115/208-230/277	300-1750	ODP	8.8/5.4- 5.0/4.8	Pot/0-10V	320589	4
	115/208-230/277	350-1750	ODP	11.0/ 7.0/6.3	Pot/0-10V	328132	4
	115/208-230/277	350-2200	ODP	10.5/ 6.5/5.0	Pot/0/10V	328179	4
1	115	300-1725	ODP	12.4	Pot/0-10V	310359	3
						312362	
	115/ 208-240	300-1725	TEFC	12.0/6.0	Pot/0-10V	311156	5
	208-240	300-1725	ODP	8.6	Pot/0-10V	314945	3
	277	350-1725	ODP	7.3	Pot/0-10V	316499	3
	115/208-230/277	300-1750	TENV	11.5/7.0- 6.5/5.8	Pot/0-10V	320590	4
	115/208-230/277	350-1750	ODP	13.0/ 8.0/6.7	Pot/0-10V	328133	4
2	208-240	300 - 1725	TEFC	12.0	Pot/0-10V	310420	5

*****Actual maximum RPM may vary. See RPM column in chart on page 11 for specific motor and fan combinations.

Controls 7-11
Maximum RPM Table 12

Vari-Green® Motor

The Vari-Green Motor is an electronically commutated (EC) motor that uses AC input power and internally converts it to a DC power supply which provides an 80% turndown capability and increased energy savings.



NOTE

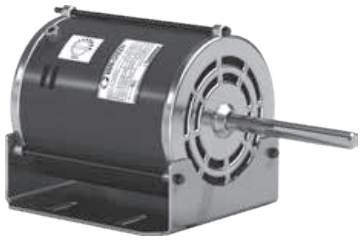
When using a clamp meter to measure input amp draw, the meter must be capable of reading a non-linear current. Erroneous readings will occur otherwise.

WARNING

To reduce the risk of fire or electric shock, do not use this motor with any solid-state speed control device.

Features, Operation and Wiring, and Troubleshooting

Features



Soft start – All motors feature soft-start technology which eliminates inrush current at start-up. The motors will reliably start at any speed setting.

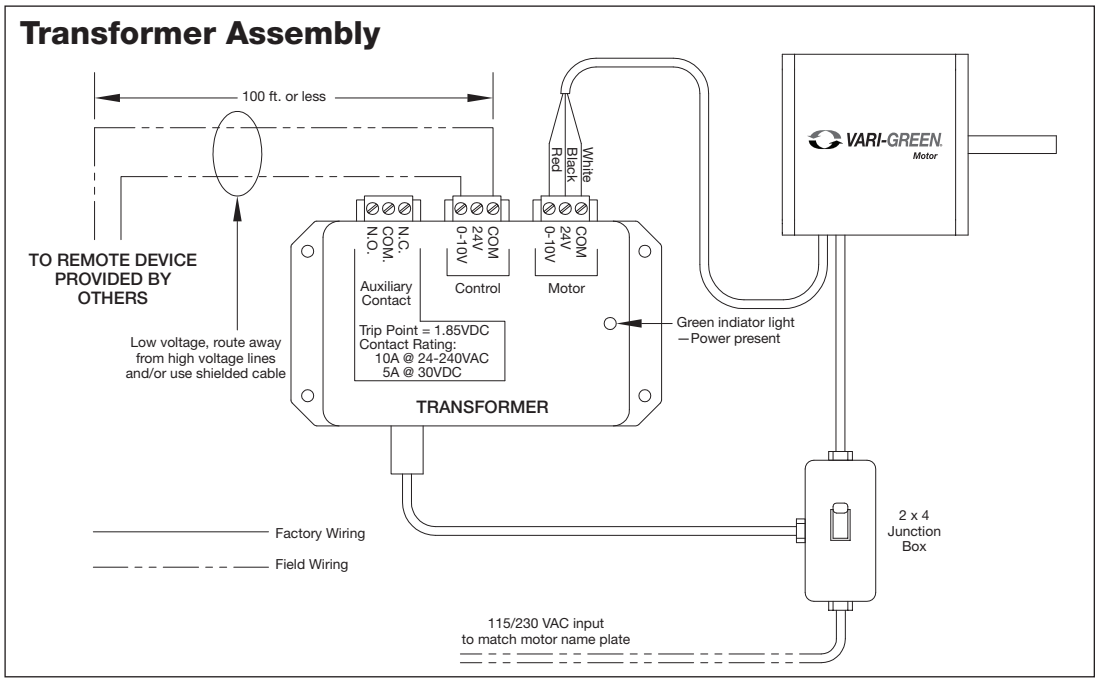
Overload protection – If the motor becomes overloaded, it will automatically reduce its speed until it is no longer overloaded. This means that the motor will never operate in the “service factor” which is possible with many AC motors.

Locked rotor protection – If the motor ever encounters a locked-rotor scenario, the motor will automatically shut itself down. It will try to restart up to 3 times, and if after the 3rd time the motor will still not rotate, the motor will not attempt to start again until power is cycled.

Thermal protection – The motors have a one-shot fuse thermal protector. This is meant to protect the motor from a severe temperature rise. Additionally, the motors have on-board temperature sensors which will reduce the speed of the motor should it become too hot. The fuse is used as a last resort to prevent a fire.

RPM measurement – The motors have a small shaft extension on the end of the motor to measure motor RPM with either a contact or optical tachometer.

Fig. 1 **0-10 VDC External connection with factory mounted transformer (See page 4 for details)**



Operation and Wiring
- Potentiometer Dial Only

Part Numbers Covered in this Section				
309028	309029	310108	310475	310476
311353				

These motors feature a potentiometer dial on the motor for speed adjustment. A small screwdriver can be used to make the speed adjustment. To increase the speed, rotate the dial clockwise. To decrease the speed, rotate the dial counterclockwise.

The motor is pre-wired at the factory and cannot be changed inside the motor. Connect single-phase power at the voltage listed on the nameplate.

These motors cannot be converted to receive a remote control signal – a different motor is needed. Please consult the factory.

Operation and Wiring
- 0-10V Input Only

Part Numbers Covered in this Section				
309025	309026	310107	310306	310307
311352				

These motors will accept a 0-10 VDC control signal for speed control. From 0-1.9V, the motor will be off, and will operate in the 2-10V range. 24 VAC/DC power is also required for operation. The motor will consume 0.7VA at 24 VAC or 25mA at 24 VDC. A factory mounted transformer is available to supply this voltage. (See Fig. 1)

The motor is pre-wired at the factory and cannot be changed inside the motor. Connect single-phase power at the voltage listed on the nameplate, along with the 0-10 VDC and 24V signal for speed control.

NOTE: The motor will not operate without the proper control voltages.

Operation and Wiring
- Potentiometer Dial and 0-10V Input

Part Numbers Covered in this Section				
310359	311731	311377	311388	311812
312359	312360	312361	312362	312619
313233	313234	313235	313712	313713
313714	313715	314534	314945	316495
316496	316497	316498	316499	317706
317707	317708	317709	317886	317887

These motors have both a potentiometer dial on the motor for speed adjustment AND have the ability to accept a 0-10 VDC signal for remote speed control.

There is a 4 second delay between the application of power and the motor starting.

The motor is pre-wired at the factory and cannot be changed inside the motor. Connect single-phase power at the voltage listed on the nameplate. If remote control is desired, connect the 0-10 VDC and 24V signal for remote speed control.

Dial on Motor – A small screwdriver can be used to make the speed adjustment. To increase the speed, rotate the dial clockwise. To decrease the speed, rotate the dial counterclockwise. There is no need to connect the control wires.

0-10 VDC signal – The dial on the motor must be rotated fully clockwise to achieve the full speed range. If this is not done, the dial will act as a maximum speed limiter.

From 0-1.9V, the motor will be off, and will operate in the 2-10V range. 24 VAC/DC power is also required for operation. The motor will consume 0.7VA at 24 VAC or 25mA at 24 VDC. A factory mounted transformer is available to supply this voltage. (See Fig. 1, page 2)

A low voltage wiring harness is needed to supply the 0-10V signal to the motor. This harness is available from the factory if conversion is necessary.

Low Voltage Harness Part Numbers			
Type	**Use with Motor**	**18 in. long**	**36 in. long**
3-pin	311731, 310359	384431	384432
9-pin	311377, 311812, 311388, 312359, 312360, 312361, 312362, 312619, 313233, 313234, 313235, 313712, 313713, 313714, 313715, 314534, 314945, 316495, 316496, 316497, 316498, 316499, 317706, 317707, 317708, 317709, 317886, 317887	384804	384805

NOTE

The 9-pin connector on the motor contains 6 wires. The red, black and white wires are used for the external control signal and the other three are used for factory initialization and programing.

0-10V Analog input connection	
Red	+ 0-10 VDC
White	Common*
Black	+24 VAC/DC
*Common is shared between both 24V power and 0-10V signal.	
The impedance of 0-10V circuit is 12KΩ	

Troubleshooting

Motor does not operate

1. Check all wiring connections to ensure they are correct and secure.
2. Verify that all voltages are present at the motor, including 24V and 0-10 VDC, if applicable.
3. Make sure that the fan wheel will rotate freely and there are no foreign objects in the wheel. If fan wheel does not rotate freely, disconnect power from the motor and adjust the wheel or housing until the wheel can freely rotate. Apply power and the motor should restart.
4. If motor has both the dial on the motor and 0-10 VDC control option, control wiring issues can be tested by disconnecting the control wires from the motor. The motor should then operate using the dial on the motor for speed control.

Motor will not reach maximum speed

1. Make sure dial is rotated full clockwise, if applicable.
2. Make sure motor is receiving 10 VDC, if applicable.
3. There are some motor/fan combinations where the motor may not reach nameplate RPM. See Max RPM table on page 11 for the maximum motor speed for your application.

Factory Mounted Transformer (Fig. 1, page 2)

A factory mounted transformer is available to supply 24 VDC power to the motor when the 0-10V signal is by others. This transformer has the capability to power a remote device if desired. The power available to a remote device is 400mA at 24 VDC. If the remote device is powered by a different source, connect the analog output to the 0-10V and COM terminals of the transformer. This will pass the signal through to the motor.

WARNING

Do not connect an external 24V supply to the transformer's control terminal labeled 24V. If the external device providing the 0-10V signal is powered elsewhere, this terminal can remain unused.

Operation and Wiring

- Potentiometer and 0-10V Input

Part Numbers Covered in this Section				
318003	318004	318013	319356	319357
320587	320588	320589	320590	328128
328129	328130	328131	328132	328133
328173	328174	328178	328179	

These motors have the ability to accept a plug-in potentiometer for speed adjustment AND the ability to accept a 0-10V signal for remote control.

There is a 4 second delay between the application of power and the motor starting.

Motor part numbers 318003, 318004 – The motor is prewired at the factory and cannot be changed inside the motor. Connect single-phase power at the voltage listed on the nameplate.

Motor part numbers 318013, 319356, 319357, 320587, 320588, 320589, 320590, 328128, 328129, 328130, 328131, 328132, 328133, 328173, 328174, 328178, and 328179 – The motor is prewired at the factory and can operate on 115v up to 277v. Operating voltage is changed via voltage red jumper wire.

Voltage jumper – For 115v the red jumper wire on the side of the motor must be connected (closed). For 208v-277v operation the red jumper must be disconnected (open). If disconnected, red jumper wire has 120 VAC potential. Ensure leads are capped/ covered.

Dial on Motor – A potentiometer (PN 385806) can be plugged into the 9-pin connector of the motor. To increase speed, rotate the dial clockwise. To decrease speed, rotate the dial counterclockwise.

0-10 VDC Signal – From 0-1.9V, the motor will be off, and will operate in the 2-10V range. A low voltage wiring harness is needed to supply the 0-10V signal to the motor. The harness is available from the factory if conversion is necessary.

0-5 VDC Signal – From 0-0.9V, the motor will be off and will operate in the 1-5V range. A low voltage wiring harness is needed to supply the 0-5V signal to the motor. The harness is available from the factory if conversion is necessary.

Low Voltage Harness Part Numbers			
Type	Use with Motor	18 in. long	36 in. long
9-pin	318003, 318004, 318013, 319356, 319357, 320587, 320588, 320589, 320590, 328128, 328129, 328130, 328131, 328132, 328133, 328173, 328174, 328178, 328179	385821 (0-10 VDC only) 386518 (0-5 VCD and 0-10V DC compatible)	385822 (0-10 VDC only) 386519 (0-5 VCD and 0-10V DC compatible)

NOTE

The 9-pin connector on the motor contains 6 wires. The yellow, orange, red and white wires are used for external control. The other two wires are used for factory initialization and programming.

0-10V Analog Input Connection	
Red	+ 0-10 VDC
White	Common
Green	+0-5 VDC Signal
Black	5 VDC Supply

Troubleshooting

Motor does not operate

1. Verify the motor is wired correctly and all connections are secure.

2. If using dial on motor, verify the potentiometer is fully seated in the 9-pin connector.
3. If using 0-10 or 0-5 VDC, verify that all voltages are present at the motor.

Motor does not reach maximum speed

1. Make sure dial is rotated full clockwise, if applicable.
2. Make sure motor is receiving 10 or 5 VDC, if applicable.
3. There are some motor/fan combinations where the motor may not reach nameplate RPM. See Max RPM table on page 11 for the maximum motor speed for your application.
4. Make sure black wire is disconnected when using 0-10 VDC.

Operation and Wiring

- 0-5V Input

Part Numbers Covered in this Section	
328447	328448

Motor PN 328447 has the ability to accept 0-5V signal for speed adjustment via a 0-5V dial on fan, PN 386512.

Motor PN 328448 has the ability to accept a 0-5V signal for speed adjustment via a plug-in potentiometer PN 385806.

There is a four second delay between the application of power and the motor starting.

Motor part numbers 328447, 328448 - the motor is prewired at the factory and can operate at single phase 115-120V or 208-230V. The motor detects the incoming voltage and automatic switches adjust for it inside the motor. All that is required is to connect single phase power at the voltage listed on the nameplate.

Dial on Motor – A potentiometer (PN 385806) can be plugged into the 9-pin connector of the motor. To increase speed, rotate the dial clockwise. To decrease speed, rotate the dial counterclockwise.

0-5V Dial on Fan – From 0-1V, the motor will be off and will operate in the 2-5V range. The low voltage wiring harness is built into the design of the motor PN 328447.

NOTE
The 9-pin connector on the motor contains 3 wires. The green, white and black wires in the white jacketing are used for external control.

0-10V Analog Input Connection	
Green	+0-5 VDC Signal
White	Ground
Black	5 VDC Supply

Troubleshooting

Motor does not operate

1. Verify the motor is wired correctly and all connections are secure.
2. If using dial on motor, verify the potentiometer is fully seated in the 9-pin connector.
3. If using 0-5V dial on fan controller, verify that all voltages are present at the motor.

Motor does not reach maximum speed

1. Make sure dial is rotated full clockwise, if applicable.
2. Make sure motor is receiving 5 VDC.

Part Numbers Covered in this Section	
310420	311156

Features

Speed control - These motors can be controlled by either a dial on the motor or a 0-10 VDC signal for remote control.

Soft start – All motors feature soft-start technology which eliminates inrush current at start-up. The motors will reliably start at any speed setting. There will be up to a 30 second delay between the application of power and the motor starting. The motor will "rock" back and forth upon startup as part of its normal operation.

Overload protection – If the motor becomes overloaded, it will automatically shut itself down. The maximum programmed motor speeds have been selected to prevent this from happening in normal operation.

Locked rotor protection – If the motor encounters a locked-rotor scenario, it will automatically shut itself down. It will try to restart up to 3 times, and if after the 3rd time the motor will still not rotate, the motor will not attempt to start again until power is cycled.

Thermal protection – The motors have an automatic reset thermal protector. This is meant to protect the motor from a severe temperature rise.

RPM measurement – The motor RPM can be measured by removing the cooling fan cover and using a contact or optical tachometer. Be sure to replace the cooling fan cover when finished.

Reversible rotation – The motor direction has been pre-set at the factory for the rotation of the fan but can be reversed if necessary.

Operation and Wiring

These motors can be controlled by either a dial on the motor or a 0-10 VDC signal for remote control. The motor will be supplied from the factory with the correct accessory depending on what was ordered.

Dial on Motor - Turn the dial with your fingers to adjust. To increase the speed, rotate the dial clockwise. To decrease the speed, rotate the dial counterclockwise. Turning the dial full Counter Clock Wise will turn the motor off.

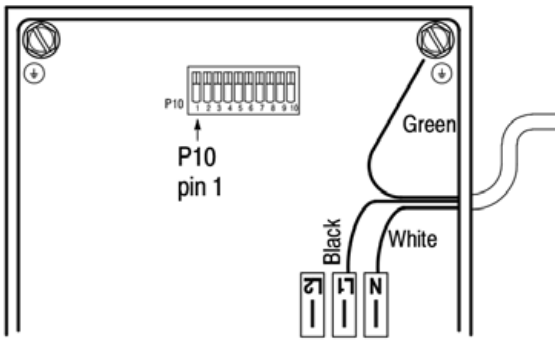
0-10 VDC Signal - From 0-1.9V, the motor will be off, and will operate in the 2-10V range. This motor does not require 24V power for operation.

0-10V Analog Input Connection	
Red	+ 0-10 VDC
White	Ground

Wiring

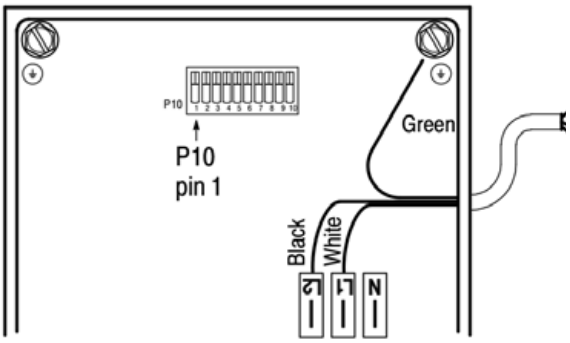
1. All high and low voltage wiring connections are made inside the motor control box at the factory. Normally, there is no reason to enter the control box of the motor. If there is a need to enter the control box, disconnect power and wait at least five minutes to allow the capacitors to discharge.
2. The motors are factory wired for the ordered voltage. If the factory wired voltage does not match the desired voltage, the voltage can be changed, with exception of the 2HP motor (310420), which is 208-240V only.

115V: Connect 115 VAC to L1, connect Neutral to N. The L2 terminal remains empty. Connect ground to grounding stud.



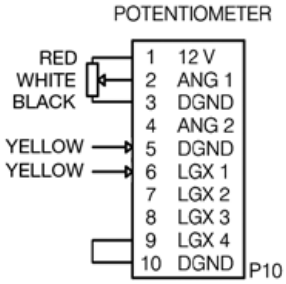
115V Connection inside control box

208-240V - Connect line voltage to L1 and L2. The N terminal remains empty. Connect the ground to the grounding stud.



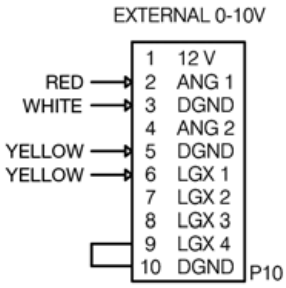
208-240V Connection inside control box

Dial on Motor - the dial is factory-wired into the low voltage terminal block inside the control box. The wires are connected as shown.



Dial on motor connection inside control box

0-10 VDC Signal - a two-wire pigtail is factory-wired into the low voltage terminal block. The wires are connected as shown.

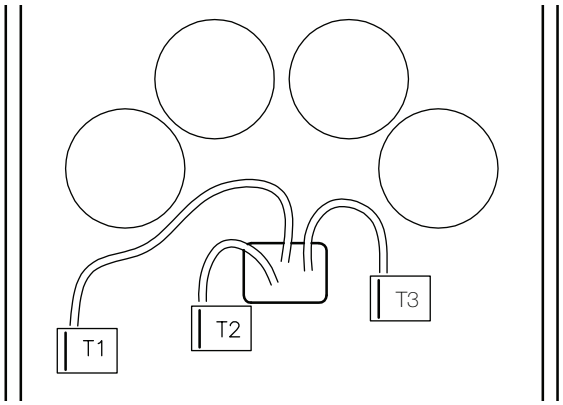


0-10 VDC signal connection inside control box

If the motor needs to be tested before the 0-10 VDC signal is available, a jumper can be placed between terminals 1 and 2. This will force the motor to run at full speed.

Motor Rotation

To reverse the rotation of the motor, swap any two of the red, black and blue wires connecting the control board to the motor at terminals T1, T2 and T3. Note that motor warranty is void if motor is rotating in the wrong direction. See fan instruction manual for correct rotation direction.



Rotation selection wires inside control box

Troubleshooting

These motors have a diagnostic red LED on the circuit board inside the control box, or on the exterior of the control box, that will be solid (not flashing) when power is applied to the motor and the motor is operating normally. The LED may be solid even if the motor is not spinning, such as when power is applied but the motor may be commanded to be off with a 0-1.9V VDC signal.

1. If external LED is not present, to view the status of the LED the control box cover must be removed while power is applied to the motor. If the control box cover is removed while power is applied, extreme care must be taken not to touch any of the components inside the box.
2. If a fault occurs, the LED will blink a specific number of times to identify the fault that has occurred. The fault indications are as follows:

Number of Blinks	Indicated Fault
2	Hardware Fault
3	Overvoltage
4	Undervoltage
5	Communication Error
6	Sync Loss
7	Spin Fault
8	Motor Overload
9	Motor Over Temperature

3. When the LED is blinking, it will consecutively blink from 2 to 9 times, followed by a pause, and repeat the blink sequence. It is best to count the number of flashes 2 or 3 times to ensure accuracy.
4. Under most fault conditions the motor will automatically restart. If a motor overload fault occurs more than 10 times in one hour, the motor will shut down and require a power cycle to reset.
5. If the fault persists, consult the factory.

Motor does not operate

1. Verify the motor is wired for the correct voltage.
2. Verify that the dial on the motor is properly connected to the control board - or - verify that the 0-10 VDC wires are properly connected to the control board.
3. Verify that the Status LED is solid red.
4. Verify that a jumper is in place between terminals 9 and 10. The motor will not run without this jumper in place.
5. Verify that the two yellow wires coming from the motor are in place on terminals 5 and 6.

Controls: Operation, Wiring and Troubleshooting

Remote Dial/Touch Remote and 2-Speed Control

Remote Dial

Installation Overview: The remote dial is provided with the fan, shipped loose for remote installation. It also includes a factory mounted 24 VDC transformer.

1. Disconnect power to the fan.
2. Identify where the remote dial will be mounted.
3. Mount a standard single-gang 2x4 junction box.
4. Run a 3-wire control cable from the remote dial to the fan motor compartment. The maximum distance from the fan to the remote dial is 100 feet. If a greater distance is required, signal loss may occur and cause the fan to operate erratically.
5. Connect control cable to transformer mounted inside fan motor compartment. Connect control cable to remote dial.
6. Secure remote dial to 2x4 junction box.

Remote Dial with Min/Max Setting

Remote dials (PN 385803) are capable of setting minimum and maximum voltage limits. Setting voltage limits will require a multi-meter. To set a voltage span:

1. Install and wire remote dial as previously instructed.
2. Install multi-meter probes into the red (0-10v) and black (ground) connectors.
3. To set maximum voltage limit, apply power to the motor, transformer and remote dial. With remote dial set to zero (0), hold the Upper Limit button down and turn the dial until the desired voltage is displayed on your multi-meter. Release button to save max voltage setting.
4. To set lower voltage, turn remote dial back to zero (0). Hold down Lower Limit button while turning dial to desired voltage on your multi-meter. Release button to set minimum voltage limit.
5. To reset to default (0-10v) limits, hold both Upper and Lower limit buttons down simultaneously until the LED indicator lights up. Then release buttons and default levels will be restored.

   NOTE: Upper voltage limit must be set prior to setting lower voltage limit. Upper and lower limits can only be within 0.5v of each other.

Touch Remote

Follow installation instructions for remote dial above. After power is applied to the system, operate as follows:

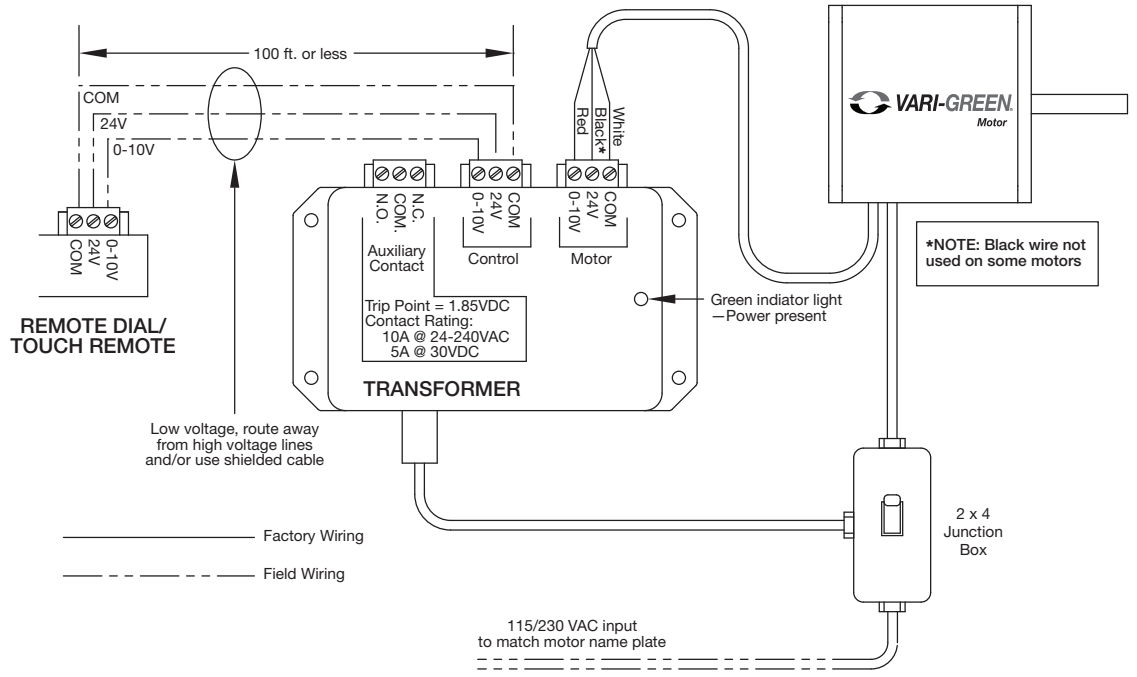
1. Touch power button to turn fan on.
2. Touch UP/DOWN arrow to increase/decrease speed.
3. Subsequent touches of the power button will start the countdown timer of 90, 60, 30 or 10 minutes.
4. LED's will turn off after a period of inactivity.
5. To lock/unlock buttons, hold the UP and DOWN arrows for 3 seconds. When locked, the power button will light up red.

Other Vari-Green® controls, such as the Constant Pressure and Air Quality families of controls, have their own manual that ship with the controller. They can also be found on Greenheck.com. See table on page 11 for document numbers.

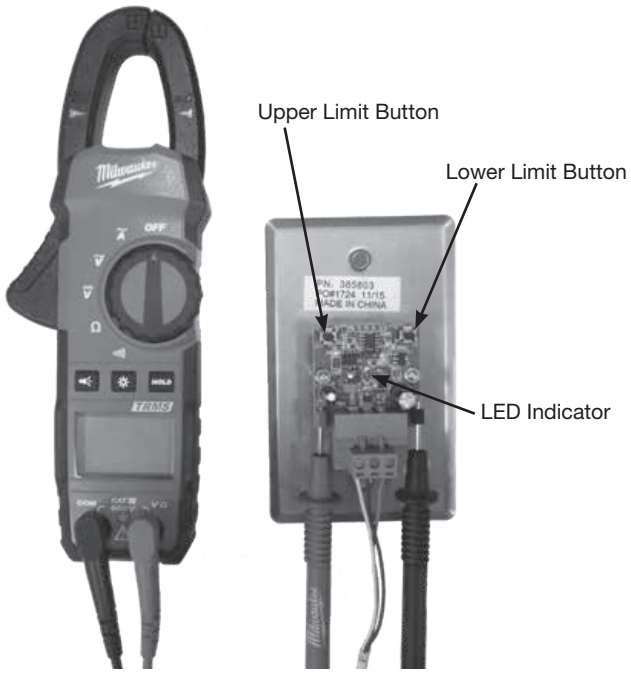
CAUTION

Even though the motor may not be operating, high voltage power may still be present at the motor. Make sure to disconnect power to the fan before servicing.

Remote Dial/Touch Remote Assembly



Remote Dial with Min/Max Setting



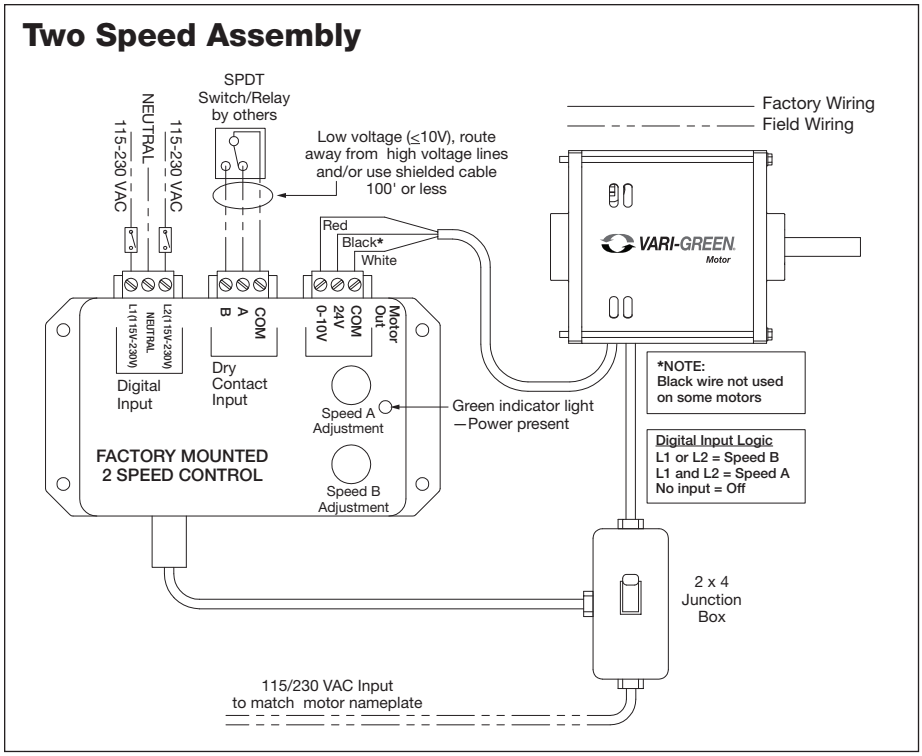
Troubleshooting - Remote Dial/Touch Remote

Remote Dial does not adjust motor RPM

1. Check voltage to ensure the motor and transformer are receiving the correct line voltage.
2. Check voltage at the remote dial. 24 VDC should be present across the 24V and COM terminals. 0-10 VDC should be present across the 0-10V and COM terminals.
3. Verify all of the connections at the transformer and make certain that they are secure.
4. Touch remote: Verify that the touch remote is unlocked.
5. To reset to default (0-10v) limits, hold both Upper and Lower limit buttons down simultaneously until the LED indicator lights up. Then release buttons and default levels will be restored.

Terminals	Desired Voltage
24V-COM	24 VDC Nominal
0-10V-COM	0-10 VDC (varies with dial position)

Two Speed Assembly



Two Speed Control

Installation Overview: The two speed control is factory mounted to the fan and may be set to provide any two speeds the application requires. It also includes a 24 VDC transformer. A green LED will be illuminated when the 2-speed control is powered.

1. There are two methods of toggling between speed A and speed B:
   a. **Dry contact input** - this utilizes an external switching device such as a relay or SPDT switch to toggle between the two speeds.
      - Connect terminal “A” to “COM” for speed A.
      - Connect terminal “B” to “COM” for speed B.

      If no contact is made between either terminal the motor will be off.
   b. **AC digital input** - this input allows an AC voltage signal to be fed directly into the 2-speed control to change speeds.
      - Send 115-230V AC to L1 **OR** L2 for speed B.
      - Send 115-230V AC to L1 **AND** L2 for speed A.

      If no voltage is applied to either terminal, the motor will be off.
   c. DO NOT CONNECT BOTH DRY CONTACT AND DIGITAL INPUTS SIMULTANEOUSLY.
2. To test fan operation before the external control devices are installed, a jumper wire can be connected between the COM and A or B terminal on the dry contact input for fan operation.

Troubleshooting - Two Speed Control

1. Check all wiring connections to ensure they are correct and secure.
2. Verify AC line voltage is present at the motor and 2-speed control.
3. Verify 24 `VDC is present at the 24V and COM terminals of the "Motor" terminal block.
4. Measure DC voltage between the 0-10V and COM terminals of the "Motor" terminal block. This voltage should match the dial position of the active dial.
   a. If using dry contact input - ensure contact closure is connecting the proper terminals.
   b. If using AC digital input - disconnect connector from 2-speed control and measure voltage between L1 and Neutral or L2 and Neutral.

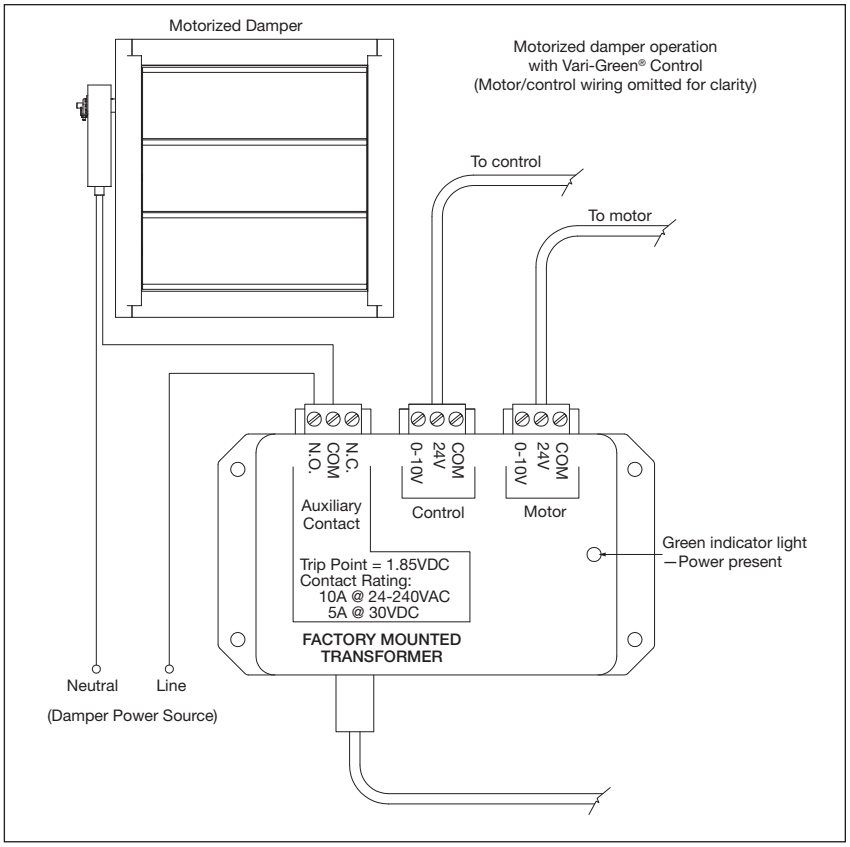
Motorized Backdraft Damper Control

The available factory mounted transformer (PN 385253) has the ability to signal a motorized back draft damper to open/close as the motor starts/stops.

A N.O./N.C. set of contacts is provided which will change state when above or below a control voltage of 1.85 VDC. See wiring diagram for example.

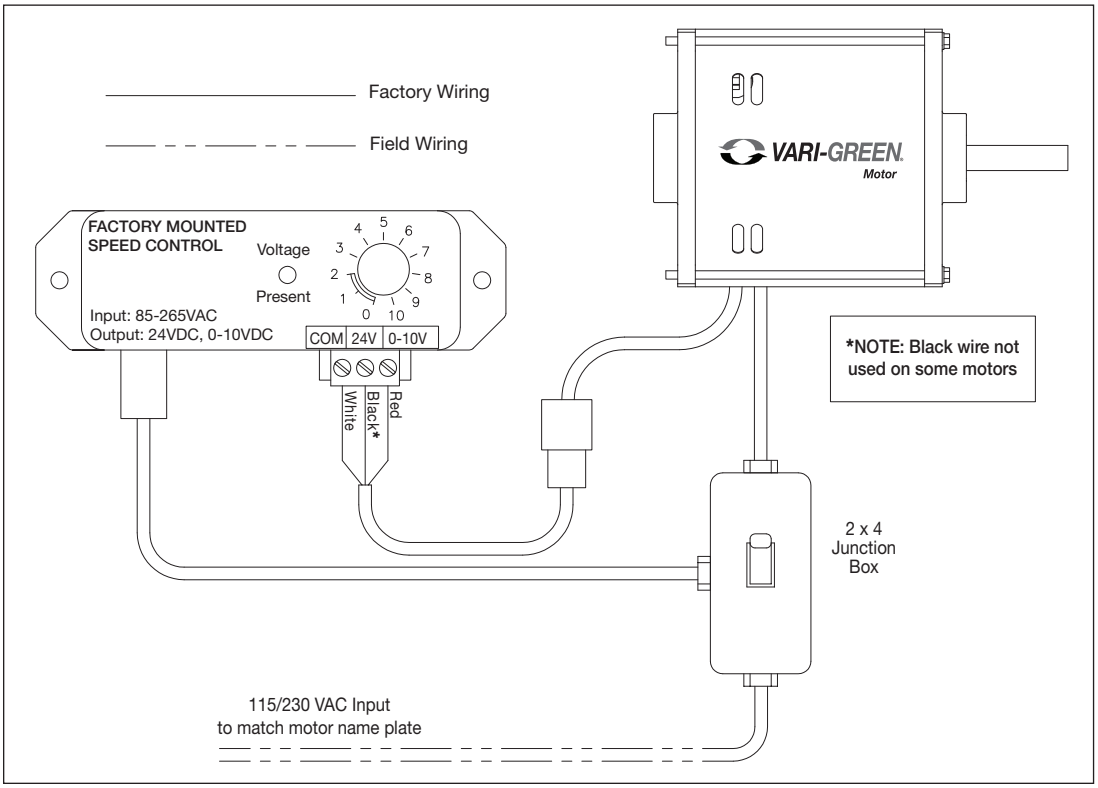
Contact Rating:

- 10A @ 24-240 VAC
- 5A @ 30 VDC



Fans Where Dial on Motor is Not Accessible

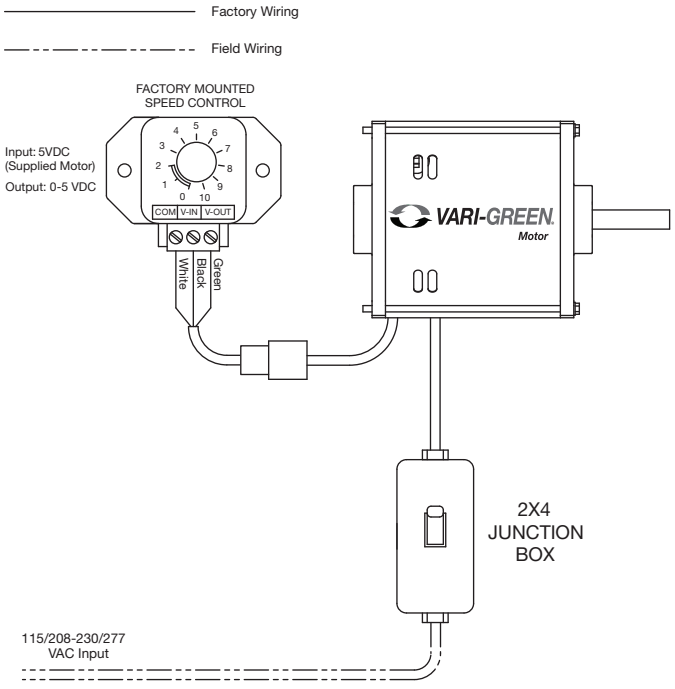
A control is available to mount on the outside of a fan where the dial on motor may be difficult to access (model SQ). This control is powered by the line voltage entering the fan and will send 24 VDC and 0-10 VDC to the motor. Control Part Number is 385611



Alternative: Fans Where Dial on Motor is Not Accessible

A control is available to mount on the outside of a fan where the dial on motor may be difficult to access (model SQ). In many cases, the tri-voltage platform of VG motors can work off either 0-5V signal or a 0-10V signal. This control is powered by 5VDC output signal wire of the motor and will send a 0-5VDC to the motor to adjust the speed. Control PN 386512.

Control	Compatible Motor P/N
386512	328447, 319356, 328128, 319357, 328129, 318013, 328130, 320587, 320588, 328131, 320589, 328132, 320590, 328133 328173, 328174



Multiple Motors on One Control

Refer to the table below for the recommended number of motors to be driven from one controller. Note that the controllers do not have the ability to distinguish between more than one motor, therefore all motors will receive the same control voltage. Control voltage must be wired in parallel to all motors.

Controls	Max. Motor Quantity
Remote Dial	4
2-speed	6
Constant Pressure/Airflow	4
Temperature/Humidity	2
VOC	2

Maintenance

Vari-Green® motors use brushless technology with sealed bearings. No routine maintenance is required other than keeping any debris from accumulating on the motor and controls.

Other Vari-Green® Control Instruction Manuals

Description	Document Number
Indoor Air Quality - VOC	475407
Indoor Air Quality - Temperature/Humidity	475573
Constant Pressure Control	474766
Generation 2 Constant Pressure/Airflow Control	479653

Maximum RPM Table

This table will show the available motor and fan combinations with the correlating maximum motor RPM for each combination.

CUE/CW	Max RPM	Motor HP
60, 70	1725	1/15
80, 90	1725	1/10
95	1725	1/6
99	1725	1/4
101	1725	1/4
101HP	1725	1/4
	2500	1/2
121	1400	1/4
	1725	1/2
131	1200	1/4
	1450	1/2
	1725	3/4
141	1000	1/4
	1300	1/2
	1550	3/4
	1725	1
141HP	1450	1/4
	1725	1/2
	2200	3/4
161	1000	1/2
	1200	3/4
	1300	1
	1725	2
161HP	1300	1/2
	1650	3/4
	1725	1
180	875	3/4
	1000	1
	1325	2

SQ	Max RPM	Motor HP
60, 70	1725	1/15
80, 90	1725	1/10
95	1725	1/6
97	1725	1/4
	2500	1/2
98	1725	1/4
	2200	3/4
99	1725	1/4
	2200	3/4
100	1725	1/4
120	1725	1/2
130	1725	3/4
130HP	1250	1/4
	1450	1/2
	1950	3/4
140	1500	3/4
	1725	1
140HP	1100	1/2
	1450	3/4
	1725	1
160	1140	3/4
	1300	1
	1725	2
160HP	850	1/2
	1000	3/4
	1600	1
	1725	2

USF	Max RPM	Motor HP
4	1660	1/4
	1725	1/2
	1725	3/4
6	1660	1/4
	1725	1/4
	1725	1/2
	1725	3/4
7	1140	1/4
	1725	1/2
8	1660	1/4
	1725	1/2
	1725	3/4
10	1660	1/4
	1725	1/2
	1725	3/4
13	1370	1/4
	1725	1/2
	1725	3/4
15	1110	1/4
	1400	1/2
	1600	3/4
16	910	1/4
	1150	1/2
	1320	3/4
18	740	1/4
	940	1/2
	1050	3/4

LD/LDP	Max RPM	Motor HP
80-90	1725	1/10
95	1725	1/6
100	1725	1/4
120	1725	1/2

SP/CSP	Max RPM	Motor HP
510	1275	1/6
710	1450	1/4
700	1750	1/3
1050	1225	1/3

G	Max RPM	Motor HP
60, 70	1725	1/15
80, 90	1725	1/10
95	1725	1/6
97-99	1725	1/4
103	1725	1/4
103HP	1725	1/4
	2500	1/2
123	1200	1/4
	1725	1/2
133	1150	1/4
	1550	1/2
	1725	3/4
143	900	1/4
	1200	1/2
	1300	3/4
	1725	1
143HP	1500	1/4
	1725	1/2
	2200	3/4
163	750	3/4
	1200	1
	1725	2
183	900	3/4
	1000	1
	1325	2

SE1/SS1	Max RPM	Motor HP
8-440*	1725	1/15
8-440*	1725	1/10
10-440*	1725	1/15
10-440*	1725	1/6
12-426	1725	1/4
12-432	1725	1/4
12-436	1725	1/4
14-432	1725	1/4
14-436	1725	1/2
14-440	1725	1/2
16-421	1725	1/2
16-426	1725	1/2
16-428	1725	3/4
16-436	1725	3/4
18-424	1725	3/4
18-429	1725	3/4
20-420	1725	1
***SE1 Model Only**		

Our Commitment

As a result of our commitment to continuous improvement, Greenheck reserves the right to change specifications without notice.

