

Indoor Replacement AHU



Outdoor Replacement AHU



# Site Assembled Air Handling Replacement Units

## Installation, Operation, and Maintenance Manual

November 2023  
IOM-SL-A-051521-ACCESS

# Air Handling Replacement Units

Installation, Operation, and Maintenance Manual

November 2023

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### WARNING

Only qualified personnel should install and service the equipment. Improperly installed, adjusted or altered equipment by an unqualified person could result in death or serious injury. When working on the equipment, observe all precautions in the literature and on the tags, stickers, and labels that are attached to the equipment.

### 1.0 General

This manual is a guide for the installation, operation, and maintenance of ClimateCraft custom air handling units. Due to the custom nature of ClimateCraft air handling units, it is not possible to cover every aspect or attribute of your unit. Contact your local ClimateCraft representative or ClimateCraft, Inc. for additional information.

Some components of the air handling unit may be manufactured by third-party suppliers to ClimateCraft, Inc. Applicable maintenance instructions are provided by the specific component manufacturer. References to some components may not be applicable to your unit. Attention to all warnings and caution statements is required.

ClimateCraft's FanMatrix™ fan array products allow for fans to be turned off for safety, repair, and maintenance purposes. ClimateCraft's fan array products are not designed to turn individual fans on and off for the purpose of improving efficiency, and ClimateCraft does not endorse turning individual fans on and off for the purpose of improving fan array efficiency. Any statement to the contrary is not supported by ClimateCraft.

ClimateCraft's custom air handling units are considered partial unit air conditioners, complying with partial unit requirements of the UL 60335-2-40 international standard and must only be connected to other units that have been confirmed as complying to corresponding partial unit requirements of this international standard.

**Attention:** Warning, Cautions, and Notices appear at appropriate sections throughout this literature. Read these carefully.

#### **WARNING**

Indicates a potentially hazardous situation which, if not avoided, could result in death or serious injury.

#### **CAUTION**

Indicates a potentially hazardous situation which, if not avoided, could result in minor or moderate injury. It could also be used to alert against unsafe practices

#### **NOTICE**

Indicates a situation that could result in equipment or property-damage only accidents.

### 2.0 Receiving

ClimateCraft air handling units are factory inspected prior to shipment. Digital photos are taken of the unit and loose parts. These photos are available for review by calling ClimateCraft. Please verify all components and loose parts immediately upon receipt of your custom air handling unit. Note any damage on the Bill of Lading immediately and in the presence of the freight carrier's delivering agent. Report the damage to the freight carrier and file appropriate claim documents in accordance with ICC regulations. It is the responsibility of the recipient to contact ClimateCraft, Inc.

### 3.0 Storage

#### 3.1 Short-Term Storage

If your ClimateCraft air handling unit will not be installed immediately, it is important to properly store your unit to maintain its condition and warranty coverage.

1. The air handling unit must be stored on a dry level surface. The unit must be elevated if the surface may become wet. On page 4, Figures 3-1 and 3-2 provide guidelines for the placement of dunnage under the air handling unit.
2. Securely close all service doors and seal all supply and return air openings.
3. Units designed for indoor use must be stored indoors.
4. Internal condensation should be minimized through the use of desiccant or dehumidification.
5. Units must be inspected weekly, internally and externally, and damage or leaks repaired immediately.
6. Electrical components should be protected from the elements and condensation.
7. Fan wheels must be rotated 10-turns every three months while the unit is stored.

#### 3.2 Long-Term Storage

If your ClimateCraft air handling unit will be stored 6-months or longer, in addition to the tasks in Section 3.1, the following steps should be taken:

1. De-tension fan belts, if equipped.
2. Reinstall shipping bolts (FanMatrix™).
3. Coat exposed motor shafts with a rust preventer such as Exxon Rust Ban #392 or equivalent.
4. Maintain humidity inside the unit below 60% RH, storing the unit indoors if possible.

#### **WARNING**

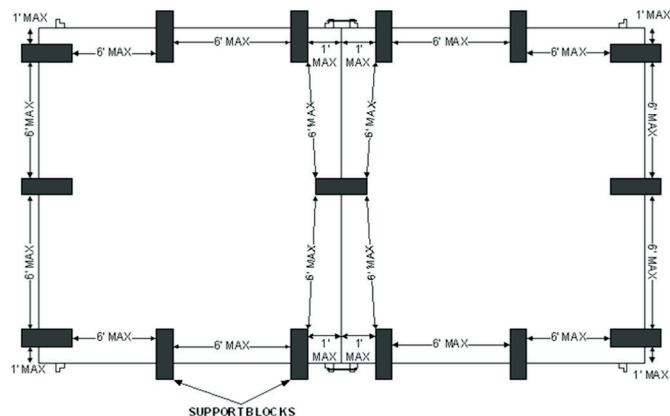
Ensure that ClimateCraft custom air handling units that come with direct expansion evaporation coils are only connected to systems or appliances suitable for the same type of refrigerant.

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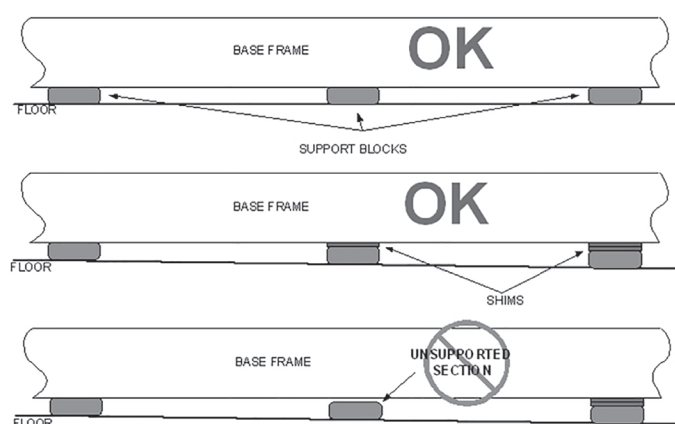
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Figure 3-1.



**SUPPORT BLOCKS REQUIRED WITHIN 1FT OF ALL SECTION CORNERS WITH NO MORE THAN 6FT BETWEEN BLOCKS**

Figure 3-2.



**ALL SUPPORT BLOCKS MUST CONTACT BASE FRAME**

**Note: The warranty does not cover damage to the unit or controls during storage.**

## 4.0 Roof Curb Installation

ClimateCraft ships roof curbs unassembled for assembly at the job site. Assembly instructions are provided by the curb manufacturer and attached to each curb package. Each part is clearly identified with proper tags and markings. It is critical curbs and/or structural steel is level, flat, square and plumb. Curbs and structural steel must be out-of-level no more than 1/64" per foot and no more than 1/8" over the entire air handling unit. Curb gasket must be placed between the curb and

the air handling unit. Curb gasket provides an air seal between the unit and the curb. A sealant may be used in place of the curb gasket if desired.

Your ClimateCraft air handling unit will fit over the roof curb and rest on the curb angle within the perimeter of the unit base as shown in Figure 4-1. The overall outside roof curb dimensions are 6" less than the air handling unit base frame dimensions.

Figure 4-1.

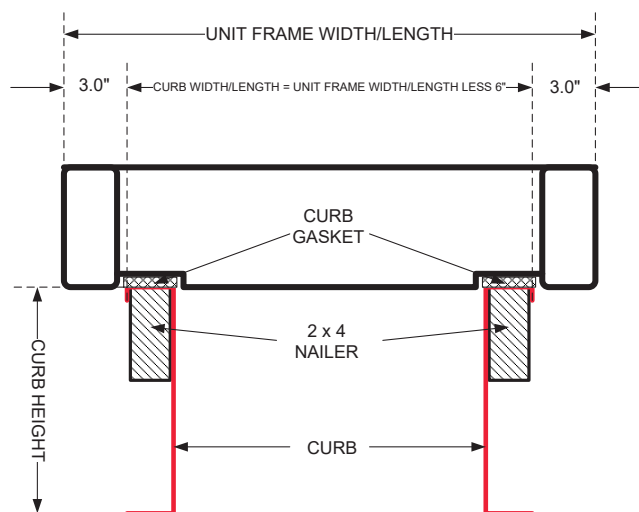


Figure 4-2. Suggested Roof Curb Installations.