Product warranties can be found online at Greenheck.com, either on the specific product page or in the literature section of the website at Greenheck.com/Resources/Library/Literature.

AMCA Publication 410-96, Safety Practices for Users and Installers of Industrial and Commercial Fans, provides additional safety information. This publication can be obtained from AMCA International, Inc. at www.amca.org.

GREENHECK
Building Value in Air.

Phone: 715.359.6171 • Fax: 715.355.2399 • Parts: 800.355.5354 • E-mail: gfcinfo@greenheck.com • Website: www.greenheck.com

Quick Start Guide

Single/Three Phase Vari-Green® Motor

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Vari-Green Motor Quick Start Guide

When delivered, the Vari-Green Motor is pre-programed to run from either an on-board dial or a 0-10 VDC control signal. A 0-1.99 Volt control signal will be received as a "stand-by" command.

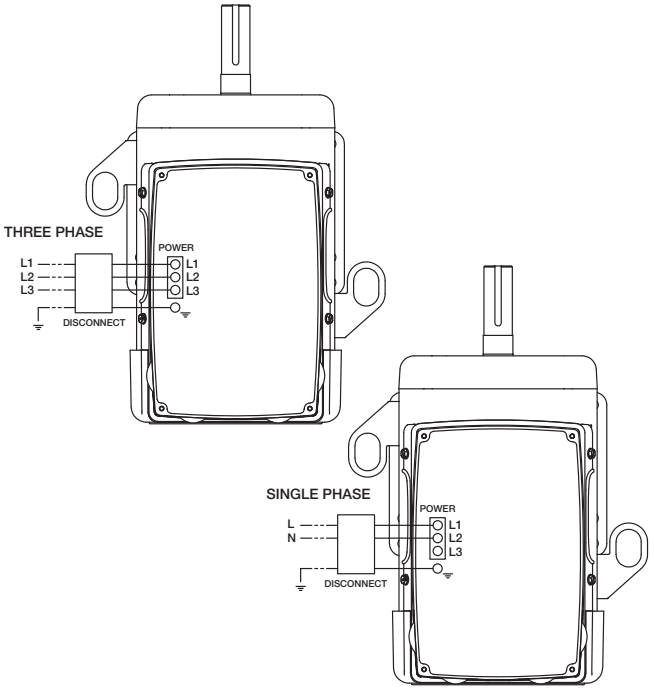
A run command is acknowledged, as well as a speed reference from 2-10 V.

For more information about this Vari-Green Motor, please review the Installation, Operation and Maintenance Manual found by following this QR code:

www.greenheck.com/vari-green/vari-green-motors

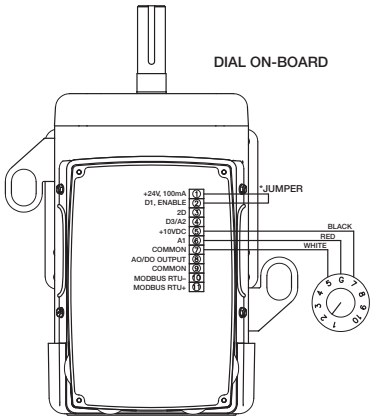
Step 1

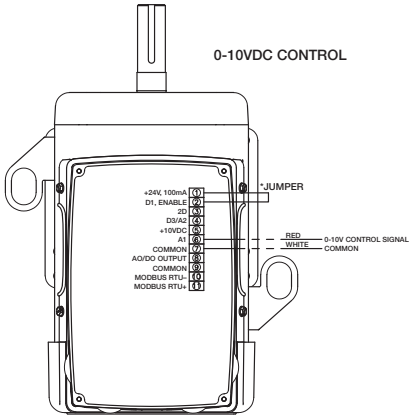
Connect the power supply. Verify Input Voltage and phase matches nameplate of motor/drive.



Step 2

Connect control wiring to the control terminal.



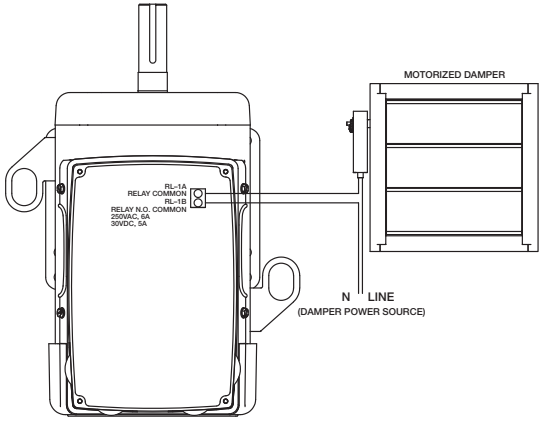


NOTE: Factory default settings:

1. Terminal 2 is set as an ENABLE command. From the factory there is a jumper from terminal 1 to 2. A START/STOP switch can be used between these terminals to ENABLE/DISABLE the drive.
2. When this Vari-Green Motor is ordered in a 0-10 VDC Control configuration, the motor is shipped with a jumper between terminal 5 and 6. This will run the motor at full speed when power is connected. Remove this jumper before landing 0-10 VDC control wires.

Step 3

Install motorized backdraft damper wiring, if applicable. The relay RL-1 is set from the factory to close when a run command is given.



Step 4

Apply power to unit. If a control signal is present, the RL-1 relay will close and the motor will ramp up to the referenced speed. If a jumper is installed between terminals 5 and 6, the motor will go to 100%.

Step 5

Balance the fan. Whether changing the position of the on-board dial or adjusting the control voltage, the fans speed can be set from the minimum to the motor's factory programmed maximum speed. Re-apply the motor cover.

VARI-GREEN® Motor

Quick Start Guide

Single/Three Phase Vari-Green® Motor

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Step 6

Review the Installation, Operation and Maintenance Manual for the fan for any specific installation questions. The manual is shipped with the fan, and can also be found at www.greenheck.com or by scanning the QR code located within the drive compartment.

Electrical Data	
Supply Voltage Range	110 Volt Units, 99-126 V
	230 Volt Units, 180-264 V
	400 Volt Units, 342-528 V
Short Circuit Capacity	5kA Without Fused Disconnect
	100kA With Fused Disconnect
Control Terminal Wiring	
Maximum Size	0.05-0.5mm2 / 20-26 AWG
RL-1 Relay	
Relay N.O. Contact	250VAC, 6A/30VDC, 5A
Motor Enclosure	
Totally Enclosed Fan Cooled, IP54	

WARNING

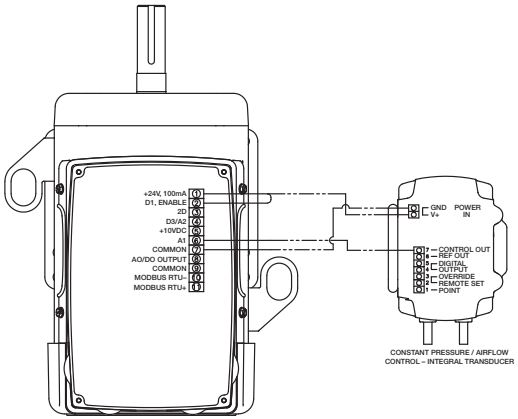
- Do not remove the drive cover for wiring or periodic inspections while power is applied or the unit is in operation. Electric shock may occur from the exposed terminals.
- Wait at least 1 minute after disconnecting the input power before performing any wiring tasks and/or periodic inspections of the drive.
- Operate the Vari-Green motor and control devices with dry hands.
- Do not use this device if power or motor cable is damaged.
- As this is a permanent magnet motor, this motor will generate voltage when the shaft is rotated. Shaft must be locked out for safe servicing.

CAUTION

- Disconnect the input power if the Vari-Green motor has been damaged. Failure to do so may result in fire and/or secondary damage or accidents.
- Do not touch the Vari-Green motor immediately after shutting down or disconnecting it. It can remain hot for a few minutes. Bodily injuries such as skin-burn or damage may occur.
- Do not apply power to a damaged Vari-Green motor or to a Vari-Green motor that is missing parts.
- Do not allow lint, paper, wood chips, dust, metallic chips or other foreign material into the drive as it may cause fire or accident.

Vari-Green Controls

Vari-Green Controls all use a 0-10 VDC control signal to provide a speed reference to Vari-Green Motors. See below for typical Vari-Green wiring. Reference the individual controls Installation, Operation and Maintenance Manual for programing, wiring and troubleshooting of that control.



VARI-GREEN®
Motor

GREENHECK
Building Value in Air.

Document 484279
Microprocessor Controller for Dedicated Outdoor Air System

Reference Guide for Microprocessor Controller

Please read and save these instructions for future reference. Read carefully before attempting to assemble, install, operate or maintain the product described. Protect yourself and others by observing all safety information. Failure to comply with these instructions will result in voiding of the product warranty and may result in personal injury and/or property damage.

DOAS v4.001

Technical Support
Call 1-866-478-2574

Introduction

Program Features

The microprocessor controller offers control through easy monitoring and adjustment of unit parameters by way of a lighted graphical display and an integral push-button keypad.

Pre-Programmed Operating Sequences

The controller has been pre-programmed to offer multiple control sequences to provide tempered air. Factory default settings allow for easy setup and commissioning. The sequence parameters are fully adjustable. Refer to the Sequence of Operation for details.

BMS Communication

The user can remotely adjust set points, view unit status points and alarms. The microprocessor controller is capable of communicating over several protocols:

- BACnet® MSTP
- BACnet® IP
- LonWorks®
- Modbus RTU
- Modbus TCP

Reference Points List for a complete list of BMS points.

Built-In Occupancy Schedule

The controller has an internal programmable time clock, allowing the user to set occupancy schedules for each day of the week. The controller option also has morning warm-up and cool down capability for improved comfort at the time of occupancy.

Alarm Management

The microprocessor controller will monitor the unit's status for alarm conditions. Upon detecting an alarm, the controller will record the alarm description, time, date, and input/output status points for user review. A digital output is reserved for remote alarm indication. Alarms are also communicated via BMS (if equipped).

Occupancy Modes

The microprocessor controller offers three modes of determining occupancy: a digital input, occupancy schedule or the BMS. If in the unoccupied mode, the unit will either be shut down, continue normal operation utilizing adjustable unoccupied set points, recirculate with unoccupied set points or will cycle on to maintain adjustable unoccupied space temperature and humidity set points (space temperature and humidity sensor is optional).

Remote Unit Access (if equipped)

The WebUI and Remote Display are two ways to gain access to the unit controller allowing monitoring of the unit and parameter adjustment without being at the unit.

The WebUI can be accessed via a building network and is included with every unit controller. The Remote Display is an LCD to be panel mounted in a remote location and is an option available for purchase.

WARNING

Electrical shock hazard. Can cause personal injury or equipment damage. Service must be performed only by personnel that are knowledgeable in the operation of the equipment being controlled.

WARNING

Mechanical high static protection cutoffs must be installed by others to protect the system and equipment from over-pressurization when using factory provided control sensors. The manufacturer does not assume responsibility for this.

Table of Contents

Sequence of Operation 3-7
Controller Overview 8-11
Display Use 12
Parameter Adjustment 12
Web User Interface 13
Main Menu 14
Unit Status Overview 15-18
Unit Enable 19
Menu
Control Variables
Temp Control 19-21
Dehumidification 22-23
Refrigeration 24
Damper Control 24-25
Energy Recovery 26
Fan Control 27-28
Occupancy 29
Advanced 30-36
Alarms 37
Appendix
A: Remote Display 38
B: I/O Expansion Board Quick Start 39
C: Space Thermostat Quick Start 40-41
D: GreenTrol® Airflow Monitoring Quick Start 42
E: Points List 43-54
F: Modbus Connections 55
Our Commitment . . . . . Backcover

Sequence of Operation

The microprocessor controller can be configured for air handler, energy recovery, and dedicated outdoor air systems. Each application utilizes similar technologies for heating and cooling: chilled water, hot water, indirect gas, electric heat, and packaged or split DX cooling. All set points, lockouts and delays are user adjustable via the integral keypad display, remote display, or web user interface.

General Operation

UNIT START COMMAND: The microprocessor controller requires a digital input to enable operation. The unit can then be commanded on or off by this digital input, keypad, the BMS or schedule. When a start command becomes active the following steps occur:

- Energy recovery wheel starts, if equipped
- Factory mounted and wired dampers are powered (Outside air, exhaust air, and recirculation air dampers, if equipped)
- Exhaust fan, if equipped, starts after adjustable delay
- Supply fan starts after adjustable delay
- Tempering operation starts after adjustable delay

UNIT STOP COMMAND: A shutdown occurs when there is not an occupied or unoccupied start command. The following shutdown methods can occur.

Hard shutdown occurs under the following conditions:

- A user or the BMS disables the system, and the supply temperature is less than the soft shutdown enable set point.
- Occupancy is commanded to unoccupied while there is no unoccupied start command, and the supply temperature is less than the soft shutdown enable set point.

When a hard shutdown occurs:

- The unit shuts down immediately.
- Dampers spring-return to their off position. Damper power is cut 30 sec. after the fans. This allows the fans to slow down prior to spring closing the dampers.

Soft shutdown occurs under the following conditions:

- A user or the BMS disables the system, and the supply temperature is greater than or equal to the soft shutdown enable set point.
- There is no unoccupied or occupied start command and the supply temperature is greater than or equal to the soft shutdown enable set point.

The following occurs during a soft shutdown:

- Tempering outputs immediately revert back to their off value; while
- Dampers remain open and fans continue to run; until
  - The supply air temperature falls below the soft shutdown enable set point minus 5.0°F; or
  - The soft shutdown delay timer has expired.

UNIT/SYSTEM DISABLED COMMAND:
The unit becomes disabled due to the following:

- The unit was disabled from the controller's Unit Enable screen.
- The unit enable digital input changes to the disabled state.
- The unit was disabled from the BMS.
- The remote start input is in the off position.
- The shutdown input is in the shutdown position.
- A system shutdown alarm was activated.

When disabled the following actions occur:

- The unit shuts down immediately; and
- Dampers spring-return to their off position.

OCCUPANCY: The microprocessor controller offers five modes of determining occupancy: digital input, occupancy schedule, BMS, always occupied, or always unoccupied. When in the unoccupied mode, the unit can be configured to shut down, or cycle on to maintain the unoccupied space set points. The unit can be temporarily overridden to the occupied mode via a digital input, keypad display, or space thermostat, if equipped.

- **Occupied Mode:**
  - Exhaust fan on, if equipped
  - Supply fan on
  - Energy Recovery Wheel Control (refer to Energy Recovery Wheel section), if equipped
  - Damper Control (refer to Outside Air and Recirculated Air section), if equipped
  - Heating (refer to Heating section)
  - Cooling (refer to Cooling section)
- **Unoccupied Mode:**
  - **Unit Off:** Unit remains off when in unoccupied mode.
  - **Normal operation with unoccupied set points:** Unoccupied mode will operate as if in occupied mode but will utilize adjustable unoccupied set points.
    - Exhaust fan on, if equipped
    - Supply fan on
    - Energy Recovery Wheel Control (refer to Energy Recovery Wheel section), if equipped
    - Damper Control (refer to Outside Air and Recirculated Air section), if equipped
    - Heating (refer to Heating section)
    - Cooling (refer to Cooling section)
  - **Recirculation with unoccupied set points**: Optional unoccupied mode when there is an unoccupied recirculation damper. The unit will continue to run, but in full recirculation.
    - Supply fan on
    - Recirculation air damper open
    - OA damper closed
    - Tempering operations begin

- **Night Setback:** Unoccupied mode when there is space temperature and/or humidity sensor(s) connected to the controller. The unit will cycle on to maintain unoccupied space set points if there is a call for unoccupied heating, cooling or dehumidification.
    - ° Exhaust fan off, if equipped
    - ° Supply fan on
    - ° Recirculation air damper open
    - ° OA damper closed
    - ° Tempering operations begin

Set Point Control (Occupied)

Supply air temperature set point can be configured as constant, or can be reset by either outside air temperature, or space temperature set point. If equipped with BMS communications, the user can also directly command the temperature set point, if equipped.

- **Outside Air Temperature Reset Function:** The controller will default to supply temperature reset based on OA temperature. The controller will monitor the OA temperature and reset the supply temperature set point based upon the OA reset function.
- **Space temperature Reset:** With a space temperature sensor, the controller will adjust the supply air temperature set point between the min (55°F) and max (90°F), to satisfy the desired space temperature. The temperature set point can be adjusted locally at the microprocessor, the BMS or a space thermostat.

Set Point Control (Unoccupied)

When equipped with an unoccupied recirculation damper and optional space temperature and/or humidity sensors, the unit will cycle on to maintain the unoccupied space set points.

- **Unoccupied Heating:** If equipped with heating, the unit is enabled when the space temperature is less than the unoccupied heating set point minus differential (60°F). The supply air temperature set point will be set to the supply max reset limit (90°F). The unit cycles off when the space temperature reaches the unoccupied heating set point.
- **Unoccupied Cooling:** If equipped with cooling, the unit is enabled when the space temperature is greater than the unoccupied cooling set point plus differential (80°F+5°F). The supply air temperature set point will be set to the supply min reset limit (55°F). The unit cycles off when the space temperature reaches the unoccupied cooling set point.
- **Unoccupied Dehumidification:** If equipped with cooling, the unit is enabled when the space relative humidity exceeds the unoccupied space relative humidity set point plus differential (50%+5%). The supply air temperature set point will be set to the equivalent occupied supply set point.
- **Morning Warm-Up/Cool Down:** At the request to occupy the space, the unit will run using the warm-up or cool down sequence until the occupied set point is achieved. The heating or cooling mode must not be locked out and the space temperature is below or above set point by the unoccupied hysteresis (5°F, adj). This optional sequence requires a space temperature sensor and is field-enabled.

  The following steps occur during a morning warm-up/cool down:

  - The dampers would be in full recirc if the damper if the damper actuators are not powered (adj) during occupied mode. Otherwise the following is true:
    - Outside air damper is open to minimum OAD position.
    - Recirculation air damper is open at 100% minus OAD position.
  - Supply Fan is ON at 100%.
  - Exhaust fan is OFF.
  - In heating, controls to maintain the maximum supply set point (90ºF).
  - In cooling, controls to the minimum supply set point (50ºF).
  - Reheat off.
  - Energy recovery wheel off.

Heating

The heating is controlled to maintain the supply temperature set point. The heating will be locked out when the outside air temperature is above the heating lockout (80°F adj).

- **Indirect Gas Furnace:** Microprocessor controller will modulate the indirect gas furnace to maintain the supply temperature set point.
- **Hot Water Coil:** Microprocessor controller will modulate a hot water valve (provided by others) to maintain the supply temperature set point. **Coil freeze protection must be provided by others in the field!**
- **Electric Heater:** Microprocessor controller will modulate an electric heater to maintain the supply temperature set point.

Cooling

The cooling is controlled to maintain the supply temperature set point. The cooling will be locked out when the outside air temperature is below the cooling lockout (55°F).

- **Chilled Water:** Microprocessor controller will modulate a chilled water valve (provided by others) to maintain supply air set point. **Coil freeze protection must be provided by others in the field!**

- **Mechanical Cooling:** Microprocessor controller enables stages of cooling to maintain the supply air setpoint. When a modulating compressor is installed (Digital or Inverter Scroll), the compressor modulates to maintain the supply air setpoint. Mechanical cooling is available in the following configurations:
  - **Packaged DX:** Unit with compressors and condensing section located within the same unit. This unit may have lead standard, lead digital scroll, or lead inverter scroll compressors.
  - **Split DX:** Unit with compressors located in the unit and utilizes a remote condenser section. This type of unit may have lead standard, or lead digital scroll compressors.

Air Source Heat Pump

When a unit is configured as an ASHP, compressors are used for cooling and heat pump heating. A reversing valve is energized when the unit is in heating mode to reverse the flow of the refrigerant. The ASHP is only available as a packaged unit with an inverter scroll as the lead compressor.

- **Cooling:** Mechanical cooling operates the same as any other unit with compressors by controlling the compressors to maintain the supply air temperature set point in cooling mode and to maintain the cooling coil temperature in dehumidification mode.
- **Heat Pump Heating:** When heat is required, the reversing valve is switched, and the compressors are staged to maintain the supply air temperature set point.
- **Heat Pump Heating Lockout:** Heat pump heating may be locked out for any of the following reasons:
  - Defrost is initiated 3 times in one hour.
  - Supply Air temperature is 5ºF below set point for more than 10 minutes and secondary heat is available as backup only.
  - Outside ambient temperature is below the HP ambient lockout set point(10ºF).
- **Resetting HP Heating Lockout:** One of the following conditions must occur to return to HP heating:
  - The outside temperature increases by 5ºF.
  - The outside humidity decreases by 20%RH, if humidity sensor is installed.
  - The unit has been locked out for more than 2 hours when a humidity sensor is not installed and not locked out on low ambient condition.
- **Defrost:** Periodically, the ASHP need to initiate a defrost cycle to remove accumulated frost from the outside coil when operating in heating mode. The saturated suction temperature, the outside ambient temperature and/or the outside humidity determine when a defrost initiates and terminates.

  Initiation: One of the following must be true for a defrost cycle to initiate:
  - The saturated suction temperature is less than -15ºF; or
  - The saturated suction temperature is less than ambient conditions (temp/dewpoint) minus an offset (35ºF/25ºF).

  Termination: The defrost cycle is terminated when one of the following occur:
  - The saturated discharge temperatures of all refrigerant circuits are greater than the cancel defrost set point (80ºF); or
  - The max defrost time (5 min) has been exceeded.
- **Outside Coil Fan Control:** Refrigerant pressure control with outside coil fans will have lead EC fans and utilize refrigerant transducers to stage fans on and off in cooling and heating. The following sequences are based on the current mode of operation:
  - **Cooling/Dehumidification:** The lead outside fan turns on with the first compressor and holds for a min of 30 seconds based on the OA temperature. The lead fan modulates to maintain the refrigerant pressure control set point for cooling mode. Each additional outside fan stage turns on based on the saturated temperature reaching set point plus an offset and turns off when the temperature falls below set point after a delay.
  - **Heating:** The lead outside fan turns on with the first compressor. The lead fan modulates to maintain the refrigerant pressure control set point for heating mode. Each additional outside fan stage turns on based on the saturated temperature being below set point minus an offset and turns off when the temperature rises above set point after a delay.
  - **Defrost:** When defrost is initiated, the outside fans turn off allowing the heat to build and defrost the outside coil. When defrost is terminated, the outside fans turn on to bring the pressure down before switching back to heating mode.
- **Secondary Heat:** A secondary heating device may be installed in the unit. This device may be electric heat, gas furnace, or a hot water coil. The following sequences are available for secondary heat:
  - **Backup**: Secondary heat only operates when heat pump heating is not available.
  - **Supplemental**: Secondary heat will operate simultaneously with heat pump heating when the compressors are not producing enough heat to stay within 2ºF of set point.

Economizer

If the application requires cooling, and the OA conditions are suitable for free cooling, the controller will enter economizer mode. If the unit is economizing and the discharge temperature set point is not being met, the controller will bring on mechanical cooling. If equipped with a modulating OA and recirculated air damper, the dampers will modulate between the min OA and max positions to maintain the supply temperature set point. If equipped with an energy wheel, Reference Energy Recovery Wheel Sequence.

- **Temperature:** The economizer will be locked out when:
  - The outside air is greater than the economizer high lockout (65°F).
  - The unit is operating in dehumidification mode.
  - There is a call for heating.
- **Temperature/Enthalpy:** The economizer will be locked out when:
  - The outside air is greater than the economizer high lockout (65°F dry-bulb).
  - The outside air is greater than the economizer high enthalpy lockout (23 btu/lb).
  - The unit is operating in dehumidification mode.
  - There is a call for heating.

Dehumidification

The cooling is controlled to maintain the cold coil set point. Dehumidification is enabled when the OA temperature is greater than the cold coil set point plus an offset (adj. 10°F). Dehumidification is disabled when the OA temperature falls below the enable point by a hysteresis (2°F). If equipped with BMS communications, the user can also directly set the cold coil leaving air set point.

- **Optional Room Relative Humidity Sensor or Thermostat:** The controller will adjust the cold coil leaving air temperature set point between the min (50°F) and max (55°F) set point to satisfy the desired space relative humidity set point.

Reheat

While the unit is dehumidifying, the supply air temperature is maintained by controlling the reheat device to the supply air set point.

- **Hot Gas Reheat (valve):** The microprocessor controller modulates to maintain set point.
- **Reheat Plus:** The microprocessor controller can be configured to use the primary heat source as secondary reheat.

Supply Fan VFD Sequence

The factory installed VFD is wired to the controller. Supply fan speed needs to be set during test and balance of the unit. If equipped with BMS communications, the user can also directly command the supply fan speed. The following sequences are selectable for supply fan control. The fan speed in constrained by its min and max speed set points.

- **Constant Volume:** Supply fan operates at a constant speed based on a constant volume set point based on occupancy.
- **0-10 VDC by Others to VFD:** The supply fan is enabled by the unit controller. An external field-supplied 0-10 VDC signal to the fan's VFD is responsible for modulating the supply fan's speed. The signal is linear and the speed is at min when 0V is present and at max when 10V is present.
- **CO_2 Control:** The supply fan modulates to maintain CO_2 set point based on a sensor located in the space or return duct. A CO_2 sensor or BMS communicated value is required for this sequence.
- **Duct Static Pressure Sensor:** The supply fan modulates to maintain an adjustable duct static set point based on a sensor located in the supply duct. A static pressure sensor or BMS communicated value in required for this sequence.
- **Space Static Pressure:** The supply fan modulates to maintain a space static pressure set point based on a sensor located in the space. A space static pressure sensor or BMS communicated value in required for this sequence.
- **Single Zone VAV :** The controller will control the supply air temperature and supply fan speed in order to maintain the space temperature.

  Heating Mode- The supply temperature set point will be increased before increasing the supply fan speed in order to maintain the space temperature set point. If the calculated supply temperature set point is greater than the current space temperature, the supply fan speed will be increased while the supply temperature set point is increased.

  Cooling Mode - The supply temperature set point will be decreased before increasing the supply fan speed in order to maintain the pace temperature set point.

Exhaust Fan VFD Sequence

The factory installed VFD is wired to the controller. Exhaust fan speed needs to be set during test and balance of the unit. If equipped with BMS communications, the user can also directly command the exhaust fan speed. The following sequences are selectable for exhaust fan control. The fan speed constrained by its min and max speed set points.

- **Constant Volume:** Exhaust fan operates at a constant speed based on a constant volume set point based on occupancy.
- **0-10 VDC by Others to VFD:** The exhaust fan is enabled by the unit controller. An external field-

supplied 0-10 VDC signal to the fan's VFD is responsible for modulating the supply fan's speed. The signal is linear and the speed is at min when 0V is present and at max when 10V is present.

- **Space Static Pressure:** The exhaust fan modulates to maintain a space static pressure set point based on a sensor located in the space. A space static pressure sensor or BMS communicated value in required for this sequence.
- **Supply Fan Tracking:** The exhaust fan proportionally modulates based on the supply fan speed plus an adjustable offset.
- **Outside Air Damper Tracking:** The exhaust fan proportionally modulates based on the outdoor air damper modulation. (This sequence requires a modulating outdoor air damper.)

Outside Air and Recirculated (Recirc) Air Damper Control

If equipped with a modulating OA and recirculated air damper, the recirculated air damper will operate inverse of the OA damper. The OA damper opens to its min position. If the controller is configured to modulate the supply fan speed, the min and max OA positions can be reset based on supply fan speed. If equipped with BMS communications, the BMS can directly control the outside damper position. The damper position is constrained by its min and max set point positions.

- **CO_2 Control:** The controller will proportionally modulate the OA/RA dampers based upon a comparison of the CO_2 set point to the actual CO_2 level reported from the sensor. As the CO_2 level rises, the controller will proportionally modulate the OA damper open, between the min OA damper position and max CO_2 position.
- **Space Static Pressure:** The OA/RA dampers will modulate based upon the signal from a building static pressure sensor. The controller will modulate the dampers, between the min and max OA positions, based upon a comparison of the building static pressure set point to the actual building static pressure level reported from the sensor.

Energy Recovery Wheel Sequences

Economizer: If the unit is equipped with an energy recovery wheel, the economizer will modulate/stop the energy wheel to achieve free cooling.

- **Stop Wheel:** When economizer mode is enabled and there is a call for cooling, the wheel will stop rotating to allow free cooling. Jog wheel control is available during stop wheel economizer operation. This sequence allows the wheel to rotate for a short period of time exposing a new section to the air stream.
- **Modulate Wheel:** When economizer mode is enabled and there is a call for cooling, the controller modulates wheel speed to maintain the supply temperature set point.
- **Energy Wheel Bypass Dampers, if equipped:** During normal operation, the dampers shall remain closed to allow full operation of the energy wheel. During economizer sequences, the dampers will be open to bypass the energy wheel.

Frost Control: The microprocessor controller will activate the frost control method when the OA temperature is less than the defrost set point (5°F) and the wheel pressure switch is closed due to a high wheel pressure drop. Once the pressure drop decreases below the pressure switch point or the OA temperature increases, the unit will resume normal operation.

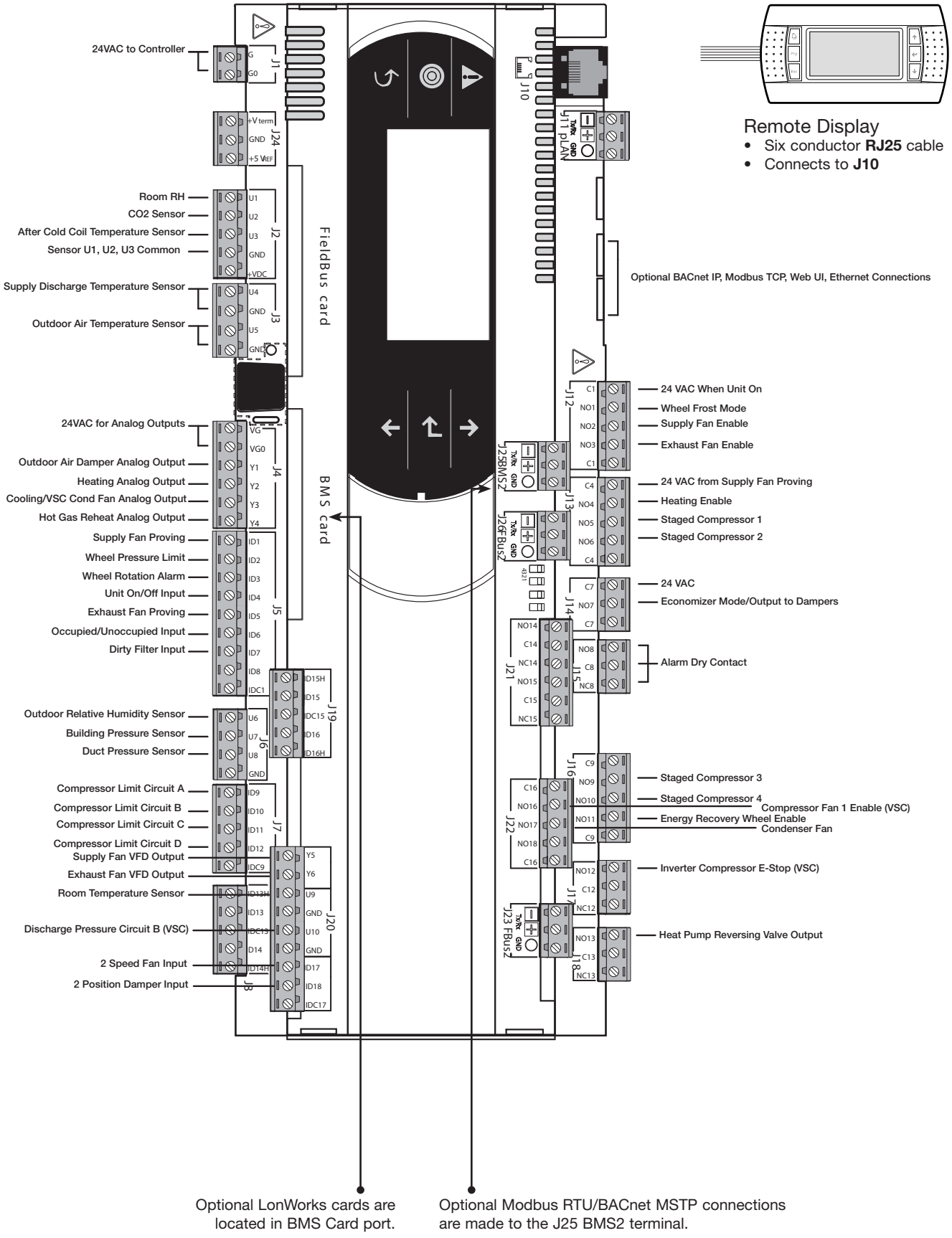
- **Electric Preheater:** When frosting is occurring, the preheater is energized to defrost the wheel.
- **Modulate Wheel:** When frosting is occurring, the wheel slows to allow defrosting to occur.
- **Cycle Wheel:** When frosting is occurring, the energy wheel is cycled off for a defrost cycle time (5 minutes). After the defrost cycle time, the wheel is re-energized to continue normal operation. The controller will not allow another defrost cycle for a min normal operating cycle time (30 minutes).
- **Timed Exhaust:** When frosting is occurring, the supply fan is cycled off along with the tempering for a defrost cycle time (5 minutes). The exhaust fan will continue to run allowing the warm exhaust air to defrost the wheel. After the defrost cycle time, the supply fan and tempering are re-energized to continue normal operation. The controller will not allow another defrost cycle for a min normal operating cycle time (30 minutes).

Alarms

The microprocessor controller includes a digital output for remote indication of an alarm condition, which connects via the **J15** port. Alarms include:

- **Dirty Filter Alarm:** If the outside air or return air filter differential pressure rises above the differential pressure switch set point, the microprocessor controller will activate an alarm.
- **Supply and Exhaust Air Proving Alarm:** Microprocessor controller monitors proving switch on each blower and displays an alarm in case of blower failure.
- **Sensor Alarm:** Microprocessor controller will send an alarm if a failed sensor is detected (temperature, pressure, relative humidity).
- **Supply Air Low Limit:** If the supply air temperature drops below the supply air low limit (35°F), the controller disables the unit and activate the alarm output after a preset time delay (300 sec.).
- **Other Alarms:** Wheel Rotation, High Wheel Pressure, High/Low Refrigerant Pressure.

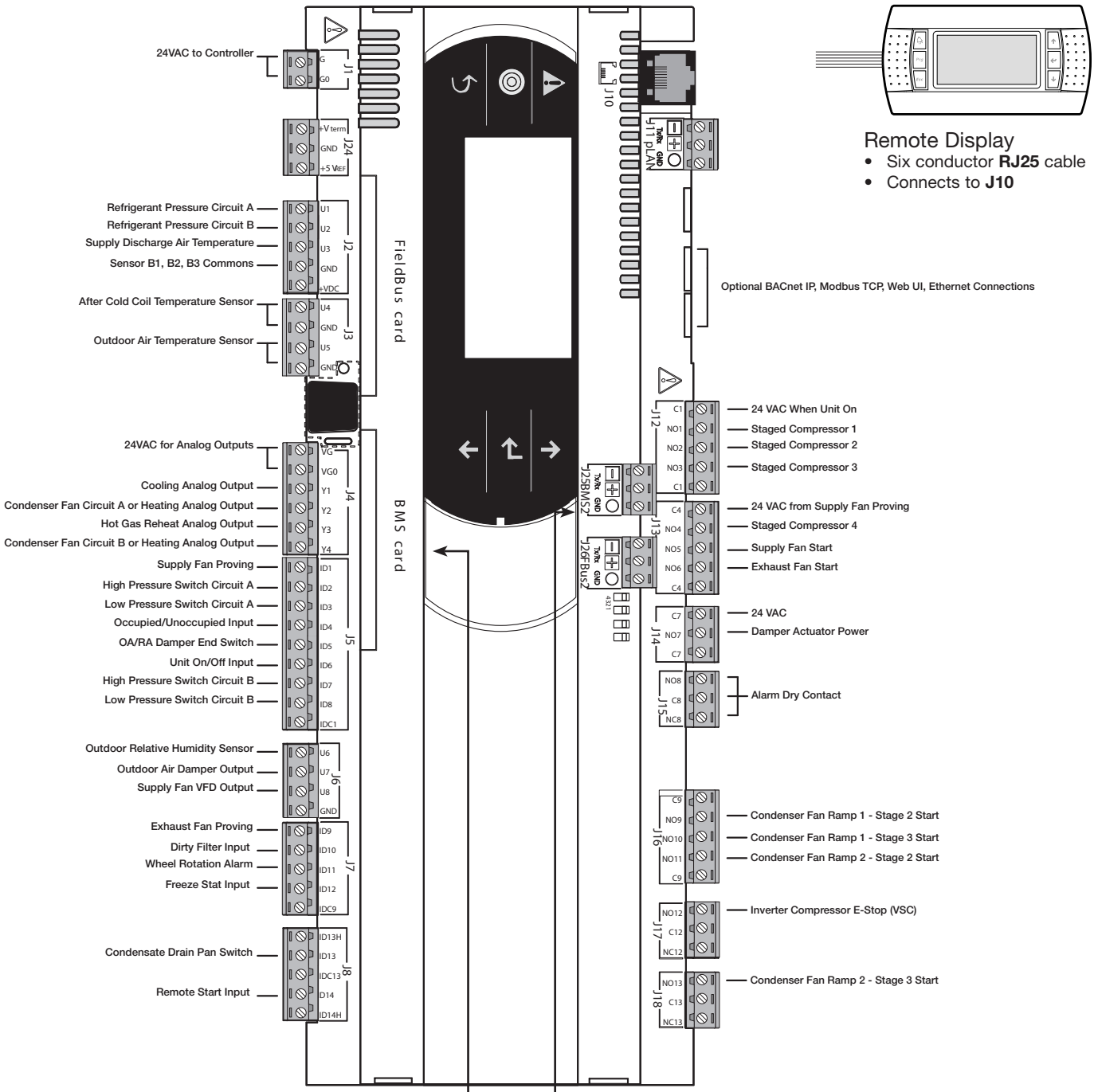
Large Controller Overview



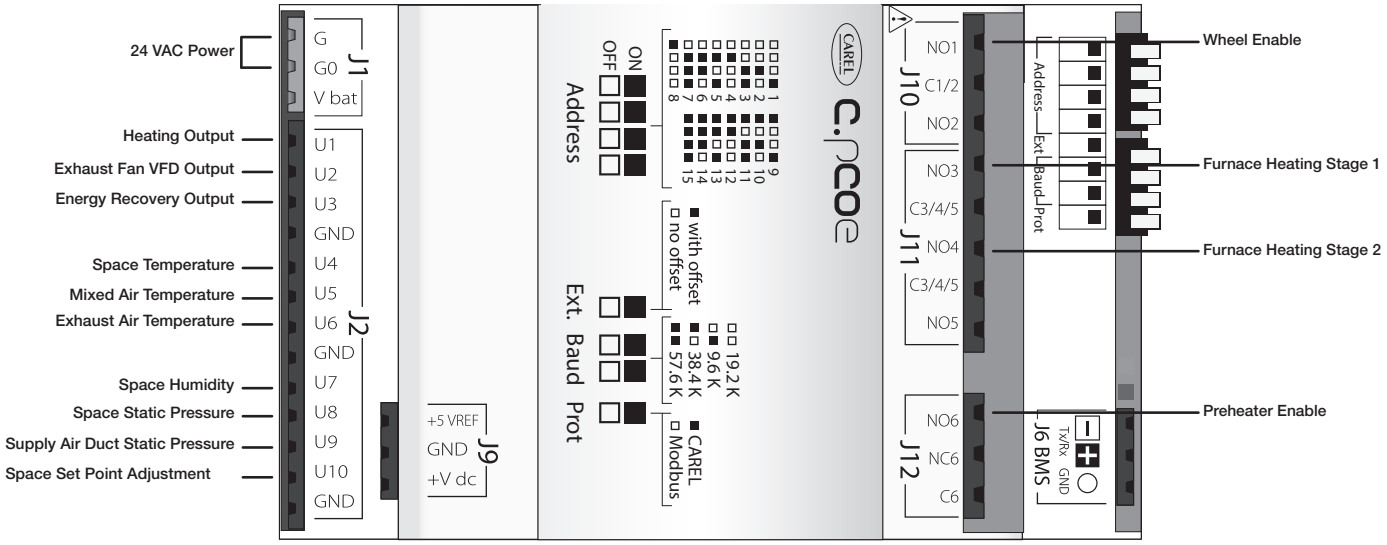
Optional LonWorks cards are located in BMS Card port.

Optional Modbus RTU/BACnet MSTP connections are made to the J25 BMS2 terminal.

Medium Controller Overview

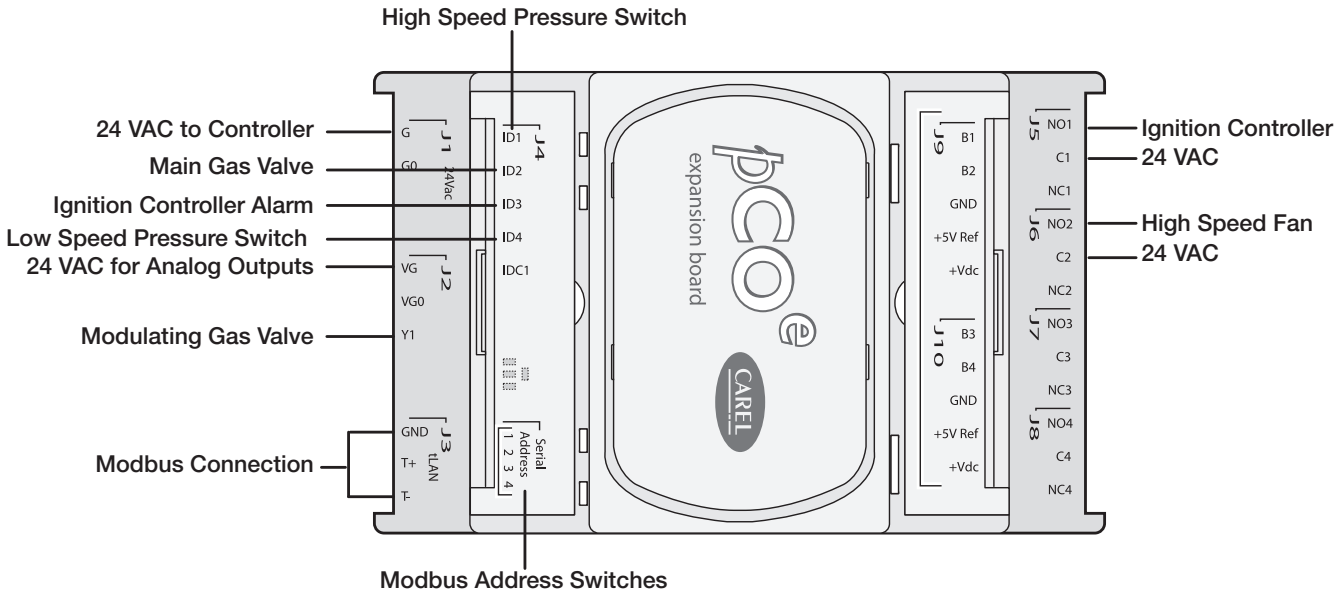


c.pCOe - Expansion Board Overview, Medium Controller Arrangement

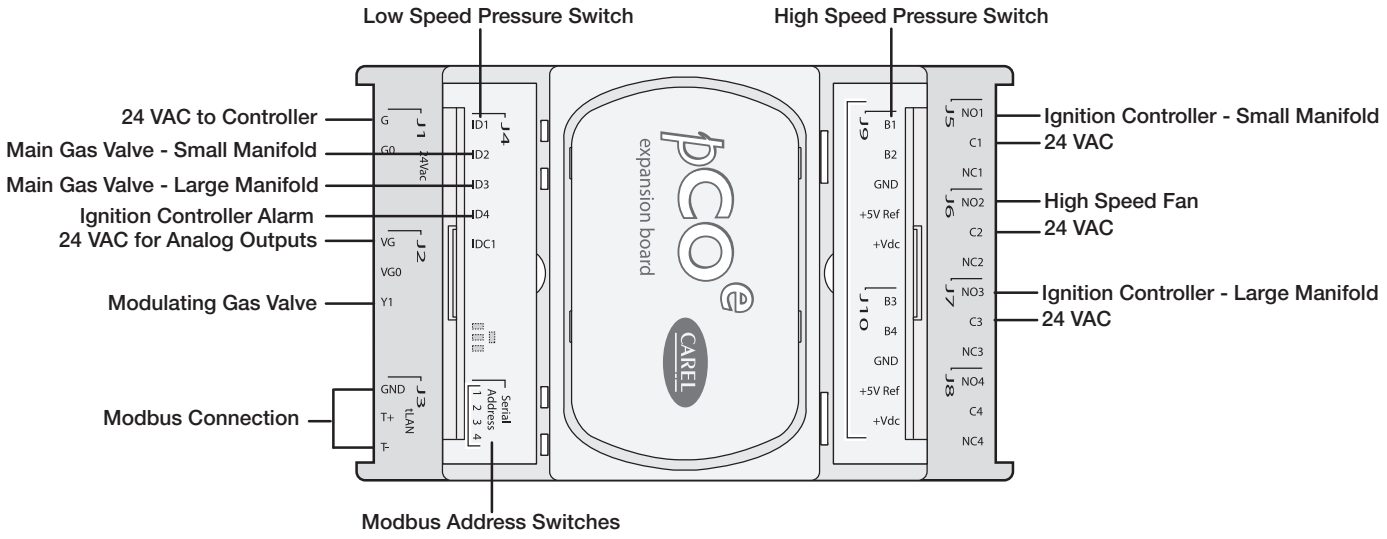


The expansion board is an I/O module than can be used to monitor additional statuses or provide commands from medium board controller.

pCOe - 4:1 Furnace Overview



pCOe - High Turndown Furnace



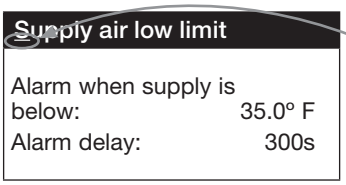
Display Use

The microprocessor controller is located in the unit control center. The face of the controller has six buttons, allowing the user to view unit conditions and alter parameters. The microprocessor controller is pre-programmed with easy to use menus. A remote display is also available, which connects via the **J10** port with six wire patch.

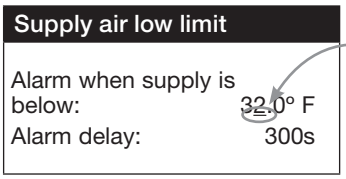
Keypad Description

Button	Description	Functions
	Main Menu	Press to go directly to the Main Menu from any screen. From the Main Menu, navigate to the following screens: • Unit Enable • Unit Status • Ctrl Variables • Alarm Menu
	Alarm	The Alarm button flashes when there is an active alarm. Press to view alarms. Press twice to go to the alarms reset screen.
	Escape	Press from the Main Menu to view the Unit Status screen. Press to go back one menu level.
	Up	Press to navigate through the menus/screens. Press after entering a variable to increase a current value.
	Enter	Press to enter a highlighted menu or screen item. Press to enter a writable variable and press again to confirm the new variable value.
	Down	Press to navigate menus/screens. Press after entering a variable to decrease the current value.
		Unit display on web interface only. These two buttons on the virtual keypad/display are used to simulate two-button actions on the handheld keypad/display. To simulate pressing two buttons simultaneously: 1. Click on 2-Button Click. 2. Then, sequentially click on two keypad buttons (Main, Alarm, Escape, Up, Enter, Down). To simulate pressing and holding two buttons simultaneously: 1. Click on 2-Button Hold. 2. Then, sequentially click on two keypad buttons (Main, Alarm, Escape, Up, Enter, Down).

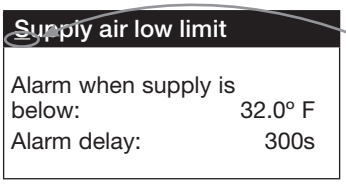
Parameter Adjustment



The cursor always begins in the upper left corner of the display and will be blinking. Press the ↵ button to move the cursor down for parameter adjustment.



Once the cursor has reached the desired parameter, press the ↑ ↓ buttons to adjust the value.



When satisfied with the adjustment, press the ↵ button to save the parameter. When finished, make certain the cursor is in the upper left corner. If the cursor is not in the upper left corner, the changes will not be saved. The cursor must be in the upper left corner to enable screen advancement.

Web User Interface

The Web User Interface allows access to the unit controller through the building network. Reference Ctrl Variables/ Advanced/Network Settings to set the IP network protocol. Once proper communication is established, the user can click on the follow tabs:

Overview – Includes a functioning unit graphic, monitoring points, and active set point adjustment.

Alarms – Shows current and cleared alarms.

Trending – User can view past and present controller points.

Information – Provides manufacturer support information as well as IOM resources.

Service – User must be logged with service access criteria (9998). Once proper login is established, the user can view configured input/output points associated with the unit controller

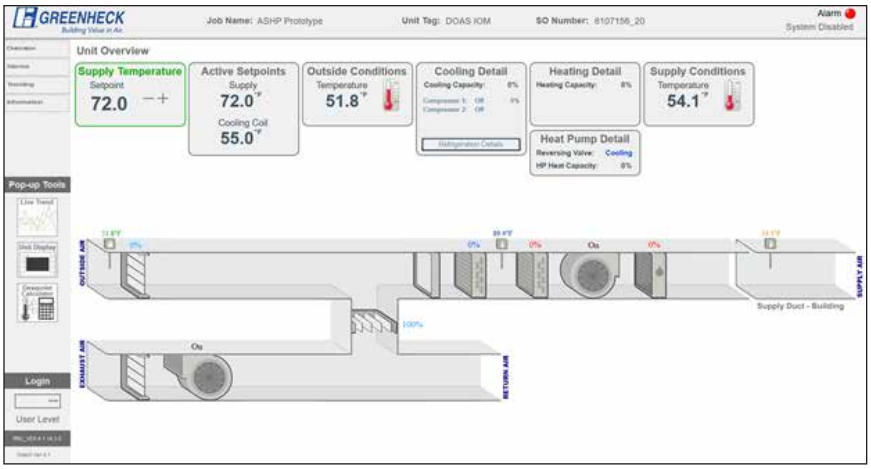
Pop-Up Tools

Live Trend - User can see current values from the controller. The list of variables available is preselected based on the configuration of the unit.

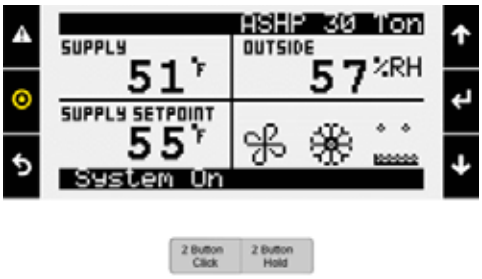
Unit Display - Mimics the unit controller display. Allows the user full access to the controller without having to physically be at the unit.

Dewpoint Calculator - A calculator with three sliders to determine the dew point, temperature, or humidity. Two of the three values are necessary to get the third.

Upgrade Application - A new application program can be loaded to the controller via the WebUI.



Web User Interface



Unit Display

Web User Interface
Logged in with Service, red boxes will appear after logging in.

Main Menu Navigation

Unit Enable

Main Status

- Unit Status
- Input Output Status

Note:
Additional status screens are displayed depending on unit configuration. Screens may include, but are not limited to:

- Occupancy
- Damper positions
- Fan status
- Airflow
- Set Points
- Economizer
- Energy recovery
- Cooling
- Circuit pressure
- Heating
- Dehumidification
- Static pressure

Ctrl Variables

- Temp Control
- Dehumidification
- Refrigeration
  - Compressor Control
  - Pressure Control
  - Heat Pump Control
- Damper Control
- Energy Recovery
- Fan Control
  - Supply Fan Control
  - Exhaust Fan Control
- Occupancy
- Advanced

Note:
The Advanced menu is read-only. The service password is required to change these settings. Reference the Advanced menu section for more information.

*Consult factory for more information.

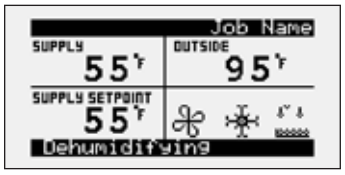
  - Login
  - Manual Overrides
  - Adv. Set Points*
  - PID Tuning*
  - Network Settings
  - Backup/Restore
  - IO Status/Offset*
  - IO Config
  - Unit Config*
    - Service Config
    - Factory Config
  - Unit Settings*
  - Service Info*
  - Alarm Management
    - Shutdown Alarms
    - General Alarms

Alarm Menu

- Alarm History
- Active Alarms
- Reset History
- Clear History
- Export History

Unit Status Overview

The microprocessor controller will revert to a default main menu loop. This loop includes several screens to view the operating conditions of the unit. Scroll through the menu screens by using the ↑ ↓ buttons.



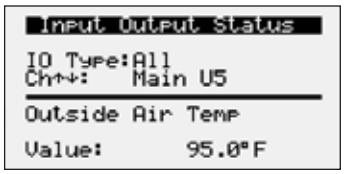
THE INITIAL MENU SCREEN DISPLAYS THE JOB NAME, UNIT TAG, UNIT STATUS, OUTSIDE AIR CONDITIONS, SPACE CONDITIONS AND SET POINTS.

Possible modes include:

- Off/Standby
- Unoccupied Start
- Dampers Open
- Fan Start Delay
- Fans Starting
- Startup Delay
- System On
- Soft Shutdown
- System Disabled
- Remote Off
- Shutdown Alarm
- Fans Only
- Economizing
- Cooling
- Dehumidifying
- Heating
- HGRH Purging
- Defrost Active
- Overrides Active
- Expansion Offline

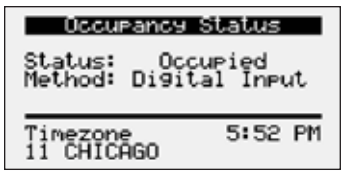
Unit Status Screen Symbols

Symbol	Indicates
	Supply air fan status. Rotation indicates airflow; static blades indicate no airflow.
	Cooling
	Heating
	Dehumidifying
	Economizing
	Defrost



INPUT OUTPUT STATUS

Displays real time conditions from sensors located in the unit and building space if equipped with space mounted sensors. Controller output conditions can also be viewed from this screen. To view the desired input/output point, the user must select the desired channel. Reference the Controller Overview section in this manual for individual point locations.

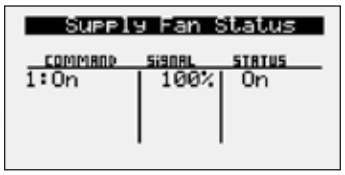


OCCUPANCY STATUS

Displays current status of occupancy and the configured occupancy control method and time zone.

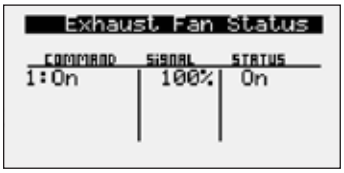
DAMPER COMMANDED POS

This screen appears if equipped with modulating OA and recirculated air dampers. Displays current position of the OA damper.



SUPPLY FAN STATUS

This screen displays the fan enable command, fan proving status, and the supply fan ramp being sent from the controller to the VFD. The min and max speeds are set in the VFD (Reference unit Installation and Operation Manual for VFD programming). The controller can modulate the fan between the min and max speeds via an analog output.

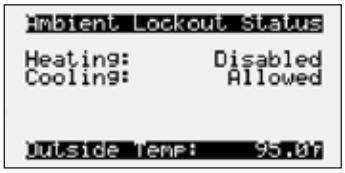


Exhaust Fan Status

This screen displays the fan enable command, fan proving status, and the exhaust fan ramp being sent from the controller to the VFD. The min and max speeds are set in the VFD (Reference unit Installation and Operation Manual for VFD programming). The controller can modulate the fan between the min and max speeds via an analog output.

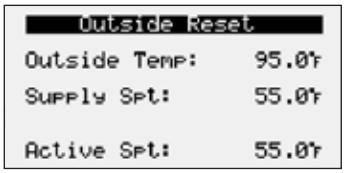
Airflow Status

This screen displays the current status of airflow volumes if the unit is provided with airflow monitoring.



Ambient Lockout Status

Displays heating and cooling lockout status based on the outside air ambient temperature. Ambient lockouts for heating and cooling can be altered by entering Main Menu/Ctrl Variables/Temp Control/Cooling or Heating.

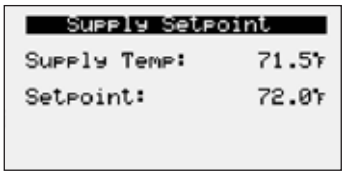


Outside Reset

This screen will be active if the controller is configured for outside air reset. The heating and cooling devices modulate to maintain the supply air temperature set point as determined by the outside reset calculation.

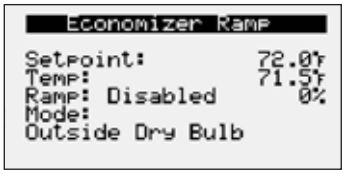
Active Reset

This screen will be active if temperature control mode is set for space or return air reset. The supply temperature set point is calculated based on the active set point and the current space or return temperature. The calculated set point is scaled between the supply temperature min and max set points determined by the current mode of operation.



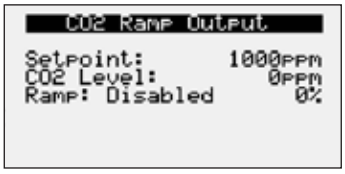
Supply Set Point

This screen is active when supply temp control is selected or the active mode of control. Displays current supply temperature and supply temperature set point to be achieved.



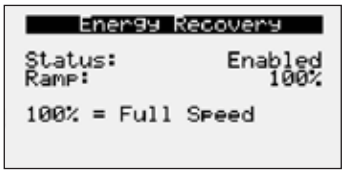
Economizer Ramp

The economizer ramp screen will be active if the unit is configured for economizer control. This screen displays the economizer set point, supply air discharge temperature, economizer ramp status, and economizer control mode. Economizer control mode options include, outside dry bulb, outside enthalpy, comparative dry bulb, and comparative enthalpy.



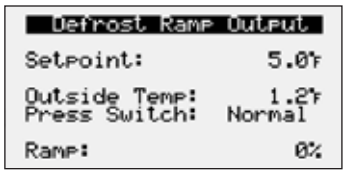
CO_2 Ramp Output

The CO_2 Ramp Output screen will be active if the unit is configured for CO_2 control. This screen displays the CO_2 set point, CO_2 level from the space, and the status of the control ramp.



Energy Recovery Wheel Status

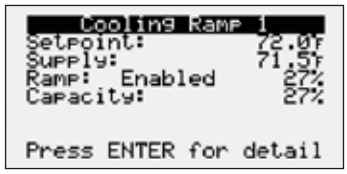
This screen provides overall status of the energy recovery wheel.



Defrost Ramp Output

This screen only appears if the unit has an energy recovery wheel and a frost control method was provided on the unit.

Upon sensing a high differential pressure across the energy wheel, the unit will go into defrost if the outside air temperature is below the defrost temperature set point.

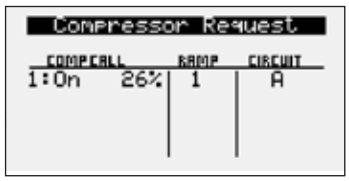


Cooling Ramp 1

This screen displays the active set point, supply discharge temperature, cooling enable/disable, cooling ramp being sent from the controller, and the overall capacity being demanded.

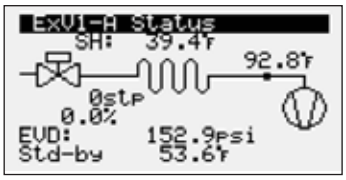
Heat Pump Heating Ramp

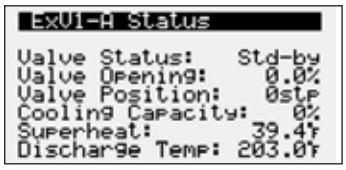
The Heat Pump Heating Ramp status screen is active when the unit is configured as a heat pump. The screen displays the active set point, supply temperature, status of the heat pump heating control ramp, the current ramp percentage, and the current capacity of the operating compressors.



Compressor Request

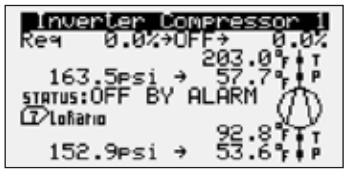
The compressor request screen will be active if the unit is equipped with DX cooling. This screen displays overall status of individual compressor operation being sent from the unit controller. Example: Circuit A compressor enable (On) with modulating value of 26%.





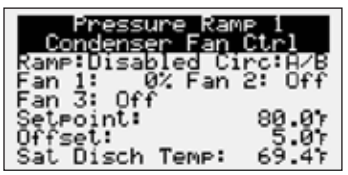
ExV Status

The ExV Status screen is active when the unit is equipped with an inverter scroll compressor and electronic expansion valve (ExV). The screen displays information from the EVD (electronic valve driver) including the number of steps (stp) of the valve, the open percentage of the valve, the EVD control status, the suction superheat, the suction temperature, the suction pressure, and the saturated suction temperature. The second status screen also displays the capacity of the circuit the valve is installed on and the discharge refrigerant temperature for that circuit.



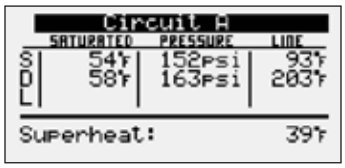
Inverter Compressor Status

The inverter compressor screen is active when an inverter scroll compressor is installed in the unit. This screen displays information about the operation of the inverter scroll starting with the requested capacity of the compressor compared to its actual operating capacity. The requested capacity and the actual could be different at startup and depending on where it is in the operating envelope. The status of the compressor, current envelope zone and current refrigerant temperatures and pressures are also displayed.



Condenser Fan Status

The pressure control status screen is active when a unit is equipped with active head pressure control, this is currently available only with inverter scroll compressors. This screen provides information regarding the outside fan ramp status, circuits affected by the ramp, the status of the fans, and the set point, offset and current saturated temperature.

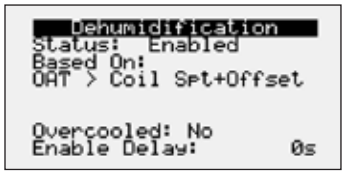


Refrigerant Circuit Status

The refrigerant circuit status screen is active when the unit is equipped with active head pressure control. This screen provides temperatures and pressures for suction, discharge, and liquid line sensors when installed. Superheat is also displayed when suction temperature and pressure sensors are installed.

Heating Ramp

This screen displays the active set point, supply air temperature, status of the heating control ramp, and heating ramp being sent from the controller.



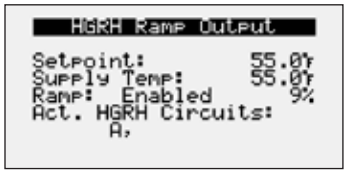
Dehumidification

This screen will display the overall dehumidification status and selected dehumidification control mode.

The following dehumidification modes are available when the space is in occupied mode:

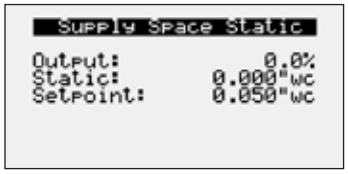
- Cold coil set point plus offset (10°F)
- Inside RH*
- Inside dew point*
- Outside dew point
- Inside RH or inside dew point*
- Inside RH or inside dew point or outside dew point
- Inside RH and inside dew point*
- Inside RH and inside dew point or outside dew point

*Available during unoccupied mode.



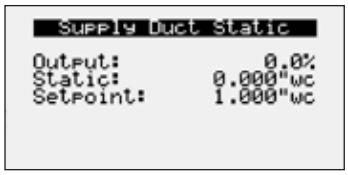
HGRH Ramp

This screen will display the status of the hot gas reheat ramp. The screen includes the active set point, supply air discharge temperature, the ramp status, and hot gas reheat valve request being sent from the controller.



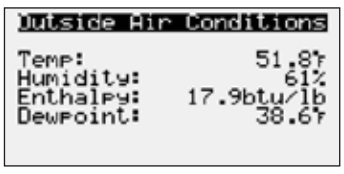
Supply Space Static

This screen displays status points if the unit is configured for space static pressure control. Status points include controller output ramp, static pressure in the space, and the space static pressure set point. Similar status screen will appear for the exhaust fan if the unit is configured for exhaust fan space static control.



Supply/Return Duct Static

This screen displays status points if the unit is configured for duct static pressure control. Status points include controller output ramp, static pressure in the duct, and the duct static pressure set point. Similar status screen will appear for the exhaust fan if the unit is configured for exhaust fan duct static control.



Conditions

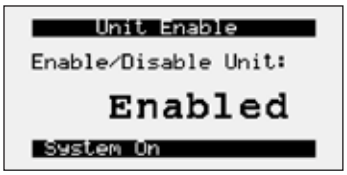
The condition screens are active when both temperature and humidity sensors for the location are installed in the unit. The enthalpy and dew point are calculated based on the temperature and humidity readings. The unit altitude is used for the enthalpy calculation.

Menu

The controller is equipped with several menus to help guide users with altering program parameters. The following menus can be accessed by pressing the ⊙ button. To enter the desired menu, press the ↵ button.

Unit Enable

The **Unit Enable** menu allows the user to enable and disable the unit through the controller. Reference sequence of operation for additional unit starts/stop details.



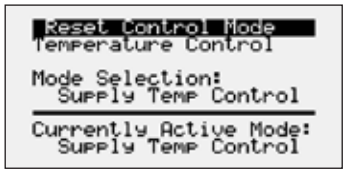
The unit ships from the factory in a disabled state. To allow the unit to operate, the controller must receive a run command from digital input ID4. **Jumper unit terminals R - G to allow the unit to operate.**

Change to (Enabled/Disabled): Enables user to manually turn unit on/off via display. Unit terminal **G** must have 24 VAC power to enable the unit.

Control Variables

The **Control Variables** menu allows the user to view and adjust unit control parameters.

The **Temperature Control** menu allows the user to view and adjust temperature control conditions of the unit.



Method for Temperature Control

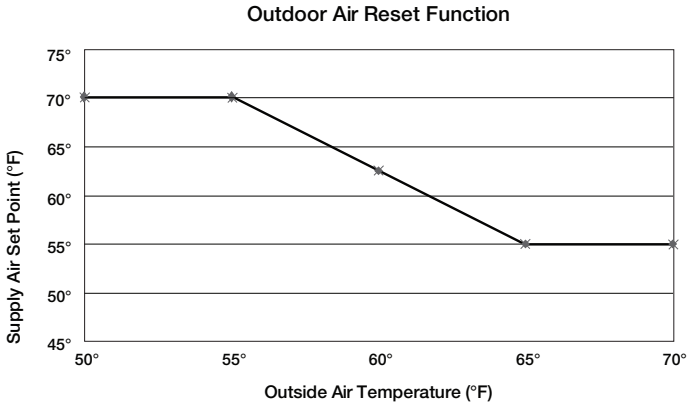
Set Point Selections:

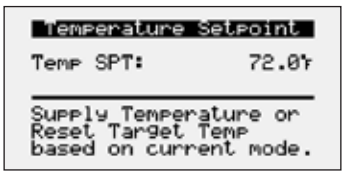
Supply Temp Control – The supply discharge set point is a constant value (e.g. 72°F). Reference Temperature Set point screen for set point adjustment.

Space Reset – The controller will reset the supply air temperature set point to maintain the space temperature set point (requires space temp sensor). Reference the Temperature Set point screen for space set point adjustment.

Return Reset – The controller will reset the supply air temperature set point to maintain the return air temperature set point (requires duct mounted return air temp sensor). Reference the Temperature Set point screen for return air set point adjustment.

OA Reset – The controller monitors the OA temperature and adjusts the desired supply temperature set point accordingly. For example, when the OA is below 55°F, the controller will change the supply set point to 70°F. If the OA is above 65°F, the controller will change the supply set point to 55°F. If the OA temperature is between 55°F and 65°F, the supply set point changes according to the OA reset function. A visual representation of the OA reset function is shown below. Reference Outside Set points for min and max outside air limits.





Temperature Set Point

This screen only appears if supply temp control, space reset, or return reset is selected as the reset control mode.

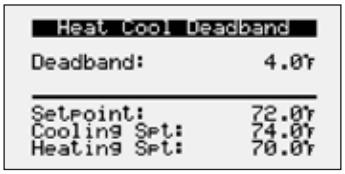
Set Point Selections:

Local – The space set point will be constant; set from screen (e.g. 72°F).

BMS – The BMS can directly control the space temperature set point (requires BMS communication option).

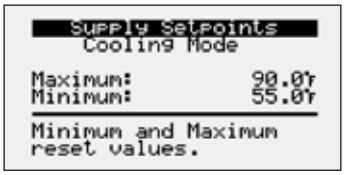
T-Stat – The space set point will be adjustable from the space thermostat.

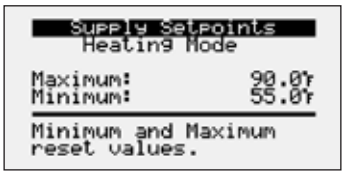
Reference Appendix: Room Thermostat Quick Start for additional information.



Heat Cool Deadband

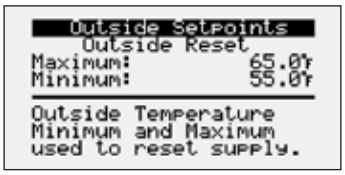
This screen only appears if space reset or return air reset is selected as the reset control mode. The heat cool deadband allows for separate cooling and heating set points when the reset control mode is set for space reset or return air reset.





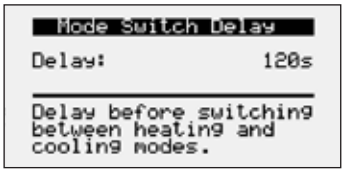
Supply Set Points

Cooling and heating supply set points screens only appear if outdoor reset, space reset, or return air reset is selected. These screens allow the user to set the min and max set point limits for cooling or heating operation. The controller will adjust the supply temperature set point between the set limits depending on mode of operation.



Outside Set Points

This screen only appears if outside reset is selected as the reset control mode.



Mode Switch Display

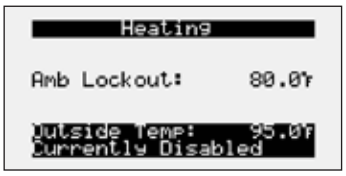
This screen displays the delay time required before switching between heating and cooling mode.

Startup Display

This screen displays the delay time after the fans have started and tempering begins

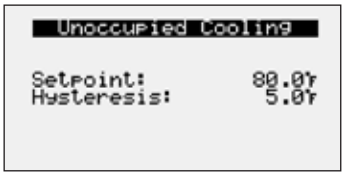
Cooling Lockout

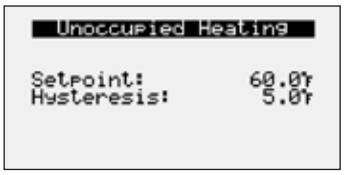
This screen displays the cooling lockout temperature. Cooling will be disabled when outside air is below the cooling lockout temperature (55°F).



Heating Lockout

This screen displays the heating lockout temperature. Heating will be disabled when outside air is above the lockout temperature (80°F)**.**

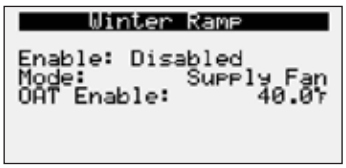




Space Set Points during Unoccupied Mode

The controller will have separate screens for unoccupied cooling and heating set points.
Unoccupied Cooling Example: If set point = 80°F, unoccupied cooling is enabled when space equals 80°F and above. Unoccupied cooling is disabled when space temperature is below 75°F.

Unoccupied Heating Example: If set point = 60°F, unoccupied heating is enabled when space temperature equals 60°F and below. Unoccupied heating is disabled when space temperature is above 65°F.



Winter Ramp

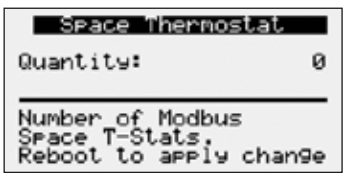
The winter ramp function prevents the supply temperature from dropping below set point under the following conditions:

- Outside air temperature is below the winter ramp enable set point; and
- Heating capacity is at 100%

One of the following is used to perform the winter ramp function:

- Supply fan speed; or
- Outside air damper position

Note: If the unit is a heat pump, the supply fan is always used.



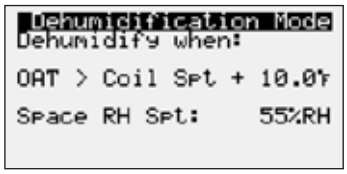
Modbus Space T-Stat

The quantity of thermostats installed in the space that communicate the temperature, humidity, and set point to the controller. The controller averages the temperature and humidity readings when there is more than one installed. See Appendix C for more information.

Control Variables

↳ Dehumidification

The **Dehumidification** menu allows the user to view and adjust dehumidification control parameters.



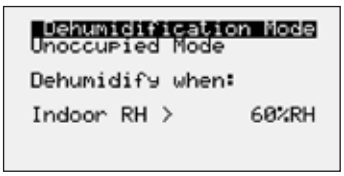
Dehumidification Mode - Occupied.

Possible Modes:

- Outside Air Temp is greater than cold coil set point plus offset (10ºF)
- Inside RH*
- Inside dew point*
- Outside dew point
- Inside RH or inside dew point*
- Inside RH or inside dew point or outside dew point
- Inside RH and inside dew point*
- Inside RH and inside dew point or outside dew point

*Available during unoccupied mode.

There must be a constant call for dehumidification for the duration of the enable delay for dehumidification mode to become enabled. The call remains active until conditions are satisfied and dehumidification mode has been active for the min active time. Reference Ctrl Variables/Advanced/Unit Config/Unit Configuration Occupied Dehum Call for dehumidification method options.



Dehumidification Mode - Unoccupied.

If the unit is unoccupied while there is a dehumidification call, the unit will start and dehumidify until the unoccupied dehumidification set points are satisfied. The above dehumidification modes marked with an * indicate availability during unoccupied mode. The unoccupied dehumidification mode can be set differently than the occupied dehumidification mode. Reference Ctrl Variables/Advanced/ Unit Config/Unit Configuration Unoccupied Dehum Call for dehumidification method options.

Dehumidification Hysteresis

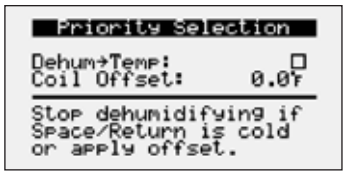
This screen displays hysteresis for enabling dehumidification during occupied and unoccupied conditions. %RH for indoor RH control and ºF for indoor dew point control. Example: If indoor RH set point = 50%, dehumidification is enabled when indoor RH equals 50% and above. Dehumidification is disabled when indoor RH is below 44%.

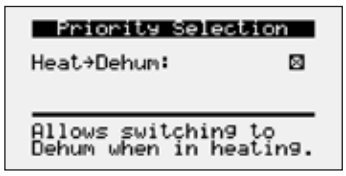
Dehumidification Timers

This screen allows adjustment for delay and min on time for dehumidification mode. Times are in place to prevent short cycling between dehumidification and other control modes.

Cold Coil Set Point

This screen displays the temperature set pints for the cooling coil. This screen only appears if the unit is equipped with cooling. When in dehumidification mode, the cooling ramp maintains the cold coil set point by increasing or decreasing the amount of cooling provided from the cooling device installed. The calculated coil set point has a min and max set point that is based on the demand from the dehumidification ramp. When the demand is high, the temperature is low. If a constant temperature off the coil is desired during dehumidification, the min and max can be set to the same value. If a BMS is available, the set points can be adjusted over the BMS.





Dehumidification Priority

The following priorities are used to determine what is more important in the unit: temperature over dehumidification or heating over dehumidification. Both priority selections determine when the unit is allowed to dehumidify.

1. Temperature over Dehumidification

   Determines when the unit is allowed to dehumidify based on the space/return air temperatures.

   a. Temperature - If temperature is set as the priority,box not checked, and the space or return air is over cooled, dehumidification is locked out until the space or return temperature is no longer overcooled.

   b. Dehumidification - If the priority is dehumidification, box checked, and the space or return air is overcooled, the coil offset will be added to the coil leaving set point. (Default 0°F offset).

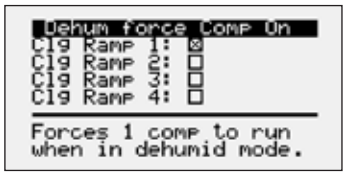
   c. Overcooled - If space or return reset is enabled, the target is considered over cooled when it is 4°F below set point for 5 minutes. It remains overcooled until the target is at set point and the over-cool logic has been active for a min of 5 minutes.

2. Heating over Dehumidification

   Determines when the unit is allowed to dehumidify when heating is active.

   a. Heating - If priority is set to heating, box in checked, the unit locks out dehumidification while heating is active.

   b. Dehumidification - If priority is set to dehumidification, box is not checked, the unit is allowed to switch to dehumidification when heating is active.



Compressor Dehumidification Force.

In dehumidification mode, the lead compressor will continue to run as long as the dehumidification mode sequence has been enabled in order to prevent compressor cycling and potential reevaporation of moisture. To disable this operation and allow the compressor to cycle in dehumidification mode, uncheck the applicable cooling ramps.

Control Variables
↳ Refrigeration

The **Refrigeration** menu allows the user to view and adjust compressor and condenser settings, if equipped.

Control Variables
↳ Refrigeration
↳ Compressor Control

Compressor Control

Consult factory prior to adjusting parameters in the compressor control menu.

Control Variables
↳ Refrigeration
↳ Pressure Control

Pressure Control

Consult factory prior to adjusting parameters in the pressure control menu.

Control Variables
↳ Refrigeration
↳ Heat Pump Control

Compressor Control

Allows the user to adjust heat pump heating control set points.

Air-Source Heat Pump Ambient Lockout

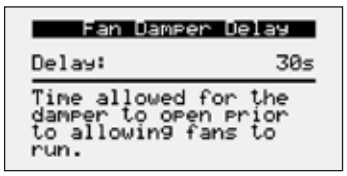
The screen allows the user to adjust the minimum ambient temperature the compressors can be utilized for heating. When the outside air temperature drops below this temperature, heating with the compressors will not be allowed.

Heat Pump Defrost

Consult factory prior to adjusting set points related to heat pump defrost operation.

Control Variables
↳ Damper Control

The **Damper Control** menu's allows the user to adjust damper control set points. Economizer set point adjust will also be found at this location if the unit is equipped with outside air and recirculation dampers.



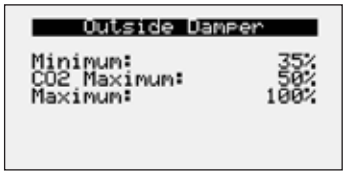
Fan Damper Delay

This screen allows adjustment for delay time between damper opening and fan operation. This timer allows the damper to open before the fan start sequence begins. This prevents the fans from having to overcome higher static pressure when the damper(s) are opening.

Outside Damper Position

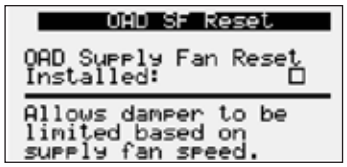
This screen only appears if equipped with a modulating OA and recirculating damper. The screen displays the min and max positions for the outside air damper. These set points reflect the percentage of the outside air damper being opened.

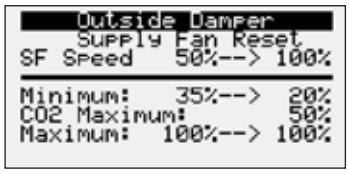
0% = Full recirculation air
100% = Full OA



Minimum Position – When in the occupied mode, the active set point will be equal to a local min OA set point, which may be constant or reset by fan speed if equipped with a modulating supply fan.

The OA damper set point can then be further adjusted between the min and max OA settings with sequences such as DCV CO_2, Building Pressure and Economizer.





Maximum Position – Each sequence that can adjust the OA damper set point contains a max position to prevent excess OA. The active set point will be determined based on the greatest demand of the configured sequences. For example, if a unit is equipped with a DCV CO_2 and an economizer sequence, the OA damper set point will react to an economizer demand even if the CO_2 set point is satisfied. Likewise, if economizer is not available but CO_2 is above set point, the OA damper will open to satisfy the CO_2 set point.

Economizer – The active set point will be reset based on Economizer demand, between the min and max positions.

Set Point Selections:

Local – The min OA percentage is constant; set by the controller.

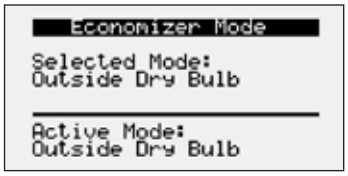
SF Reset – The min and max positions are reset by the supply fan speed.

BMS – The BMS can directly control the OA damper position between the min ad max percentages.

Building Pressure – Damper position is reset by a building pressure control loop.

DCV CO_2 – Damper position is reset by a demand-controlled ventilation control loop based on space CO_2 levels. The CO_2 max is the highest percentage that the OA damper can modulate when solely based on CO_2.

2 Position – Damper position is reset to "2-Pos/Max Vent:" set point when a contact closure is made. The 2-position damper operation can be configured to temporarily force the unit into occupied mode until the contact is open (Max Ventilation Mode - enabled in Advanced menu).



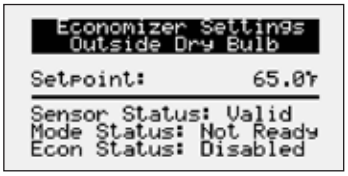
Economizer Control Variables.

The economizer screen appears when economizer function is enabled.

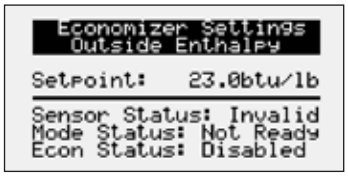
The outside air damper will modulate between the min and max position to maintain the supply temperature set point.

The user can select the economizer control method from the following options:

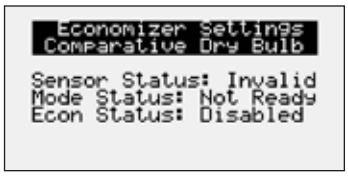
Outside Dry Bulb – Economizing is allowed when the outside dry bulb is less than the economizer temperature enable set point.



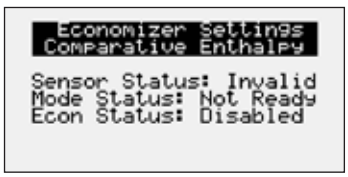
Outside Enthalpy - Economizing is allowed when outside enthalpy is less than the economizer enthalpy set point.



Comparative Dry Bulb - Economizing is allowed when outside temperature is less than the space or return temperature.



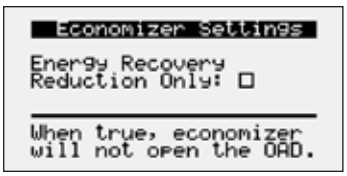
Comparative Enthalpy - Economizing is allowed when outside enthalpy is less than the space or return enthalpy.



Economizer Settings

There is a built-in hysteresis that disables economizer above the economizer set point.

(Example: If economizer uutside dry bulb = 65°F, economizer operation is disabled above 67°F).



Energy Reduction Only Control.

If enabled, the OA damper and recirculation damper will not modulate during economizer. Instead, only the energy recovery wheel will be stopped to ensure no energy is transferred from the supply airstream and exhaust airstream.

Control Variables

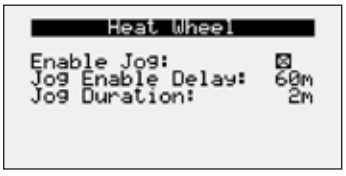
↳ Energy Recovery

The **Energy Recovery** menu allows the user to adjust energy recovery wheel sequence set points.

Defrost Ramp

This screen displays the temperature at which the unit will enable frost control mode if necessary (factory default = 5ºF) This screen only appears if the unit has an energy recovery wheel and a frost control method was provided with the unit.

Upon sensing a high differential pressure across the energy wheel, the unit will enter defrost mode if the outside air temperature is below this temperature setting. Max active time and min off time will be available if the frost control method was provided as timed exhaust or cycle wheel.



Energy Recovery Wheel Jog Function

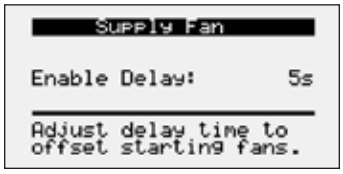
This screen display the energy recovery wheel jog function. This screen only appears if the unit has an energy recovery wheel and stop wheel economizer method for control.

Momentarily enables the wheel in order to expose a new section to the airstream.

Control Variables

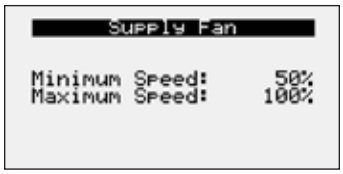
↳ Fan Control
↳ Supply Fan Control

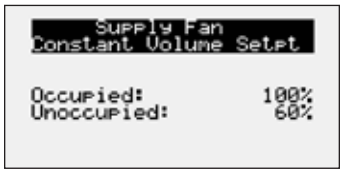
The **Supply Fan Control** menu allows the user to adjust exhaust control set points

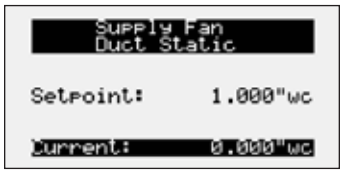


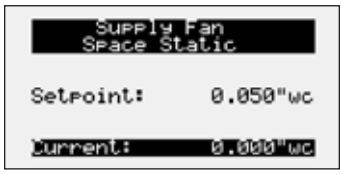
Supply Fan Delay

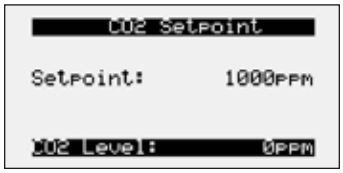
The supply fan delay will begin once the damper sequence is complete. This delay can be used to offset starting times between the supply fan and exhaust fan.











Supply Fan Speed

This screen displays min and max supply fan speed percentages. The speed set point is the proportional percentage of the analog output from the controller to the VFD.

50% Speed = Min speed

100% Speed = Max speed

Set Point Selections:

Constant Volume – The fan speed will be constant; set from screen (e.g. 100%).

BMS – The BMS can directly control the fan speed (requires BMS communication option).

Duct Pressure – Fan speed is determined by duct pressure control loop.

Space Pressure – Fan speed is determined by building pressure control loop.

CO_2 – Fan speed is determined by CO_2 control loop.

Single Zone VAV - The supply fan is modulated in addition to the supply air temperature to satisfy the space temperature set point.

2-Speed (High Speed Set Point) - Supply fan speed is reset to max speed when a contact closure is made. (Max Ventilation Mode).

Soft Shutdown Enable Conditions

During a soft shutdown the following will occur:

- Tempering outputs immediately revert back to their off value; while
- Dampers remain open and fans continue to run; until
  - The supply air temperature falls below the soft shutdown enable set point minus 5ºF; or
  - The soft shutdown delay timer has expired.

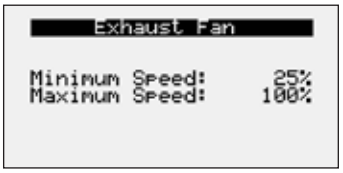
Control Variables

↳ Fan Control
↳ Exhaust Fan Control

The **Exhaust Fan Control** menu allows the user to adjust exhaust control set points.

Exhaust Fan Delay and Enable

This screen displays min and max exhaust fan speed percentages. This screen displays the exhaust fan delay and enable based on OA damper position. The exhaust fan delay will begin once the damper sequence is complete. This delay can be used to offset starting times between the supply fan and exhaust fan. This screen also provides the ability to enable the exhaust fan on a set OA damper position if the unit is equipped with a modulating OA damper.

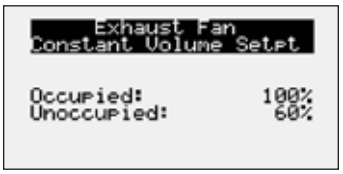


Exhaust Fan Speed Percentages

The speed set point is the proportional percentage of the analog output from the controller to the VFD.

25% Speed = Min speed

100% Speed = Max speed

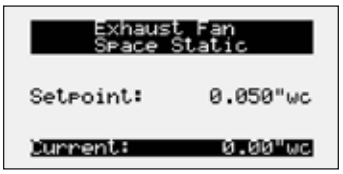


Set Point Selections:

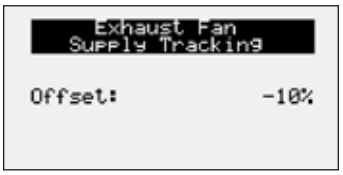
Constant Volume – The fan speed will be constant; set from screen (e.g. 100%).

BMS – The BMS can directly control the fan speed (requires BMS communication option).

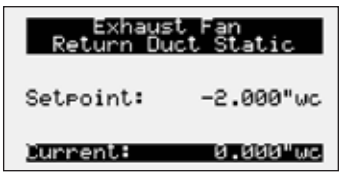
Space Pressure – Fan speed is determined by building pressure control loop.



Supply Fan Tracking with Offset – The exhaust fan will track the supply fan, between a min and max position. An offset can be added to achieve the proper balance.



Outside Air Damper Tracking – The exhaust fan will proportionally track the OA damper, between a min and max position.