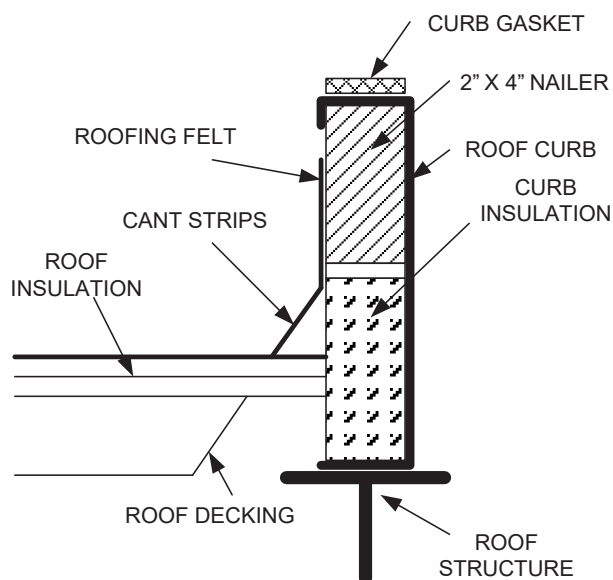
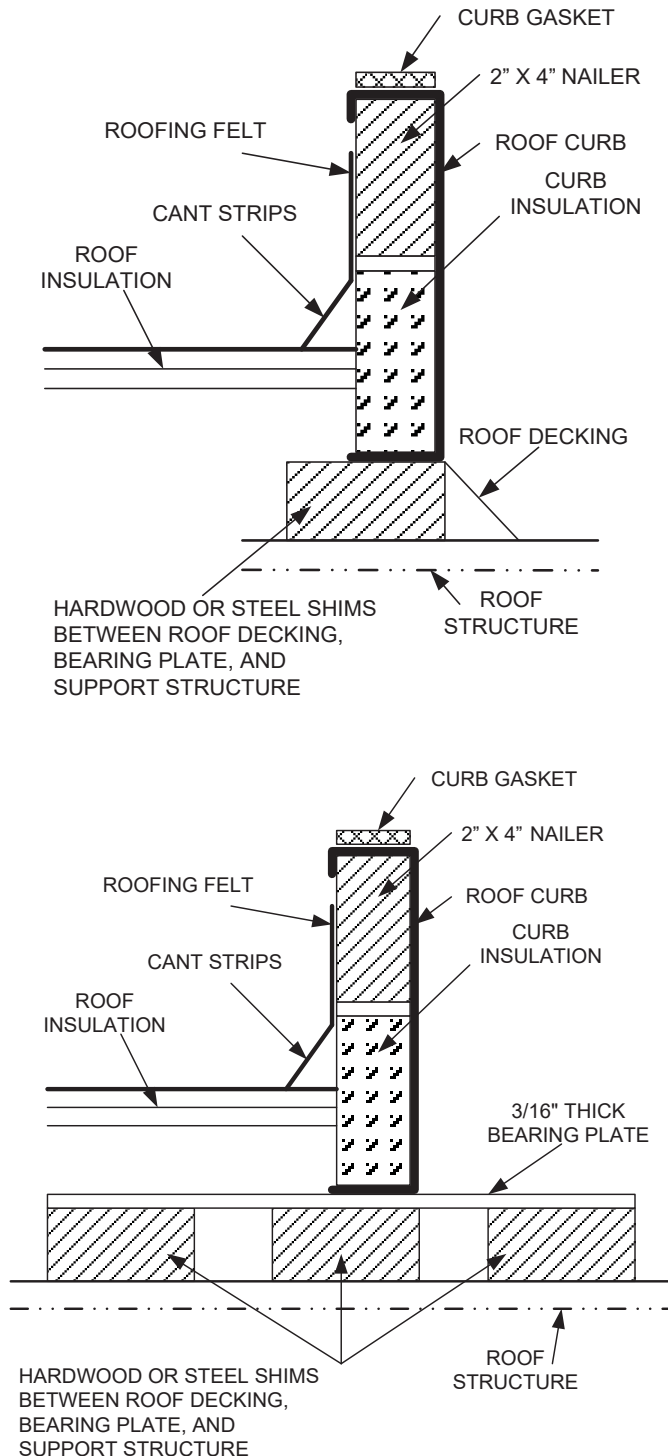


Figure 4-2, Suggested Roof Curb Installations.



## 5.0 Rigging

Proper equipment handling is critical to avoid damage to your ClimateCraft air handling unit during lifting. ClimateCraft air handling units may be delivered fully assembled or in sections requiring on-site assembly. In either case, each section will have a minimum of 4 lifting lugs bolted or welded to the unit base frame.

### CAUTION

Spreader bars are required to prevent crushing the sides and top of the unit. All lifting lugs must be used when lifting the ClimateCraft air handling unit. Improper rigging can cause damage to the unit.

### WARNING

Crush Hazard when lifting. Rig from base only using ALL lifting lugs provided. Do not allow rigging lines to vary more than 15 degree from vertical. Use spreader bar(s) to avoid rigging line damage to cabinet.

### CAUTION

When more than two lifting lugs are supplied on each side of unit, an adjustable turnbuckle must be used on each side to even the hoisting load on each hoisting strap. This is mandatory to prevent damage to the unit.

### CAUTION

Separate Sections Prior to Lifting. Occasionally Units with section splits are bolted together for shipping purposes.

Figure 5-1. Example of proper rigging and lifting.

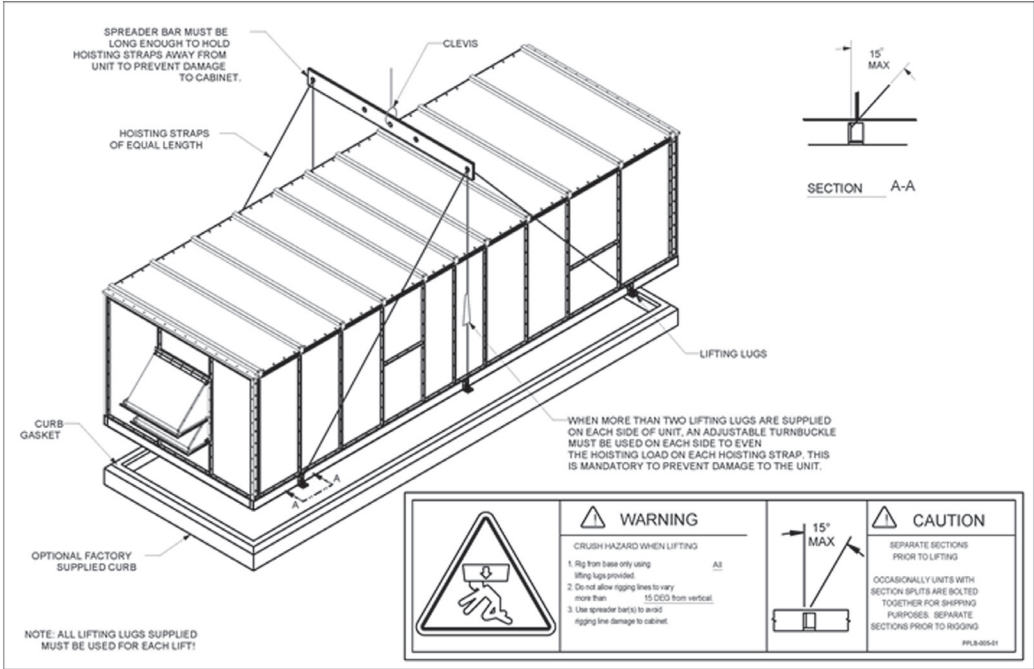


Figure 5-2. Example of proper rigging and lifting.