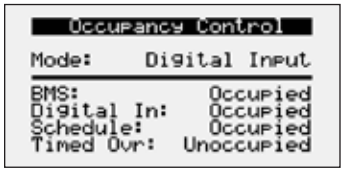


Return Duct Static Pressure – Fan speed is determined by duct pressure control loop.

Control Variables

↳ Occupancy

The **Occupancy** menu allows the user to adjust occupancy control parameters which includes occupancy control mode and schedule.



Occupancy Control

This screen displays the current mode of operation for occupancy control. Status of the other mode option can also be found on this screen. This screen allows the user to select the source of determining occupancy. The factory default is BMS control.

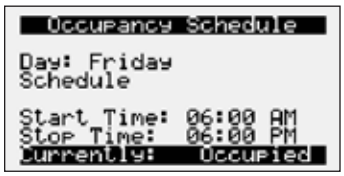
BMS: BMS control (Reference Points List). BMS can be overridden with ID6.

Digital Input: Typically used with a remote time clock, motion sensor or switch.

Always Occ: Controller will always remain in occupancy mode.

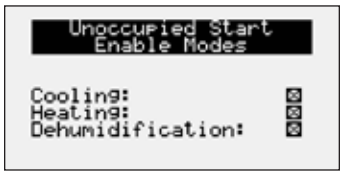
Always Unocc: Controller will always remain in unoccupancy mode.

Schedule: Allows the user to set an occupancy schedule for each individual day of the week.



Occupancy Schedule

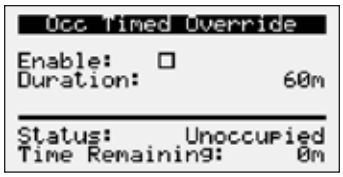
This screen allows the user to adjust the schedule. Requires the user to enter a start time, stop time and the applicable days of the schedule.



Unoccupied Start Enable Modes.

This screen only appears if unit is provided with unoccupied recirculation.

This screen allows the user to enable/disable modes of operation when in unoccupied recirculation control.



Occupancy Timed Override

Screen allows the user to override occupancy for a set duration.

Control Variables

↳ Advanced

The **Advanced** menu allows the user to access several submenus regarding controller information, controller overrides, network settings, I/O configuration, and unit configuration. Submenu options are read only and will require the user to input proper login criteria. The **service password (9998)** is required to change service access menus. Consult factory for factory level access.

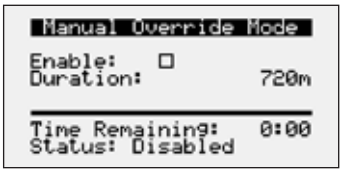
Control Variables

↳ Advanced
↳ Manual Overrides

The Manual Overrides menus are for start-up, commissioning, and troubleshooting.

IG Furnace Commissioning Menu

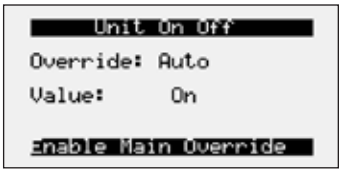
This screen only appears if an indirect gas furnace was provided with the unit. Entering the furnace commissioning menu will step the user through the furnace start-up.



Manual Override Mode

The Manual Overrides menu is for start-up, commissioning, and troubleshooting. This menu allows the user to override the control loops and specific inputs and outputs.

To access the Manual Overrides submenus, enter the **service password (9998)**. Manual overrides must be enabled at this screen to allow the user to override control loops. Override options must be changed from Auto to Manual for manual control.

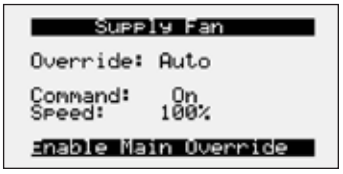


Override the Unit On or Off

When manual override is set to enable, use the arrow buttons to turn the unit on or off.

Override Occupancy Control

When manual override is set to enable, use the arrow buttons to change occupancy control.



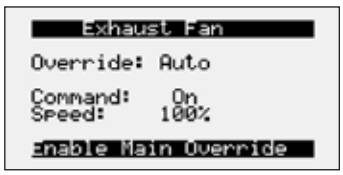
Override the Supply Fan VFD Speed

The speed is the proportional percentage of the analog output from the controller to the VFD.

0% Speed = Min speed (determined by VFD)

100% Speed = Max speed (determined by VFD)

(Reference unit Installation and Operation Manual for VFD programming).



Override Exhaust Fan VFD Speed

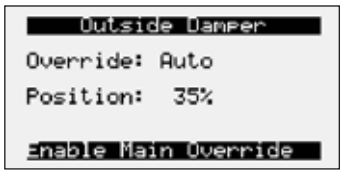
This screen only appears if the unit is equipped with a exhaust fan VFD controlled by the microprocessor.

The speed is the proportional percentage of the analog output from the controller to the VFD.

0% Speed = Min speed (determined by VFD)

100% Speed = Max speed (determined by VFD)

(Reference unit Installation and Operation Manual for VFD programming).

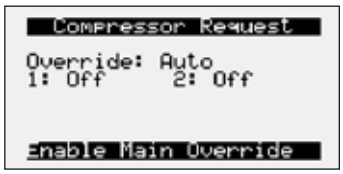


Override the Position of the Outside Air Damper

This screen only appears if the unit is equipped with a modulating OA and recirculation damper. The recirculation damper position will be the inverse of the OA damper position shown.

0% = Outside air damper closed

100% = Outside air damper fully open

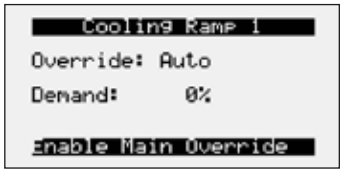


Override the Compressor

This screen only appears if the unit is equipped with DX cooling. When manual override is set to enable, use the arrow buttons to turn individual compressor requests on or off.

Override the Modulating Compressor Control Loop

When manual override is set to enable, use the arrow buttons to change the compressor modulation value.



Override Cooling

When the cooling control is in the manual mode, use the arrow buttons to vary the cooling output.

Chilled Water: The cooling percent is directly proportional to the 0 - 10 VDC output signal.

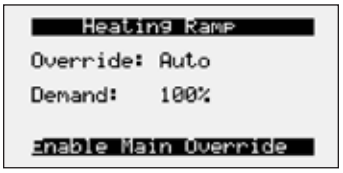
0% Cooling = 0 VDC

100% Cooling = 10 VDC

Packaged Cooling: The cooling percent displays compressor engagement as a percent. The compressors are subject to the min on/off times and heating/cooling lockouts.

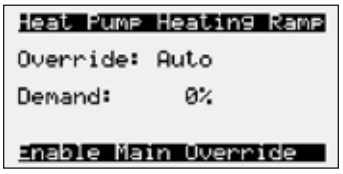
Override the Electric Heater

This screen only appears if the unit is equipped with electric post heat. Electric heater percentage is directly proportional to the 0 – 10 VDC output signal.



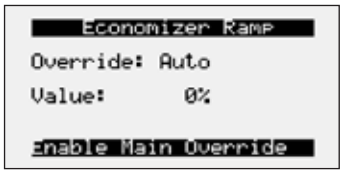
Override Heating

When the heating control is in the manual mode, use the arrow buttons to vary the heating output.



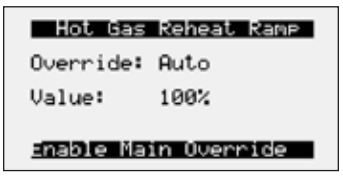
Override Heat Pump Heating

This screen will be available when the unit is configured as a heat pump. When in manual mode, change the demand to control the position of the reversing valve and the amount of compressor request. The compressors are subject to the min on/off times and heating lockouts.



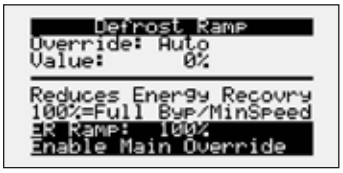
Override the Economizer Control

When the heating control is in the manual mode, use the arrow buttons to vary the heating output.



Override the Hot Gas Reheat

This screen only appears if modulating hot gas reheat option was provided with the unit. When the hot gas reheat loop control is in the manual mode, use the arrow buttons to vary the reheat output.

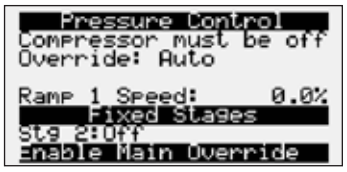


Override the Energy Recovery Defrost

This screen only appears if modulating wheel frost control is equipped. When the defrost control ramp is in manual mode, use the arrow buttons to vary the defrost output.

0% = Maximum Wheel Speed

100% = Minimum Wheel Speed



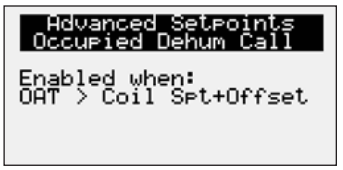
Override Pressure Control Fans

This screen will be available when active head pressure control is installed in the unit. When in manual mode, with the compressors off, the modulating fan speed can be altered by using the arrows to change the output. The fixed stage fan can be enabled by changing the output to On.

Control Variables

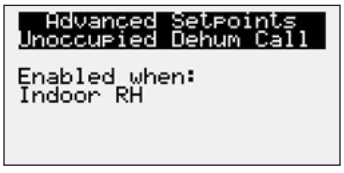
↳ Advanced
↳ Advanced Setpoints

The Advanced Setpoints Menus allows the user to view and modify network settings. The **service password (9998)** is required to make changes.



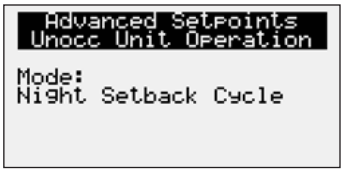
Occupied Dehumidification Call.

Reference control variables for possible Occupied dehumidification call methods.



Unoccupied Dehumidification Call.

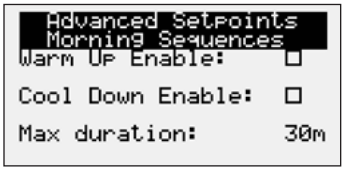
Reference control variables for possible unoccupied dehumidification call methods.



View and Change the Unoccupied Unit Operation.

Possible unoccupied unit operation methods include:

- Unit Off
- Night Setback Cycle
- Recirculation with Unoccupied Set Points
- Normal Operation with Unoccupied Set Points



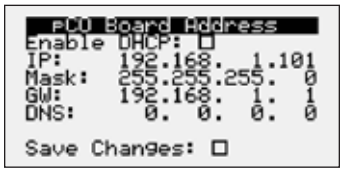
Enable Morning Warm Up and Cool Down.

The user can enable morning warm up, morning cool down, and set the duration for the sequence.

Control Variables

↳ Advanced
↳ Network Settings

The Network Settings Menus allows the user to view and modify network settings. The **service password (9998)** is required to make changes.



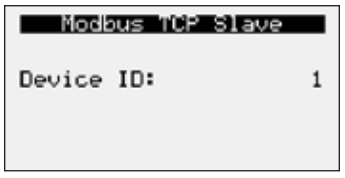
c.pCO Board Address

This screen will appear with or without a network protocol provided with the unit.

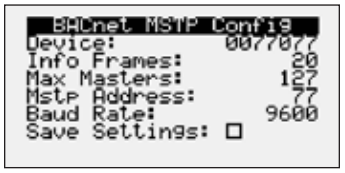
This screen allows the user to configure the IP setting for BMS and/or when the Web User Interface will be utilized. The controller may have a DHCP server-assigned address or a manually-assigned static IP address. Factory settings are shown in the screen to the left.

Controller BACnet IP Config

This screen will appear if the unit is set for BACnet IP and allows the user to set the device and port settings.



Modbus TCP Slave. This screen will appear if the unit is set for Modbus TCP and allows the user to set device ID number.

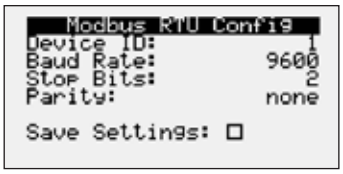


BACnet MSTP Parameters

This screen only appears if the selected BMS protocol is set to BACnet MSTP. Factory settings are shown in the screen to the left.

To change BACnet MSTP parameters:

1. Go to Network Settings menu and view BACnet MSTP Config screen.
2. Move cursor to desired parameter by pressing the enter button. Press up and down arrows to adjust the parameter. Press enter to accept adjusted value.
3. Once desired parameters have been entered, enable the 'Save Settings' option and press the enter button.
4. Reboot the controller by cycling power to the unit. Allow several minutes for the controller to initialize.



Modbus RTU Parameters

This screen only appears if the selected BMS protocol is set to Modbus. Factory settings are shown in the screen to the left.

To change Modbus RTU parameters:

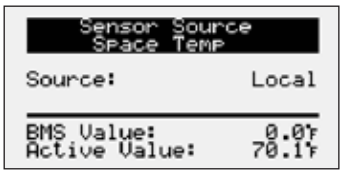
1. Go to Network Settings menu and view Modbus RTU Config screen.
2. Move cursor to desired parameter by pressing the enter button. Press up and down arrows to adjust the parameter. Press enter to accept adjusted value.
3. Once desired parameters have been entered, enable the 'Save Settings' option and press the enter button.
4. Reboot the controller by cycling power to the unit. Allow several minutes for the controller to initialize.

BMS Watchdog

The BMS watchdog function verifies BMS connectivity. The watchdog is required for the BMS to take the place of a hardwired sensor. The BMS toggles the watchdog variable from true to false within the timeout delay. If the timer expires, the controller falls back to hardwired sensors until the BMS connection can be established. At this time, a BMS watchdog alarm activates.

The following variables may be used by the BMS in place of hardwired sensors:

- Outside_RH_from_BMS
- Outside_Temp_from_BMS
- Return_RH_from_BMS
- Return_Temp_from_BMS
- Space_1_CO2_from_BMS
- Return_CO2_from_BMS
- Space_RH_from_BMS
- Space_Static_from_BMS
- Space_Temp_from_BMS



Sensor Source

The sensor source can be changed to source by BMS through the controller or by a dedicated BMS point. Reference Points List above and in the Appendix for more detailed point information. Screen to the left is an example of the sensor source type. Source can be set for local or BMS at this screen.

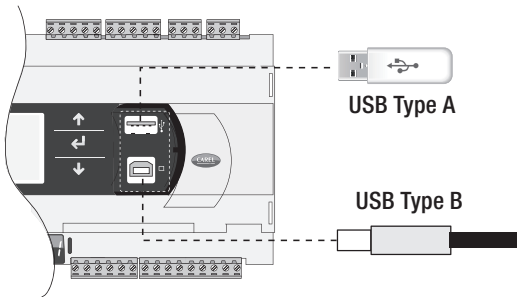
Control Variables

↳ Advanced
↳ Backup/Restore

The Backup/Restore Menus allows the user to create a backup file of set points and configuration variables on a USB drive or in the controller's internal memory.

Connecting to USB Drives

The controller has built-in USB ports for connecting to USB drives. The USB drives can be used for backing up all settings and reported conditions such as alarm history and current values. This creates a file named User_Backup.txt.



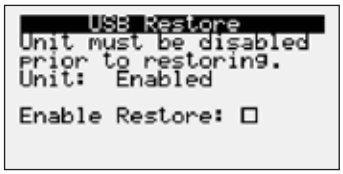
Creating a Backup File

Important:

- At first startup or commissioning, or prior to communicating with Technical Support about performance issues, we recommend creating a backup file for each controller.
- Name each file with the unit sales order–line number found on the silver nameplate attached to the electrical access door.
- Also consider creating a backup file whenever significant program changes are made.

To create a system backup file using the handheld or virtual keypad/display buttons:

1. Go to the Main Menu/Ctrl Variables/Advanced/Login screen. Press the Enter and Up or Down arrow buttons to enter the service password, which is 9998.
2. Go to the Main Menu/Ctrl Variables/Advanced/Backup/Restore screen.
3. Press the Up or Down arrow buttons to navigate to the Backup Settings screen.
4. Press the Enter and Up or Down arrow buttons to select the backup location (internal memory or USB). If creating a backup to a USB drive, insert a USB drive into the main controller.
5. Press Enter to highlight and then the Up or Down arrow buttons to fill the Save checkbox. This action creates the backup file.



Restoring from a Backup File

From USB

1. Place the restore file in the root directory of a USB drive. (Do not place the file within a folder on the USB drive.) The file must be named: User_Backup.txt
2. Insert the USB drive into the controller's USB port.
3. Go to the Main Menu/Unit Enable screen. Press the Enter and Up or Down arrow buttons to disable the unit.
4. Go to the Main Menu/Ctrl Variables/Advanced/Login screen. Press the Enter and Up or Down arrow buttons to enter the service password (9998).
5. Go to the Main Menu/Ctrl Variables/Advanced/Backup/Restore screen.
6. Press the Up or Down arrow buttons to navigate to the USB Restore screen.
7. Press Enter to highlight and then the Up or Down arrow buttons to fill the Restore checkbox. This action restores the backup file. If there is an error during the process, the specific error is displayed on this screen.
8. Cycle power to the controller.

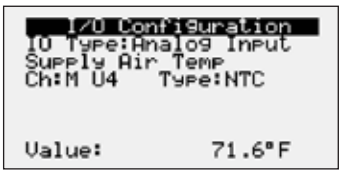
From internal memory

1. Go to the Main Menu/Unit Enable screen. Press the Enter and Up or Down arrow buttons to disable the unit.
2. Go to the Main Menu/Ctrl Variables/Advanced/Login screen. Press the Enter and Up or Down arrow buttons to enter the service password, which is 9998.
3. Go to the Main Menu/Ctrl Variables/Advanced/Backup/Restore screen.
4. Press the Up or Down arrow buttons to navigate to the Internal Restore screen. This screen is only available when a backup file exists in internal memory.
5. Press Enter to highlight and then the Up or Down arrow buttons to fill the Restore checkbox. This action restores the backup file. If there is an error during the process, the specific error is displayed on this screen.
6. Cycle power to the controller.

Control Variables

↳ Advanced
↳ I/O Configuration

The **IO Configuration Menu** allows the user to view and modify controller input and output points.

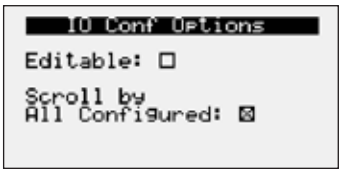


I/O Configuration

This screen is read only and will require the factory password to make changes. Screen to the left is an example of an analog input configuration screen. Similar screens appear for remaining I/O when selected.

To monitor individual I/O points:

1. Press the enter button to highlight the I/O type.
2. Press the up and down arrows to change the IO type.
3. Press the enter button to highlight the controller channel.
4. Press the up and down arrows to change the channel.



I/O Configuration Options

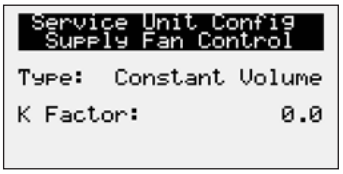
Changes to the IO configuration requires the factory login password. Consult factory for IO configuration changes.

ADJUSTMENT OF I/O CONFIGURATION MUST ONLY BE DONE UNDER FACTORY GUIDANCE! IMPROPER ADJUSTMENT MAY RESULT IN SYSTEM DAMAGE!

Control Variables

↳ Advanced
↳ Unit Config
↳ Service Config

The **Unit Configuration** menus allows the user to view unit configuration provided from factory. Configuration menus listed below can be altered with the service password. Consult factory for unit configuration changes!



Supply Fan Control Type

Reference control variables for possible supply fan control methods.

Exhaust Fan Control Type

Reference control variables for possible exhaust fan control methods.

Alarms

The **Alarms** menu allows the user to view active alarms, reset active alarm (if possible), and alarm history.

Active Alarms

If an alarm occurs, the button will glow red on the controller and the remote display (if installed).

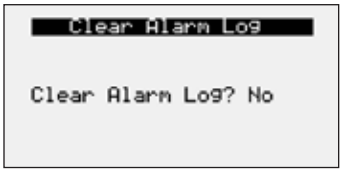
To view alarm, press the Alarm button once. This will display the most recent alarm. If the alarm cannot be cleared, the cause of the alarm has not been fixed. Press the up and down buttons to view any additional occurring alarms.

Reset Active Alarms

This screen allows the user to clear active alarms.

Alarm Event History

This screen allows the user view recent alarms. To view all saved alarms, press the “down” button to enter the data logger.



Clear Alarm Log

This screen allows the user to clear all alarms in alarm log history.

IG Furnace Alarm (AL) Descriptions		
IG no flame 3 try AL	Indicates a furnace failure to light or properly sense flame after 3 trials.	Alarm only
IG combustion fan high pressure switch failure	Indicates a call for high speed combustion fan but high pressure switch did not close.	Alarm only
IG furnace ignition control	Indicates an alarm from the ignition controller.	Alarm only
Pressure switch closed with combustion fan off	Indicates low pressure switch was closed with no call for combustion fan.	Alarm only
Combustion fan not proved	Indicates a call for low speed combustion fan but low pressure switch did not close.	Alarm only
IG furnace max retry	Indicates that the max number of retries was reached.	Alarm and Furnace lockout
IG High Temp AL	Indicates that power was lost from the High Temp Limit Sensor. Check for high limit trip.	Alarm only
IG offline	Indicates communication with furnace control has failed.	Alarm only
IG Lg Man No Flame AL	No flame after 3 trials for ignition on the large manifold.	Alarm only

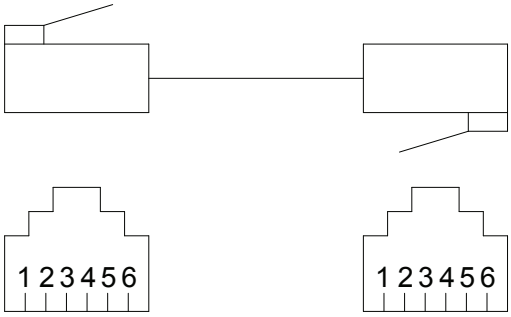
Appendix A: Remote Display (pGD1)

The pGD1 is an optional remote display for use with manufacturer's microprocessor controllers. The remote display allows for remote monitoring and adjustment of parameters of the unit mounted controller. The remote display allows identical access to menus and screens as the unit mounted controller display.

Specifications	
Carel Model	PGD1000W00
Power Supply	Power supplied from unit controller through RJ25 cable
Max distance from unit controller	150 feet
Required Cable	6P6C RJ25/RJ12 Cable (straight)
Operating Conditions	-4°F to 140°F, 90%RH (non-condensing)
Display Type	Backlit LED with lighted buttons

Installation

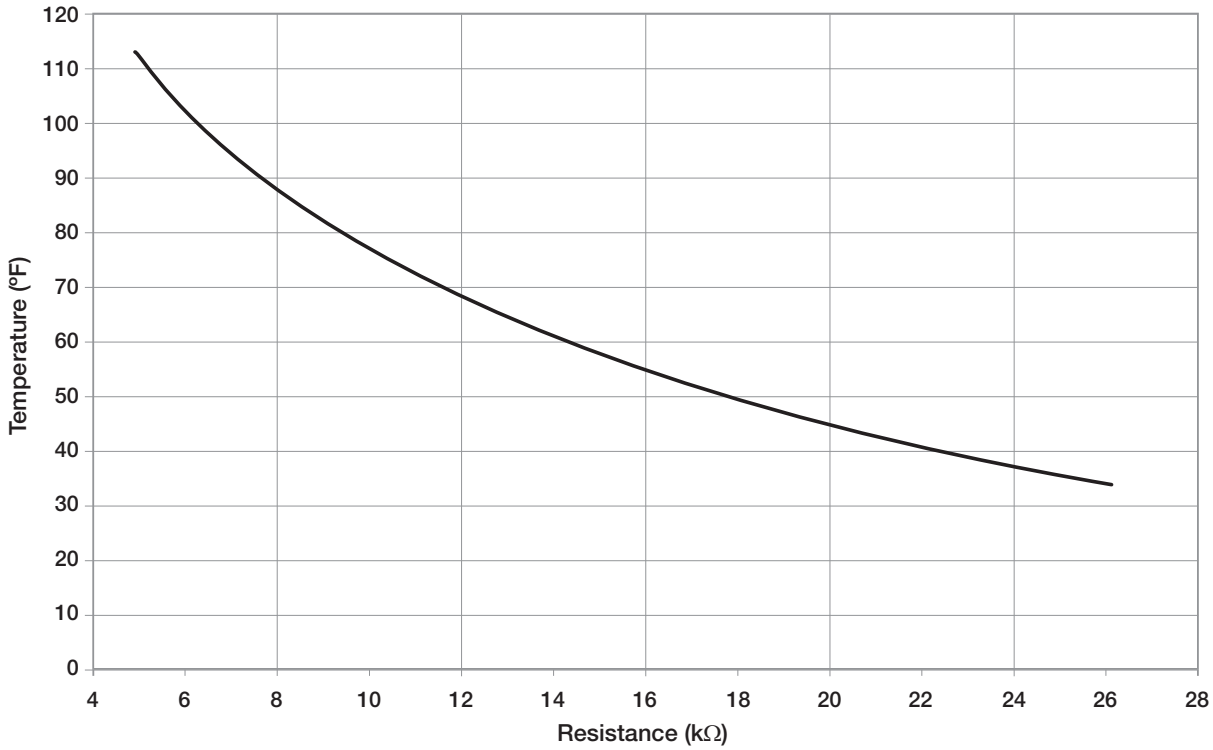
The remote display connects to the unit mounted controller through a six-wire RJ25 or RJ12 telephone cable (straight). When ordered from the factory, a 10 ft. cable is provided with the remote display. The display and cable can be used to assist with start-up and maintenance.



Connecting Cable

If mounted remotely, the factory cable can either be extended or replaced with a longer cable to obtain the necessary distance. The resulting cable connections should be a "straight through cable," where pins on one end correspond identically to the pins on the opposite end. If making your own cable, use the same pin-out for each end.

NTC Temperature Sensor Chart

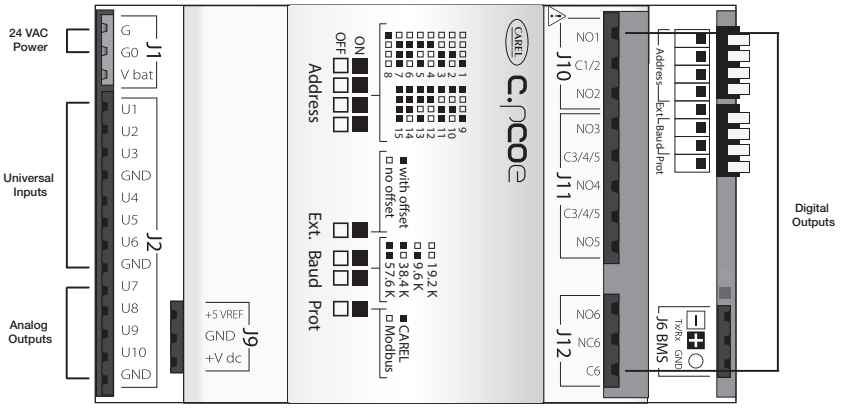


Appendix B: I/O Expansion Board (c.pCOe) Quick Start

The expansion board is an I/O module than can be used to monitor additional statuses or provide commands from large board controller. It allows the user to view and control:

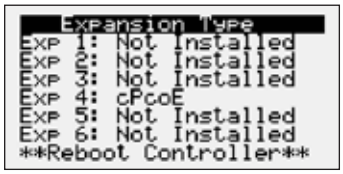
- 6 Universal Inputs (Digital Input*, NTC, 0/1VDC, 0/10VDC, 0/20mA, 4/20mA, 0/5VDC)
  *Only dry to ground contacts can be utilized for digital inputs. Applying voltage will result in damage to the I/O expansion board.
- 4 Analog Outputs (VDC)
- 6 Digital Outputs

The inputs and outputs can be monitored and controlled by the Building Management System. Reference Points List for detailed point information.

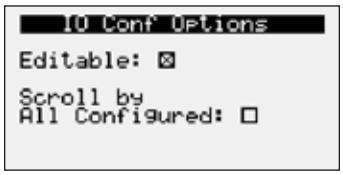


Setup

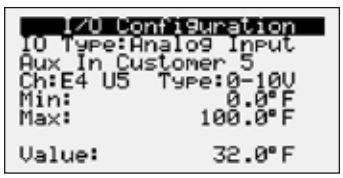
In order for the controller to communicate with the c.pCOe, several parameters must be adjusted. If you have a c.pCOe installed from the factory, the controller is already set up for communication with the main controller. The factory password is required for expansion board and I/O configuration updates. Consult factory for I/O configuration changes.



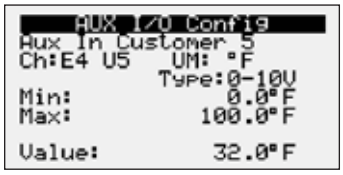
Enabling the c.pCOe in the Main Controller. - To enable the c.pCOe expansion I/O module, go to Ctrl Variables/Advanced/Unit Config. User will have to enter the Factory Password to make any edits at this point. Consult factory for factory password and configuring the expansion board. The expansion board must be enabled to configure spare I/O points. Once enabled, the user must reboot the controller. See screens to the left for expansion board enable points.



Configuring the I/O Type - In order to edit and configure the I/O configuration of the unit, go to Ctrl Variables/Advanced/I/O Configuration. The user must enable the Editable option for configuring I/O points. If configuring a new I/O point, 'Scroll by All Configured' must be deselected to view all I/O options.



Change or Update the I/O Point - Once the editable option is selected, the user must scroll to the I/O Configuration Menu. At this menu the desired I/O type can be selected. Once selected the user can configure the desired channel at the expansion board. The channel will have an 'E' designation for expansion board. Aux In Customer 1–6, Aux Analog Out 1-4, and Aux Digital Out 1-6 will be allocated for the I/O expansion board. See example to the left.



Viewing c.PCOe Auxiliary Values – Once the expansion board I/O is configured, the user can view and/or change the I/O type by navigating to Ctrl Variables/Aux I/O Config.

Appendix C: Space Thermostat Quick Start

The space thermostat gives users the ability to view the space temperature and relative humidity (optional) and control the active space set points from the adjustable display. The space thermostat also has the ability to send the unit into temporary occupied mode. It is also provides the functionality to average up to 4 temperature readings through the microprocessor.
The space thermostat is shipped loose with installation by others and is a Modbus connected device.

Room thermostat functions:

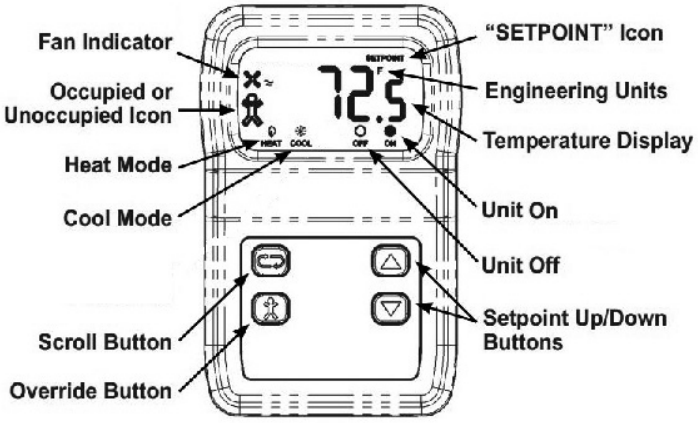
- Temporary occupancy override control
- Temperature and relative humidity monitoring
- Temperature and relative humidity set point adjustability
- Status icon on LCD display with push buttons
- Optional temperature monitoring up to 4 sensors

Display

If more than one space thermostat is provided for averaging, only one space thermostat will be provided with a display and push buttons for adjustment.

Adjusting SET POINT - The default display will show the current temperature value for the room. Use the scroll button to index through additional sensor parameters. Parameters with the "SET POINT" icon displayed above the temperature display are adjustable. Use the Up/Down buttons to adjust the set point, and use the scroll button to view the next parameter or return to the normal display mode.

Up/Down Button Function - The Up/Down buttons are used to adjust editable parameters including the temperature and humidity set point.

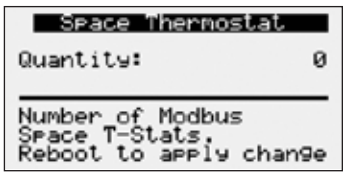


Override Button Function - The display shows a person in the lower left corner of the display at all times. If the person is solid, the unit is operating in occupied mode. If it is an outline of the person, the unit is in unoccupied mode. Pushing the Override button when the unit is in unoccupied mode will allow a temporary override sequence to Occupied mode for a period of 1 to 3 hours (adjustable at the unit microprocessor).

Initial Setup and Communication Configuration

The space thermostat is a Modbus connected device There can be up to three additional Modbus temperature sensors added for space temperature averaging. The sensors must all be connected in a daisy chain configuration.

The microprocessor controller will be pre-configured for one space thermostat. If space temperature averaging is desired, additional field setup will be required both in the controller and on the Modbus space sensors:



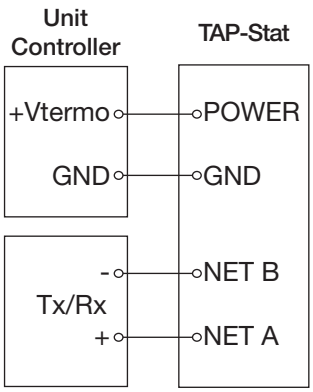
- Each space sensor must have the DIP switches adjusted on the back of the sensor to the corresponding switches. Reference Room Thermostat Modbus Address chart on the following page for DIP switches settings.
- Once the address is set and the wires are connected the “Status” LED should be a steady green and the “Network” LED should be a quick blinking amber/green color.
- In the Controller, enter the Ctrl Variables Menu/Temperature and scroll down in the Temperature Menu to select Space Thermostat. Choose the number of space sensor being used (1-4).

Appendix C: Space Thermostat Quick Start

Status LED

Green indicates that the unit is operating properly.
Red indicates that there is a problem with the unit.

Terminal	Description
GND	Power Supply Ground (common to the controller)
Net B	RS485 network connection (Data -)
Net A	RS485 network connection (Data +)
Power	Power supply hot



Network LED

Flashing Red Slowly indicates that there has been no communications for 60 seconds.

Flashing Green Slowly indicates that there have been normal communications within the last 60 seconds.

Flashing Green Slowly with Quick Red Flashes; the quick red flashes indicate active communications.

Space Thermostat Modbus Address				
	T-Stat 1 (Display)	T-Stat 2	T-Stat 3	T-Stat 4
Address in Microprocessor	10	11	12	13
Dip Switch Set on Stat	Sw 2 + Sw 8	Sw 1 + Sw 2 + Sw 8	Sw 4 + Sw 8	Sw 1 + Sw 4

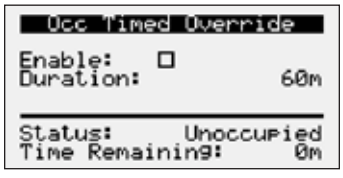
Baud Rate Setting

In order for the space thermostat to communicate with the microprocessor, the correct baud rate must be set in the space thermostat. To set the baud rate:

- The “PROG” DIP switch on the back of the space thermostat must be flipped to the right side.
- Use the Set Point Down button to display P11 on the space thermostat.
- Push the Scroll button and use the Set Point Up/Down buttons to adjust the baud rate to 192.
- Once 192 is displayed, push the Scroll button again to save the setting. Once the setting is saved, P11 should appear on the display.
- Flip the “PROG” DIP switch on the back of the space thermostat back to the left. The space thermostat should communicate and be set back to normal mode.

Occupancy Override Time Adjustment

If the occupancy override time needs to be adjusted:



- If the occupancy override is enabled from the space thermostat or the unit microprocessor, it will override for the period of time set on this menu screen.
- To adjust the temperature override time, enter the following menu options at the controller, Ctrl Variables/Occupancy. Scroll down at the Occupancy Menu and select Occ Timed Override. This menu will allow the user to enable occupancy override from the controller and set override duration.

Appendix D: GreenTrol® Airflow Monitoring Quick Start

The GreenTrol® airflow monitoring station measures airflow using advanced thermal dispersion technology. An integral LCD display provides a local indication of airflow measurement and device configuration. The airflow monitor also features Modbus communication allowing the main unit microprocessor to monitor the airflow as well. The GreenTrol also accepts up to two airflow probes for averaging.

GreenTrol Airflow Monitor functions:

- LCD readout of measured airflow
- Dual airflow probe averaging
- Modbus connectivity

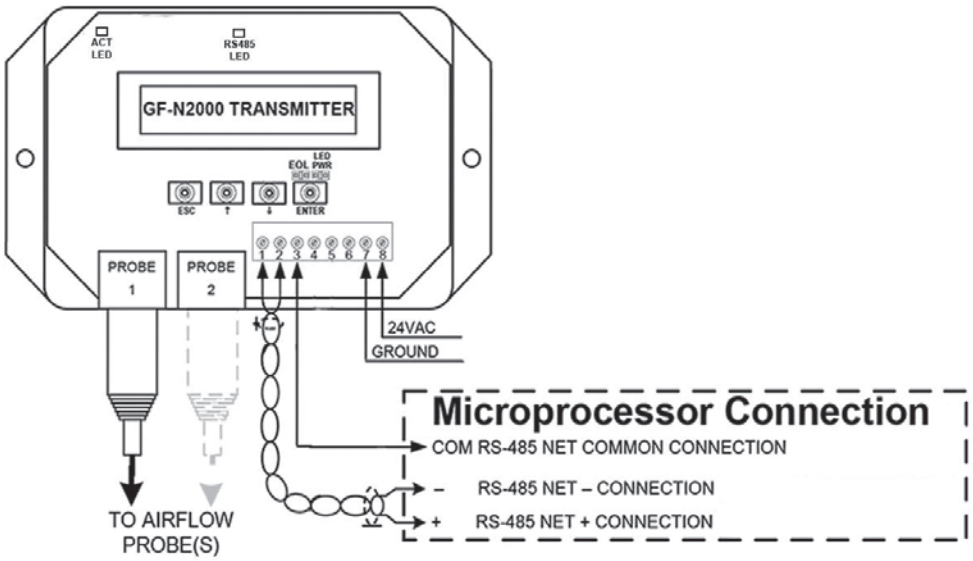
Display and Navigation

The LCD screen will by default show the current airflow that is being measured. To enter the menu to set up the monitoring station the user must remove the front cover of the GreenTrol to uncover the navigation buttons. Press and hold the UP and DOWN buttons at the same time for 3 seconds to enter the menu.

Enter Button Function - The ENTER button allows the user to go into the selected menu or function, as well as save the selected value.

Up/Down Button Function - The Up/Down buttons are used to navigate the menu and to change values in the menu.

Esc Button Function - The ESC button allows the user to exit the current menu or function.