## 6.0 Unit Assembly

### 6.1 Squaring the Unit Sections

Units shipped in sections due to shipping requirements or clearance limitations must be assembled at the unit split joint. If the unit sections have racked, they must be squared and plumbed prior to assembly.

### NOTICE

If the unit is not properly aligned after rigging & placement, it must be square and plumb prior to section assembly.

Figure 6-1. Unit base frames properly aligned, gasketed and joined

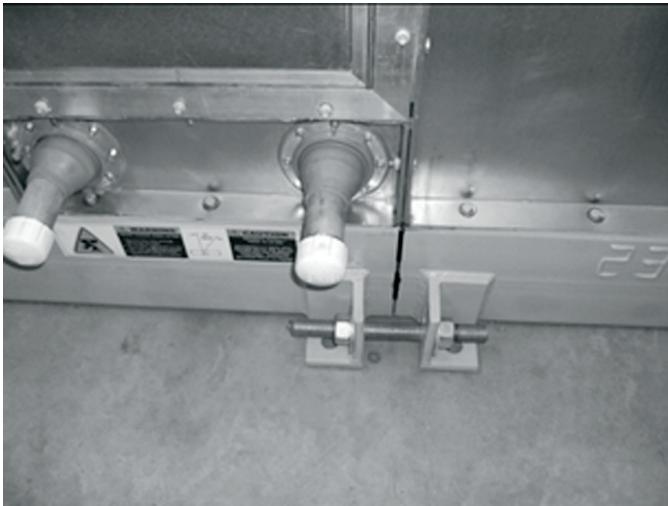
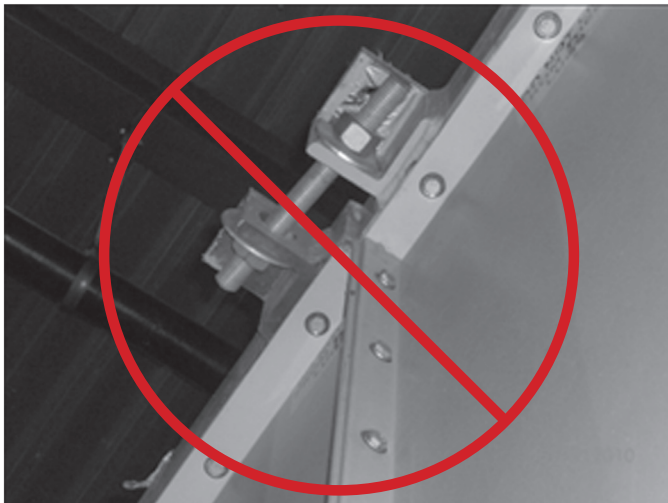
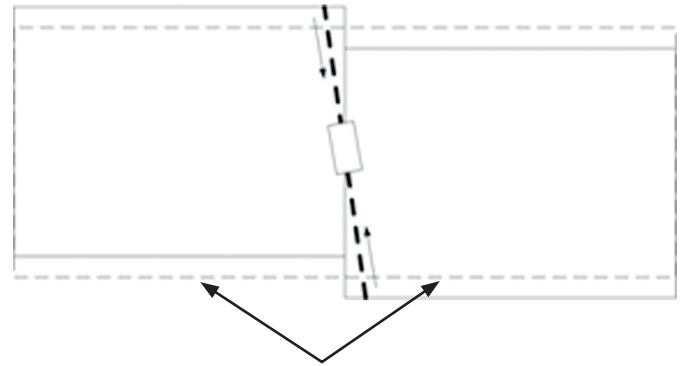


Figure 6-2. Unit pulled together before it was properly aligned



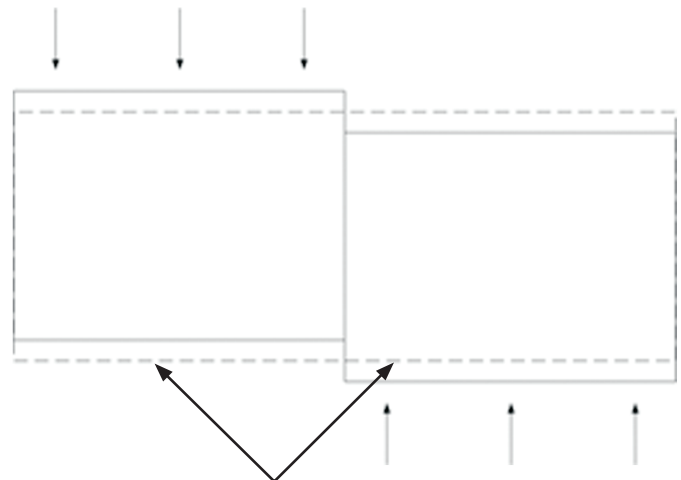
Squaring and alignment can be accomplished by using a “come-along” or other device to apply pressure to the opposing side to square it up prior to assembly. Figures 6-3 and 6-4 show depictions of how the squaring of the unit can be accomplished.

Figure 6-3.



Correct alignment of base frame

Figure 6-4.



Correct alignment of base frame

### 6.2 Assembling Unit Sections

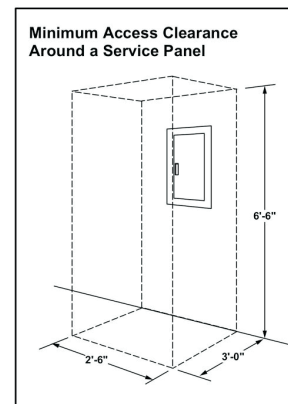
1. Place unit sections as close to their final installation position as possible, making sure all sections are correctly oriented to mating sections. Serial numbers for each section will be on the same side and in order, SNXXXXX-1, SNXXXXX-2, etc., continuing for all sections of unit.
2. Remove bolts along unit split planes on wall and roof panels. Remove shipping lugs if installed between unit sections. Remove plastic covering the unit split opening.
3. Install panel joint gasket, ClimateCraft part number PGSK-001-001 along base frame tube. Two pieces of gasket material should be used as shown in Figure 6-5. The first piece of gasket should be at floor level with wide portion of "T" gasket close to top of base rail following its radius. The second piece should be inverted and close to the center of the tube. Both pieces of gasket need to be installed using the double-sided tape provided in loose parts box inside unit. Gasket material should extend beyond edges of each section. Gasket installation must be done before sections are pulled together.  
**NOTE:** On units where floor seams will be welded together; gasket placement along beams and floor seams should be lower (away from weld seams) in order to avoid burning or damaging the gasket.
4. Install panel joint gasket, ClimateCraft part number PGSK-001-001, on wall and roof panel flanges. If the sections are level, plumb and at the same height, all wall panel and roof panel bolt holes should be aligned. If they are not, the condition preventing alignment must be corrected prior to pulling the sections together. See Section 6.1 above.
5. Maneuver unit sections into final position. Ensure base frames are as close as possible (touching) while maintaining hole alignment.
6. Draw unit sections together using section split assembly hardware. **DO NOT ATTEMPT TO DRAW THE SECTIONS TOGETHER USING THE PANEL BOLTS.**
7. Check unit for proper alignment prior to bolting of wall panels and roof sections. If unit is not square and plumb it is possible for air/water leaks to occur. Proper alignment of roof rails can be seen at the section joints, roof rails should be almost touching and flush together if unit is level, square and plumb.

8. Once the sections are together, insert panel bolts and nuts along roof and wall panels. Tighten bolts and nuts securely.
9. After verifying unit section bases are touching along unit split planes, caulk joint between adjacent base frame sections and at end seam of roof panel joints of unit.
10. Units that are wider than 12 feet and/or have a steel roof frame instead of aluminum require caulk along the roof rail at the point both sections of the unit come together.
11. For outdoor units, the roof seam cover caps must be installed. Do not seal seam-cover end caps as this will prevent rainwater from draining off roof.

### 6.3 Component Clearances

Because ClimateCraft, Inc. specializes in the manufacture of custom products, it is difficult to generalize about product clearances. However, certain minimum clearances should be observed to facilitate access to the unit and major components.

- Access Doors – The area around an access door should be clear to allow the door to swing fully open without obstruction.
- Coils & Major Components – In order to allow for replacement of coils and other major components, the area adjacent to the component should be clear an equivalent of the width of the component, plus an additional 5 feet to allow for equipment access.
- For electrical cabinets and enclosures, make sure there is adequate clearance around the panel in accordance to all NEC clearance requirements.



## NOTICE

Maintaining clearances around the air handling unit required for local, state, and national codes is the responsibility of the licensed installing contractor.

### 6.4 General Section Electrical Hookup

ClimateCraft offers a variety of different hookup options, those options can include the following:

- Exterior-mounted electrical panels for 230/460/575 main incoming power
- Flush-mounted electrical panels for 230/460/575 main incoming power
- Exterior-mounted junction boxes for 120V Lighting Power wired to the lighting circuit
- Exterior-mounted junction boxes for 230/460/575 wired to individual Fans/motors
- Exterior-mounted junction boxes for 120/230/277 wired to UV Light circuits

For ClimateCraft Flush Mounted Electrical Panels, see image for electrical penetration/connection location. The connection method and materials should conform to all national and local electrical code requirements.

For ClimateCraft Exterior-Mounted NEMA-Rated panels, electrical penetration/connection methods and location should conform to all national and local electrical code requirements.

For exterior-mounted junction boxes, the electrical contractor should conform to all national and local electrical code requirements when making connections to these boxes.

### 6.5 Flush Mount Unit Electrical Panel

This custom air handling unit is a partial unit air conditioner, complying with partial unit requirements of this international standard, and must be only connected to other units that have been confirmed as complying to corresponding partial unit requirements of this international standard.

#### Flush Mount Unit Electrical Panel Example



This space is designed for incoming electrical service

Wire to Main disconnect switch

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Figure 6-5.

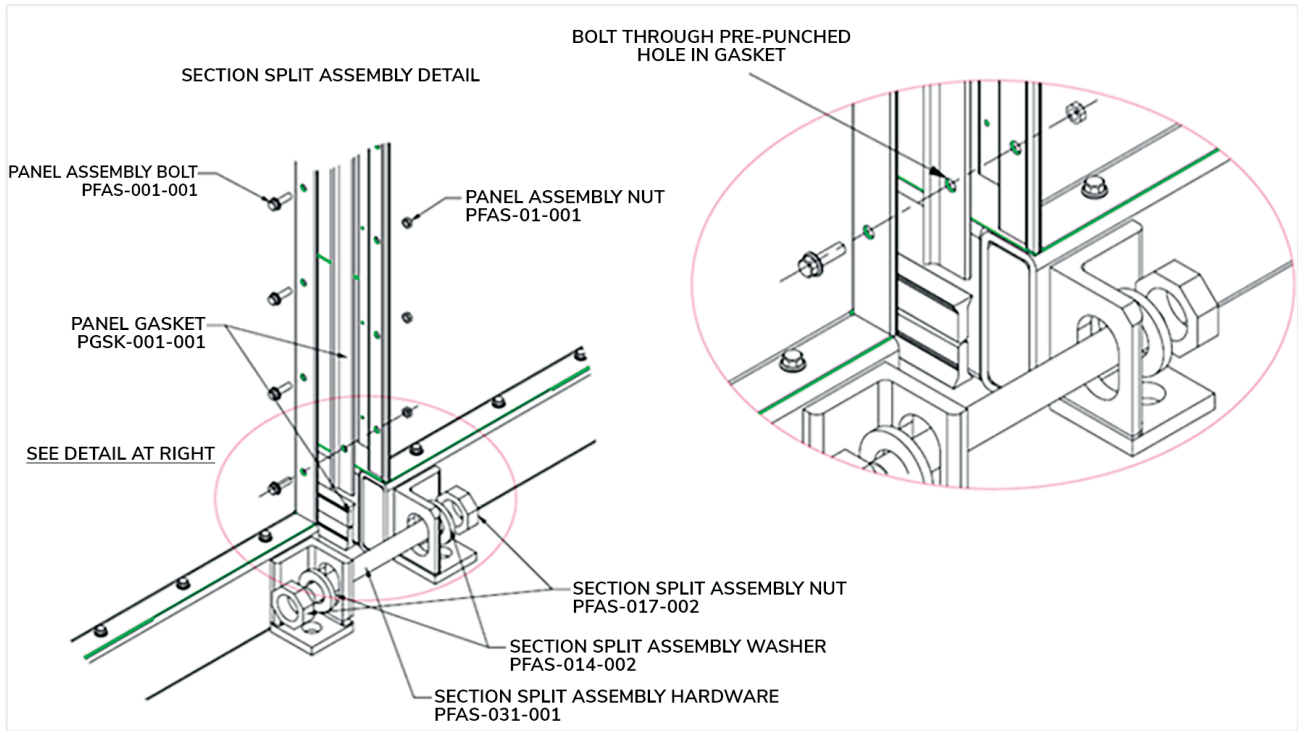


Figure 6-6.

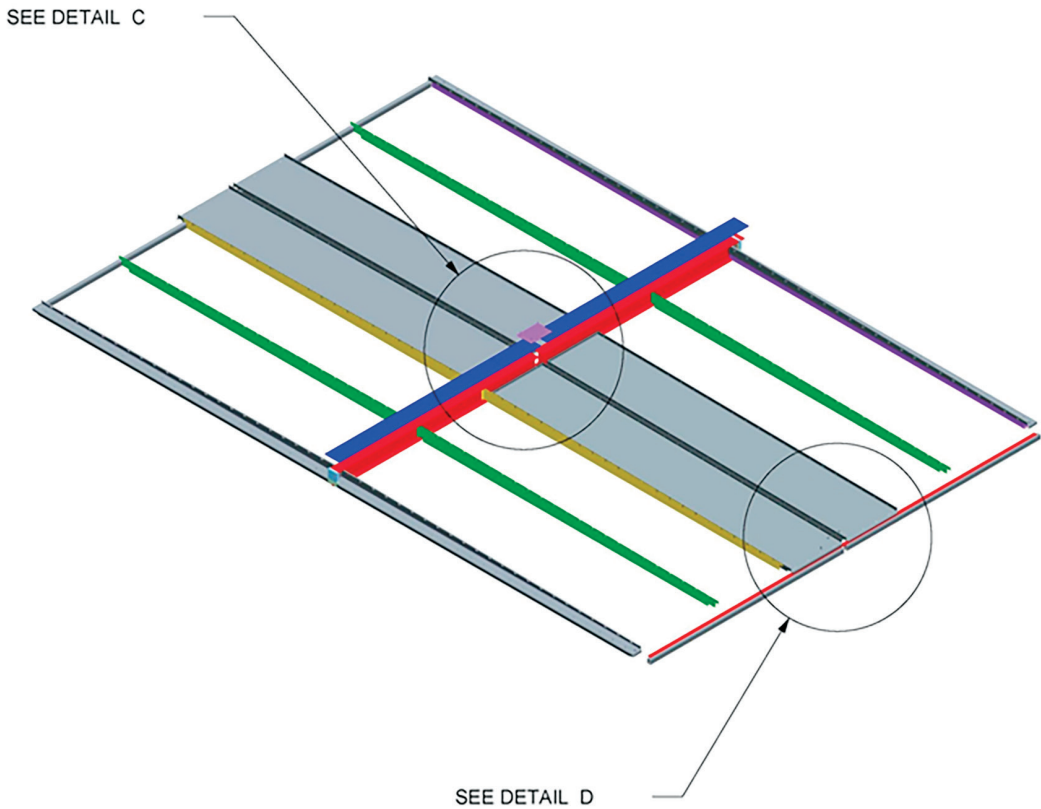


Figure 6-7.