Appendix E: Points List

VARIABLE	DESCRIPTION	ACTIVE TEXT	INACTIVE TEXT	BACNET				MODBUS		
				OBJECT INSTANCE	OBJECT TYPE	ACCESS	HYST	INDEX	REGISTER TYPE	SIZE
Analog Inputs - Read Only										
Circuit_A_Discharge_Temp_Analog_Input	Circuit A Discharge Temperature			1	AI	ReadCOV_NoWrite	0.1	30195	Input	2
Circuit_A_Suction_Temp_Analog_Input	Circuit A Suction Temperature			3	AI	ReadCOV_NoWrite	0.1	30199	Input	2
Cold_Coil_1_Temp_Analog_Input	Cold Coil 1 Temperature			25	AI	ReadCOV_NoWrite	0.1	30243	Input	2
CL_Coil_Spt_Temp	Controls Lite Cooling Coil Set Point Temperature value			31	AI	ReadCOV_NoWrite	0.1	30255	Input	2
CL_Supply_Spt_Temp	Controls Lite Supply Set Point Temperature value			32	AI	ReadCOV_NoWrite	0.1	30257	Input	2
Outside_Air_Temp_Analog_Input	Outside Air Temperature			37	AI	ReadCOV_NoWrite	0.1	30267	Input	2
Space_Temp_Analog_Input	Space Temperature			44	AI	ReadCOV_NoWrite	0.1	30281	Input	2
Supply_Temp_Analog_Input	Supply Temperature			45	AI	ReadCOV_NoWrite	0.1	30283	Input	2
Outside_RH_Analog_Input	Outside % Relative Humidity			86	AI	ReadCOV_NoWrite	0.1	30349	Input	2
Space_RH_Analog_Input	Space % Relative Humidity			89	AI	ReadCOV_NoWrite	0.1	30355	Input	2
Space_Static_Pressure_Analog_Input	Space Static Pressure			94	AI	ReadCOV_NoWrite	0.01	30365	Input	2
Supply_Duct_Static_Pressure_Analog_Input	Supply Duct Static Pressure			95	AI	ReadCOV_NoWrite	0.01	30367	Input	2
Space_CO2_1_Analog_Input	Space 1 CO2 ppm			116	AI	ReadCOV_NoWrite	10	30401	Input	2
Circuit_A_Discharge_Pressure_Analog_Input	Circuit A Discharge Pressure			119	AI	ReadCOV_NoWrite	0.1	30407	Input	2
Circuit_A_Suction_Pressure_Analog_Input	Circuit A Suction Pressure			120	AI	ReadCOV_NoWrite	0.1	30409	Input	2
Circuit_B_Discharge_Pressure_Analog_Input	Circuit B Discharge Pressure			121	AI	ReadCOV_NoWrite	1	30411	Input	2
Aux_In_Customer_1	Customer defined auxiliary input			640	AI	ReadCOV_NoWrite	0.1	30639	Input	2
Aux_In_Customer_2	Customer defined auxiliary input			642	AI	ReadCOV_NoWrite	0.1	30641	Input	2
Aux_In_Customer_3	Customer defined auxiliary input			644	AI	ReadCOV_NoWrite	0.1	30643	Input	2
Aux_In_Customer_4	Customer defined auxiliary input			646	AI	ReadCOV_NoWrite	0.1	30645	Input	2
Aux_In_Customer_5	Customer defined auxiliary input			648	AI	ReadCOV_NoWrite	0.1	30647	Input	2
Aux_In_Customer_6	Customer defined auxiliary input			650	AI	ReadCOV_NoWrite	0.1	30649	Input	2

Appendix E: Points List

VARIABLE	DESCRIPTION	ACTIVE TEXT	INACTIVE TEXT	BACNET				MODBUS		
				OBJECT INSTANCE	OBJECT TYPE	ACCESS	HYST	INDEX	REGISTER TYPE	SIZE
Analog Values - Read/Write - Commandable										
Temperature_Set Point	Main Temperature Set point. Supply, Space, or Return target temperature			1	AV	ReadCOV_ Commandable	0	40001	Holding	2
Temperature_Heat_ Cool_Deadband	Heat/Cool Spt Deadband when Room or Return control is active. Clg Spt = Deadband /2 + Temp Spt. Htg Spt = Deadband /2 - Temp Spt.			2	AV	ReadCOV_ Commandable	0	40003	Holding	2
Cooling_Coil_Set Point_Min	Cooling Coil Leaving Air Set Point			3	AV	ReadCOV_ Commandable	0	40005	Holding	2
Dehumidification_Set Point	Dehumidification Set Point. %RH for Space or Return control.			5	AV	ReadCOV_ Commandable	0	40009	Holding	2
Outside_Dewpoint_Set Point	Outside Dewpoint Dehumidification Trigger Set Point			6	AV	ReadCOV_ Commandable	0	40011	Holding	2
Indoor_Dewpoint_Set Point	Indoor Dewpoint Dehumidification Trigger Set Point			7	AV	ReadCOV_ Commandable	0	40013	Holding	2
Unocc_Indoor_ Dewpoint_Set Point	Unoccupied Indoor Dewpoint Dehumidification Trigger Set Point			9	AV	ReadCOV_ Commandable	0	40017	Holding	2
Unoccupied_Cooling_ Set Point	Unoccupied Cooling Set Point			10	AV	ReadCOV_ Commandable	0	40019	Holding	2
Unoccupied_ Dehumidification_Set Point	Unoccupied Dehumidification %RH Set Point			11	AV	ReadCOV_ Commandable	0	40021	Holding	2
Unoccupied_Heating_ Set Point	Unoccupied Heating Set Point			12	AV	ReadCOV_ Commandable	0	40023	Holding	2
Economizer_Temp_ Enable_Set Point	Economizer Ambient Temp Enable Set Point. Allow Econ when OAT<Spt			16	AV	ReadCOV_ Commandable	0	40031	Holding	2
Economizer_Enthalpy_ Enable_Set Point	Economizer Enthalpy Enable Set Point. Allow Econ when OA Enthalpy<Spt			17	AV	ReadCOV_ Commandable	0	40033	Holding	2
Outside_RH_from_ BMS	Outside RH from BMS. Used when source selection is set to BMS.			21	AV	ReadCOV_ Commandable	0.1	40041	Holding	2
Outside_Temp_from_ BMS	Outside Temp from BMS. Used when source selection is set to BMS.			22	AV	ReadCOV_ Commandable	0.1	40043	Holding	2
Return_RH_from_BMS	Return RH from BMS. Used when source selection is set to BMS.			23	AV	ReadCOV_ Commandable	0.1	40045	Holding	2
Return_Temp_from_ BMS	Return Temp from BMS. Used when source selection is set to BMS.			24	AV	ReadCOV_ Commandable	0.1	40047	Holding	2
Space_1_CO2_from_ BMS	Space 1 CO2 from BMS. Used when source selection is set to BMS.			25	AV	ReadCOV_ Commandable	0.1	40049	Holding	2
Space_RH_from_BMS	Space RH from BMS. Used when source selection is set to BMS.			28	AV	ReadCOV_ Commandable	0.1	40055	Holding	2
Space_Static_from_ BMS	Space Static from BMS. Used when source selection is set to BMS.			29	AV	ReadCOV_ Commandable	0.1	40057	Holding	2
Space_Temp_from_ BMS	Space Temp from BMS. Used when source selection is set to BMS.			30	AV	ReadCOV_ Commandable	0.1	40059	Holding	2
Cooling_Lockout_Set Point	Cooling Ambient Lockout Set Point			31	AV	ReadCOV_ Commandable	0.1	40061	Holding	2
Heating_Lockout_Set Point	Heating Ambient Lockout Set Point			32	AV	ReadCOV_ Commandable	0.1	40063	Holding	2
Space_Static_ Pressure_Set Point	Space Static Pressure Set Point			37	AV	ReadCOV_ Commandable	0.1	40073	Holding	2

Appendix E: Points List

VARIABLE	DESCRIPTION	ACTIVE TEXT	INACTIVE TEXT	BACNET				MODBUS		
				OBJECT INSTANCE	OBJECT TYPE	ACCESS	HYST	INDEX	REGISTER TYPE	SIZE
Supply_Duct_Static_Pressure_Set Point	Supply Duct Static Pressure Set Point			38	AV	ReadCOV_Commandable	0.1	40075	Holding	2
Space_CO2_Set Point	Space CO2 Set Point			39	AV	ReadCOV_Commandable	0.1	40077	Holding	2
SF_Control_Signal_BMS	BMS to control signal for supply fan speed			133	AV	ReadCOV_Commandable	0.1	40083	Holding	2
EF_Control_Signal_BMS	BMS to control signal for exhaust fan speed			134	AV	ReadCOV_Commandable	0.1	40085	Holding	2
OAD_Control_Signal_BMS	Allows the BMS to control OAD position. True = BMS. False = Local.			136	AV	ReadCOV_Commandable	0.1	40089	Holding	2
Outside_Air_Damper_Minimum_Set Point	Outside Air Damper Minimum Set Point			137	AV	ReadCOV_Commandable	1	40091	Holding	2
Aux_BMS_Analog_Output_1	BMS Commanded auxilary analog output			138	AV	ReadCOV_Commandable	0.1	40093	Holding	2
Aux_BMS_Analog_Output_2	BMS Commanded auxilary analog output			139	AV	ReadCOV_Commandable	0.1	40095	Holding	2
Aux_BMS_Analog_Output_3	BMS Commanded auxilary analog output			140	AV	ReadCOV_Commandable	0.1	40097	Holding	2
Aux_BMS_Analog_Output_4	BMS Commanded auxilary analog output			141	AV	ReadCOV_Commandable	0.1	40099	Holding	2
Cooling_Coil_Setpoint_Max	Maximum Coil Leaving Setpoint			313	AV	ReadCOV_Commandable	0.1	40101	Holding	2

Appendix E: Points List

VARIABLE	DESCRIPTION	ACTIVE TEXT	INACTIVE TEXT	BACNET				MODBUS		
				OBJECT INSTANCE	OBJECT TYPE	ACCESS	HYST	INDEX	REGISTER TYPE	SIZE
Analog Values - Read Only										
Unit_Status_Mode	0: Off/Standby 1: Unoccupied Start 2: Occupied Start 5: Dampers Open 6: Fan Start Delay 7: Fans Starting 9: Heat/Cool Delay 10: System On 11: Soft Shutdown 12: System Disabled 13: Remote Off 14: Shutdown Alarm 19: Fans Only 20: Economizing 21: Cooling 22: Heating 23: Dehumidifying 25: HGRH Purging 26: Defrost Active 28: Cooling & Heating 29: Dehum w/Heat 30: Overrides Active 31: Expansion Offline 51: IO Test. Sys Disabled			40	AV	ReadCOV_ NoWrite	0	30001	Input	2
Supply_Temperature_ Calculated_Set Point	Active Supply Temperature Set Point			41	AV	ReadCOV_ NoWrite	0.1	30003	Input	2
Cooling_1_Ramp_ Capacity	Cooling Ramp 1 Status Value			43	AV	ReadCOV_ NoWrite	1	30007	Input	2
Defrost_Ramp	Defrost Ramp			47	AV	ReadCOV_ NoWrite	1	30015	Input	2
Economizer_Ramp	Economizer Ramp			48	AV	ReadCOV_ NoWrite	1	30017	Input	2
Exhaust_Fan_Space_ Static_Pressure_Ramp	Exhaust Fan Space Static Pressure Ramp			49	AV	ReadCOV_ NoWrite	1	30019	Input	2
Exhaust_Fan_Supply_ Tracking_Ramp	Exhaust Fan Supply Tracking Ramp			50	AV	ReadCOV_ NoWrite	1	30021	Input	2
Head_Pressure_ Control_Ramp_1_ Ramp	Head Pressure Control Ramp 1			51	AV	ReadCOV_ NoWrite	1	30023	Input	2
Head_Pressure_ Control_Ramp_2_ Ramp	Head Pressure Control Ramp 2			52	AV	ReadCOV_ NoWrite	1	30025	Input	2
HP_Ramp_Capacity	Heat Pump Heating Ramp			59	AV	ReadCOV_ NoWrite	1	30039	Input	2
Heating_Ramp	Heating Ramp			60	AV	ReadCOV_ NoWrite	1	30041	Input	2
Hot_Gas_Reheat_ Ramp	Hot Gas Reheat Ramp			61	AV	ReadCOV_ NoWrite	1	30043	Input	2
Space_CO2_Control_ Ramp	Space CO2 Control Ramp			71	AV	ReadCOV_ NoWrite	1	30063	Input	2
Supply_Duct_Static_ Pressure_Ramp	Supply Duct Static Pressure Ramp			72	AV	ReadCOV_ NoWrite	1	30065	Input	2
Supply_Fan_Space_ Static_Pressure_Ramp	Supply Fan Space Static Pressure Ramp			74	AV	ReadCOV_ NoWrite	1	30069	Input	2
Winter_Ramp_Output	Winter Ramp Output			75	AV	ReadCOV_ NoWrite	1	30071	Input	2
Outside_Dewpoint	Outside Dewpoint			82	AV	ReadCOV_ NoWrite	0.1	30085	Input	2
Outside_Enthalpy	Outside Enthalpy			83	AV	ReadCOV_ NoWrite	0.1	30087	Input	2
Return_Dewpoint	Return Dewpoint			86	AV	ReadCOV_ NoWrite	0.1	30093	Input	2
Return_Enthalpy	Return Enthalpy			87	AV	ReadCOV_ NoWrite	0.1	30095	Input	2
Space_Dewpoint	Space Dewpoint			88	AV	ReadCOV_ NoWrite	0.1	30097	Input	2
Space_Enthalpy	Space Enthalpy			89	AV	ReadCOV_ NoWrite	0.1	30099	Input	2

Appendix E: Points List

VARIABLE	DESCRIPTION	ACTIVE TEXT	INACTIVE TEXT	BACNET				MODBUS		
				OBJECT INSTANCE	OBJECT TYPE	ACCESS	HYST	INDEX	REGISTER TYPE	SIZE
Circuit_A_Superheat	Circuit A Superheat			93	AV	ReadCOV_ NoWrite	0.1	30107	Input	2
Total_Exhaust_Fan_ CFM_BMS	Total Exhaust Fan CFM			107	AV	ReadCOV_ NoWrite	10	30135	Input	2
OAD_CFM_BMS	OAD CFM			129	AV	ReadCOV_ NoWrite	10	30173	Input	2
OAD_Space_Static_ Pressure_Ramp	OAD Static Pressure Ramp			131	AV	ReadCOV_ NoWrite	1	30177	Input	2
Active_Temperature_ Set Point	Active Temperature Set point			132	AV	ReadCOV_ NoWrite	0.1	30179	Input	2
Chilled_Water_1_ Valve_Analog_Output	Chilled Water 1 Valve Analog Output			201	AV	ReadCOV_ NoWrite	0.1	30473	Input	2
Condenser_1_Analog_ Output	Condenser 1 Analog Output			205	AV	ReadCOV_ NoWrite	0.1	30481	Input	2
Condenser_2_Analog_ Output	Condenser 2 Analog Output			206	AV	ReadCOV_ NoWrite	0.1	30483	Input	2
Electric_Heater_1_ Analog_Output	Electric Heater 1 Analog Output			221	AV	ReadCOV_ NoWrite	0.1	30513	Input	2
Energy_Recovery_ Analog_Output	Energy Recovery Analog Output			229	AV	ReadCOV_ NoWrite	0.1	30517	Input	2
Exhaust_Fan_Speed_ Analog_Output	Exhaust Fan Speed Analog Output			231	AV	ReadCOV_ NoWrite	0.1	30521	Input	2
Hot_Gas_Reheat_ Analog_Output	Hot Gas Reheat Analog Output			235	AV	ReadCOV_ NoWrite	0.1	30523	Input	2
Hot_Water_Valve_1_ Analog_Output	Hot Water Valve 1 Analog Output			236	AV	ReadCOV_ NoWrite	0.1	30525	Input	2
Mod_Gas_Furnace_1_ Analog_Output	Mod Gas Furnace 1 Analog Output			242	AV	ReadCOV_ NoWrite	0.1	30537	Input	2
Outside_Air_Damper_ Analog_Output	Outside Air Damper Analog Output			250	AV	ReadCOV_ NoWrite	0.1	30541	Input	2
Supply_Fan_Speed_ Analog_Output	Supply Fan Speed Analog Output			264	AV	ReadCOV_ NoWrite	0.1	30557	Input	2
Modulating_ Compressor_Analog_ Output_BMS	Modulating Compressor Analog Output - BMS			285	AV	ReadCOV_ NoWrite	0.1	30585	Input	2
Circuit_A_Sat_ Discharge_ Temperature	Circuit A Saturated Discharge Temperature			286	AV	ReadCOV_ NoWrite	0.1	30587	Input	2
Circuit_B_Sat_ Discharge_ Temperature	Circuit B Saturated Discharge Temperature			287	AV	ReadCOV_ NoWrite	0.1	30589	Input	2
Circuit_A_Sat_ Suction_Temperature	Circuit A Saturated Suciton Temperature			294	AV	ReadCOV_ NoWrite	0.1	30603	Input	2
Coil_Temperature_ Calculated_Setpoint	Calculated Coil Leaving Setpoint			312	AV	ReadCOV_ NoWrite	0.1	30653	Input	2

Appendix E: Points List

VARIABLE	DESCRIPTION	ACTIVE TEXT	INACTIVE TEXT	BACNET				MODBUS		
				OBJECT INSTANCE	OBJECT TYPE	ACCESS	HYST	INDEX	REGISTER TYPE	SIZE
Binary Inputs - Read Only										
Exhaust_Fan_1_Status_Digital_Input	Exhaust Fan 1 Status	Active	Inactive	23	BI	ReadCOV_NoWrite	0	24	Discrete	
Occupancy_Digital_Input	Occupancy Digital Input Status	Active	Inactive	53	BI	ReadCOV_NoWrite	0	54	Discrete	
Outside_Filter_Alarm_Digital_Input	Outside Filter Alarm Digital Input Status	Active	Inactive	54	BI	ReadCOV_NoWrite	0	55	Discrete	
Shutdown_Alarm_Digital_Input	Shutdown Alarm Digital Input Status	Active	Inactive	75	BI	ReadCOV_NoWrite	0	76	Discrete	
Supply_Fan_1_Status_Digital_Input	Supply Fan 1 Status	Active	Inactive	78	BI	ReadCOV_NoWrite	0	79	Discrete	
Unit_Enable_Digital_Input	Remote Unit Enable Digital Input Status	Active	Inactive	82	BI	ReadCOV_NoWrite	0	83	Discrete	
Wheel_Status_Digital_Input	Heat Wheel Status	Active	Inactive	83	BI	ReadCOV_NoWrite	0	84	Discrete	
Binary Values - Read/Write - Commandable										
BMS_Watchdog	BMS Watchdog command. Used to determine comm status. Must heartbeat within the watchdog timeout delay to detect comm status.	Active	Inactive	1	BV	Read_Commandable	0	2	Coil	
System_Enable	Master system enable/disable point.	Enable	Disable	2	BV	Read_Commandable	0	3	Coil	
BMS_Occupancy_Command	Occupancy Command. True = Unoccupied. False = Occupied.	Unoccupy	Occupy	3	BV	Read_Commandable	0	4	Coil	
Reset_All_Alarms	Alarm Reset Command.	Reset	Normal	4	BV	Read_Commandable	0	5	Coil	
Outside_RH_Source_BMS	Outside RH Source Selection. True = BMS. False = Local.	BMS	Local	5	BV	Read_Commandable	0	6	Coil	
Outside_Temp_Source_BMS	Outside Temp Source Selection. True = BMS. False = Local.	BMS	Local	6	BV	Read_Commandable	0	7	Coil	
Return_RH_Source_BMS	Return RH Source	BMS	Local	7	BV	Read_Commandable		8	Coil	
Return_Temp_Source_BMS	Return Temp Source	BMS	Local	8	BV	Read_Commandable		9	Coil	
Space_1_CO2_Source_BMS	Space 1 CO2 Source Selection. True = BMS. False = Local.	BMS	Local	9	BV	Read_Commandable	0	10	Coil	
Space_RH_Source_BMS	Space RH Source Selection. True = BMS. False = Local.	BMS	Local	12	BV	Read_Commandable	0	13	Coil	
Space_Static_Source_BMS	Space Static Source Selection. True = BMS. False = Local.	BMS	Local	13	BV	Read_Commandable	0	14	Coil	
Space_Temp_Source_BMS	Space Temp Source Selection. True = BMS. False = Local.	BMS	Local	14	BV	Read_Commandable	0	15	Coil	
SF_Control_Source_BMS	Allows the BMS to control supply fan speed. True = BMS. False = Local.	BMS	Local	56	BV	Read_Commandable	0	19	Coil	
EF_Control_Source_BMS	Allows the BMS to control exhaust fan speed. True = BMS. False = Local.	BMS	Local	57	BV	Read_Commandable	0	20	Coil	
OAD_Control_Source_BMS	Allows the BMS to control OAD position. True = BMS. False = Local.	BMS	Local	59	BV	Read_Commandable	0	22	Coil	

Appendix E: Points List

VARIABLE	DESCRIPTION	ACTIVE TEXT	INACTIVE TEXT	BACNET				MODBUS		
				OBJECT INSTANCE	OBJECT TYPE	ACCESS	HYST	INDEX	REGISTER TYPE	SIZE
Binary Values - Read Only										
Occupied	Occupied Status.	Occupied	Unoccupied	16	BV	ReadCOV_ NoWrite	0	10002	Discrete	
Unoccupied	Unoccupied Status.	Unoccupied	Occupied	17	BV	ReadCOV_ NoWrite	0	10003	Discrete	
Unoccupied_Cooling_ Call	Unoccupied Cooling Call Status	Active	Inactive	18	BV	ReadCOV_ NoWrite	0	10004	Discrete	
Unoccupied_ Dehumidification_Call	Unoccupied Dehumidification Call Status	Active	Inactive	19	BV	ReadCOV_ NoWrite	0	10005	Discrete	
Unoccupied_Heating_ Call	Unoccupied Heating Call Status	Active	Inactive	20	BV	ReadCOV_ NoWrite	0	10006	Discrete	
Occupied_Start	Occupied Start Command Status	Active	Inactive	21	BV	ReadCOV_ NoWrite	0	10007	Discrete	
Unoccupied_Start	Unoccupied Start Command Status	Active	Inactive	22	BV	ReadCOV_ NoWrite	0	10008	Discrete	
Enable_Controls	Status to indicate startup is complete and the unit is ready.	Enabled	Disabled	23	BV	ReadCOV_ NoWrite	0	10009	Discrete	
Global_Alarm	General alarm point. Optionally set to indicate any alarm is active, or a shutdown alarm is active.	Alarm	Normal	24	BV	ReadCOV_ NoWrite	0	10010	Discrete	
System_Shutdown_ Alarm	Shutdown alarm status. When true, System Enable will be set to false and the unit will remain off.	Shutdown	Normal	25	BV	ReadCOV_ NoWrite	0	10011	Discrete	
Damper_Open	Indicates there is a open air path and the supply fan can run.	Open	Closed	26	BV	ReadCOV_ NoWrite	0	10012	Discrete	
Cooling_is_On	Indicates that the unit is cooling.	Active	Inactive	27	BV	ReadCOV_ NoWrite	0	10013	Discrete	
Economizer_is_On	Indicates that the unit is economizing.	Active	Inactive	28	BV	ReadCOV_ NoWrite	0	10014	Discrete	
Heating_is_On	Indicates that the unit is heating.	Active	Inactive	29	BV	ReadCOV_ NoWrite	0	10015	Discrete	
Dehumidification_ Mode_Enabled	Indicates that the unit is dehumidifying.	Active	Inactive	31	BV	ReadCOV_ NoWrite	0	10017	Discrete	
Manual_Override_ Active	Indicates that manual overrides are active.	Override	Normal	32	BV	ReadCOV_ NoWrite	0	10018	Discrete	
Cooling_Not_Locked_ Out	Indicates that cooling is allowed.	Allowed	Locked_ Out	33	BV	ReadCOV_ NoWrite	0	10019	Discrete	
Heating_Not_Locked_ Out	Indicates that heating is allowed.	Allowed	Locked_ Out	34	BV	ReadCOV_ NoWrite	0	10020	Discrete	
Preheat_Not_Locked_ Out	Indicates that preheat is allowed.	Allowed	Locked_ Out	36	BV	ReadCOV_ NoWrite	0	10022	Discrete	
HGRH_Purging	Indicates that the hot gas reheat value is purging.	Active	Inactive	37	BV	ReadCOV_ NoWrite	0	10023	Discrete	
Allow_Dampers	Startup sequence command to open dampers	Yes	No	43	BV	ReadCOV_ NoWrite	0	10029	Discrete	
Allow_Exhaust_Fans	Startup sequence command to trigger exhaust fans to start	Yes	No	44	BV	ReadCOV_ NoWrite	0	10030	Discrete	
Allow_Supply_Fans	Startup sequence command to trigger supply fans to start	Yes	No	48	BV	ReadCOV_ NoWrite	0	10034	Discrete	
BMS_Watchdog_Active	Status of the BMS watchdog ping.	Active	Inactive	49	BV	ReadCOV_ NoWrite	0	10035	Discrete	
BMS_Occupancy_ Status	Status of the BMS occupancy command.	Occupied	Unoccupied	50	BV	ReadCOV_ NoWrite	0	10036	Discrete	
Compressor_1_ Enable_Digital_Output	Compressor 1 Enable Digital Output	Active	Inactive	111	BV	ReadCOV_ NoWrite	0	10164	Discrete	
Compressor_2_ Enable_Digital_Output	Compressor 2 Enable Digital Output	Active	Inactive	112	BV	ReadCOV_ NoWrite	0	10165	Discrete	
Compressor_3_ Enable_Digital_Output	Compressor 3 Enable Digital Output	Active	Inactive	113	BV	ReadCOV_ NoWrite	0	10166	Discrete	

Appendix E: Points List

VARIABLE	DESCRIPTION	ACTIVE TEXT	INACTIVE TEXT	BACNET				MODBUS		
				OBJECT INSTANCE	OBJECT TYPE	ACCESS	HYST	INDEX	REGISTER TYPE	SIZE
Compressor_4_Enable_Digital_Output	Compressor 4 Enable Digital Output	Active	Inactive	114	BV	ReadCOV_NoWrite	0	10167	Discrete	
Condenser_Fan_1_Digital_Output	Condenser Fan 1 Digital Output	Active	Inactive	119	BV	ReadCOV_NoWrite	0	10172	Discrete	
Condenser_Fan_2_Digital_Output	Condenser Fan 2 Digital Output	Active	Inactive	120	BV	ReadCOV_NoWrite	0	10173	Discrete	
Condenser_Fan_3_Digital_Output	Condenser Fan 3 Digital Output	Active	Inactive	121	BV	ReadCOV_NoWrite	0	10174	Discrete	
Exhaust_Fan_1_Start_Stop_Digital_Output	Exhaust Fan 1 Start Stop Digital Output	Active	Inactive	127	BV	ReadCOV_NoWrite	0	10180	Discrete	
Furnace_1_Stage_1_Digital_Output	Furnace 1 Stage 1 Digital Output	Active	Inactive	131	BV	ReadCOV_NoWrite	0	10184	Discrete	
Furnace_2_Stage_1_Digital_Output	Furnace 2 Stage 1 Digital Output	Active	Inactive	133	BV	ReadCOV_NoWrite	0	10186	Discrete	
Heat_Wheel_Enable_Digital_Output	Heat Wheel Enable Digital Output	Active	Inactive	163	BV	ReadCOV_NoWrite	0	10208	Discrete	
PreHeat_Enable_Digital_Output	PreHeat Enable Digital Output	Active	Inactive	166	BV	ReadCOV_NoWrite	0	10211	Discrete	
Supply_Fan_1_Start_Stop_Digital_Output	Supply Fan 1 Start Stop Digital Output	Active	Inactive	186	BV	ReadCOV_NoWrite	0	10231	Discrete	
BMS_Offline_Alarm.Active	BMS Offline Alarm (0=Normal 1=Alarm)	Alarm	Normal	313	BV	ReadCOV_NoWrite	0	10264	Discrete	
Circuit_A_Discharge_Pressure_Analog_Input_Alarm.Active	Circuit A Discharge Pressure Analog Input Alarm	Alarm	Normal	315	BV	ReadCOV_NoWrite		10266	Discrete	
Circuit_A_Discharge_Temp_Analog_Input_Alarm.Active	Circuit A Discharge Temp Analog Input Alarm	Alarm	Normal	316	BV	ReadCOV_NoWrite		10267	Discrete	
Circuit_A_Suction_Pressure_Analog_Input_Alarm.Active	Circuit A Suction Pressure Analog Input Alarm	Alarm	Normal	319	BV	ReadCOV_NoWrite		10270	Discrete	
Circuit_A_Suction_Temp_Analog_Input_Alarm.Active	Circuit A Suction Temp Analog Input Alarm	Alarm	Normal	320	BV	ReadCOV_NoWrite		10271	Discrete	
Circuit_B_Discharge_Pressure_Analog_Input_Alarm.Active	Circuit B Discharge Pressure Analog Input Alarm	Alarm	Normal	324	BV	ReadCOV_NoWrite		10275	Discrete	
Cold_Coil_1_Temperature_Sensor_Alarm.Active	Cold Coil 1 Temperature Sensor Alarm (0=Normal 1=Alarm)	Alarm	Normal	387	BV	ReadCOV_NoWrite	0	10338	Discrete	
Comp_Maintenance_Alarm.Active	Comp Maintenance Alarm (0=Normal 1=Alarm)	Alarm	Normal	411	BV	ReadCOV_NoWrite	0	10362	Discrete	
Exhaust_Fan_1_Alarm.Active	Exhaust Fan 1 Alarm (0=Normal 1=Alarm)	Alarm	Normal	423	BV	ReadCOV_NoWrite	0	10373	Discrete	
Expansion_Board_1_Alarm.Active	Expansion Board 1 Alarm (0=Normal 1=Alarm)	Alarm	Normal	434	BV	ReadCOV_NoWrite	0	10384	Discrete	
Expansion_Board_2_Alarm.Active	Expansion Board 2 Alarm (0=Normal 1=Alarm)	Alarm	Normal	435	BV	ReadCOV_NoWrite	0	10385	Discrete	
Expansion_Board_3_Alarm.Active	Expansion Board 3 Alarm (0=Normal 1=Alarm)	Alarm	Normal	436	BV	ReadCOV_NoWrite	0	10386	Discrete	
Internal_Board_Temp_Alarm.Active	Internal Board Temp Alarm (0=Normal 1=Alarm)	Alarm	Normal	498	BV	ReadCOV_NoWrite	0	10448	Discrete	
Multi_Channel_Conf_Alarm.Active	Multi Channel Conf Alarm (0=Normal 1=Alarm)	Alarm	Normal	503	BV	ReadCOV_NoWrite	0	10453	Discrete	
Outside_Air_Temperature_Sensor_Alarm.Active	Outside Air Temperature Sensor Alarm (0=Normal 1=Alarm)	Alarm	Normal	507	BV	ReadCOV_NoWrite	0	10457	Discrete	
Outside_Filter_Alarm.Active	Outside Filter Alarm (0=Normal 1=Alarm)	Alarm	Normal	508	BV	ReadCOV_NoWrite	0	10458	Discrete	
Outside_RH_Sensor_Alarm.Active	Outside RH Sensor Alarm (0=Normal 1=Alarm)	Alarm	Normal	509	BV	ReadCOV_NoWrite	0	10459	Discrete	
Space_CO2_1_Analog_Input_Alarm.Active	Space CO2 1 Analog Input Alarm (0=Normal 1=Alarm)	Alarm	Normal	535	BV	ReadCOV_NoWrite	0	10485	Discrete	
Space_High_Static_Alarm.Active	Space High Static Alarm (0=Normal 1=Alarm)	Alarm	Normal	537	BV	ReadCOV_NoWrite	0	10487	Discrete	

Appendix E: Points List

VARIABLE	DESCRIPTION	ACTIVE TEXT	INACTIVE TEXT	BACNET				MODBUS		
				OBJECT INSTANCE	OBJECT TYPE	ACCESS	HYST	INDEX	REGISTER TYPE	SIZE
Space_RH_Sensor_Alarm.Active	Space RH Sensor Alarm (0=Normal 1=Alarm)	Alarm	Normal	538	BV	ReadCOV_NoWrite	0	10488	Discrete	
Space_Set Point_Slider_Alarm.Active	Space Set Point Slider Alarm (0=Normal 1=Alarm)	Alarm	Normal	539	BV	ReadCOV_NoWrite	0	10489	Discrete	
Space_Static_Pressure_Analog_Input_Alarm.Active	Space Static Pressure Analog Input Alarm (0=Normal 1=Alarm)	Alarm	Normal	540	BV	ReadCOV_NoWrite	0	10490	Discrete	
Space_Temperature_Sensor_Alarm.Active	Space Temperature Sensor Alarm (0=Normal 1=Alarm)	Alarm	Normal	541	BV	ReadCOV_NoWrite	0	10491	Discrete	
Shutdown_Input_Alarm.Active	Shutdown Input Alarm (0=Normal 1=Alarm)	Alarm	Normal	546	BV	ReadCOV_NoWrite	0	10496	Discrete	
Supply_Air_Temp_Low_Limit.Active	Supply Air Temp Low Limit Alarm (0=Normal 1=Alarm)	Alarm	Normal	551	BV	ReadCOV_NoWrite	0	10501	Discrete	
Supply_Air_Temperature_Sensor_Alarm.Active	Supply Air Temperature Sensor Alarm (0=Normal 1=Alarm)	Alarm	Normal	552	BV	ReadCOV_NoWrite	0	10502	Discrete	
Supply_Duct_Static_Pressure_Analog_Input_Alarm.Active	Supply Duct Static Pressure Analog Input Alarm (0=Normal 1=Alarm)	Alarm	Normal	553	BV	ReadCOV_NoWrite	0	10503	Discrete	
Supply_Fan_1_Alarm.Active	Supply Fan 1 Alarm (0=Normal 1=Alarm)	Alarm	Normal	554	BV	ReadCOV_NoWrite	0	10504	Discrete	
Supply_High_Duct_Static_Alarm.Active	Supply High Duct Static Alarm (0=Normal 1=Alarm)	Alarm	Normal	563	BV	ReadCOV_NoWrite	0	10513	Discrete	
Supply_RH_Sensor_Alarm.Active	Supply RH Sensor Alarm (0=Normal 1=Alarm)	Alarm	Normal	564	BV	ReadCOV_NoWrite	0	10514	Discrete	
Supply_Temp_High_Limit_Alarm.Active	Supply Temp High Limit Alarm (0=Normal 1=Alarm)	Alarm	Normal	565	BV	ReadCOV_NoWrite	0	10515	Discrete	
TMem_Error.Active	TMem Error Alarm (0=Normal 1=Alarm)	Alarm	Normal	567	BV	ReadCOV_NoWrite	0	10517	Discrete	
Wheel_Rotation_Alarm.Active	Wheel Rotation Alarm (0=Normal 1=Alarm)	Alarm	Normal	576	BV	ReadCOV_NoWrite	0	10526	Discrete	
AI_Batt_EVD_1.Active	EVD Battery Alarm (0=Normal 1=Alarm)	Alarm	Normal	589	BV	ReadCOV_NoWrite	0	10539	Discrete	
AI_ConfigErr_EVD_1.Active	EVD Configuration Alarm (0=Normal 1=Alarm)	Alarm	Normal	590	BV	ReadCOV_NoWrite	0	10540	Discrete	
AI_DscgHiP_COMP_1.Active	Compressor Envelope - High Discharge Pressure Alarm (0=Normal 1=Alarm)	Alarm	Normal	591	BV	ReadCOV_NoWrite	0	10541	Discrete	
AI_DscgHiTemp_COMP_1.Active	Compressor Envelope - High Discharge Temperature Alarm (0=Normal 1=Alarm)	Alarm	Normal	592	BV	ReadCOV_NoWrite	0	10542	Discrete	
AI_DscgLowP_COMP_1.Active	EVD Low Discharge Pressure Alarm (0=Normal 1=Alarm)	Alarm	Normal	593	BV	ReadCOV_NoWrite	0	10543	Discrete	
AI_EEPROM_EVD_1.Active	EVD EEPROM Alarm (0=Normal 1=Alarm)	Alarm	Normal	594	BV	ReadCOV_NoWrite	0	10544	Discrete	
AI_EEV_A_EVD_1.Active	ExV Motor Alarm - Valve 1 (0=Normal 1=Alarm)	Alarm	Normal	595	BV	ReadCOV_NoWrite	0	10545	Discrete	
AI_EmergencyClosing_EVD_1.Active	EVD Emergency Closing Alarm (0=Normal 1=Alarm)	Alarm	Normal	597	BV	ReadCOV_NoWrite	0	10547	Discrete	
AI_EVD_Offline_EVD_1.Active	EVD Offline Communication Alarm (0=Normal 1=Alarm)	Alarm	Normal	598	BV	ReadCOV_NoWrite	0	10548	Discrete	
AI_FW_CompatibErr_EVD_1.Active	EVD Firmware Compability Alarm (0=Normal 1=Alarm)	Alarm	Normal	599	BV	ReadCOV_NoWrite	0	10549	Discrete	
AI_HiCurr_COMP_1.Active	Compressor Envelope - High Current Alarm (0=Normal 1=Alarm)	Alarm	Normal	600	BV	ReadCOV_NoWrite	0	10550	Discrete	
AI_HiRatioP_COMP_1.Active	Compressor Envelope - High Pressure Ratio Alarm (0=Normal 1=Alarm)	Alarm	Normal	601	BV	ReadCOV_NoWrite	0	10551	Discrete	
AI_HiT_Cond_EVD_1.Active	AI_HiT_Cond_EVD_1 (0=Normal 1=Alarm)	Alarm	Normal	602	BV	ReadCOV_NoWrite	0	10552	Discrete	
AI_IncompleteClosing_EVD_1.Active	EVD Incomplete Closing Alarm (0=Normal 1=Alarm)	Alarm	Normal	603	BV	ReadCOV_NoWrite	0	10553	Discrete	

Appendix E: Points List

VARIABLE	DESCRIPTION	ACTIVE TEXT	INACTIVE TEXT	BACNET				MODBUS		
				OBJECT INSTANCE	OBJECT TYPE	ACCESS	HYST	INDEX	REGISTER TYPE	SIZE
AI_LOP_A_EVD_1. Active	EVD Low Operating Pressure Alarm - Valve 1 (0=Normal 1=Alarm)	Alarm	Normal	604	BV	ReadCOV_ NoWrite	0	10554	Discrete	
AI_Low_SH_A_EVD_1. Active	EVD Low SuperHeat Alarm - Valve 1 (0=Normal 1=Alarm)	Alarm	Normal	606	BV	ReadCOV_ NoWrite	0	10556	Discrete	
AI_LowDeltaP_ COMP_1.Active	Compressor Envelope - Low Pressure DeltaAlarm (0=Normal 1=Alarm)	Alarm	Normal	608	BV	ReadCOV_ NoWrite	0	10558	Discrete	
AI_LowRatioP_ COMP_1.Active	Compressor Envelope - Low Pressure Ratio Alarm (0=Normal 1=Alarm)	Alarm	Normal	609	BV	ReadCOV_ NoWrite	0	10559	Discrete	
AI_LowSuct_A_EVD_1. Active	Low Suction Refrigerant Temperature - Valve 1 (0=Normal 1=Alarm)	Alarm	Normal	610	BV	ReadCOV_ NoWrite	0	10560	Discrete	
AI_MOP_A_EVD_1. Active	EVD Max Operating Pressure Alarm - Valve 1 (0=Normal 1=Alarm)	Alarm	Normal	612	BV	ReadCOV_ NoWrite	0	10562	Discrete	
AI_S1_EVD_1.Active	EVD-S1 Suction Pressure Sensor Alarm (0=Normal 1=Alarm)	Alarm	Normal	614	BV	ReadCOV_ NoWrite	0	10564	Discrete	
AI_S2_EVD_1.Active	EVD-S2 Suction Temperature Sensor Alarm (0=Normal 1=Alarm)	Alarm	Normal	615	BV	ReadCOV_ NoWrite	0	10565	Discrete	
AI_S4_EVD_1.Active	EVD-S4 Discharge Temperature Sensor Alarm (0=Normal 1=Alarm)	Alarm	Normal	617	BV	ReadCOV_ NoWrite	0	10567	Discrete	
AI_SuctHiP_COMP_1. Active	Compressor Envelope - SuctHiP_COMP (0=Normal 1=Alarm)	Alarm	Normal	618	BV	ReadCOV_ NoWrite	0	10568	Discrete	
AI_SuctLowP_ COMP_1.Active	Compressor Envelope - SuctLowP_COMP (0=Normal 1=Alarm)	Alarm	Normal	619	BV	ReadCOV_ NoWrite	0	10569	Discrete	
HP_Defrost_Active. Active	Heat Pump Defrost Alarm	Alarm	Normal	631	BV	ReadCOV_ NoWrite		10579	Discrete	
Comp_Staging_Order_ Skipped.Active	Compressor Staging Order is Skipped Warning (0=Normal 1=Alarm)	Alarm	Normal	632	BV	ReadCOV_ NoWrite	0	10580	Discrete	
Heat_Pump_Heating_ Lock_Out_Alarm. Active	Heat Pump Heating Locked Out Alarm	Alarm	Normal	633	BV	ReadCOV_ NoWrite		10581	Discrete	
EVD_PrePosition_ Alarm_1.Active	Unexpected EEV Position (0=Normal 1=Alarm)	Alarm	Normal	634	BV	ReadCOV_ NoWrite	0	10582	Discrete	
ER_Wheel_High_ DP.Active	Energy Recovery Wheel high differential pressure (0=Normal 1=Alarm)	Alarm	Normal	731	BV	ReadCOV_ NoWrite	0	10679	Discrete	
OAD_Feedback_Error_ Not_Economizing. Active	Feedback indicates OAD is not opening during economizer	Alarm	Normal	741	BV	ReadCOV_ NoWrite		10690	Discrete	
OAD_Feedback_Error_ Economizing.Active	Feedback indicates OAD is open	Alarm	Normal	742	BV	ReadCOV_ NoWrite		10692	Discrete	
OAD_Feedback_Error_ OAD_Not_Modulating. Active	Feedback indicates the OAD is not modulating	Alarm	Normal	743	BV	ReadCOV_ NoWrite		10694	Discrete	
OAD_Feedback_Error_ Excess_OA.Active	Feedback indicates the OAD is not closing	Alarm	Normal	744	BV	ReadCOV_ NoWrite		10696	Discrete	

Appendix E: Points List

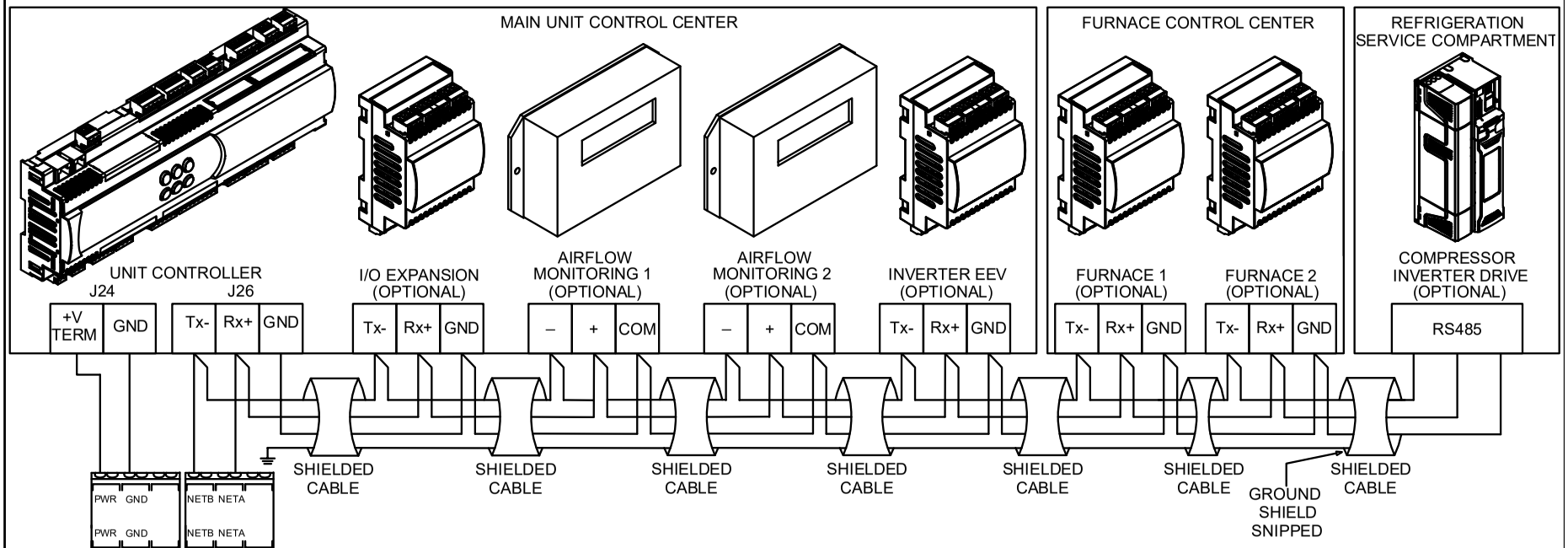
VARIABLE	DESCRIPTION	ACTIVE TEXT	INACTIVE TEXT	BACNET				MODBUS		
				OBJECT INSTANCE	OBJECT TYPE	ACCESS	HYST	INDEX	REGISTER TYPE	SIZE
Binary Values - Commandable										
Aux_BMS_Digital_Output_1	BMS Commanded auxilary digital output	Active	Inactive	207	BV	ReadCOV_Commandable	0	24	Coil	
Aux_BMS_Digital_Output_2	BMS Commanded auxilary digital output	Active	Inactive	208	BV	ReadCOV_Commandable	0	25	Coil	
Aux_BMS_Digital_Output_3	BMS Commanded auxilary digital output	Active	Inactive	209	BV	ReadCOV_Commandable	0	26	Coil	
Aux_BMS_Digital_Output_4	BMS Commanded auxilary digital output	Active	Inactive	210	BV	ReadCOV_Commandable	0	27	Coil	
Aux_BMS_Digital_Output_5	BMS Commanded auxilary digital output	Active	Inactive	211	BV	ReadCOV_Commandable	0	28	Coil	
Aux_BMS_Digital_Output_6	BMS Commanded auxilary digital output	Active	Inactive	212	BV	ReadCOV_Commandable	0	29	Coil	
Integer Values - Read Only										
Allow_Fan_Delay_Remaining	Startup Sequence Fan Damper Delay. Time before enabling Fan startup sequence.			1	IV	ReadCOV_NoWrite	1	30182	Input	1
Supply_Fan_Delay_Remaining	Supply Fan startup sequence. Time before starting supply fan.			2	IV	ReadCOV_NoWrite	1	30184	Input	1
Exhaust_Fan_Delay_Remaining	Exhaust Fan startup sequence. Time before starting exhaust fan.			3	IV	ReadCOV_NoWrite	1	30186	Input	1
LatestAlm	Most recent alarm. See alarm table.			7	IV	ReadCOV_NoWrite	1	30195	Input	2
Large Board Points										
Binary Values - Read Only										
High_Low_Press_Circ_A_Alarm.Active	High Low Pressure Switch Alarm Circuit A	Alarm	Normal	733	BV	ReadCOV_NoWrite	0	10682	Discrete	
High_Low_Press_Circ_B_Alarm.Active	High Low Pressure Switch Alarm Circuit B	Alarm	Normal	734	BV	ReadCOV_NoWrite	0	10683	Discrete	
High_Low_Press_Circ_C_Alarm.Active	High Low Pressure Switch Alarm Circuit A	Alarm	Normal	735	BV	ReadCOV_NoWrite	0	10684	Discrete	
High_Low_Press_Circ_D_Alarm.Active	High Low Pressure Switch Alarm Circuit B	Alarm	Normal	736	BV	ReadCOV_NoWrite	0	10685	Discrete	
High_Low_Press_Circ_C_Alarm.Active	High Low Pressure Switch Alarm Circuit C	Alarm	Normal	735	BV	ReadCOV_NoWrite	0	10684	Discrete	
High_Low_Press_Circ_D_Alarm.Active	High Low Pressure Switch Alarm Circuit D	Alarm	Normal	736	BV	ReadCOV_NoWrite	0	10685	Discrete	
Greentrol_1_Alarm.Active	Greentrol Device Alarm	Alarm	Normal	737	BV	ReadCOV_NoWrite	0	10686	Discrete	
Greentrol_2_Alarm.Active	Greentrol Device Alarm	Alarm	Normal	738	BV	ReadCOV_NoWrite	0	10687	Discrete	
Greentrol_3_Alarm.Active	Greentrol Device Alarm	Alarm	Normal	739	BV	ReadCOV_NoWrite	0	10688	Discrete	
Medium Board Points										
Analog Inputs - Read Only										
Mixed_Temp_Analog_Input	Mixed Temperature			35	AI	ReadCOV_NoWrite	0.1	30263	Input	2
Exhaust_Fan_Speed_Analog_Input	Exhaust Fan Speed Remote Command Analog Input value			143	AI	ReadCOV_NoWrite	1	30455	Input	2
Supply_Fan_Speed_Analog_Input	Supply Fan Speed Remote Command Analog Input value			155	AI	ReadCOV_NoWrite	1	30461	Input	2

Appendix E: Points List

VARIABLE	DESCRIPTION	ACTIVE TEXT	INACTIVE TEXT	BACNET				MODBUS		
				OBJECT INSTANCE	OBJECT TYPE	ACCESS	HYST	INDEX	REGISTER TYPE	SIZE
Binary Inputs - Read Only										
Comp_Circ_A_High_Pressure_Digital_Input	Circuit A High Pressure Switch	Active	Inactive	3	BI	ReadCOV_NoWrite	0	10052	Discrete	
Comp_Circ_A_Low_Pressure_Digital_Input	Circuit A Low Pressure Switch	Active	Inactive	4	BI	ReadCOV_NoWrite	0	10053	Discrete	
Comp_Circ_B_High_Pressure_Digital_Input	Circuit B High Pressure Switch	Active	Inactive	5	BI	ReadCOV_NoWrite	0	10054	Discrete	
Comp_Circ_B_Low_Pressure_Digital_Input	Circuit B Low Pressure Switch	Active	Inactive	6	BI	ReadCOV_NoWrite	0	10055	Discrete	
Drain_Pan_Alarm_Digital_Input	Drain Pan Alarm Digital Input Status	Active	Inactive	21	BI	ReadCOV_NoWrite	0	10070	Discrete	
EAD_End_Switch_Digital_Input	Exhaust Air Damper End Switch Digital Input Status	Active	Inactive	22	BI	ReadCOV_NoWrite	0	10071	Discrete	
OAD_End_Switch_Digital_Input	OAD End Switch Digital Input Status	Active	Inactive	52	BI	ReadCOV_NoWrite	0	10101	Discrete	
Binary Values - Read Only										
Condenser_Fan_5_Digital_Output	Condenser Fan 5 Digital Output	Active	Inactive	123	BV	ReadCOV_NoWrite	0	10176	Discrete	
Condenser_Fan_6_Digital_Output	Condenser Fan 6 Digital Output	Active	Inactive	124	BV	ReadCOV_NoWrite	0	10177	Discrete	
Condenser_Fan_7_Digital_Output	Condenser Fan 7 Digital Output	Active	Inactive	125	BV	ReadCOV_NoWrite	0	10178	Discrete	
Comp_Circ_A_High_Pressure_Alarm.Active	Comp Circ A High Pressure Alarm (0=Normal 1=Alarm)	Alarm	Normal	395	BV	ReadCOV_NoWrite	0	10346	Discrete	
Comp_Circ_A_Low_Pressure_Alarm.Active	Comp Circ A Low Pressure Alarm (0=Normal 1=Alarm)	Alarm	Normal	396	BV	ReadCOV_NoWrite	0	10347	Discrete	
Comp_Circ_B_High_Pressure_Alarm.Active	Comp Circ B High Pressure Alarm (0=Normal 1=Alarm)	Alarm	Normal	397	BV	ReadCOV_NoWrite	0	10348	Discrete	
Comp_Circ_B_Low_Pressure_Alarm.Active	Comp Circ B Low Pressure Alarm (0=Normal 1=Alarm)	Alarm	Normal	398	BV	ReadCOV_NoWrite	0	10349	Discrete	
Damper_End_Switch_Alarm.Active	Damper End Switch Alarm (0=Normal 1=Alarm)	Alarm	Normal	420	BV	ReadCOV_NoWrite	0	10371	Discrete	
Drain_Pan_Alarm.Active	Drain Pan Alarm (0=Normal 1=Alarm)	Alarm	Normal	422	BV	ReadCOV_NoWrite	0	10372	Discrete	
Exhaust_Fan_1_AMD_analog_input_Alarm.Active	Exhaust Fan 1 CFM Analog Input Alarm (0=Normal 1=Alarm)	Alarm	Normal	424	BV	ReadCOV_NoWrite	0	10374	Discrete	
Freeze_Stat_Alarm.Active	Freeze Stat Alarm (0=Normal 1=Alarm)	Alarm	Normal	441	BV	ReadCOV_NoWrite	0	10391	Discrete	
Mixed_Temperature_Sensor_Alarm.Active	Mixed Temperature Sensor Alarm (0=Normal 1=Alarm)	Alarm	Normal	502	BV	ReadCOV_NoWrite	0	10452	Discrete	
OAD_AMD_analog_input_Alarm.Active	OAD CFM Analog Input Alarm (0=Normal 1=Alarm)	Alarm	Normal	506	BV	ReadCOV_NoWrite	0	10456	Discrete	

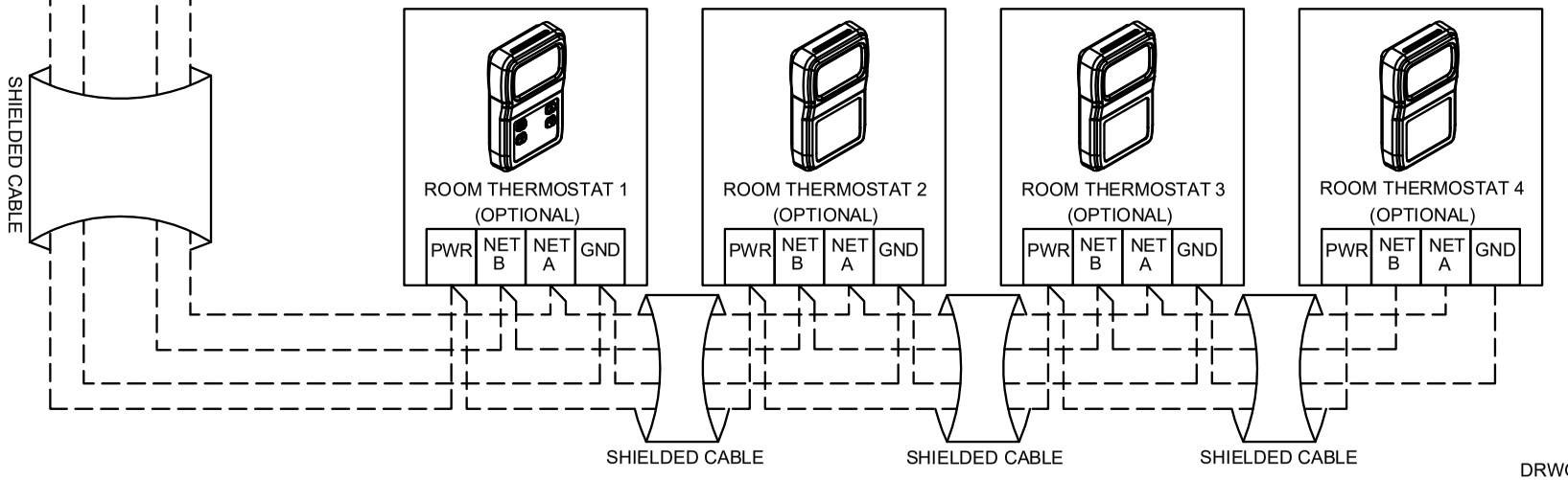
FACTORY MODBUS CONNECTIONS

COMPONENTS MOUNTED AND WIRED BY FACTORY



COMPONENTS FIELD MOUNTED AND WIRED IN ROOM/SPACE

FIELD WIRING
FACTORY WIRING



DRWG:2948063-00

Our Commitment

As a result of our commitment to continuous improvement, Greenheck reserves the right to change specifications without notice.