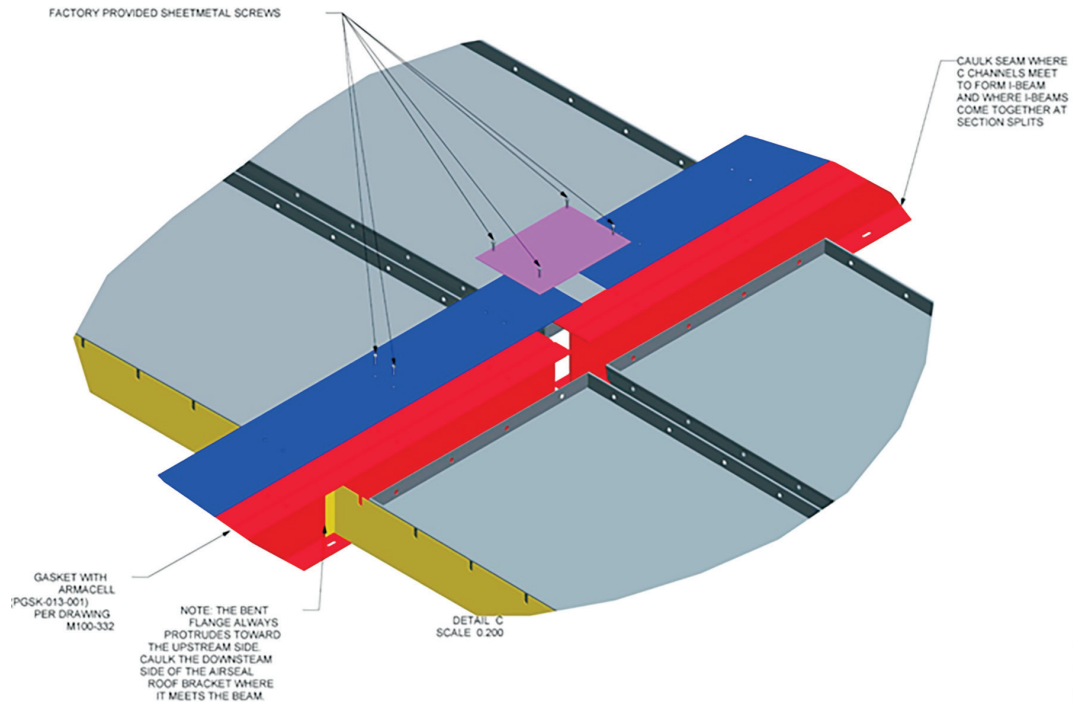
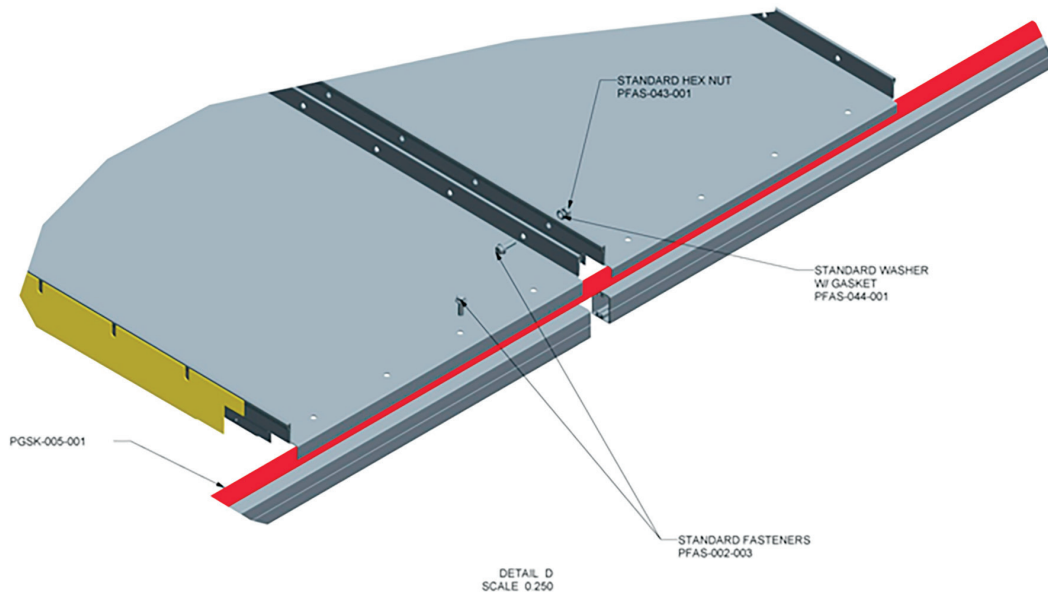


Figure 6-8.



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### 6.6 Vestibule (Doghouse) Assembly

Some ClimateCraft air handling units accept a bolt-on vestibule (doghouse) for field attachment.

1. Using double-sided tape, affix two layers of PGSK-001-001 to the base frame of vestibule as shown in Figure 6-9.
2. Affix a single layer of PGSK-001-001 to the roof panel flange of vestibule (Figure 6-10).
3. Affix, using double-sided tape, gasket PGSK-005-003 to the wall panel flanges of the vestibule (Figure 6-11).
4. Align vestibule so the holes in the vestibule wall and roof panels align with the holes in the air handling unit and draw together (Figure 6-12 and 6-13).

Figure 6-9.

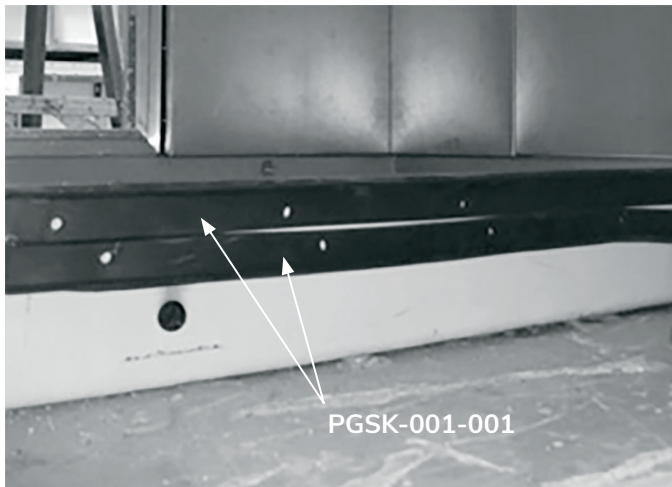


Figure 6-10.

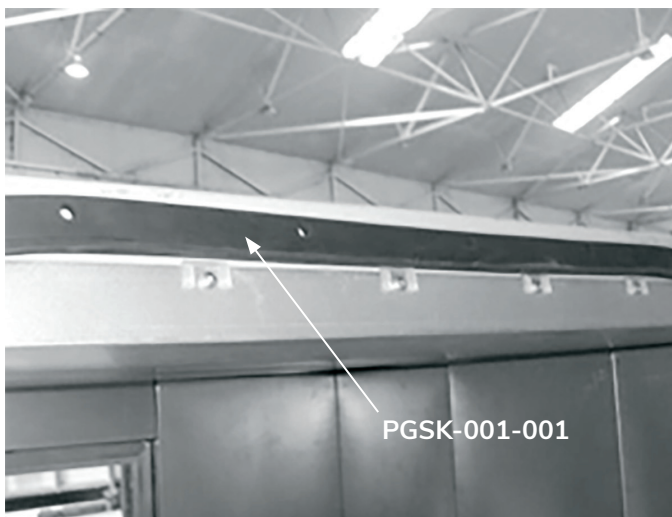


Figure 6-11.



Figure 6-12.