Specific Greenheck product warranties are located on greenheck.com within the product area tabs and in the Library under Warranties.

AMCA Publication 410-96, Safety Practices for Users and Installers of Industrial and Commercial Fans, provides additional safety information. This publication can be obtained from AMCA International, Inc. at www.amca.org.

GREENHECK
Building Value in Air.

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GREENHECK
Building Value in Air.

PN 471832
Wall Housing Assembly Instructions
Sizes 8 - 54

Assembly and Installation Instructions

Please read and save these instructions for future reference. Read carefully before attempting to assemble, install, operate or maintain the product described. Protect yourself and others by observing all safety information. Failure to comply with instructions could result in personal injury and/or property damage! Upon receiving the product, check for any damage that may have occurred during transit and report it immediately to the shipper. Also verify that all accessory items are accounted for.

Wall housings are the safest, most efficient and sturdy platform for mounting sidewall propeller fans and their optional accessories. Wall housings allow for a wide range of mounting arrangements to meet specific applications. It is constructed of galvanized steel with heavy-gauge mounting flanges and prepunched mounting holes.

Item	Description	Quantity Sizes 8-48	Quantity Size 54
1	Wall Housing Mounting Angle	4	4
2	Side Panels	2	4
3	Top Panels	1	2
4	Bottom Panels	1	2
—	Fasteners	1 bag	1 bag

NOTE: Unit sizes 8-18 use spinlock fasteners in lieu of weldstuds as listed in these instructions.

NOTE: Figure 1 shows the parts for size 54. Sizes 8-48 will not require two pieces to make up the side, top and bottom panels.

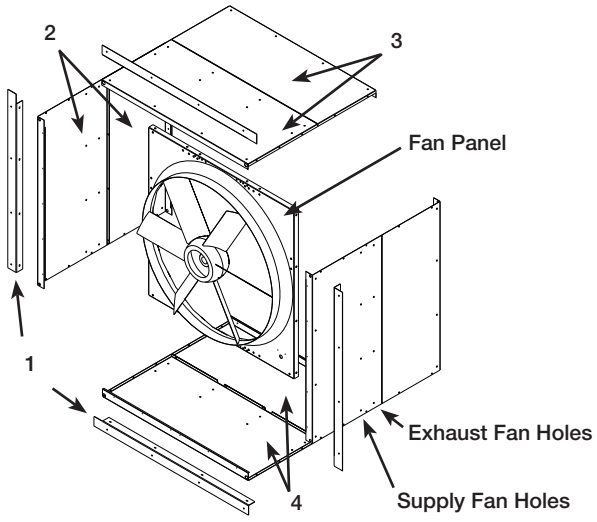

Figure 1 - Parts

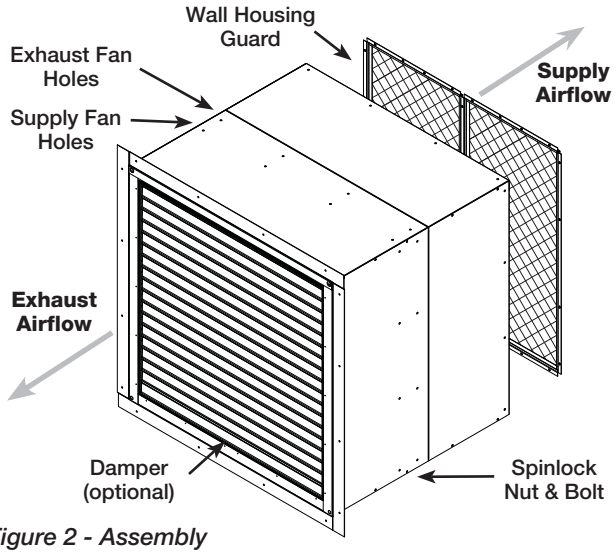

Figure 2 - Assembly

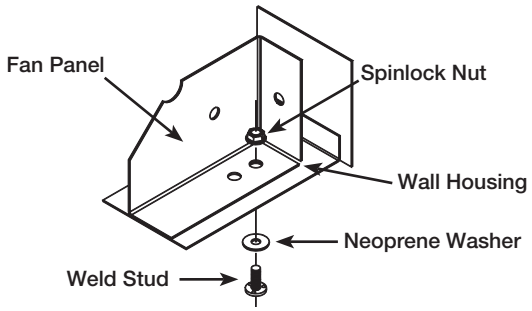

Figure 3 - Assembly

Size	Wall Housing			Damper Guard		Weatherhood			Damper	Mounting Flange	Material Gauge (ga) Thickness
	A	B*	W.O.	C	D	E	F	Width			
8	13¼ (337)	19 (483)	14¼ (362)	5½ (140)	10¼ (260)	13¼ (337)	11¼ (286)	10½ (267)	10 (254)	1½ (38)	20
10	15¼ (387)	19 (483)	16¼ (413)	6½ (165)	12¼ (311)	14⅞ (378)	13⅜ (340)	12½ (318)	12 (305)	1½ (38)	20
12	18¼ (464)	23 (584)	19¼ (489)	5⅜ (137)	14¼ (362)	16⅜ (416)	15⅝ (397)	14½ (368)	14 (356)	1½ (38)	20
14	20¼ (514)	26 (660)	21¼ (540)	6⅜ (162)	16¼ (413)	17½ (445)	17⅝ (448)	16½ (419)	16 (406)	1½ (38)	20
16	22¼ (565)	27 (686)	23¼ (591)	6¾ (171)	18¼ (464)	19⅜ (492)	19⅝ (498)	18½ (470)	18 (457)	1½ (38)	20
18	24¼ (616)	28 (711)	25¼ (641)	6 (152)	20¼ (514)	22 (559)	21⅝ (549)	20½ (521)	20 (508)	1½ (38)	20
20	26¼ (667)	32 (813)	27¼ (692)	6½ (165)	22¼ (565)	24¾ (629)	23⅝ (600)	22½ (572)	22 (559)	1½ (38)	18
24	32¼ (819)	37 (940)	33¾ (857)	6⅜ (162)	26¼ (667)	26⅞ (683)	30⅜ (772)	29⅛ (740)	26 (660)	2⅞ (73)	18
30	38¼ (972)	38 (965)	39¾ (1010)	6½ (165)	32¼ (819)	29⅛ (740)	36½ (927)	35⅛ (892)	32 (813)	2⅞ (73)	18
36	44¼ (1124)	39 (991)	45¾ (1162)	6¾ (171)	38¼ (972)	33 (838)	42½ (1080)	41⅛ (1045)	38 (965)	2⅞ (73)	18
42	50⅜ (1280)	44 (1118)	51¾ (1314)	10 (254)	44¼ (1124)	35¾ (908)	48½ (1232)	47⅛ (1197)	44 (1118)	2⅞ (73)	18
48	56⅜ (1432)	44 (1118)	57¾ (1467)	9 (229)	50¼ (1276)	40⅜ (1026)	54⅝ (1387)	53¼ (1353)	50 (1270)	2⅞ (73)	18
54	62⅜ (1584)	52 (1321)	63¾ (1619)	7½ (191)	56¼ (1429)	44¾ (1137)	60⅞ (1546)	59½ (1511)	56 (1422)	4 (102)	16

*B dimension will increase by 6 in. (152 mm) when a heavy duty motorized backdraft damper is specified. For complete dimensional information refer to submittal. All dimensions given in inches (mm).

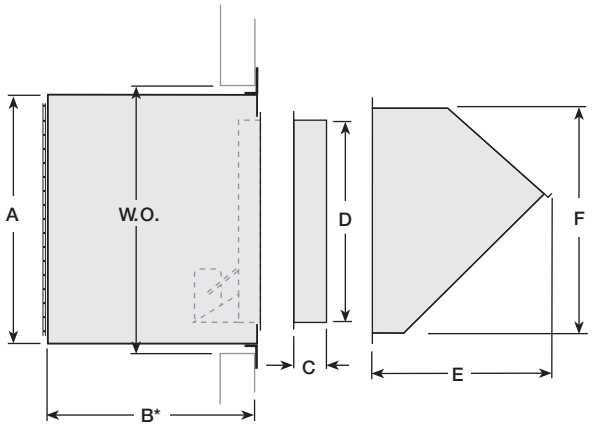

Figure 4 - Dimensional Data

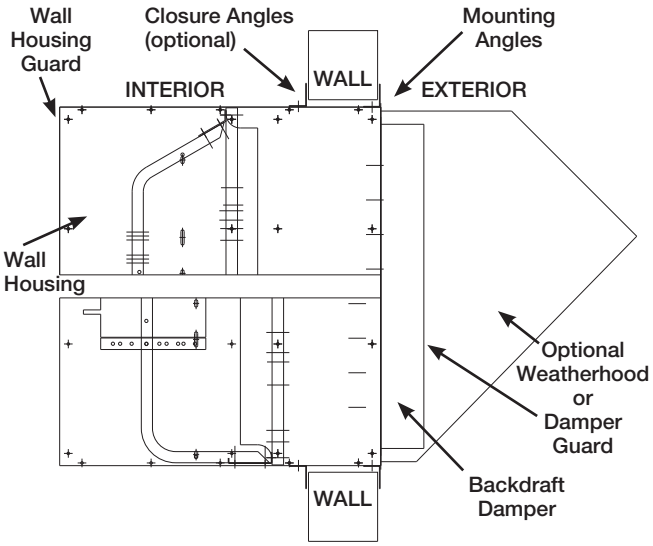

Figure 5 -
Typical Installation Configuration (Exhaust/Supply)

Assembly

1. Determine if a supply fan or exhaust fan is to be used in the wall housing (see Figure 5). Two rows of holes are provided for attaching the wall housing panels to the fan panel.

   NOTE: Exhaust fans are mounted farthest from the damper end. Supply fans are mounted nearest to the damper end (see Figure 2). Damper end has small holes in face of the wall housing. The guard end has larger extruded holes.
2. Using weldstuds and neoprene washers, attach the wall housing bottom panel (Item 4) to the bottom of the fan panel. With the weldstud heads and neoprene washers on the exterior of the housing, refer to Figure 3, place hex nuts on the spinlock bolts and finger tighten.
3. Attach side panels to the fan panel, making sure they overlap the bottom panel for weatherproofing Install weldnuts, neoprene washers and hex nuts. Finger tighten all fasteners.
4. Attach the top panels to the fan panel, assuring the formed edges overlap the side panels for weatherproofing. Install weldstuds, neoprene washers and hex nuts. Finger tighten all fasteners.
5. Install caplugs in the unused holes of the top and side panels to keep the wall housing weathertight. Unused holes in the bottom panel are used as drain holes. Tighten all fasteners securely.
6. A versatile feature of the Greenheck wall housing is a mounting flange which may be used in either a standard arrangement (Figure 5) or moved anywhere along the housing. This permits the distance the wall housing protrudes outside or inside the wall to be varied.
   5/16 inch holes must be drilled in the housing if the factory punched holes are not used.
7. Conduit holes are provided in each end of standard housings.

Damper Installation

To install an optional damper, refer to Figure 6. Using a pneumatic or electric drill, run the self-drilling screws through the holes provided in the side and bottom damper flanges into the wall housing. Check damper for freedom of movement. If an optional damper guard or weatherhood is to be installed, refer to the next section.

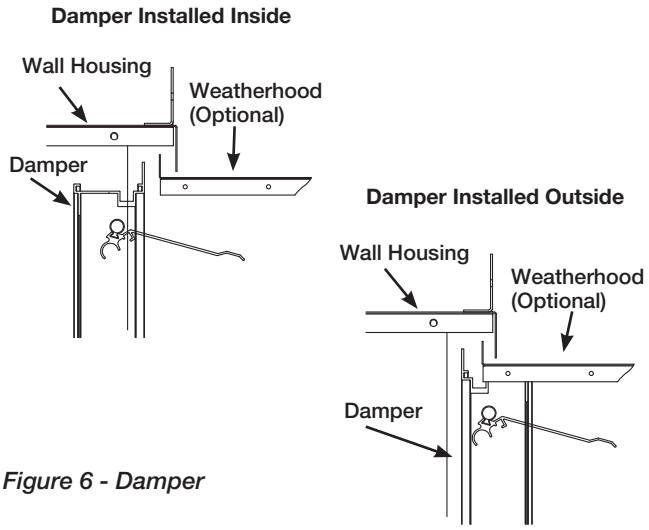

Figure 6 - Damper

Damper Guard or Weatherhood Installation

To install the damper guard, center guard over damper and fasten to wall housing using the self-drilling screws. Refer to Figure 7.

To install the weatherhood, slide the top flange of weatherhood under the flange of wall housing, see Figure 6, and fasten with self-drilling screws.

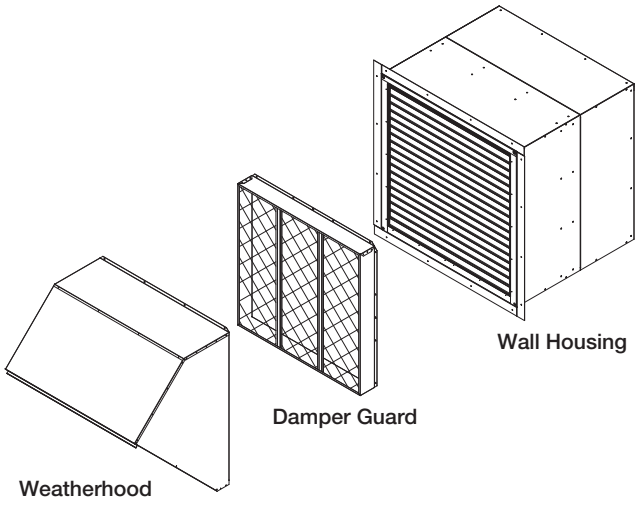

Figure 7 - Damper Guard or Weatherhood

Wall Housing Guard Installation

Attach wall housing guard to wall housing using the 1/4-20 x 3/4 thread cutting screw with washer. Refer to Figure 8.

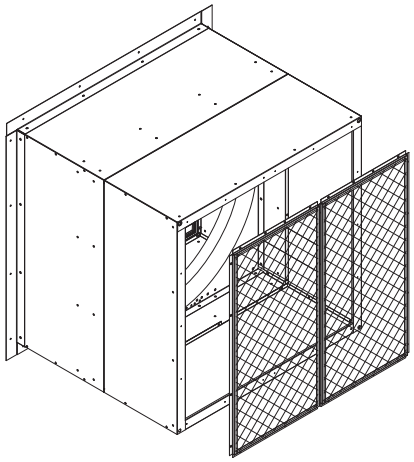

Figure 8 - Wall Housing Guard

Fit for Sidewall Propeller Fan Accessories

Figure 9 reveals the correct fit for sidewall propeller fans after all optional accessories have been assembled and installed.

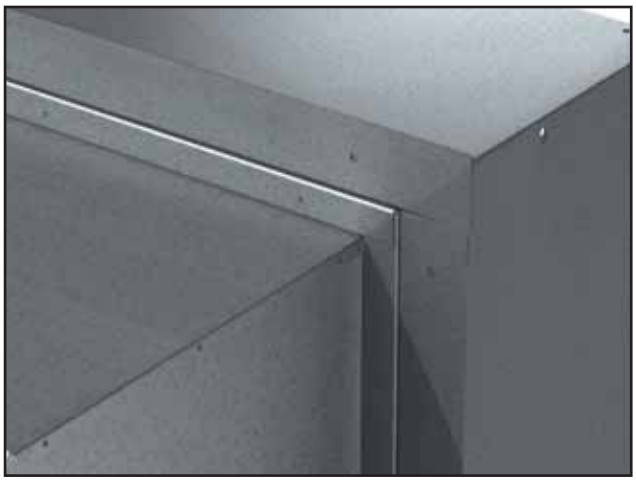

Figure 9 - Sidewall Propeller Fan Accessories

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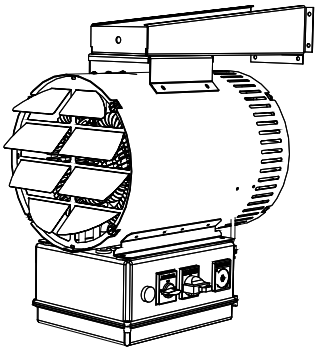


Installation, Operation & Maintenance Instructions

Specifications

Model Number	KW	Volts	Phase	Output BTU/HR	Heater Amps	Motor Volts	Motor Phase	Motor Amps	Temp Rise	CFM	Ship Weight lbs (kg)
WD02112A	2	120	1	6,824	16.7	120	1	1.554	9	700	60 (27.2)
WD02812A	2	208	1	6,824	9.6	208	1	0.896	9	700	60 (27.2)
WD02212A	2	240	1	6,824	8.3	240	1	0.777	9	700	60 (27.2)
WD03112A	3	120	1	10,236	25.0	120	1	1.554	14	700	60 (27.2)
WD03812A	3	208	1	10,236	14.4	208	1	0.896	14	700	60 (27.2)
WD03212A	3	240	1	10,236	12.5	240	1	0.777	14	700	60 (27.2)
WD03712A	3	277	1	10,236	10.8	277	1	0.673	14	700	60 (27.2)
WD03832A	3	208	3	10,236	8.3	208	1	0.896	14	700	60 (27.2)
WD03232A	3	240	3	10,236	7.2	240	1	0.777	14	700	60 (27.2)
WD03432A	3	480	3	10,236	3.6	480	1	0.388	14	700	60 (27.2)
WD05812A	5	208	1	17,060	24.0	208	1	0.896	23	700	60 (27.2)
WD05212A	5	240	1	17,060	20.8	240	1	0.777	23	700	60 (27.2)
WD05712A	5	277	1	17,060	18.1	277	1	0.673	23	700	60 (27.2)
WD05412A	5	480	1	17,060	10.4	480	1	0.388	23	700	60 (27.2)
WD05832A	5	208	3	17,060	13.9	208	1	0.896	23	700	60 (27.2)
WD05232A	5	240	3	17,060	12.0	240	1	0.777	23	700	60 (27.2)
WD05432A	5	480	3	17,060	6.0	480	1	0.388	23	700	60 (27.2)
WD05632A	5	600	3	17,060	4.8	240	1	1.8	23	1450	75 (34)
WD07812A	7.5	208	1	25,590	36.1	208	1	0.896	34	700	60 (27.2)
WD07212A	7.5	240	1	25,590	31.3	240	1	0.777	34	700	60 (27.2)
WD07712A	7.5	277	1	25,590	27.1	277	1	0.673	34	700	60 (27.2)
WD07412A	7.5	480	1	25,590	15.6	480	1	0.388	34	700	60 (27.2)
WD07832A	7.5	208	3	25,590	20.8	208	1	0.896	34	700	60 (27.2)
WD07232A	7.5	240	3	25,590	18.0	240	1	0.777	34	700	60 (27.2)
WD07432A	7.5	480	3	25,590	9.0	480	1	0.388	34	700	60 (27.2)
WD07632A	7.5	600	3	25,590	7.2	240	1	1.8	34	1450	75 (34)
WD10212A	10	240	1	34,120	41.7	240	1	0.777	22	1450	60 (27.2)
WD10712A	10	277	1	34,120	36.1	277	1	0.673	22	1450	60 (27.2)
WD10412A	10	480	1	34,120	20.8	480	1	0.388	22	1450	60 (27.2)
WD10832A	10	208	3	34,120	27.8	208	1	0.896	22	1450	60 (27.2)
WD10232A	10	240	3	34,120	24.1	240	1	0.777	22	1450	60 (27.2)
WD10432A	10	480	3	34,120	12.0	480	1	0.388	22	1450	60 (27.2)
WD10632A	10	600	3	34,120	9.6	240	1	1.8	33	2400	75 (34)
WD12812A	12.5	208	1	42,650	60.1	208	1	1.793	27	1450	60 (27.2)
WD12212A	12.5	240	1	42,650	52.1	240	1	1.554	27	1450	60 (27.2)
WD12832A	12.5	208	3	42,650	34.7	208	1	1.793	27	1450	60 (27.2)
WD12232A	12.5	240	3	42,650	30.1	240	1	1.554	27	1450	60 (27.2)
WD12432A	12.5	480	3	42,650	15.0	480	1	0.777	27	1450	60 (27.2)
WD12632A	12.5	600	3	42,650	12.0	240	1	1.8	27	2400	75 (34)
WD15812A	15	208	1	51,180	72.1	208	1	1.793	20	2400	110 (49.9)
WD15212A	15	240	1	51,180	62.5	240	1	1.554	20	2400	110 (49.9)
WD15412A	15	480	1	51,180	31.3	480	1	0.777	20	2400	110 (49.9)
WD15832A	15	208	3	51,180	41.6	208	1	1.793	20	2400	110 (49.9)
WD15232A	15	240	3	51,180	36.1	240	1	1.554	20	2400	110 (49.9)
WD15432A	15	480	3	51,180	18.0	480	1	0.777	20	2400	110 (49.9)
WD15632A	15	600	3	51,180	14.5	240	1	1.8	20	2400	125 (56.6)
WD20412A	20	480	1	68,240	41.7	480	1	0.777	26	2400	120 (54.4)
WD20232A	20	240	3	68,240	48.1	240	1	1.554	26	2400	120 (54.4)
WD20432A	20	480	3	68,240	24.1	480	1	0.777	26	2400	120 (54.4)
WD20632A	20	600	3	68,240	19.3	240	1	1.8	26	2400	135 (61.2)
WD25832A	25	208	3	85,300	69.4	208	1	1.793	33	2400	120 (54.4)
WD25232A	25	240	3	85,300	60.1	240	1	1.554	33	2400	120 (54.4)
WD25432A	25	480	3	85,300	30.1	480	1	0.777	33	2400	120 (54.4)
WD25632A	25	600	3	85,300	24.1	240	1	1.8	33	2400	135 (61.2)
WD30832A	30	208	3	102,360	83.3	208	1	1.793	39	2400	120 (54.4)
WD30232A	30	240	3	102,360	72.2	240	1	1.554	39	2400	120 (54.4)
WD30432A	30	480	3	102,360	36.1	480	1	0.777	39	2400	120 (54.4)
WD30632A	30	600	3	102,360	28.9	240	1	1.8	39	2400	135 (61.2)
WD39432A	39	480	3	133,068	46.9	480	1	0.777	51	2400	120 (54.4)
WD39632A	39	600	3	133,068	37.6	240	1	1.8	51	2400	135 (61.2)

NOTE: Heaters over 48 amps require supplemental fusing.

SAVE THESE INSTRUCTIONS

IMPORTANT INSTRUCTIONS

WARNING

WHEN USING ELECTRIC APPLIANCES, BASIC PRECAUTIONS SHOULD ALWAYS BE FOLLOWED TO REDUCE THE RISK OF FIRE, ELECTRIC SHOCK, AND INJURY TO PERSONS, INCLUDING THE FOLLOWING:

1. Read all instructions before installing or using this heater.
2. This heater is a commercial/industrial product not intended for use in a residential setting.
3. This heater has hot and arcing or sparking parts inside and is not intended for use in hazardous atmospheres where flammable vapors, gases, liquids or other combustible atmospheres as defined in the National Electrical Code are used or stored. Failure to comply can result in explosion or fire.
4. This heater is hot when in use. To avoid burns, do not let bare skin touch hot surfaces. Keep combustible materials, such as furniture, pillows, bedding, papers, clothes, etc. and curtains at least 3 feet (0.9 m) from the front of the heater.
5. Extreme caution is necessary when any heater is used by or near children or invalids and whenever the heater is left operating and unattended.
6. Do not operate any heater after it malfunctions. Disconnect power at service panel and have heater inspected by a reputable electrician before using.
7. Do not use outdoors.
8. To disconnect heater, turn controls to OFF, and turn OFF power to heater circuit at main disconnect panel.
9. Do not insert or allow foreign objects to enter any ventilation or exhaust opening as this may cause an electric shock, fire, or damage to the heater.
10. To prevent a possible fire, do not block air intake or exhaust in any manner.
11. Use this heater only as described in this manual. Any other use not recommended by the manufacturer may cause fire, electric shock, or injury to persons.
12. When installing, see INSTALLATION INSTRUCTIONS for additional warnings and precautions.
13. For safe and efficient operation, and to extend the life of your heater, keep your heater clean - See MAINTENANCE INSTRUCTIONS.

NOT FOR RESIDENTIAL USE.

INSTALLATION INSTRUCTIONS

WARNING

To prevent a possible fire, injury to persons or damage to the heater, adhere to the following:

Important Note: This heater must be installed by a qualified person.

1. Disconnect all power coming to heater at main service panel before wiring or servicing.
2. All wiring procedures and connections must be in accordance with the National and Local Codes having jurisdiction and the heater must be grounded.

CAUTION: All electrical conduit and fittings must be listed for watertight applications to maintain the NEMA 4X enclosure classification to prevent hose-directed water from entering electrical box.

3. Verify the power supply voltage coming to heater matches the ratings as shown on the heater nameplate.

CAUTION: ENERGIZING HEATER AT A VOLTAGE GREATER THAN THE VOLTAGE PRINTED ON THE NAMEPLATE WILL DAMAGE THE HEATER AND VOID THE WARRANTY AND COULD CAUSE A FIRE.

4. To reduce the risk of fire, do not store or use gasoline or other flammable vapors and liquids in the vicinity of the heater.
5. The ceiling or wall mounting structure and the anchoring provisions must be of sufficient strength to support the combined weight of the heater and mounting bracket. See Specificatinos for total weight.
6. Heater must be mounted for horizontal air flow only. The heater must be mounted at least 7' (2134 mm) above the floor to avoid accidental contact with the fan blade which could cause injury.
7. Keep at least 5' (1524 mm) clearance in front of the heater. Refer to Figure 2 for side, top and back clearance requirements.
8. Do not mount mercury type thermostat directly on unit. Vibration could cause heater to malfunction.
9. Outlet grille is factory formed with louvers set at a 45 ° angle. This is the minimum angle allowable to avoid potential overheating. Louvers may be opened up to 90° if desired to allow for better air throw by bending each louver outward. See Figure 3.

General

Heater Location Instructions:

Arrange units so their discharge air streams:

A. Are subjected to minimum interference from columns, machinery and partitions.

B. Wipe exposed walls without blowing directly at them.

C. Are directed away from room occupants in comfort heating.

D. Are directed along the windward side when installed in a building exposed to a prevailing wind.

If not provided with internal thermostat, locate remote thermostat on interior partition walls or posts away from cold drafts, internal heat sources and away from heater discharge air streams.

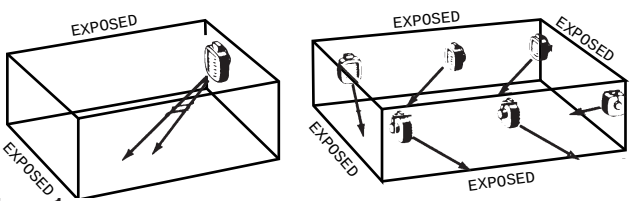


Figure 1

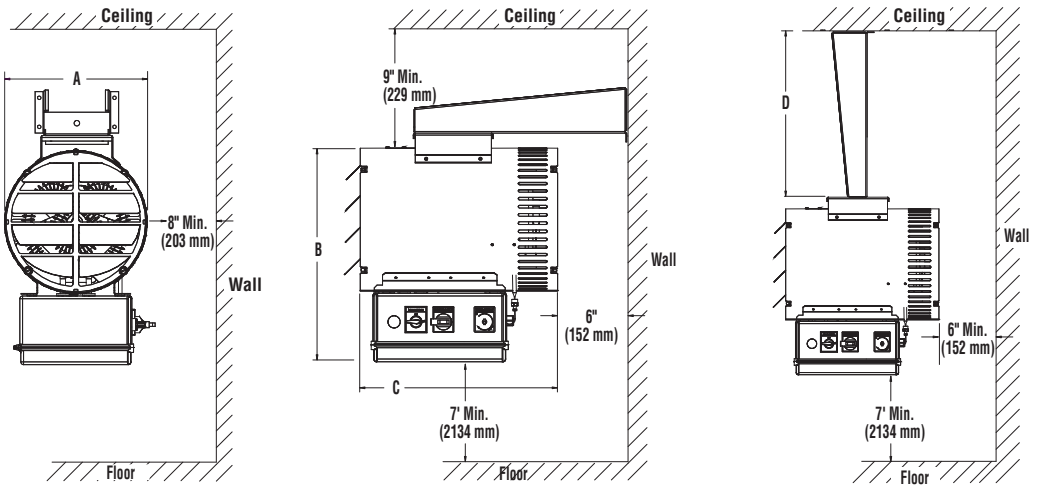


Figure 2

kW	Dimensions Inches (mm)			
	A	B	C	D
2-10	13 (330)	19.5 (495)	18 (457)	19.5 (495)
12.5-39.0	20 (508)	31 (787)	27 (686)	24.2 (615)

Small rooms can be heated by one unit heater. Where two walls are exposed, the heater should be mounted as shown in Figure 1.

Large rooms require multi-unit installations. Number and capacity of units will be determined by volume of building and square feet of floor area to be heated. Arrange units to provide perimeter air circulation where each unit supports the air stream from another.

Mounting Heaters with supplied Universal Mounting Bracket

NOTICE — These heaters are designed for wall and ceiling mounting with horizontal air discharge only. Other modes of mounting voids factory warranty.

1. Height above floor
   A. In areas where ceiling height is more than 12 feet (3658 mm), recommended mounting height is approximately 10 feet (3048 mm) to underside of heater.
   B. For ceiling heights of 12 feet (3658 mm) or less, maximum mounting height is determined by use of the mounting bracket offered for these heaters. Minimum spacing to ceiling is 9" (229 mm). (See Figure 2.)
   C. In either case the minimum mounting height is 7 feet (2134 mm) from floor to bottom of heater. (Figure 2)
2. Spacing to adjacent walls (See Figure 2).
   A. Rear of case to back wall 6" (152mm) minimum.
   B. Side of case to side wall 8" (203 mm) minimum.

NOTE: If two or more units are operated in the same enclosed air space, their discharges should be directed to aid in development of mass air movement for uniform heat dispersal.

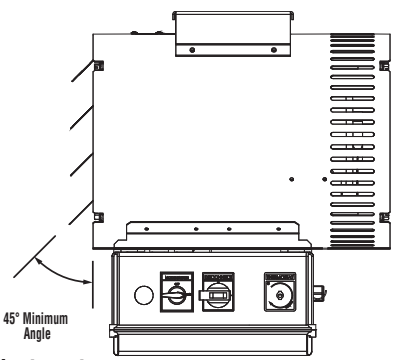


Figure 3 - Louver Adjustment

Wiring

Refer to wiring diagram included with the unit.
The wiring diagram can be found on the inside of the door to the wiring compartment. Should you have any questions, please contact Technical Service at 800-642-4328. Have your model number found on the name plate for reference.

CAUTION ⚠

ALL ELECTRICAL CONDUIT AND FITTINGS MUST BE LISTED FOR WATERTIGHT APPLICATIONS TO MAINTAIN THE NEMA 4X ENCLOSURE CLASSIFICATION TO PREVENT HOSE DIRECTED WATER FROM ENTERING ELECTRICAL BOX.

NOTE: All electrical wiring must be done according to National Electrical and local codes by a qualified person.

IMPORTANT NOTE - **Installation Screw Lug Torque:** During transportation it is possible screw lug connections can loosen. After installation, before power is turned on to the heater, check all screw lug connections for tightness to a recommended minimum torque of 35 in-lbs. (3.9 N-m). A tool is included for tightening lugs in hard to reach locations

⚠ WARNING ⚠

ELECTRIC SHOCK HAZARD. ANY INSTALLATION INVOLVING ELECTRIC HEATERS MUST BE PERFORMED BY A QUALIFIED PERSON AND MUST BE EFFECTIVELY GROUNDED IN ACCORDANCE WITH THE NATIONAL ELECTRICAL CODE TO ELIMINATE SHOCK HAZARD.

1. Connect heater according to the voltage and frequency specified on the nameplate.
2. All units are provided with control and power terminal blocks for customer's connection.
3. Protection against overheating is provided by an internal automatic thermal cutout (manual reset cutout optional) which opens the electric circuit if the normal air-flow is restricted or stopped. Cutout automatically energizes heater on removal of the obstruction. If optional manual reset is tripped, determine cause before re-energizing.

⚠ WARNING ⚠

THE SYSTEM DESIGNER IS RESPONSIBLE FOR THE SAFETY OF THIS EQUIPMENT AND SHOULD INSTALL ADEQUATE BACK-UP CONTROLS AND SAFETY DEVICES WITH THEIR ELECTRIC HEATING EQUIPMENT. WHERE THE CONSEQUENCES OF FAILURE COULD RESULT IN PERSONAL INJURY OR PROPERTY DAMAGE, BACK-UP CONTROLS ARE ESSENTIAL.

4. Heaters are equipped with fan delay control. This control continues fan operation for a short time after elements are de-energized to dissipate residual heat.

⚠ WARNING ⚠

FAN BLADE ROTATION MUST BE CHECKED. IF AIRFLOW IS NOT MOVING OUT THROUGH THE OUTLET GRILLE, INTERCHANGE ANY TWO OF THE THREE INCOMING SUPPLY POWER LEADS ON THREE-PHASE UNITS ONLY.

Optional Equipment

- **Built-in Thermostat** (bulb and capillary type) for automatic temperature control. The thermostat controls the heating elements and fan simultaneously to achieve set temperature.

  The Lo setting of the thermostat is approximately 40˚F and the Hi setting is approximately 90˚F.
- **Mode Switch** (heater on, heater off, fan only) to permit air flow with or without energizing the heating elements. The switch is accessible from outside the NEMA 4X enclosure.
- **Pilot Light** to indicate when heating elements are energized.
- **Internal Fusing**
- **Manual Reset Limit**
- **ON/OFF Switch**
- For wiring diagram containing options, see label on inside cover of terminal box.

OPERATING INSTRUCTIONS

1. Heater must be properly installed before operation.
2. To check out the installation, turn the Mode Switch to the OFF position. Turn power ON to the heater at the main disconnect panel and check to see that the heater is not operating. If it is operating, disconnect power and check wiring.
3. Rotate built-in (or remote mounted) thermostat clockwise to the highest heat setting. With Heat-Cool Switch in OFF position, heater should not operate.
4. Turn Heat-Cool Selector Switch to the Fan Only position. The fan should come on and operate with no heat.
5. Turn Heat-Cool Selector Switch to the Heat position. The fan and heater should come on producing heat.
6. The heater should be allowed to operate with the thermostat at max or high heat until room temperature reaches the desired level. The thermostat should then be rotated counter-clockwise until the heater elements turn off (an audible click). This should set the thermostat to cycle the heater on and off to maintain the ambient temperature. Fine adjustments may need to be made to obtain the desired room ambient. Slight rotating of the thermostat in the clockwise direction will increase the room ambient while rotation in the counter-clockwise direction will lower the room ambient. If remote thermostat is provided, follow the instructions provided with thermostat

NOTE: A built in fan delay will cause the fan to run after the elements turn off to dissipate residual heat.

NOTE: If a Disconnect Switch option is provided, this switch will be accessible from the outside of the control box and will be marked ON and OFF accordingly. In the OFF position, the heater will not operate.

NOTE: If a Manual-Reset Cutout option is provided, the RESET button will be marked and accessible on the control panel. This safety control will operate only if the heater overheats.

⚠ WARNING ⚠

DO NOT TAMPER WITH OR BYPASS ANY SAFETY LIMITS INSIDE HEATER.

MAINTENANCE INSTRUCTIONS

It is important to keep this heater clean. Your heater will give you years of service and comfort with only minimum care. To assure efficient operation follow the simple instructions below.

⚠ WARNING ⚠

ALL SERVICING BEYOND SIMPLE CLEANING THAT REQUIRES DISASSEMBLY SHOULD BE PERFORMED BY QUALIFIED SERVICE PERSONNEL.

⚠ WARNING ⚠

TO REDUCE RISK OF FIRE AND ELECTRIC SHOCK OR INJURY, DISCONNECT ALL POWER COMING TO HEATER AT MAIN SERVICE PANEL AND CHECK THAT THE ELEMENT IS COOL BEFORE SERVICING OR PERFORMING MAINTENANCE.

User Cleaning Instructions:

1. Turn off power to heater and allow elements to cool.
2. Vacuum or hose off heater with water (at city pressure) before activating for next heating season to remove accumulated dust or lint which otherwise may smoke or incinerate on initial heat up.
3. Return power to heater and check to make sure it is operating properly.

Maintenance Cleaning Instructions:

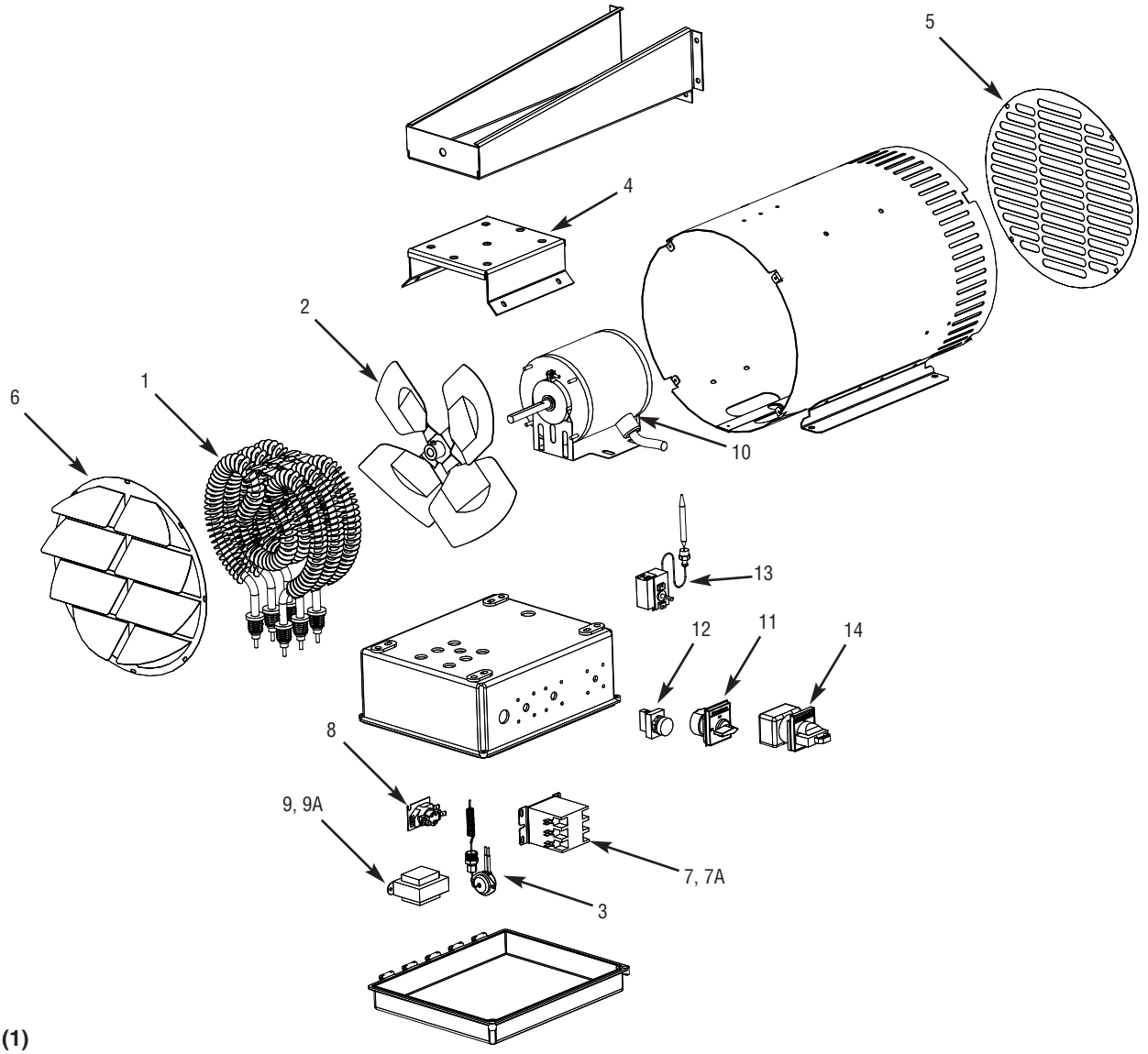
(To be performed only by Qualified Service Personnel)

At least annually, the heater should be cleaned and serviced by a qualified service person to assure safe and efficient operation. This should include as necessary, vacuuming dust and debris from the elements and fan, and check all screw lug connections for tightness to a recommended minimum torque of 35 in-lbs. (3.9 N-m) using the included tool(s) for hard to reach lugs if necessary. After completing the cleaning and servicing, the heater should be fully reassembled and checked for proper operation.