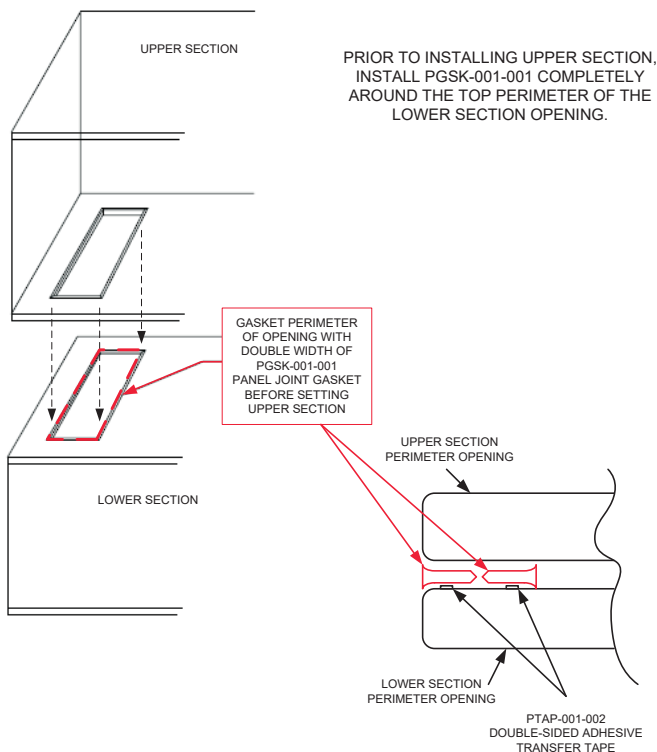
Figure 6-13.



## 6.7 Stacked Unit Assembly

When a ClimateCraft air handling unit contains a “stacked” configuration where one unit section sits atop a lower section, it is essential to seal any air openings between the sections. Gasket is provided by ClimateCraft for this purpose and must be installed per the instructions below.

Figure 6-14.

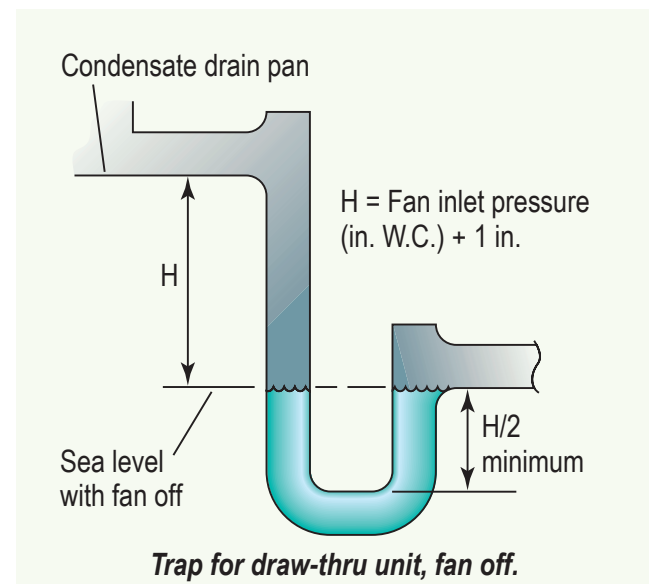


## 7.0 Condensate Drain

Static pressure in the drain pan section will be negative if the cooling coil is in a draw through application. Static pressure will not allow the drain pan to empty if a properly plumbed trap is not used. Cooling coils and drain pans in a blow through or positive pressure section also need to be properly trapped to prevent air from blowing through the drain.

The following trap sizes are required as a minimum for proper operation of the air handling unit. On startup, it may be necessary to fill the trap manually. If the air handling unit is exposed to freezing conditions during winter months, an antifreeze solution should be placed in the trap or the trap should be drained and plugged.

Figure 7-1. Negative Internal Static Pressure in Coil Section- Fan Off (Draw-Through Application).



$H = \text{Negative Internal Static Pressure in Drain Pan Section (in w.g.)} + 1"$

$H/2 = \text{Negative Internal Static Pressure in Drain Pan Section (in. wg) divided by 2.}$

Example:

Neg SP in Drain Pan Section = 3.6 in/w.g.

$$H = 3.6 + 1 = 4.6"$$

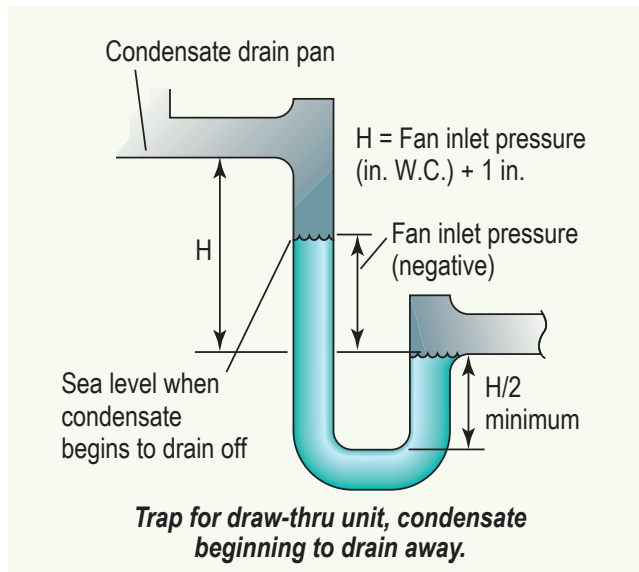
$$H/2 = (3.6 / 2) = 1.8"$$

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**Figure 7-2. Negative Internal Static Pressure in Coil Section-Fan On (Draw-Through Application).**



$H = \text{Negative Internal Static Pressure in Drain Pan Section (in w.g.)} + 1"$

$H/2 = \text{Negative Internal Static Pressure in Drain Pan Section (in. wg) divided by 2.}$

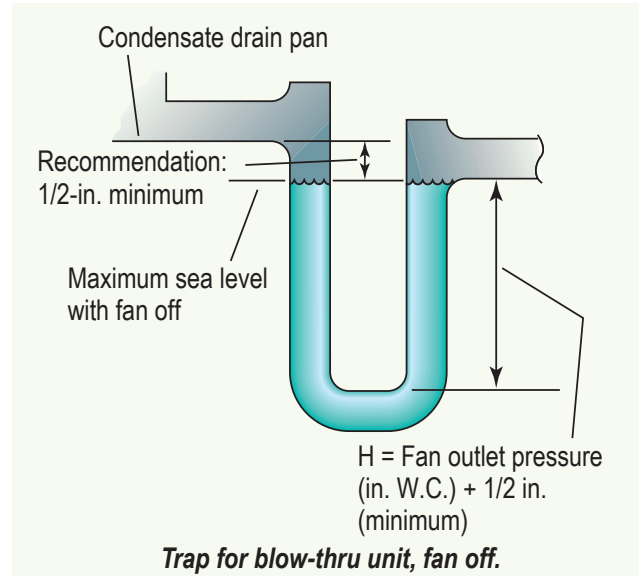
Example:

Neg SP in Drain Pan Section = 3.6 in/w.g.

$$H = 3.6 + 1 = 4.6"$$

$$H/2 = (3.6 / 2) = 1.8"$$

**Figure 7-3. Positive Internal Static Pressure in Coil Section-Fan Off (Blow-Through Application).**



$H = \text{Positive Internal Static Pressure in Drain Pan Section (in W.G.)} + .5"$

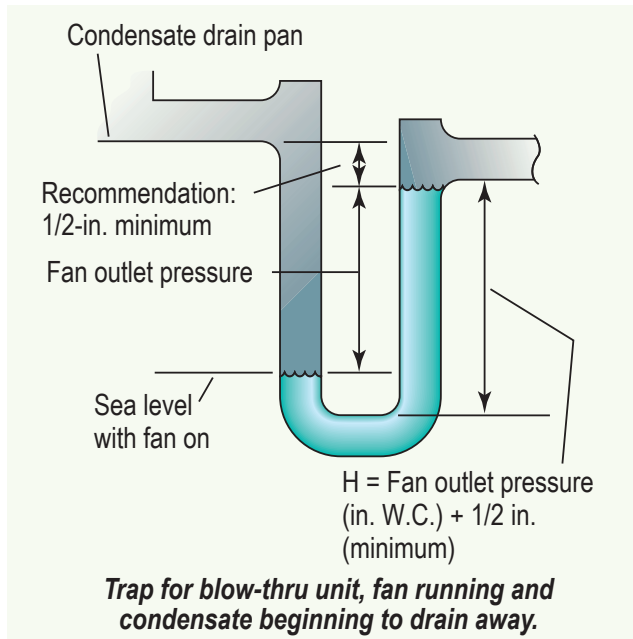
Example:

Pos SP in Drain Pan Section = 3.6 in/w.g.

$$H = 3.6 + .5 = 4.1"$$

$$\text{Total Trap Dimension} = 4.1 + .5 = 4.6"$$

**Figure 7-4. Positive Internal Static Pressure in Coil Section-Fan On (Blow-Through Application).**



$H$  = Positive Internal Static Pressure in Drain Pan Section (in W.G.)+.5"

Example:

Pos SP in Drain Pan Section=3.6 in/w.g.

$$H = 3.6 + .5 = 4.1"$$

$$\text{Total Trap Dimension} = 4.1 + .5 = 4.6"$$

## 8.0 Filters

Air filters are usually shipped loose, in boxes, inside the air handling unit. Although they may be shipped, in bulk, directly to the job site. It is essential air filters be installed before putting the unit into operation, thus making sure coils and ductwork are protected and kept clean.

### 8.1 Slide Type Filter Rack

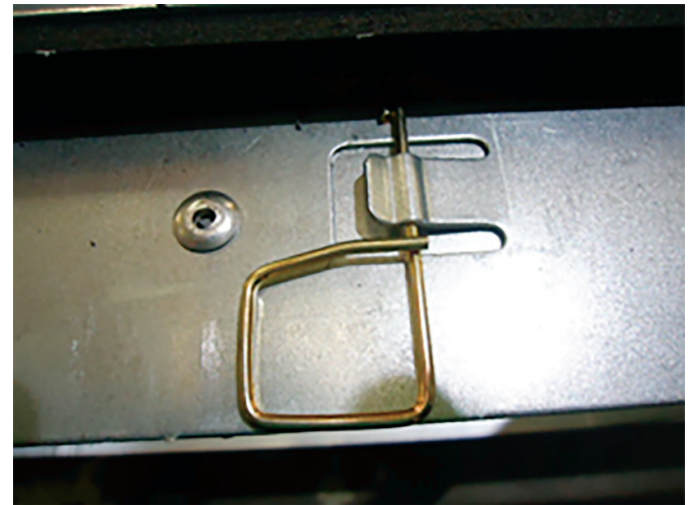
This filter rack uses horizontal channels into which the filters slide. Filters are loaded in the frame through a removable end or on the side where a portion of the channel has been removed. Frequently, spacers are used to make up the difference between the length of the rack, which is governed by the cabinet width, and the length of the standard sized filters.

### 8.2 Universal Holding Frames

The universal holding frame (Figure 8-1) surrounds each filter and can accommodate a variety of filters from the standard 2" filter, to a 2" filter plus a 12" high-efficiency filter. The universal holding frame's versatility allows the use of many combinations of different filter types.

Filter clips are supplied with the frames to hold the filter in place and are sized for the selected filter combination. If a unit has multiple filter banks, associate the clips with the correct bank before installing. Clips are shipped loose and are to be attached to the frames as shown in Figure 8-2.

**Figure 8-1.**



**Figure 8-2.**



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## 9.0 Isolators

### 9.1 Plenum and Centrifugal Fan Isolators

ClimateCraft installs spring isolators under most fans. Figure 9-1 shows the configuration of the typical isolator for centrifugal or plenum fans. The springs should arrive properly adjusted, but with the shipping block installed.

#### NOTICE

Prior to operation remove the shipping blocks and verify all springs are free-floating.

If adjustment is required, counter-clockwise rotation of the adjusting nut compresses the spring and raises the fan, while clockwise rotation of the adjusting nut lowers the fan.

Begin the adjusting process at the heaviest corner of the fan and proceed as shown in Figure 9-1.

Figure 9-1.

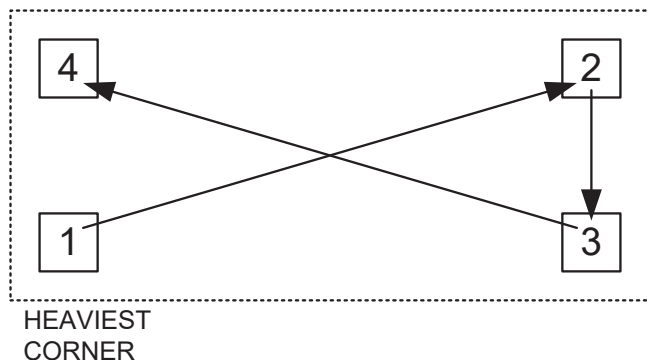
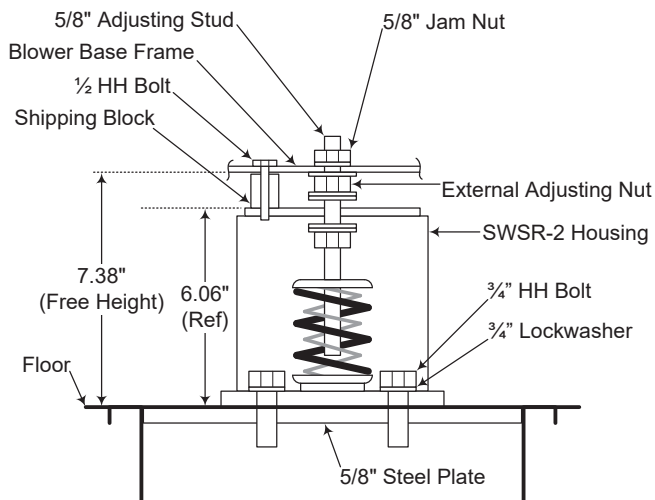


Figure 9-2.



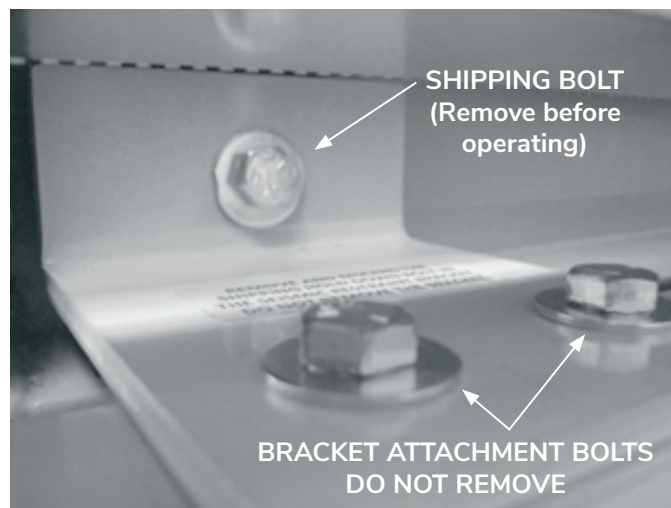
### 9.2 FanMatrix™ Isolators

ClimateCraft FanMatrix™ isolators (Figure 9-3) do not require adjustment. The shipping bolt should be removed before operation with the bracket left in place (Figure 9-4).

Figure 9-3.



Figure 9-4.