IMPORTANT NOTE: For heaters used in a hose down application, it is recommended that periodically after the heater has been hosed down (with power off at panel) the wiring enclosure cover be opened and the interior inspected for water penetration. If water is discovered, the heater must be repaired by a qualified electrician to assure the seals are properly installed.

During each cleaning, all seals should be inspected for damage as it is critical that they maintain a water tight seal. If damage is discovered (such as tears or cracking), they should be replaced or repaired with an appropriate silicone sealant.

Replacement Parts



Elements (1)

Heater KW	120 V	208 V	240 V	277 V	480 V	600 V
2	1802-11012-001	1802-11012-002	1802-11012-003	-	-	
3	1802-11012-001	1802-11012-002	1802-11012-003	1802-11012-004	1802-11012-004	
5	-	1802-11012-005	1802-11012-006	1802-11012-007	1802-11012-008 1PH 1802-11012-007 3 PH	1802-11012-027
7.5	-	1802-11012-011	1802-11012-012	1802-11012-009	1802-11012-008	1802-11012-027
10	-	1802-11012-010	1802-11012-011	1802-11012-012	1802-11012-013	1802-11012-028
12.5	-	1802-11013-001	1802-11013-002	-	1802-11013-003	1802-11013-021
15	-	1802-11013-004	1802-11013-005	-	1802-11013-006	1802-11012-027
20	-	-	1802-11013-007	-	1802-11013-008	1802-11012-010
25	-	1802-11013-001	1802-11013-002	-	1802-11013-003	1802-11012-011
30	-	1802-11013-004	1802-11013-005	-	1802-11013-006	1802-11013-022
39	-	-	-	-	1802-11013-009	1802-11013-023

Mechanical Parts and Cutout - KW Dependent

Heater KW	Fan Blade (2)	Limit (3)	Mounting Bracket(4)	Inlet Grill (5)	Outlet Grill (6)
2kw, 3kw, 5kw, 7.5kw	1210-11007-003	4520-11013-000	1215-11081-000	2504-11018-000	2504-11019-001
10kw	1210-11007-002				
12.5kw	1210-11008-000	4520-11013-001	1215-11081-001	2504-11020-000	2504-11021-001
15kw, 20kw, 25kw, 30kw, 39kw	1210-11008-001				

Electrical Parts

Heater KW	Heater Line Voltage	Heater Control Voltage	Heater Phase	Contactor (7)	Contactor (7A)	Fan Delay Relay(8)	Transformer (9)	Transformer (9A)	Terminal Block (Not Shown)
2kw, 3kw,	120	24	1	5018-0006-000	N/A	5018-11005-000	5814-0003-006	N/A	5823-0004-002
5kw, 7.5kw,	208	24	1 or 3				5814-0003-000		(480V also req
10kw	240	24					5814-0003-000		2900-0030-000)
	277	24	1				5814-0003-001		
	480	24	1 or 3				5814-0003-002		
	600	24	3	5018-0006-000	5018-0005-004	5018-11005-000	5814-0003-000	490015027	
2kw, 3kw,	120	120	1	5018-0006-001	N/A	5018-11005-001	N/A	N/A	
5kw, 7.5kw,	208	120	1 or 3				5814-0003-003		
10kw	240	120					5814-0003-003		
	277	120	1				5814-0003-004		
	480	120	1 or 3				5814-0003-005		
	600	120	3	5018-0006-001	5018-0005-005	5018-11005-001	5814-0003-003	490015027	
Unfused	208	24	3	5018-0006-000	5018-11005-000		5814-0003-000		
large units	240	24					5814-0003-000		
12.5kw,15kw,	480	24					5814-0003-002		
	600	24			5018-0005-004	5018-11005-000	5814-0003-000	490015027	
	208	120	3	5018-0006-001	5018-11005-001		5814-0003-003		
	240	120					5814-0003-003		
	480	120					5814-0003-005		
	600	120			5018-0005-005	5018-11005-001	5814-0003-003	490015027	
Fused	208	24	1	5018-0006-000	5018-11005-000		5814-0003-000		480034002
large units	240	24					5814-0003-000		
	480	24					5814-0003-002		
	208	120	1	5018-0006-001	5018-11005-001		5814-0003-003		
	240	120					5814-0003-003		
	480	120					5814-0003-005		

Electrical Parts (Continued)

Heater KW	Heater Line Voltage	Heater Control Voltage	Heater Phase	Motor (10)	Mode Switch (11) (Accy)	Pilot Light Green (12) (Accy)
2kw, 3kw,	120	24	1	3900-11029-002	5216-11016-000	3510-11009-000
5kw, 7.5kw,	208	24	1 or 3	3900-11029-000		
10kw	240	24				
	277	24	1	3900-11029-001		
	480	24	1 or 3	3900-11029-000		
	600	24	3			
2kw, 3kw,	120	120	1	3900-11029-002		3510-11009-001
5kw, 7.5kw,	208	120	1 or 3	3900-11029-000		
10kw	240	120				
	277	120	1	3900-11029-001		
	480	120	1 or 3	3900-11029-000		
	600	120	3			
Unfused	208	24	3	3900-11031-000		3510-11009-000
large units	240	24				
12.5kw,15kw	480	24				
	600	24	3			
	208	120	3	3900-11031-000		3510-11009-001
	240	120				
	480	120				
	600	120	3			
Fused	208	24	1	3900-11031-000	5216-11016-000	3510-11009-000
large units	240	24				
	480	24				
	208	120	1	3900-11031-000		3510-11009-001
	240	120				
	480	120				

Disconnect Switch (14)

Size Amps	Part Number
40	4529-11009-031
60	4529-11009-032
100	4529-11009-033
125	4529-11009-034

Miscellaneous

Description	Part Number
Thermostat (13)	5813-11010-000
Gasket (Not Shown)	5206-11009-000

LIMITED WARRANTY

All products manufactured by Marley Engineered Products are warranted against defects in workmanship and materials for one year from date of installation. This warranty does not apply to damage from accident, misuse, or alteration; nor where the connected voltage is more than 5% above the nameplate voltage; nor to equipment improperly installed or wired or maintained in violation of the product's installation instructions. All claims for warranty work must be accompanied by proof of the date of installation.

The customer shall be responsible for all costs incurred in the removal or reinstallation of products, including labor costs, and shipping costs incurred to return products to Marley Engineered Products Service Center. Within the limitations of this warranty, inoperative units should be returned to the nearest Marley authorized service center or the Marley Engineered Products Service Center, and we will repair or replace, at our option, at no charge to you with return freight paid by Marley. It is agreed that such repair or replacement is the exclusive remedy available from Marley Engineered Products.

THE ABOVE WARRANTIES ARE IN LIEU OF ALL OTHER WARRANTIES EXPRESSED OR IMPLIED, AND ALL IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE WHICH EXCEED THE AFORESAID EXPRESSED WARRANTIES ARE HEREBY DISCLAIMED AND EXCLUDED FROM THIS AGREEMENT. MARLEY ENGINEERED PRODUCTS SHALL NOT BE LIABLE FOR CONSEQUENTIAL DAMAGES ARISING WITH RESPECT TO THE PRODUCT, WHETHER BASED UPON NEGLIGENCE, TORT, STRICT LIABILITY, OR CONTRACT.

Some states do not allow the exclusion or limitation of incidental or consequential damages, so the above exclusion or limitation may not apply to you. This warranty gives you specific legal rights, and you may also have other rights which vary from state to state.

For the address of your nearest authorized service center, contact Marley Engineered Products in Bennettsville, SC, at 1-800-642-4328. Merchandise returned to the factory must be accompanied by a return authorization and service identification tag, both available from Marley Engineered Products. When requesting return authorization, include all catalog numbers shown on the products.

HOW TO OBTAIN WARRANTY SERVICE AND WARRANTY PARTS PLUS GENERAL INFORMATION

1. Warranty Service or Parts **1-800-642-4328**
2. Purchase Replacement Parts **1-800-654-3545**
3. General Product Information **www.marleymep.com**

Note: When obtaining service always have the following:

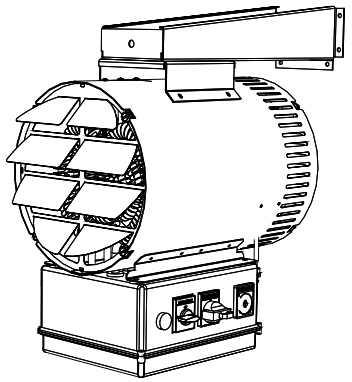
1. Model number of the product
2. Date of manufacture
3. Part number or description

Marley® Engineered Products

470 Beauty Spot Rd. East
Bennettsville, SC 29512 USA

Marley®
Engineered Products

Serie WD
Calefactor resistente a la corrosión



Instrucciones de instalación, operación y mantenimiento

Especificaciones

Número de modelo	Potencia kW	Tensión (volts)	Fases	BTU/h de salida	Consumo del calef-actor (A)	Tensión del motor (volts)	Fases del motor	Consumo delmotor (A)	Sobreelev. de temp. (°F)	Caudal de aire (cfm)	Peso para transporte, lb (kg)
WD02112A	2	120	1	6,824	16.7	120	1	1.554	9	700	60 (27.2)
WD02812A	2	208	1	6,824	9.6	208	1	0.896	9	700	60 (27.2)
WD02212A	2	240	1	6,824	8.3	240	1	0.777	9	700	60 (27.2)
WD03112A	3	120	1	10,236	25.0	120	1	1.554	14	700	60 (27.2)
WD03812A	3	208	1	10,236	14.4	208	1	0.896	14	700	60 (27.2)
WD03212A	3	240	1	10,236	12.5	240	1	0.777	14	700	60 (27.2)
WD03712A	3	277	1	10,236	10.8	277	1	0.673	14	700	60 (27.2)
WD03832A	3	208	3	10,236	8.3	208	1	0.896	14	700	60 (27.2)
WD03232A	3	240	3	10,236	7.2	240	1	0.777	14	700	60 (27.2)
WD03432A	3	480	3	10,236	3.6	480	1	0.388	14	700	60 (27.2)
WD05812A	5	208	1	17,060	24.0	208	1	0.896	23	700	60 (27.2)
WD05212A	5	240	1	17,060	20.8	240	1	0.777	23	700	60 (27.2)
WD05712A	5	277	1	17,060	18.1	277	1	0.673	23	700	60 (27.2)
WD05412A	5	480	1	17,060	10.4	480	1	0.388	23	700	60 (27.2)
WD05832A	5	208	3	17,060	13.9	208	1	0.896	23	700	60 (27.2)
WD05232A	5	240	3	17,060	12.0	240	1	0.777	23	700	60 (27.2)
WD05432A	5	480	3	17,060	6.0	480	1	0.388	23	700	60 (27.2)
WD05632A	5	600	3	17,060	4.8	240	1	1.8	23	1450	75 (34)
WD07812A	7.5	208	1	25,590	36.1	208	1	0.896	34	700	60 (27.2)
WD07212A	7.5	240	1	25,590	31.3	240	1	0.777	34	700	60 (27.2)
WD07712A	7.5	277	1	25,590	27.1	277	1	0.673	34	700	60 (27.2)
WD07412A	7.5	480	1	25,590	15.6	480	1	0.388	34	700	60 (27.2)
WD07832A	7.5	208	3	25,590	20.8	208	1	0.896	34	700	60 (27.2)
WD07232A	7.5	240	3	25,590	18.0	240	1	0.777	34	700	60 (27.2)
WD07432A	7.5	480	3	25,590	9.0	480	1	0.388	34	700	60 (27.2)
WD07632A	7.5	600	3	25,590	7.2	240	1	1.8	34	1450	75 (34)
WD10212A	10	240	1	34,120	41.7	240	1	0.777	22	1450	60 (27.2)
WD10712A	10	277	1	34,120	36.1	277	1	0.673	22	1450	60 (27.2)
WD10412A	10	480	1	34,120	20.8	480	1	0.388	22	1450	60 (27.2)
WD10832A	10	208	3	34,120	27.8	208	1	0.896	22	1450	60 (27.2)
WD10232A	10	240	3	34,120	24.1	240	1	0.777	22	1450	60 (27.2)
WD10432A	10	480	3	34,120	12.0	480	1	0.388	22	1450	60 (27.2)
WD10632A	10	600	3	34,120	9.6	240	1	1.8	33	2400	75 (34)
WD12812A	12.5	208	1	42,650	60.1	208	1	1.793	27	1450	60 (27.2)
WD12212A	12.5	240	1	42,650	52.1	240	1	1.554	27	1450	60 (27.2)
WD12832A	12.5	208	3	42,650	34.7	208	1	1.793	27	1450	60 (27.2)
WD12232A	12.5	240	3	42,650	30.1	240	1	1.554	27	1450	60 (27.2)
WD12432A	12.5	480	3	42,650	15.0	480	1	0.777	27	1450	60 (27.2)
WD12632A	12.5	600	3	42,650	12.0	240	1	1.8	27	2400	75 (34)
WD15812A	15	208	1	51,180	72.1	208	1	1.793	20	2400	110 (49.9)
WD15212A	15	240	1	51,180	62.5	240	1	1.554	20	2400	110 (49.9)
WD15412A	15	480	1	51,180	31.3	480	1	0.777	20	2400	110 (49.9)
WD15832A	15	208	3	51,180	41.6	208	1	1.793	20	2400	110 (49.9)
WD15232A	15	240	3	51,180	36.1	240	1	1.554	20	2400	110 (49.9)
WD15432A	15	480	3	51,180	18.0	480	1	0.777	20	2400	110 (49.9)
WD15632A	15	600	3	51,180	14.5	240	1	1.8	20	2400	125 (56.6)
WD20412A	20	480	1	68,240	41.7	480	1	0.777	26	2400	120 (54.4)
WD20232A	20	240	3	68,240	48.1	240	1	1.554	26	2400	120 (54.4)
WD20432A	20	480	3	68,240	24.1	480	1	0.777	26	2400	120 (54.4)
WD20632A	20	600	3	68,240	19.3	240	1	1.8	26	2400	135 (61.2)
WD25832A	25	208	3	85,300	69.4	208	1	1.793	33	2400	120 (54.4)
WD25232A	25	240	3	85,300	60.1	240	1	1.554	33	2400	120 (54.4)
WD25432A	25	480	3	85,300	30.1	480	1	0.777	33	2400	120 (54.4)
WD25632A	25	600	3	85,300	24.1	240	1	1.8	33	2400	135 (61.2)
WD30832A	30	208	3	102,360	83.3	208	1	1.793	39	2400	120 (54.4)
WD30232A	30	240	3	102,360	72.2	240	1	1.554	39	2400	120 (54.4)
WD30432A	30	480	3	102,360	36.1	480	1	0.777	39	2400	120 (54.4)
WD30632A	30	600	3	102,360	28.9	240	1	1.8	39	2400	135 (61.2)
WD39432A	39	480	3	133,068	46.9	480	1	0.777	51	2400	120 (54.4)
WD39632A	39	600	3	133,068	37.6	240	1	1.8	51	2400	135 (61.2)

NOTA: los calefactores de más de 48 A requieren fusibles adicionales.

GUARDE ESTAS INSTRUCCIONES

INSTRUCCIONES IMPORTANTES

ADVERTENCIA

AL UTILIZAR ARTEFACTOS ELÉCTRICOS, PARA REDUCIR EL RIESGO DE INCENDIO, CHOQUE ELÉCTRICO Y LESIONES PERSONALES DEBEN OBSERVARSE SIEMPRE ALGUNAS PRECAUCIONES BÁSICAS, COMO LAS SIGUIENTES:

1. Lea todas las instrucciones antes de instalar o utilizar este calefactor.
2. Este calefactor es un producto comercial/industrial, que no está destinado a su empleo en un entorno residencial.
3. Este calefactor tiene en su interior piezas calientes y piezas en las que se producen arcos o chispas, y no está destinado a su empleo en atmósferas peligrosas en las que se usen o almacenen vapores, gases o líquidos inflamables u otras atmósferas combustibles como las define el Código Eléctrico Nacional de los EE. UU. Si esto no se cumple, puede producirse una explosión o incendio.
4. Cuando está en funcionamiento, el calefactor está muy caliente. Para evitar quemaduras, no deje que su piel haga contacto directo con las superficies calientes. Mantenga los materiales combustibles como muebles, almohadas, ropas de cama, papeles, ropas, cortinas, etc. a 0.9 m (3 pies) como mínimo del frente del calefactor.
5. Se necesita extremo cuidado al utilizar cualquier calefactor junto a o cerca de niños o inválidos, y en todo momento en que el calefactor quede funcionando y desatendido.
6. No opere ningún calefactor después de que haya tenido una falla de funcionamiento. Desconecte la alimentación eléctrica en el tablero de servicio y haga revisar el calefactor por un electricista calificado antes de usarlo.
7. No use el equipo en exteriores.
8. Para desconectar el calefactor, lleve los controles a la posición APAGADO (OFF) y desconecte la alimentación del circuito del calefactor en el tablero de desconexión principal.
9. No inserte ni permita que entren objetos extraños en ninguna abertura de ventilación o de descarga, porque esto puede ser causa de choque eléctrico, incendio o daño al calefactor.
10. Para evitar un posible incendio, no bloquee de ningún modo la entrada ni la descarga de aire.
11. Utilice este calefactor únicamente de la manera descrita en este manual. Cualquier otra forma de uso no recomendada por el fabricante puede ser causa de incendio, choque eléctrico o daños personales.
12. Al realizar la instalación, vea las advertencias y precauciones adicionales en las INSTRUCCIONES DE INSTALACIÓN.
13. Para garantizar una operación segura y eficiente, y para extender la vida útil de su calefactor, manténgalo limpio. Vea las INSTRUCCIONES DE MANTENIMIENTO.

NO ES PARA USO RESIDENCIAL.

ADVERTENCIA

Para evitar un posible incendio, lesiones personales o daños al calefactor, observe lo siguiente:

Nota importante: este calefactor debe ser instalado por una persona competente.

1. Antes de proceder a tareas de conexionado o de reparación del calefactor, desconecte toda la alimentación eléctrica que llega al mismo desde el tablero principal de servicio.
2. Todos los procedimientos de cableado y conexiones deben hacerse de conformidad con los códigos nacionales y locales que tengan jurisdicción, y el calefactor debe estar conectado a tierra.

ATENCIÓN: todos los conductos y accesorios de conexionado deben estar aprobados (Listed) para aplicaciones estancas, a fin de mantener la clasificación de gabinete NEMA 4X para prevenir que el agua dirigida por una manguera ingrese a la caja eléctrica.

3. Verifique que la tensión de alimentación provista al calefactor coincida con la tensión nominal indicada en la placa de características del mismo.

ATENCIÓN: SI SE ENERGIZA UN CALEFACTOR CON UNA TENSIÓN MAYOR QUE EL VALOR DE TENSIÓN IMPRESO EN LA PLACA DE CARACTERÍSTICAS, SE DAÑARÁ EL CALEFACTOR, SE ANULARÁ LA GARANTÍA, Y PODRÍA PRODUCIRSE UN INCENDIO.

4. Para reducir el riesgo de incendio, no almacene ni use gasolina u otros vapores y líquidos inflamables en las cercanías del calefactor.
5. La estructura de montaje en el cielorraso o en la pared, así como los medios de anclaje, deben ser suficientemente resistentes para soportar el peso combinado del calefactor y del soporte de montaje. Vea el peso total en Especificaciones.
6. El calefactor debe montarse para flujo de aire horizontal únicamente. El calefactor debe montarse a 2134 mm (7') por encima del piso como mínimo, a fin de evitar el contacto accidental con la paleta del ventilador, que podría causar lesiones.
7. Mantenga un espacio libre de 1524 mm (5') como mínimo al frente del calefactor. Para ver los requisitos de espacio libre lateral, superior y posterior consulte la Figura 2.
8. No monte un termostato del tipo de mercurio directamente sobre la unidad. La vibración podría hacer que el calefactor funcione mal.
9. La rejilla de salida está formada en fábrica con celosías colocadas en un ángulo de 45°. Este es el ángulo mínimo admisible para evitar un posible sobrecalentamiento. Las celosías pueden abrirse hasta a 90° si se desea, para permitir un mayor alcance del chorro de aire al doblar cada celosía hacia afuera. Vea la Figura 3.

INSTRUCCIONES DE INSTALACIÓN

Información general

Instrucciones sobre la ubicación del calefactor:

Disponga las unidades de manera que las corrientes de aire de descarga:

A. Estén sujetas a un mínimo de interferencia a causa de columnas, maquinaria y tabiques;

B. Se deslicen por las paredes expuestas sin impactar directamente contra ellas;

C. Se dirijan lejos de los ocupantes de la habitación en aplicaciones de calefacción ambiental;

D. Se dirijan a lo largo del lado de donde viene el viento, cuando se instalan en un edificio expuesto a un viento preponderante.

Localice el termostato en postes o paredes divisorias interiores, lejos de corrientes de aire frío, fuentes de calor internas y de las corrientes de aire de descarga de calefactores.

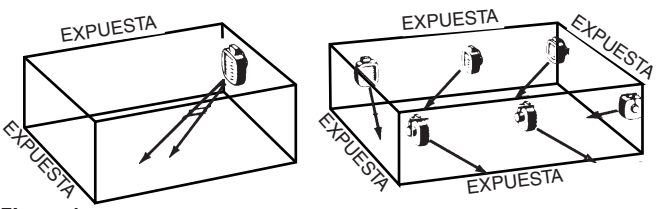


Figura 1

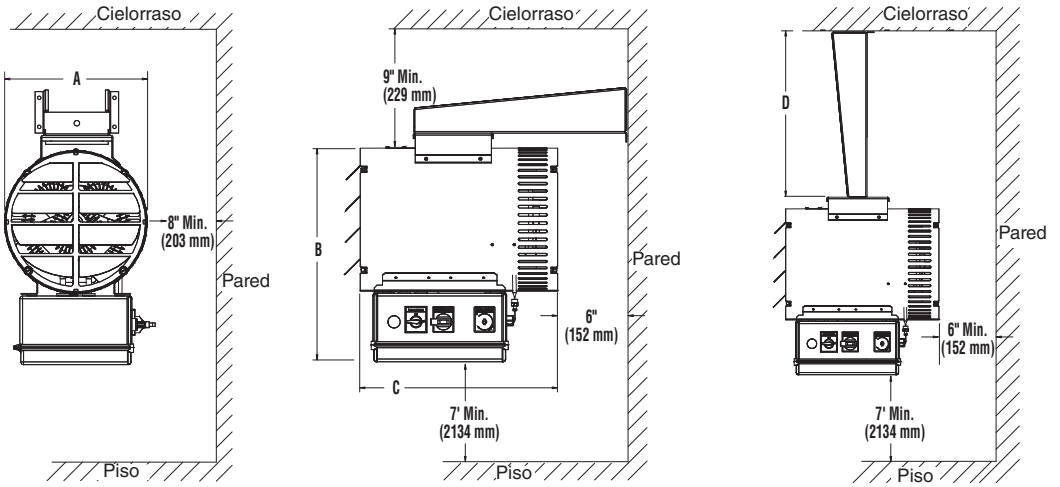


Figura 2

kW	Dimensiones, pulgadas (mm)			
	A	B	C	D
2-10	13 (330)	19.5 (495)	18 (457)	19.5 (495)
12.5-39.0	20 (508)	31 (787)	27 (686)	24.2 (615)

Las habitaciones pequeñas pueden usar una unidad calefactora única. Cuando hay dos paredes expuestas, el calefactor debe montarse como se muestra en la Figura 1.

Las habitaciones grandes requieren instalaciones de unidades múltiples. La cantidad y la capacidad de las unidades se determinará de acuerdo con el volumen del edificio y el área de piso (pies cuadrados) a calefaccionar. Disponga las unidades para proporcionar una circulación de aire perimetral, en la que cada unidad soporte la corriente de aire de otra.

Montaje de los calefactores con el soporte de montaje universal provisto

AVISO — estos calefactores están diseñados para montaje en pared o en cielorraso con descarga de aire horizontal únicamente. Los otros modos de montaje anulan la garantía de fábrica.

1. Altura sobre el piso
   A. En áreas en las que la altura del cielorraso sea mayor de 3658 mm (12 pies), la altura de montaje recomendada es aproximadamente 3048 mm (10 pies), medida desde la cara inferior del calefactor.
   B. Para alturas de cielorraso de 3658 mm (12 pies) o menores, la altura de montaje máxima está determinada por el uso del soporte de montaje que se ofrece con estos calefactores. El espaciado mínimo al cielorraso es 229 mm (9”). (Vea la Figura 2).
   C. En uno u otro caso, la altura de montaje mínima es 2134 mm (7 pies), medida desde el piso hasta el fondo del calefactor. Figura 2.
2. Espaciado respecto a las paredes adyacentes (vea la Figura 2).
   A. Desde la parte trasera del gabinete hasta la pared posterior: mín. 152 mm (6").
   B. Desde el costado del gabinete hasta la pared lateral: mín. 203 mm (8").

NOTA: si se hacen funcionar dos o más unidades en el mismo espacio de aire cerrado, sus descargas deben dirigirse de manera de ayudar al desarrollo del movimiento de la masa de aire, a fin de lograr una dispersión uniforme del calor.

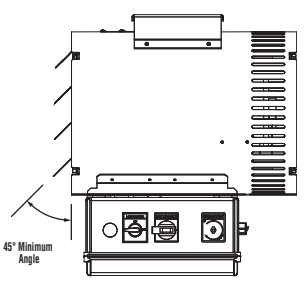


Figura 3 - Ajuste de las celosías

Conexionado

Consulte el diagrama de conexionado incluido con la unidad. El diagrama de conexionado puede encontrarse en el interior de la puerta del compartimiento de cables. Si tiene preguntas que hacer, comuníquese con el Servicio Técnico llamando al 800-642-4328. Tenga como referencia el número de modelo que se encuntra en la placa de identificación.

PRECAUCION ⚠

TODOS LOS CONDUCTOS Y ACCESORIOS DE CONEXIONADO DEBEN ESTAR APROBADOS (LISTED) PARA APLICACIONES ESTANCAS, A FIN DE MANTENER LA CLASIFICACIÓN DE GABINETE NEMA 4X PARA PREVENIR QUE EL AGUA DIRIGIDA POR UNA MANGUERA INGRESE A LA CAJA ELÉCTRICA.

NOTA: todo el cableado eléctrico debe hacerse de acuerdo con el Código Eléctrico Nacional de los EE. UU. y los códigos locales.

NOTA IMPORTANTE - **Par de apriete de los terminales de tornillo en la instalación:** Durante el transporte es posible que las conexiones de los terminales de tornillo se aflojen. Después de la instalación, antes de conectar la alimentación eléctrica al calefactor, revise las conexiones de los terminales de tornillo para verificar que cumplan con el valor de par de apriete recomendado de 3.9 N·m (35 lb·pulg.). Se incluye una herramienta para apretar los terminales en ubicaciones difíciles de alcanzar.

⚠ ADVERTENCIA ⚠

RIESGO DE CHOQUE ELÉCTRICO. TODA INSTALACIÓN QUE INCLUYA CALEFACTORES ELÉCTRICOS DEBE SER REALIZADA POR UNA PERSONA COMPETENTE Y DEBE ESTAR CONECTADA A TIERRA DE MANERA EFECTIVA, DE ACUERDO CON EL CÓDIGO ELÉCTRICO NACIONAL DE LOS EE. UU., A FIN DE ELIMINAR EL RIESGO DE CHOQUE ELÉCTRICO.

1. Conecte el calefactor únicamente a un circuito apto para la tensión (V), corriente (A) y frecuencia (Hz) especificadas en la placa de características.
2. Todas las unidades están provistas de borneras de control y de alimentación eléctrica para las conexiones del cliente.
3. Se ha provisto una protección contra sobrecalentamiento por medio de un interruptor térmico automático (el interruptor con reposición manual es opcional) que abre el circuito eléctrico si se restringe o interrumpe el flujo de aire normal. El interruptor vuelve a energizar el calefactor de manera automática cuando se elimina la obstrucción. Si se dispara el dispositivo de reposición manual opcional, determine la causa antes de volver a energizar el calefactor.

⚠ ADVERTENCIA ⚠

EL DISEÑADOR DEL SISTEMA ES RESPONSABLE DE LA SEGURIDAD DE ESTE EQUIPO, Y DEBE INSTALAR CONTROLES DE RESPALDO Y DISPOSITIVOS DE CONTROL ADECUADOS CON SU EQUIPO DE CALEFACCIÓN ELÉCTRICA. ALLÍ DONDE LAS CONSECUENCIAS DE UNA FALLA PODRÍAN PROVOCAR LESIONES PERSONALES O DAÑOS MATERIALES, LOS CONTROLES DE RESPALDO SON IMPRESCINDIBLES.

4. Los calefactores están equipados con un control de retardo de ventilador. Este control hace que continúe la operación del ventilador durante un tiempo breve después de que los elementos calefactores se hayan desenergizado, a fin de disipar el calor residual.

⚠ ADVERTENCIA ⚠

DEBE VERIFICARSE LA ROTACIÓN DE LA PALETA DEL VENTILADOR. SI NO HAY FLUJO DE AIRE QUE PASE A TRAVÉS DE LA REJILLA DE SALIDA, INTERCAMBIE DOS CUALESQUIERA DE LOS TRES CABLES DE CONEXIÓN DE ALIMENTACIÓN ELÉCTRICA (EN UNIDADES TRIFÁSICAS ÚNICAMENTE).

Equipos opcionales

- **Termostato incorporado** (del tipo de bulbo y capilar) para control automático de la temperatura. El termostato controla los elementos calefactores y el ventilador simultáneamente a fin de alcanzar la temperatura de ajuste. La temperatura de ajuste en la posición 'Bajo' (Lo) del termostato es aproximadamente 4.4 ºC (40 ºF), y en la posición 'Alto' (Hi) es aproximadamente 32.2 ºC (90 ºF).
- **Selector de modo** (calefactor encendido, calefactor apagado, ventilador únicamente) para permitir el flujo de aire a la vez que se energizan o no los elementos calefactores. El interruptor es accesible desde afuera del gabinete NEMA 4X.
- **Luz indicadora (piloto)** para indicar que los elementos calefactores están energizados.
- **Fusible interno**
- **Límite térmico con reposición manual**
- **Interruptor Encendido/Apagado (ON/OFF)**
- Para ver los diagramas de conexionado que contienen las opciones, vea la etiqueta en el interior de la cubierta de la caja de terminales.

INSTRUCCIONES DE OPERACIÓN

1. El calefactor debe instalarse correctamente antes de ponerlo en funcionamiento.
2. Para revisar la instalación, lleve el Selector de modo a la posición Apagado (OFF). Conecte la alimentación eléctrica al calefactor en el tablero de desconexión principal y verifique que el calefactor no esté funcionando. Si funciona, desconecte la alimentación eléctrica y revise el cableado.
3. Haga girar el termostato en sentido horario hasta la posición de calor máximo. Con el selector Calor-Frío en la posición Apagado (OFF), el calefactor no debe funcionar.
4. Lleve el selector Calor-Frío (Heat-Cool) a la posición Ventilador únicamente (Fan Only). El ventilador debe encenderse y funcionar sin calor.
5. Lleve el selector Calor-Frío (Heat-Cool) a la posición Calor (Heat). El ventilador y el calefactor deben encenderse, y debe haber producción de calor.
6. Debe permitirse al calefactor funcionar con el termostato en la posición de calor máximo hasta que la temperatura de la habitación alcance el nivel deseado. Luego debe hacerse rotar el termostato en sentido antihorario hasta que los elementos calefactores se apaguen (debe oírse un clic). Esto debe permitir que el termostato haga describir al calefactor ciclos de encendido y apagado para mantener esta temperatura. Es posible que se necesite hacer ajustes finos para obtener la temperatura ambiente deseada en la habitación. Al hacer girar ligeramente el termostato en sentido horario aumentará la temperatura ambiente de la habitación, mientras que al hacerlo en sentido antihorario disminuirá la temperatura ambiente de la habitación.

NOTA: el retardo de ventilador incorporado hará que el ventilador funcione después de que los elementos se apaguen, a fin de disipar el calor residual.

NOTA: si se suministra la opción del interruptor de desconexión, el mismo será accesible desde el exterior de la caja de control y estará marcado con las leyendas Encendido (ON) y Apagado (OFF). En la posición Apagado (OFF), el calefactor no funcionará.

NOTA: si se suministra la opción de interruptor térmico con reposición manual, el botón REPOSICIÓN (RESET) estará marcado y será accesible en el panel de control. Este control de seguridad funcionará únicamente si se sobrecalienta el calefactor.

⚠ ADVERTENCIA ⚠

NO ALTERE NI PUENTEE NINGÚN LÍMITE DE SEGURIDAD INTERNO DEL CALEFACTOR.

INSTRUCCIONES DE MANTENIMIENTO

Es importante mantener limpio este calefactor. Su calefactor le brindará muchos años de servicio y confort con sólo un mínimo de cuidado. Para asegurar un funcionamiento eficiente, observe las instrucciones simples que se indican a continuación.

⚠ ADVERTENCIA ⚠

TODO SERVICIO, MÁS ALLÁ DE UNA SIMPLE LIMPIEZA, QUE REQUIERA UN DESMONTAJE DEBE SER REALIZADO POR PERSONAL DE SERVICIO CALIFICADO.

⚠ ADVERTENCIA ⚠

PARA REDUCIR EL RIESGO DE INCENDIO Y DE CHOQUE ELÉCTRICO O LESIONES, DESCONECTE TODA LA ALIMENTACIÓN ELÉCTRICA QUE LLEGA AL CALEFACTOR EN EL TABLERO PRINCIPAL DE SERVICIO Y VERIFIQUE QUE EL ELEMENTO CALEFACTOR ESTÉ FRÍO ANTES DE PRESTAR SERVICIO O DE REALIZAR EL MANTENIMIENTO.

Instrucciones de limpieza de mantenimiento:

1. Desconecte la alimentación eléctrica del calefactor y deje que los elementos calefactores se enfríen.
2. Antes de activar el calefactor para una nueva temporada de calefacción, límpielo por aspiración o lávelo con manguera, con agua a la presión de suministro, para eliminar el polvo y la pelusa acumulados que podrían generar humo o quemarse en el calentamiento inicial.
3. Vuelva a conectar la alimentación eléctrica al calefactor y asegúrese de que funcione correctamente.

Maintenance Cleaning Instructions:

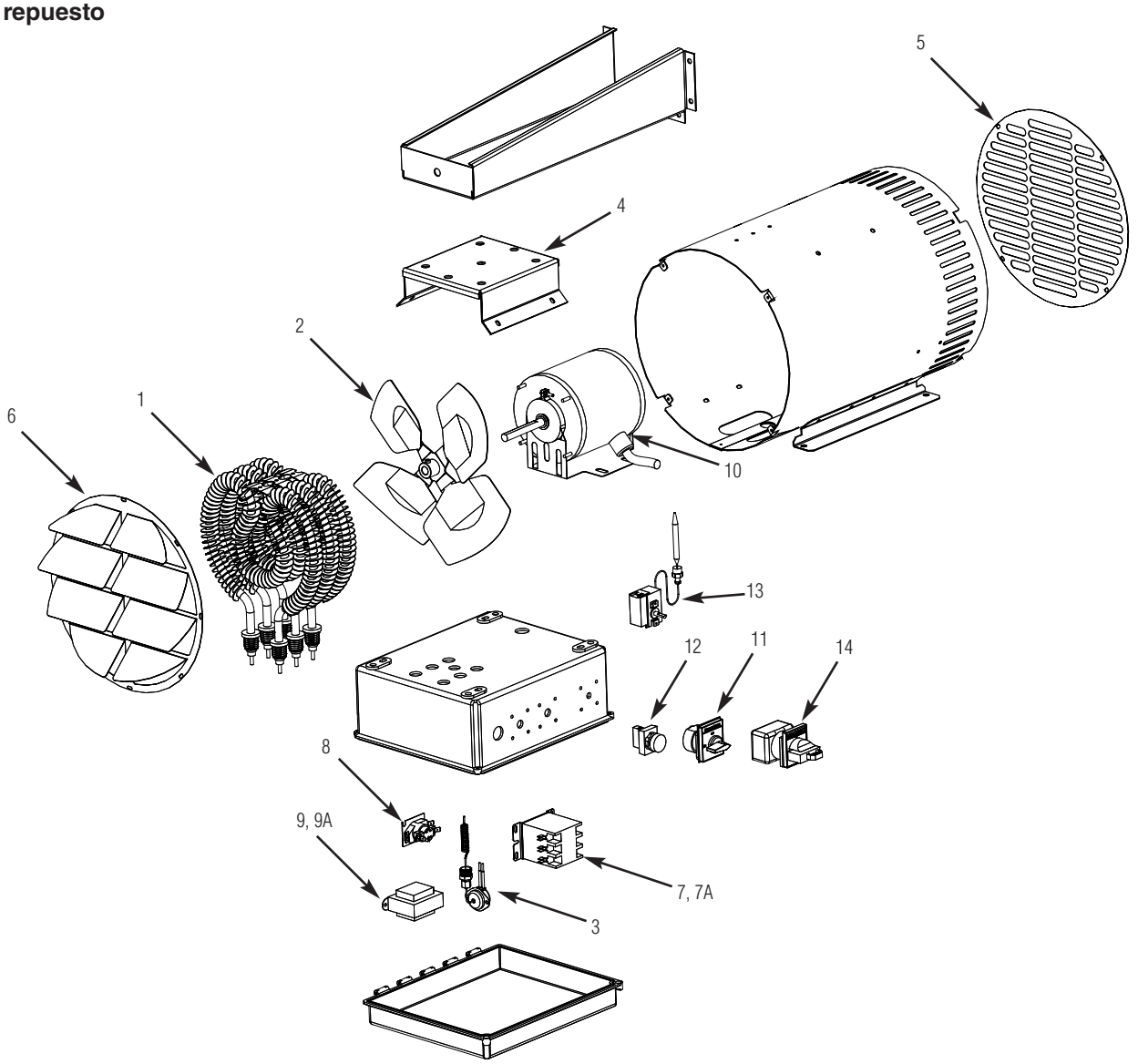
(a realizarse únicamente por personal de servicio calificado)

Al menos una vez por año, un técnico de servicio calificado debe limpiar y prestar servicio al calefactor para garantizar un funcionamiento seguro y eficiente. Esto debe incluir, según sea necesario, la aspiración del polvo y los desperdicios de los elementos calefactores y del ventilador, y la revisión de las conexiones de los terminales de tornillo para verificar que cumplan con el valor de par de apriete recomendado de 3.9 N·m (35 lb·pulg.). Si fuera necesario, use la(s) herramienta(s) incluida(s) para los terminales ubicados en lugares difíciles de alcanzar. Después de terminada la limpieza y servicio, el calefactor debe volver a montarse completamente y verificarse que funcione correctamente.

NOTA IMPORTANTE: para el caso de los calefactores que se lavan con manguera, se recomienda realizar periódicamente lo siguiente. Después del lavado (con la alimentación eléctrica desconectada en el tablero principal), abra la cubierta del compartimiento de cables e inspeccione el interior para comprobar si ha habido penetración de agua. Si se descubre agua, debe hacerse reparar el calefactor por un electricista competente para aseguar que los sellos estén instalados correctamente.

Durante cada limpieza deben inspeccionarse todos los sellos para comprobar si presentan daños, ya que esto es fundamental para que mantengan un sellado estanco. Si se encuentran daños (como desgarros o grietas), los sellos deben reemplazarse o repararse con un sellador de silicona apropiado.

Piezas de repuesto



Elementos calefactores (1)

Calefactor KW	120 V	208 V	240 V	277 V	480 V	600 V
2	1802-11012-001	1802-11012-002	1802-11012-003	-	-	
3	1802-11012-001	1802-11012-002	1802-11012-003	1802-11012-004	1802-11012-004	
5	-	1802-11012-005	1802-11012-006	1802-11012-007	1802-11012-008 1PH 1802-11012-007 3 PH	1802-11012-027
7.5	-	1802-11012-011	1802-11012-012	1802-11012-009	1802-11012-008	1802-11012-027
10	-	1802-11012-010	1802-11012-011	1802-11012-012	1802-11012-013	1802-11012-028
12.5	-	1802-11013-001	1802-11013-002	-	1802-11013-003	1802-11013-021
15	-	1802-11013-004	1802-11013-005	-	1802-11013-006	1802-11012-027
20	-	-	1802-11013-007	-	1802-11013-008	1802-11012-010
25	-	1802-11013-001	1802-11013-002	-	1802-11013-003	1802-11012-011
30	-	1802-11013-004	1802-11013-005	-	1802-11013-006	1802-11013-022
39	-	-	-	-	1802-11013-009	1802-11013-023

Piezas mecánicas e interruptor térmico según potencia (kW)

Potencia del calefactor (kW)	Paleta del ventilador (2)	Limite (3)	Soporte de montaje (4)	Rejilla de entrada (5)	Rejilla de salida (6)
2kw, 3kw, 5kw, 7.5kw	1210-11007-003	4520-11013-000	1215-11081-000	2504-11018-000	2504-11019-001
10kw	1210-11007-002				
12.5kw	1210-11008-000	4520-11013-001	1215-11081-001	2504-11020-000	2504-11021-001
15kw, 20kw, 25kw, 30kw, 39kw	1210-11008-001				

Piezas eléctricas

Potencia del calefactor (kW)	Tensión de línea del calefactor	Tensión de controldel calefactor	Fases del calefactor	Contactor (7)	Contactor (7A)	Retardo de ventilador Relé (8)	Transformador (9)	ransformador (9A)	Bornera (No se muestra)
2kw, 3kw,	120	24	1	5018-0006-000	N/A	5018-11005-000	5814-0003-006	N/A	5823-0004-002
5kw, 7.5kw,	208	24	1 or 3				5814-0003-000		(480V also req
10kw	240	24					5814-0003-000		2900-0030-000)
	277	24	1				5814-0003-001		
	480	24	1 or 3				5814-0003-002		
	600	24	3	5018-0006-000	5018-0005-004	5018-11005-000	5814-0003-000	490015027	
2kw, 3kw,	120	120	1	5018-0006-001	N/A	5018-11005-001	N/A	N/A	
5kw, 7.5kw,	208	120	1 or 3				5814-0003-003		
10kw	240	120					5814-0003-003		
	277	120	1				5814-0003-004		
	480	120	1 or 3				5814-0003-005		
	600	120	3	5018-0006-001	5018-0005-005	5018-11005-001	5814-0003-003	490015027	
Unfused	208	24	3	5018-0006-000	5018-11005-000		5814-0003-000		
large units	240	24					5814-0003-000		
12.5kw,15kw,	480	24					5814-0003-002		
	600	24			5018-0005-004	5018-11005-000	5814-0003-000	490015027	
	208	120	3	5018-0006-001	5018-11005-001		5814-0003-003		
	240	120					5814-0003-003		
	480	120					5814-0003-005		
	600	120			5018-0005-005	5018-11005-001	5814-0003-003	490015027	
Fused	208	24	1	5018-0006-000	5018-11005-000		5814-0003-000		480034002
large units	240	24					5814-0003-000		
	480	24					5814-0003-002		
	208	120	1	5018-0006-001	5018-11005-001		5814-0003-003		
	240	120					5814-0003-003		
	480	120					5814-0003-005		

Piezas eléctricas (continuación)

Potencia del calefactor (kW)	Tensión de línea del	Tensión de control del	Fases del calefactor	Motor (10)	Selector de modo (11) (accesorio)	Luz indicadora (piloto) verde (12) (accesorio)
2kw, 3kw,	120	24	1	3900-11029-002	5216-11016-000	3510-11009-000
5kw, 7.5kw,	208	24	1 or 3	3900-11029-000		
10kw	240	24				
	277	24	1	3900-11029-001		
	480	24	1 or 3	3900-11029-000		
	600	24	3			
2kw, 3kw,	120	120	1	3900-11029-002		3510-11009-001
5kw, 7.5kw,	208	120	1 or 3	3900-11029-000		
10kw	240	120				
	277	120	1	3900-11029-001		
	480	120	1 or 3	3900-11029-000		
	600	120	3			
Unfused	208	24	3	3900-11031-000		3510-11009-000
large units	240	24				
12.5kw,15kw	480	24				
	600	24	3			
	208	120	3	3900-11031-000		3510-11009-001
	240	120				
	480	120				
	600	120	3			
Fused	208	24	1	3900-11031-000	5216-11016-000	3510-11009-000
large units	240	24				
	480	24				
	208	120	1	3900-11031-000		3510-11009-001
	240	120				
	480	120				

Interruptor de desconexión (14)

Calibre (A)	Número de pieza
40	4529-11009-031
60	4529-11009-032
100	4529-11009-033
125	4529-11009-034

Otras piezas

Descripción	Número de pieza
Termostato (13)	5813-11010-000
Junta (no se muestra)	5206-11009-000

GARANTÍA LIMITADA

Todos los productos fabricados por Marley Engineered Products están garantizados contra defectos de fabricación y de materiales por 1 año desde la fecha de instalación. Esta garantía no se aplica a daños debidos a accidente, mal uso o alteración, ni a los casos en que la tensión eléctrica conectada supere a la tensión nominal -indicada en la placa de características- en más de 5 %, ni a equipos que hayan sido instalados o cableados incorrectamente, o mantenidos en forma que no cumpla lo indicado en las instrucciones de instalación del producto. Todo reclamo por trabajos en garantía debe acompañarse con una prueba de la fecha de instalación.

El cliente será responsable de todos los costos incurridos en el retiro o reinstalación de productos, incluyendo los costos de mano de obra y los costos de envío incurridos para regresar productos a un Centro de Servicio de Marley Engineered Products. Dentro de las limitaciones de esta garantía, las unidades que no funcionan deben regresarse al centro de servicio autorizado Marley más cercano, o al Centro de Servicio de Marley Engineered Products, y nosotros lo repararemos o reemplazaremos, a nuestra opción, sin cargo para usted, con el flete de retorno pagado por Marley. Se acuerda que tal reparación o reemplazo es el único recurso que Marley Engineered Products pone a su disposición.

LAS GARANTÍAS EXPUESTAS MÁS ARRIBA TOMAN EL LUGAR DE TODA OTRA GARANTÍA, EXPRESA O IMPLÍCITA, Y POR LA PRESENTE SE DECLINA Y EXCLUYE DE ESTE ACUERDO TODA GARANTÍA IMPLÍCITA DE COMERCIABILIDAD Y ADECUACIÓN A UN PROPÓSITO PARTICULAR QUE EXCEDA LAS GARANTÍAS EXPRESAS ANTEDICHAS. MARLEY ENGINEERED PRODUCTS NO SE HARÁ RESPONSABLE POR DAÑOS CONSIGUIENTES QUE SE PRODUZCAN CON RESPECTO AL PRODUCTO, EN BASE YA SEA A NEGLIGENCIA, AGRAVIO, RESPONSABILIDAD ESTRICTA, O CONTRATO.

Algunos estados o jurisdicciones no permiten la exclusión o limitación de daños incidentales o consiguientes, de modo que la exclusión o limitación expresada más arriba puede no aplicarse a su caso. Esta garantía le da derechos legales específicos, y usted puede tener también otros derechos, que varían de un estado o jurisdicción a otro.

Para obtener la dirección de su centro de servicio autorizado más cercano comuníquese con Marley Engineered Products en Bennettsville, SC, Estados Unidos, llamando al 1-800-642-4328. Toda mercadería regresada a la fábrica debe ser acompañada por una autorización de retorno y una etiqueta de identificación de servicio, disponibles ambas en Marley Engineered Products. Cuando solicite la autorización de retorno, incluya todos los números de catálogo mostrados en los productos.

CÓMO OBTENER SERVICIO EN GARANTÍA, PIEZAS DE REPUESTO E INFORMACIÓN GENERAL

1. Servicio o repuestos en garantía **1-800-642-4328**
2. Compra de repuestos **1-800-654-3545**
3. Información general sobre productos **www.marleymep.com**

Nota: cuando solicite servicio, siempre dé la información que sigue:

1. Número de modelo del producto
2. Fecha de fabricación
3. Número de parte o descripción

Marley® Engineered Products

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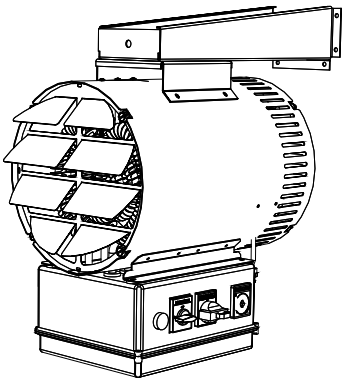


Instructions d'installation, d'utilisation et d'entretien

Spécifications

N° modèle	kW	Volts	Phase	Puissance BTU/H	Ampères radiateur	Volts moteur	Phase moteur	Ampères moteur	Montée en temp.	CFM	Poids lbs (kg)
WD02112A	2	120	1	6,824	16.7	120	1	1.554	9	700	60 (27.2)
WD02812A	2	208	1	6,824	9.6	208	1	0.896	9	700	60 (27.2)
WD02212A	2	240	1	6,824	8.3	240	1	0.777	9	700	60 (27.2)
WD03112A	3	120	1	10,236	25.0	120	1	1.554	14	700	60 (27.2)
WD03812A	3	208	1	10,236	14.4	208	1	0.896	14	700	60 (27.2)
WD03212A	3	240	1	10,236	12.5	240	1	0.777	14	700	60 (27.2)
WD03712A	3	277	1	10,236	10.8	277	1	0.673	14	700	60 (27.2)
WD03832A	3	208	3	10,236	8.3	208	1	0.896	14	700	60 (27.2)
WD03232A	3	240	3	10,236	7.2	240	1	0.777	14	700	60 (27.2)
WD03432A	3	480	3	10,236	3.6	480	1	0.388	14	700	60 (27.2)
WD05812A	5	208	1	17,060	24.0	208	1	0.896	23	700	60 (27.2)
WD05212A	5	240	1	17,060	20.8	240	1	0.777	23	700	60 (27.2)
WD05712A	5	277	1	17,060	18.1	277	1	0.673	23	700	60 (27.2)
WD05412A	5	480	1	17,060	10.4	480	1	0.388	23	700	60 (27.2)
WD05832A	5	208	3	17,060	13.9	208	1	0.896	23	700	60 (27.2)
WD05232A	5	240	3	17,060	12.0	240	1	0.777	23	700	60 (27.2)
WD05432A	5	480	3	17,060	6.0	480	1	0.388	23	700	60 (27.2)
WD05632A	5	600	3	17,060	4.8	240	1	1.8	23	1450	75 (34)
WD07812A	7.5	208	1	25,590	36.1	208	1	0.896	34	700	60 (27.2)
WD07212A	7.5	240	1	25,590	31.3	240	1	0.777	34	700	60 (27.2)
WD07712A	7.5	277	1	25,590	27.1	277	1	0.673	34	700	60 (27.2)
WD07412A	7.5	480	1	25,590	15.6	480	1	0.388	34	700	60 (27.2)
WD07832A	7.5	208	3	25,590	20.8	208	1	0.896	34	700	60 (27.2)
WD07232A	7.5	240	3	25,590	18.0	240	1	0.777	34	700	60 (27.2)
WD07432A	7.5	480	3	25,590	9.0	480	1	0.388	34	700	60 (27.2)
WD07632A	7.5	600	3	25,590	7.2	240	1	1.8	34	1450	75 (34)
WD10212A	10	240	1	34,120	41.7	240	1	0.777	22	1450	60 (27.2)
WD10712A	10	277	1	34,120	36.1	277	1	0.673	22	1450	60 (27.2)
WD10412A	10	480	1	34,120	20.8	480	1	0.388	22	1450	60 (27.2)
WD10832A	10	208	3	34,120	27.8	208	1	0.896	22	1450	60 (27.2)
WD10232A	10	240	3	34,120	24.1	240	1	0.777	22	1450	60 (27.2)
WD10432A	10	480	3	34,120	12.0	480	1	0.388	22	1450	60 (27.2)
WD10632A	10	600	3	34,120	9.6	240	1	1.8	33	2400	75 (34)
WD12812A	12.5	208	1	42,650	60.1	208	1	1.793	27	1450	60 (27.2)
WD12212A	12.5	240	1	42,650	52.1	240	1	1.554	27	1450	60 (27.2)
WD12832A	12.5	208	3	42,650	34.7	208	1	1.793	27	1450	60 (27.2)
WD12232A	12.5	240	3	42,650	30.1	240	1	1.554	27	1450	60 (27.2)
WD12432A	12.5	480	3	42,650	15.0	480	1	0.777	27	1450	60 (27.2)
WD12632A	12.5	600	3	42,650	12.0	240	1	1.8	27	2400	75 (34)
WD15812A	15	208	1	51,180	72.1	208	1	1.793	20	2400	110 (49.9)
WD15212A	15	240	1	51,180	62.5	240	1	1.554	20	2400	110 (49.9)
WD15412A	15	480	1	51,180	31.3	480	1	0.777	20	2400	110 (49.9)
WD15832A	15	208	3	51,180	41.6	208	1	1.793	20	2400	110 (49.9)
WD15232A	15	240	3	51,180	36.1	240	1	1.554	20	2400	110 (49.9)
WD15432A	15	480	3	51,180	18.0	480	1	0.777	20	2400	110 (49.9)
WD15632A	15	600	3	51,180	14.5	240	1	1.8	20	2400	125 (56.6)
WD20412A	20	480	1	68,240	41.7	480	1	0.777	26	2400	120 (54.4)
WD20232A	20	240	3	68,240	48.1	240	1	1.554	26	2400	120 (54.4)
WD20432A	20	480	3	68,240	24.1	480	1	0.777	26	2400	120 (54.4)
WD20632A	20	600	3	68,240	19.3	240	1	1.8	26	2400	135 (61.2)
WD25832A	25	208	3	85,300	69.4	208	1	1.793	33	2400	120 (54.4)
WD25232A	25	240	3	85,300	60.1	240	1	1.554	33	2400	120 (54.4)
WD25432A	25	480	3	85,300	30.1	480	1	0.777	33	2400	120 (54.4)
WD25632A	25	600	3	85,300	24.1	240	1	1.8	33	2400	135 (61.2)
WD30832A	30	208	3	102,360	83.3	208	1	1.793	39	2400	120 (54.4)
WD30232A	30	240	3	102,360	72.2	240	1	1.554	39	2400	120 (54.4)
WD30432A	30	480	3	102,360	36.1	480	1	0.777	39	2400	120 (54.4)
WD30632A	30	600	3	102,360	28.9	240	1	1.8	39	2400	135 (61.2)
WD39432A	39	480	3	133,068	46.9	480	1	0.777	51	2400	120 (54.4)
WD39632A	39	600	3	133,068	37.6	240	1	1.8	51	2400	135 (61.2)

REMARQUE : Les radiateurs de plus de 48 ampères nécessitent une protection par fusibles supplémentaire.

CONSERVEZ CES INSTRUCTIONS

INSTRUCTIONS IMPORTANTES

AVERTISSEMENT

LORS DE L'UTILISATION D'APPAREILS ÉLECTRIQUES, DES PRÉCAUTIONS DE BASE DOIVENT TOUJOURS ÊTRE SUIVIES AFIN DE RÉDUIRE LE RISQUE DE DÉPART D'INCENDIE, DE COMMOTION ÉLECTRIQUE ET DE BLESSURES AUX PERSONNES, INCLUANT CELLES QUI SUIVENT :

1. Lisez toutes les instructions avant d'installer ou d'utiliser le radiateur.
2. Ce radiateur est un produit commercial/industriel, non prévu pour une utilisation en résidentiel.
3. Ce radiateur comporte des pièces intérieures brûlantes qui génèrent des arcs ou des étincelles électriques, il ne doit pas être utilisé dans des atmosphères dangereuses, où sont entreposés ou utilisés des vapeurs ou liquides inflammables, ou d'autres combustibles tels que définis par NEC (norme électrique américaine). La non-observation de cette consigne peut entraîner explosion ou départ d'incendie.
4. Ce radiateur est chaud quand il est en fonctionnement. Pour éviter des brûlures, ne laissez pas de peau nue toucher ses surfaces chaudes. Maintenez les matières combustibles comme le mobilier, les oreillers, la literie, les papiers, les vêtements et les couvertures, à au moins 3 pieds (90 cm) de distance de l'avant du radiateur.
5. Il faut faire très attention quand un radiateur quelconque est utilisé par des enfants ou des personnes invalides ou près d'eux, et à chaque fois que le radiateur est laissé en marche sans surveillance.
6. N'utilisez plus un radiateur s'il a présenté des dysfonctionnements. Débranchez son alimentation au panneau de distribution du secteur et faites-le inspecter par un bon électricien avant de le réutiliser.
7. Ne l'utilisez pas à l'extérieur.
8. Pour déconnecter le radiateur, passez sa commande sur arrêt (Off) et coupez le secteur en amont au panneau de distribution.
9. N'insérez pas d'objets étrangers, et ne permettez pas qu'il en entre, dans toute ouverture d'admission ou d'évacuation, car cela peut causer une commotion électrique ou un départ d'incendie, ou endommager le radiateur.
10. Pour éviter un possible départ d'incendie, n'obstruez en aucune façon les admissions et les échappements d'air.
11. N'utilisez ce radiateur que comme c'est décrit dans ce manuel. Toute autre utilisation non recommandée par le constructeur peut entraîner un départ d'incendie, une commotion électrique ou des blessures aux personnes.
12. Lors de l'installation, voyez les INSTRUCTIONS D'INSTALLATION pour des mises en gardes et précautions supplémentaires.
13. Pour un fonctionnement sûr et efficace, et pour prolonger sa durée de service, gardez votre radiateur propre – Voyez les INSTRUCTIONS D'ENTRETIEN.

RADIATEUR NON PRÉVU POUR UNE UTILISATION RÉSIDENTIELLE.

AVERTISSEMENT

Pour éviter un possible départ d'incendie, des blessures corporelles ou des dommages au radiateur, respectez ces consignes :

Remarque importante: Ce radiateur doit être installé par une personne qualifiée.

1. Débranchez toute alimentation secteur arrivant au panneau de service principal avant de câbler ou d'intervenir pour du service.
2. Toutes les procédures de câblage et les raccordements doivent être en conformité avec les normes nationales et locales applicables, et le radiateur doit être relié à la terre.

ATTENTION : Tous les conduits et raccords électriques doivent être listés pour des applications étanches, afin de maintenir la classification NEMA 4X du coffret, qui évite que de l'eau envoyée par jet n'entre dans le boîtier électrique.

3. Vérifiez que la tension du secteur arrivant au radiateur correspond bien aux valeurs spécifiées sur sa plaque signalétique.

ATTENTION : ALIMENTER LE RADIATEUR AVEC UNE TENSION DÉPASSANT LA VALEUR IMPRIMÉE SUR LA PLAQUE SIGNALÉTIQUE ENDOMMAGERA LE RADIATEUR ET ANNULERA SA GARANTIE, ET CELA PEUT PROVOQUER UN DÉPART D'INCENDIE.

4. Pour réduire le risque de départ d'incendie, n'entreposez pas et n'utilisez pas d'essence ou d'autres produits inflammables sous forme de liquide ou de vapeurs à proximité du radiateur.
5. La structure de montage au plafond ou au mur et les dispositions d'ancrage doivent avoir une résistance suffisante pour supporter le poids du radiateur et de son support de montage. Consultez les Spécifications pour le poids total de radiateur.
6. Le radiateur ne doit être monté que pour un flux d'air horizontal. Le radiateur peut être monté à au moins 7' (231,4 cm) au-dessus du sol, pour éviter un contact accidentel avec la pale de ventilateur qui pourrait causer une blessure.
7. Gardez au moins 5' (152,4 cm) d'espacement sur l'avant du radiateur. Référez-vous à la Figure 2 pour les besoins en espacement sur les côtés, en haut et en bas.
8. Ne montez pas de thermostat de type au mercure directement sur le radiateur. La vibration pourrait causer un dysfonctionnement du radiateur.
9. La grille de sortie d'air est déterminée en usine avec ses volets fixés à un angle de 45°. C'est l'angle minimal permis pour éviter une surchauffe potentielle. Ces volets peuvent être ouverts jusqu'à 90° si vous le souhaitez pour permettre un meilleur envoi d'air, en écartant chaque volet vers l'extérieur. Voyez la Figure 3.

INSTRUCTIONS D'INSTALLATION

Généralités

Instructions de localisation du radiateur:

Disposez les radiateurs de façon à ce que leur flux d'air envoyé :

A. Soit soumis à un minimum d'interférence venant de colonnes, machines ou cloisons.

B. Passe sur les murs exposés sans souffler directement dessus.

C. Ne soit pas dirigé vers des occupants de la pièce en chauffage de confort.

D. Soit dirigé le long du côté face au vent quand l'installation est dans un bâtiment soumis à un vent dominant.

Placez le thermostat sur des cloisons de séparation intérieures ou des poteaux, à l'écart des courants d'air froids, des sources de chaleur intérieures et à distance des évacuations d'air du radiateur.

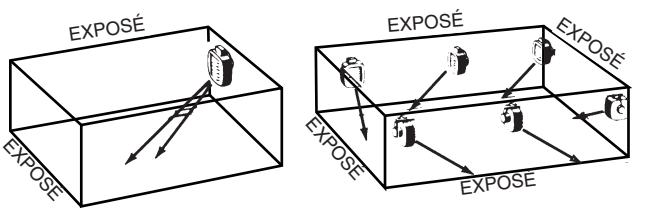


Figure 1

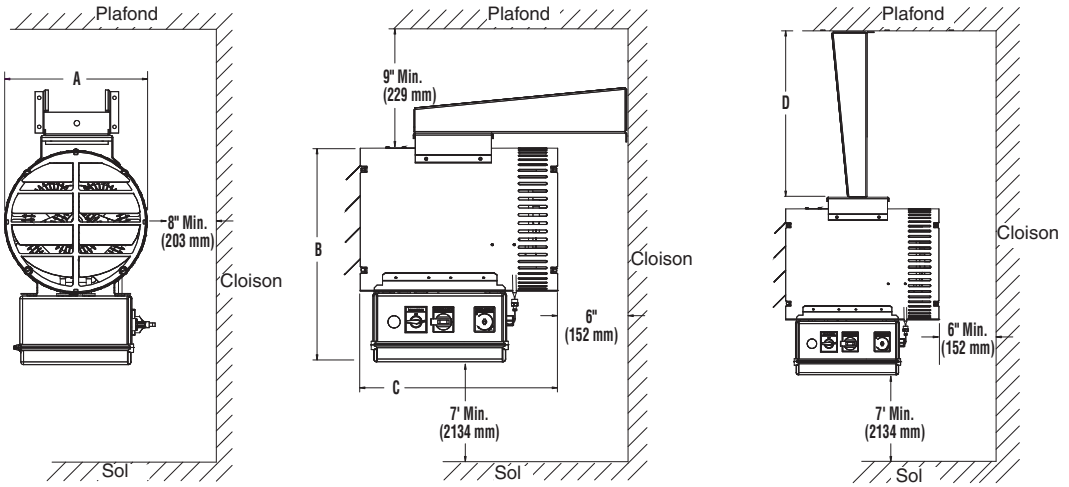


Figure 2

kW	Dimension en pouces (mm)			
	A	B	C	D
2-10	13 (330)	19.5 (495)	18 (457)	19.5 (495)
12.5-39.0	20 (508)	31 (787)	27 (686)	24.2 (615)

Des petites pièces peuvent être réchauffées avec un seul radiateur. Quand deux murs sont exposés, le radiateur doit être monté comme c'est montré en Figure 1.

Des pièces plus grandes nécessitent l'installation de plusieurs radiateurs. Le nombre et la capacité des radiateurs sont à déterminer en fonction du volume de bâtiment et de la surface en mètres carrés des zones à réchauffer. Disposez les radiateurs pour fournir une ventilation du périmètre, chaque radiateur renforçant le flux d'air du précédent.

Montage de radiateurs avec support de montage universel fourni

AVIS — Ces radiateurs sont conçus pour un montage au plafond ou sur un mur avec envoi d'air horizontal uniquement. Tout autre mode de montage annulerait la garantie.

1. Hauteur au-dessus du sol
   A. Dans des zones où la hauteur de plafond fait plus de 12 pieds (365,8 cm), la hauteur de montage recommandée est d'environ 10 pieds (304,8 cm), du sol au dessous du radiateur.
   B. Pour des hauteurs de plafond de 12 pieds (365,8 cm) ou moins, la hauteur de montage maximale est déterminée par l'utilisation du support de montage offert avec ces radiateurs. L'écartement par rapport au plafond doit être au moins de 9" (22,9 cm). (Voyez la Figure 2).
   C. Dans tous les cas la hauteur de montage minimale est de 7 pieds (213,4 cm) du sol au dessous du radiateur. (Voyez la Figure 2).
2. Écartement par rapport à des parois adjacentes (Voyez la Figure 2).
   A. De l'arrière de l'enceinte au mur d'adossement, 6" (15,2 cm) au minimum.
   B. Du côté de l'enceinte au mur latéral, 8" (20,3 cm) au minimum.

REMARQUE : Si deux radiateurs ou plus sont activés dans le même espace clos, leurs décharges d'air doivent être dirigées pour contribuer au mouvement de la masse d'air afin d'assurer une dispersion homogène de la chaleur.

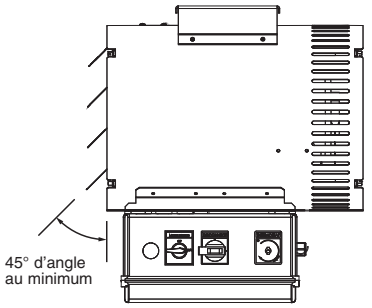


Figure 3 - Réglage des volets

Câblage

Référez-vous au schéma de câblage fourni avec le radiateur. Ce schéma de câblage se trouve sur l'intérieur de la porte du compartiment de câblage. Pour toute question, veuillez contacter le service technique au 800-642-4328. Ayez sous la main votre référence de modèle, que vous trouvez sur sa plaque signalétique.

CAUTION ⚠

TOUS LES CONDUITS ET RACCORDS ÉLECTRIQUES DOIVENT ÊTRE LISTÉS POUR DES APPLICATIONS ÉTANCHES, AFIN DE MAINTENIR LA CLASSIFICATION NEMA 4X DU COFFRET, QUI ÉVITE QUE DE L'EAU ENVOYÉE PAR JET N'ENTRE DANS LE BOÎTIER ÉLECTRIQUE.

REMARQUE : Tout le câblage électrique doit être effectué par une personne qualifiée, en conformité avec la norme américaine (NEC) et les normes locales.

NOTE IMPORTANTE - **Couple des bornes à vis d'installation :** Durant le transport il est possible que les connexions par cosses à visser se soient desserrées. Après l'installation, avant de mettre sous tension l'appareil de chauffage, vérifiez toutes les connexions par borne à vis, leur serrage doit être à un couple d'au moins 35 in-lbs. (3,9 N-m). Un outil est inclus pour resserrer les vissages des cosses dans les endroits difficiles à atteindre.

⚠ AVERTISSEMENT ⚠

TOUS LES CONDUITS ET RACCORDS ÉLECTRIQUES DOIVENT ÊTRE LISTÉS POUR DES APPLICATIONS ÉTANCHES, AFIN DE MAINTENIR LA CLASSIFICATION NEMA 4X DU COFFRET, QUI ÉVITE QUE DE L'EAU ENVOYÉE PAR JET N'ENTRE DANS LE BOÎTIER ÉLECTRIQUE.

1. Branchez le radiateur sur une alimentation secteur conforme (tension/ampérage/fréquence) à la spécification de la plaque signalétique.
2. Tous les radiateurs sont fournis avec des borniers de commandes et l'alimentation secteur pour les raccordements par le client.
3. Des protections contre une surchauffe sont assurées par une coupure thermique automatique (coupure avec restauration manuelle en option) qui ouvre le circuit électrique d'alimentation si le flux normal d'air est gêné ou obstrué. Le dispositif réactive automatiquement le radiateur si la cause de l'obstruction est éliminée. En cas de dispositif optionnel à restauration manuelle, il faut déterminer et solutionner la cause avant de réactiver.

⚠ AVERTISSEMENT ⚠

LE CONCEPTEUR DU SYSTÈME EST RESPONSABLE DE LA SÉCURITÉ DE CET ÉQUIPEMENT, ET DOIT INSTALLER DES CONTRÔLES DE SECOURS ET DES DISPOSITIFS DE SÉCURITÉ AVEC SES APPAREILS BLESSURES CORPORELLES OU DES DÉGÂTS MATÉRIELS, DES CONTRÔLES DE SECOURS SONT DE CHAUFFAGE ÉLECTRIQUES. LÀ OÙ DES CONSÉQUENCES DE PANNE PEUVENT ENTRAÎNER DES ESSENTIELS.

4. Les radiateurs sont équipés d'une commande de temporisation de ventilateur. Cette commande fait poursuivre l'activation du ventilateur un court délai après la désactivation des éléments de chauffe, afin de dissiper leur chaleur résiduelle.

⚠ AVERTISSEMENT ⚠

LE SENS DE ROTATION DE LA PALE DE VENTILATEUR DOIT ÊTRE VÉRIFIÉ. S'IL N'Y A PAS DE FLUX D'AIR QUI SORT DE LA GRILLE D'ÉVACUATION, PERMUTEZ DEUX DES TROIS FILS D'ARRIVÉE DE L'ALIMENTATION, SUR LES MODÈLES EN SECTEUR TRIPHASÉ UNIQUEMENT.

Équipement optionnel

- **Thermostat intégré** (type à bulbe ou capillaire) pour un contrôle automatique de la température. Le thermostat contrôle simultanément les éléments de chauffe et le ventilateur pour atteindre et maintenir la température fixée.

  Son réglage bas (Lo) du thermostat est pour environ 40°F (4,4 °C) et son réglage haut (Hi) pour environ 90°F (32,2 °F).
- **Commutateur de mode** (radiateur activé, radiateur désactivé, ventilation uniquement) fait passer un flux d'air, toute en faisant chauffer ou non les éléments. Ce commutateur est accessible depuis l'extérieur de l'enceinte NRMA 4X.
- **Voyant indicateur** pour signaler que les éléments de chauffe sont activés.
- **Fusible interne**
- **Détecteur de limite à restauration manuelle**
- **Commutateur M/A (On/Off)**
- Pour trouver un schéma de câblage contenant ces options, voyez celui collé sur l'intérieur du couvercle du boîtier de raccordement.

INSTRUCTIONS D'UTILISATION

1. Le radiateur doit être correctement installé avant d'être mis en marche.
2. Pour contrôler l'installation, passez le commutateur de mode en position d'arrêt (Off). Envoyez l'alimentation secteur vers le radiateur à partir du tableau de distribution en amont et constatez que le radiateur ne fonctionne pas. Si le radiateur chauffait déjà, débranchez-le et vérifiez le câblage.
3. Faites tourner la consigne du thermostat en sens horaire sur la position de demande de chauffe la plus forte. Avec son commutateur de mode toujours en position d'arrêt (Off) le radiateur ne chauffe pas.
4. Passez ce commutateur de mode en position de ventilation uniquement. Le ventilateur doit démarrer et souffler de l'air non réchauffé.
5. Passez ce commutateur de mode en position de chauffe. Le ventilateur doit s'activer et souffler de l'air réchauffé par les éléments du radiateur.
6. Le radiateur doit être laissé en fonctionnement dans ce dernier mode avec la consigne de thermostat à une valeur de température élevée ou à fond, jusqu'à ce que la température de la pièce atteigne le niveau voulu. Le réglage du thermostat doit alors être ramené en sens antihoraire jusqu'à la désactivation des éléments de chauffe (un déclic est audible). Cela devrait permettre au thermostat d'activer/désactiver par cycles le radiateur afin de maintenir cette température. Des ajustements fins peuvent être nécessaires pour obtenir la température ambiance désirée dans la pièce. Le fait de tourner légèrement le réglage de thermostat en sens horaire élèvera un peu la température ambiante, en sens antihoraire l'abaissera un peu.

REMARQUE: Une temporisation de ventilateur intégrée prolongera son activation une fois que les éléments de chauffe sont désactivés, afin de dissiper leur chaleur résiduelle.

REMARQUE: Si une option de commutateur M/A est fournie, ce commutateur sera accessible depuis l'extérieur du tableau de commandes et sera marqué ON et OFF. En position d'arrêt OFF le radiateur ne fonctionnera pas.

REMARQUE: Si une option de restauration manuelle de la coupure sur dépassement de limite est fournie, un bouton de restauration marqué RESET sera accessible sur le tableau de commandes. Ce dispositif de sécurité ne déclenchera que si le radiateur passe en surchauffe.

⚠ AVERTISSEMENT ⚠

NE TOUCHEZ PAS ET NE CONTOURNEZ PAS LES LIMITES DE SÉCURITÉ À L'INTÉRIEUR DU RADIATEUR .

INSTRUCTIONS D'ENTRETIEN

Il est important de garder propre le radiateur. Votre radiateur vous fournira des années de bon service et de confort avec juste un minimum de soins. Pour assurer son fonctionnement efficace, suivez les instructions simples ci-dessous :

⚠ AVERTISSEMENT ⚠

TOUTE INTERVENTION DE SERVICE AU-DELÀ D'UN SIMPLE NETTOYAGE, QUI NÉCESSITE UN DÉMONTAGE, DEVRA ÊTRE RÉALISÉE PAR DU PERSONNEL DE SERVICE QUALIFIÉ.

⚠ AVERTISSEMENT ⚠

POUR RÉDUIRE LE RISQUE DE DÉPART D'INCENDIE ET DE COMMOTION ÉLECTRIQUE OU DE BLESSURE, DÉBRANCHEZ TOUTE ALIMENTATION ÉLECTRIQUE ALLANT AU RADIATEUR EN AMONT AU PANNEAU DE SERVICE, ET VÉRIFIEZ QUE L'ÉLÉMENT DE CHAUFFE EST FROID AVANT D'INTERVENIR POUR DU SERVICE OU DE L'ENTRETIEN..

Instructions de nettoyage par l'utilisateur :

1. Une fois que le radiateur est froid, vous pouvez utiliser un aspirateur avec son accessoire brosse pour éliminer la poussière et les peluches des surfaces extérieures du radiateur, y compris les ouvertures de la grille.
2. Avec un chiffon humide, enlevez poussière et peluche de la grille et des surfaces extérieures.
3. Remettez le radiateur sous tension et vérifiez son bon fonctionnement.

Instructions de nettoyage d'entretien :

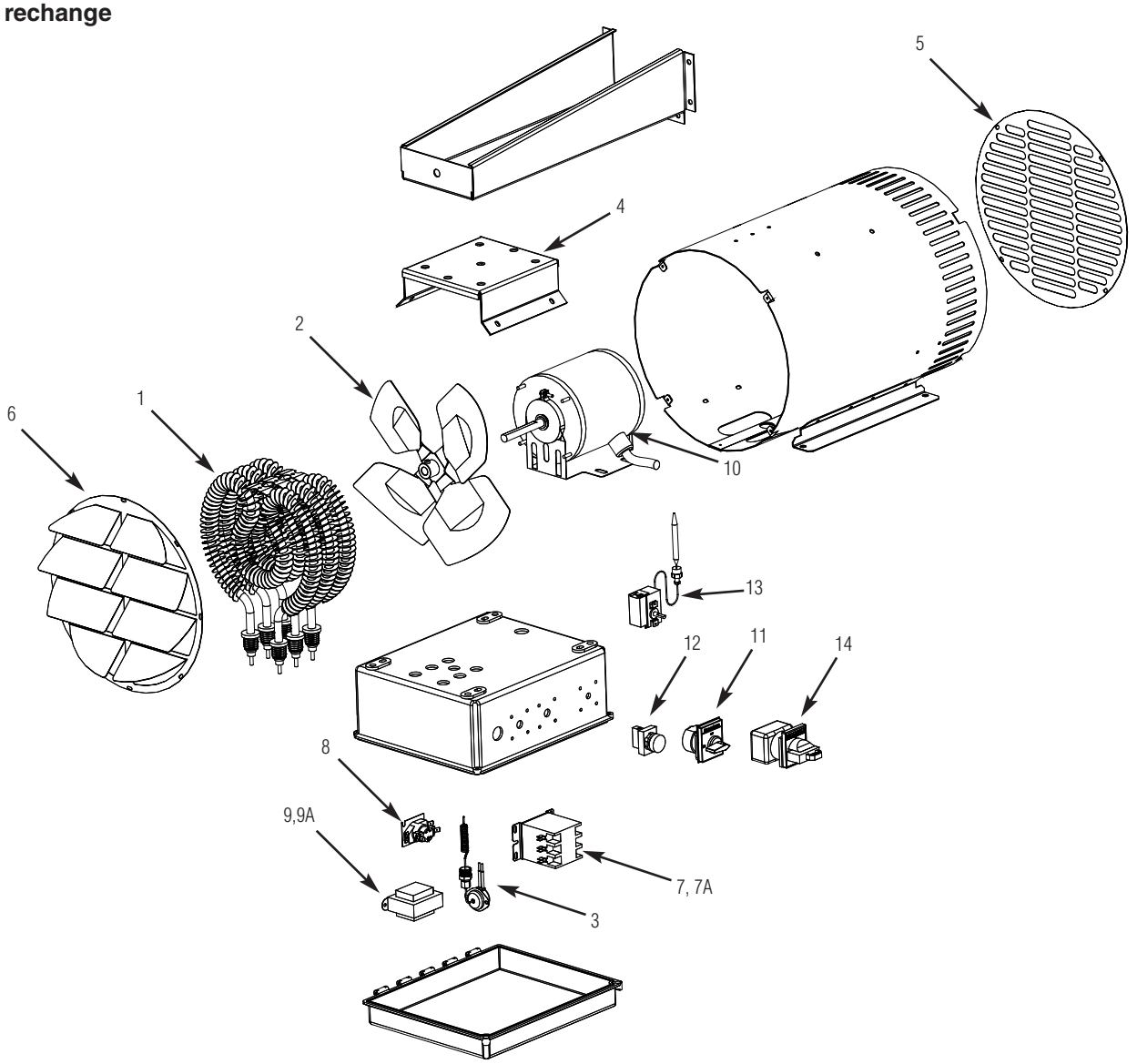
(Ne doit être exécuté que par du personnel de service qualifié)

Au moins une fois par an le radiateur doit être nettoyé et vérifié par une personne de service qualifiée afin d'assurer un fonctionnement sûr et efficace. Cela doit inclure si nécessaire l'aspiration des poussières et débris des éléments et du ventilateur, et un contrôle du bon serrage de tous les raccordements par cosses à visser, avec un couple recommandé de 35 in-lbs. (3.9 N-m) en utilisant le ou les outils pour les cosses difficiles à atteindre si nécessaire. Une fois le nettoyage et le service terminés, le radiateur doit être complètement remonté et son bon fonctionnement vérifié.

IMPORTANT NOTE: Pour des radiateurs utilisés dans une application avec arrosage, il est recommandé que périodiquement après un arrosage ayant atteint le radiateur (étant coupé à son panneau de commande) le couvercle du compartiment de câblage soit ouvert et l'intérieur inspecter pour vérifier l'absence d'infiltration d'eau. Si de l'eau est découverte dedans, le radiateur doit être réparé par un électricien qualifié pour s'assurer que les joints d'étanchéité sont bien en place.

Durant chaque nettoyage, tous les joints sont à inspecter pour chercher d'éventuels dommages, car il est critique qu'ils puissent préserver une étanchéité à l'eau. Si des dommages sont découverts (comme des déchirures ou craquelures), il faut remplacer ces joints ou les réparer avec un produit d'étanchéité adéquat aux silicones.

Pièces de rechange



Éléments (1)

Radiateur KW	120 V	208 V	240 V	277 V	480 V	600 V
2	1802-11012-001	1802-11012-002	1802-11012-003	-	-	
3	1802-11012-001	1802-11012-002	1802-11012-003	1802-11012-004	1802-11012-004	
5	-	1802-11012-005	1802-11012-006	1802-11012-007	1802-11012-008 1PH 1802-11012-007 3 PH	1802-11012-027
7.5	-	1802-11012-011	1802-11012-012	1802-11012-009	1802-11012-008	1802-11012-027
10	-	1802-11012-010	1802-11012-011	1802-11012-012	1802-11012-013	1802-11012-028
12.5	-	1802-11013-001	1802-11013-002	-	1802-11013-003	1802-11013-021
15	-	1802-11013-004	1802-11013-005	-	1802-11013-006	1802-11012-027
20	-	-	1802-11013-007	-	1802-11013-008	1802-11012-010
25	-	1802-11013-001	1802-11013-002	-	1802-11013-003	1802-11012-011
30	-	1802-11013-004	1802-11013-005	-	1802-11013-006	1802-11013-022
39	-	-	-	-	1802-11013-009	1802-11013-023

Parties mécaniques et coupure – En fonction de la puissance

Puissance de radiateur en kW	Pale de ventilateur (2)	Limite (3)	Support de montage (4)	Grille d'amission (5)	Grille d'évacuation (6)
2 kW, 3 kW, 5 kW, 7.5 kW	1210-11007-003	4520-11013-000	1215-11081-000	2504-11018-000	2504-11019-001
10 kW	1210-11007-002				
12.5 kW	1210-11008-000	4520-11013-001	1215-11081-001	2504-11020-000	2504-11021-001
15 kW, 20 kW, 25 kW, 30 kW, 39 kW	1210-11008-001				

Pièces électriques

Puissance de calefactor (kW)	Tension secteur línea del calefactor	Tension de controldel calefactor	Phase du calefactor	Contactor (7)	Contactor (7A)	Relais de ventilador Relé (8)	Transformador (9)	Transformador (9A)	Bornier (No se muestra)
2kw, 3kw,	120	24	1	5018-0006-000	N/A	5018-11005-000	5814-0003-006	N/A	5823-0004-002
5kw, 7.5kw,	208	24	1 or 3				5814-0003-000		(480V also req
10kw	240	24					5814-0003-000		2900-0030-000)
	277	24	1				5814-0003-001		
	480	24	1 or 3				5814-0003-002		
	600	24	3	5018-0006-000	5018-0005-004	5018-11005-000	5814-0003-000	490015027	
2kw, 3kw,	120	120	1	5018-0006-001	N/A	5018-11005-001	N/A	N/A	
5kw, 7.5kw,	208	120	1 or 3				5814-0003-003		
10kw	240	120					5814-0003-003		
	277	120	1				5814-0003-004		
	480	120	1 or 3				5814-0003-005		
	600	120	3	5018-0006-001	5018-0005-005	5018-11005-001	5814-0003-003	490015027	
Unfused	208	24	3	5018-0006-000	5018-11005-000		5814-0003-000		
large units	240	24					5814-0003-000		
12.5kw,15kw,	480	24					5814-0003-002		
	600	24			5018-0005-004	5018-11005-000	5814-0003-000	490015027	
	208	120	3	5018-0006-001	5018-11005-001		5814-0003-003		
	240	120					5814-0003-003		
	480	120					5814-0003-005		
	600	120			5018-0005-005	5018-11005-001	5814-0003-003	490015027	
Fused	208	24	1	5018-0006-000	5018-11005-000		5814-0003-000		480034002
large units	240	24					5814-0003-000		
	480	24					5814-0003-002		
	208	120	1	5018-0006-001	5018-11005-001		5814-0003-003		
	240	120					5814-0003-003		
	480	120					5814-0003-005		

Pièces électriques (Suite)

Puissance de radiateur en kW	Tension secteur de radiateur	Tension de commande de radiateur	Phase du secteur de radiateur	Moteur (10)	Commutateur de mode (11) (Accessoire)	Transformateur (9) (Accessoire)
2kw, 3kw,	120	24	1	3900-11029-002	5216-11016-000	3510-11009-000
5kw, 7.5kw,	208	24	1 or 3	3900-11029-000		
10kw	240	24				
	277	24	1	3900-11029-001		
	480	24	1 or 3	3900-11029-000		
	600	24	3			
2kw, 3kw,	120	120	1	3900-11029-002		3510-11009-001
5kw, 7.5kw,	208	120	1 or 3	3900-11029-000		
10kw	240	120				
	277	120	1	3900-11029-001		
	480	120	1 or 3	3900-11029-000		
	600	120	3			
Unfused	208	24	3	3900-11031-000		3510-11009-000
large units	240	24				
12.5kw,15kw	480	24				
	600	24	3			
	208	120	3	3900-11031-000		3510-11009-001
	240	120				
	480	120				
	600	120	3			
Fused	208	24	1	3900-11031-000	5216-11016-000	3510-11009-000
large units	240	24				
	480	24				
	208	120	1	3900-11031-000		3510-11009-001
	240	120				
	480	120				

Interrupteur de coupure (14)

Calibre en courant	N° de pièce
40	4529-11009-031
60	4529-11009-032
100	4529-11009-033
125	4529-11009-034

Divers

Description	N° de pièce
Thermostat (13)	5813-11010-000
Joint (non montré)	5206-11009-000

GARANTIE LIMITÉE

Tous les produits fabriqués par Marley Engineered Products sont garantis contre les défauts de fabrication et de matériau pendant une année à compter de leur date d'installation. Cette garantie ne couvre pas les dommages causés par un accident, une mauvaise utilisation ou une altération et ne s'applique pas si la tension d'alimentation dépasse de 5% ou plus celle de la plaque signalétique, si l'équipement est mal installé, mal câblé ou mal entretenu, contrairement aux instructions d'installation et d'utilisation du produit. Toutes les réclamations sous garantie doivent être accompagnées d'une preuve de date d'installation.

Le client sera responsable de tous les coûts encourus pour enlever et réinstaller le produit, ce qui inclut les frais de main d'œuvre et les frais de port encourus pour retourner le produit au centre de réparation de la société Marley Engineered Products. Sous réserve des restrictions figurant dans cette garantie, tout appareil défectueux doit être retourné au centre de réparation agréé par Marley le plus près ou au centre de réparation de la société Marley Engineered Products. Il sera ensuite gratuitement réparé ou remplacé, à notre discrétion, et les frais de port de retour seront pris en charge par Marley. Il est entendu que cette réparation ou ce remplacement constitue le seul et unique recours disponible auprès de la société Marley Engineered Products.

LA GARANTIE CI-DESSUS REMPLACE ET PRÉVAUT SUR TOUTE AUTRE GARANTIE EXPRESSE OU IMPLICITE ET TOUTE GARANTIE IMPLICITE DE COMMERCIALISATION OU DE CONVENANCE À UN USAGE QUELCONQUE ALLANT AU-DELÀ DE LA GARANTIE EXPRESSE CI-DESSUS EST PAR LES PRÉSENTES RÉFUTÉE ET EXCLUE DE CETTE ENTENTE. LA SOCIÉTÉ MARLEY ENGINEERED PRODUCTS NE PEUT SOUS AUCUNE CIRCONSTANCE ÊTRE RESPONSIBLE DE QUELQUE DOIMMAGE ACCESSOIRE ASSOCIÉ À CE PRODUIT, SANS QU'IL SOIT POSSIBLE D'INVOQUER UNE NÉGLIGENCE, UN DÉLIT CIVIL, UNE RESPONSABILITÉ STRICTE OU UNE OBLIGATION CONTRACTUELLE.

Puisque certaines juridictions interdisent d'exclure ou de limiter les dommages indirects et accessoires, il est possible que les exclusions et restrictions ci-dessus ne s'appliquent pas à vous. Cette garantie vous accorde des droits juridiques spécifiques, mais il est possible que vous ayez également d'autres droits selon votre lieu de résidence.

Pour connaître l'adresse du centre de réparation agréé le plus près, contactez la société Marley Engineered Products à Bennettsville (Caroline du Sud) au 1-800-642-4328. Les produits retournés à l'usine doivent être accompagnées d'un numéro d'autorisation de retour et d'une étiquette d'identification de service, tous deux disponibles auprès de la société Marley Engineered Products. Lorsque vous demandez une autorisation de retour, indiquez tous les numéros de catalogue indiqués sur les produits.

POUR OBTENIR UNE RÉPARATION OU DES PIÈCES SOUS GARANTIE, DE MÊME QUE DES INFORMATIONS GÉNÉRALES

1. Réparations et pièces sous garantie **1-800-642-4328**
2. Achat de pièces de rechange **1-800-654-3545**
3. Informations générales sur les produits **www.marleymep.com**

Remarque : Lorsque vous demandez une intervention, ayez toujours en main les informations suivantes :

1. Numéro de modèle du produit
2. Date de fabrication
3. Numéro de pièce ou description

Marley® Engineered Products

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Bennettsville, SC 29512 USA