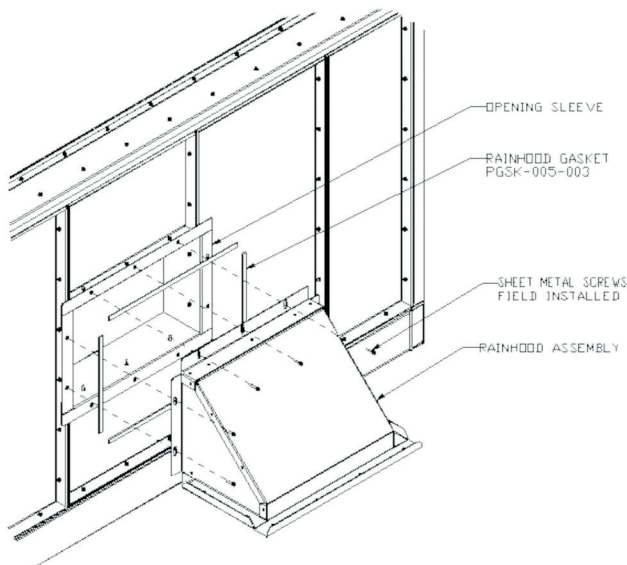
### 10.0 Rainhoods

Due to shipping size constraints, ClimateCraft generally ships rainhoods loose for field installation. The installation process differs slightly if there is more than one rainhood assembly.

#### 10.1 Single Rainhood

1. Install flat black gasket on opening sleeve using double-sided tape;
2. Apply continuous bead of sealant (Degaseal 2000) to gasket;
3. Align rainhood with opening sleeve;
4. Secure rainhood to opening sleeve with sheet metal screws provided, assuring continuous seal between gasket and rainhood.

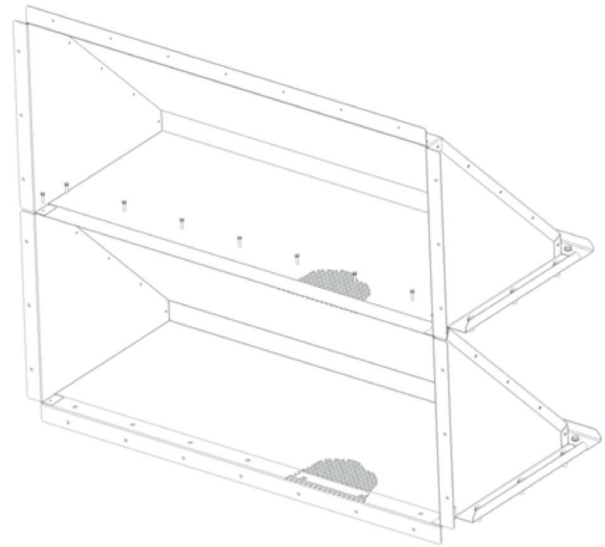
Figure 10-1.



#### 10.2 Stacked Rainhoods

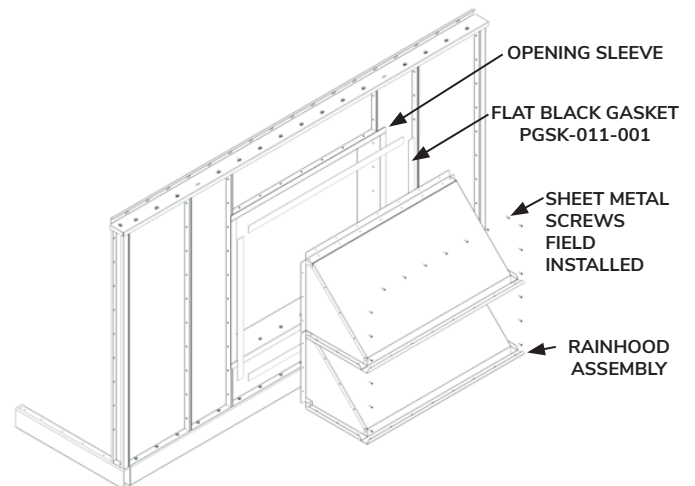
Prior to installation, stacked rainhoods must be assembled. This is so the edge of the birdscreen of an upper hood can be attached to the top of the hood immediately under. Figure 10-2 shows the birdscreen of the top rainhood being attached to the lower rainhood.

Figure 10-2.



Once the pre-assembly is completed, the rainhood assembly can be installed as shown below.

Figure 10-3.



### 11.0 Startup

Once the ClimateCraft air handling unit is fully assembled, installed and all utilities have been connected, the unit is now ready for operation. However, before doing so, check the following:

- Confirm building supply voltage matches the voltage for which the unit is wired. If the unit receives 575V power or the VFD has 100' or more wire between it and the motor, ClimateCraft recommends the insertion of a load reactor between the VFD and the motor;
- Check contractor-made pipe and wire penetrations for water tightness. Penetrations must be watertight to prevent water damage to the unit and building;
- Manually rotate fans to ensure free operation. Remove any dirt or debris that may have accumulated during installation;
- Verify all shipping bolts from fan bases have been removed so fan/motor assemblies are free floating on isolators;
- Check the fan bearing setscrews for tightness;
- Check alignment of sheaves and V-Belts (see maintenance section);
- Inspect all fasteners to ensure none have loosened during shipment or installation;
- Verify all filters are installed;
- Verify damper blades have free movement;
- Verify proper rainhood installation, if applicable.

#### 11.1 Fan Startup

- Connect power to the unit;
- Turn on disconnect;
- Momentarily energize fan contactor and verify fan rotation; (Typically, a fan rotation arrow is clearly marked on the side of the fan.) If the fan rotates the wrong direction, disconnect power and reverse rotation of the fan by interchanging any two of the three-phase power leads at the fan contactor. If the unit has multiple fans, take care not to interchange power leads for correctly operating fans.
- Repeat steps "b" and "c" until all fans have been verified.
- Check bearing and motor lubrication after the initial run.
- Variable pitch sheaves should be replaced with fixed pitch sheaves once the system is balanced. This will reduce the potential for belt failure and possibly quiet the unit.

A ClimateCraft startup form is available for recording startup conditions by contacting ClimateCraft Service by email at [support@climatecraft.com](mailto:support@climatecraft.com).

### 12.0 Maintenance

#### WARNING

Disconnect all electric power, including remote disconnects before servicing. Follow proper lockout/tagout procedures to ensure the equipment cannot be inadvertently energized. Verify with an appropriate voltmeter that all capacitors have discharged. Failure to disconnect power and discharge capacitors before servicing could result in death or serious injury.

#### 12.1 Belt-Driven Fan Maintenance

A scheduled maintenance program is required for proper operation of the belt-driven fans in your ClimateCraft air handling unit. A preventive maintenance schedule should be developed and coordinated with maintenance personnel. Following is a list of items that should be included in the preventive maintenance program:

- Verify fan is rotating in the intended direction;
- Remove dirt, oil and grease build-up on and around the fan and motor bearings and on shafts;
- Check sheave alignment;
- Check sheaves and belts for wear and proper tension;
- Check set screws on sheaves;
- Lubricate fan and motor bearings on a regular basis in accordance with usage guidelines.
- Verify integrity of extended lube lines, if installed. Extended lube lines should be securely attached and free of kinks, cracks or other damage.

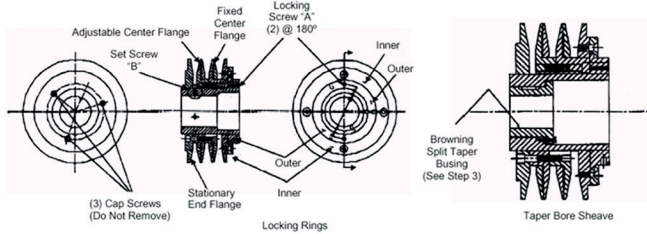
#### 12.2 Sheave Adjustment

##### MVP Variable Speed – Figure 12-1

- Slack off all belt tension by moving motor towards driven shaft until belts are free of grooves. For easiest adjustment, remove the belts from the grooves.
- Loosen both locking set screws A in outer locking ring.
- Adjust Sheave to desired pitch diameter by turning the outer locking ring. Three holes 120° apart are provided for a spanner wrench or drift for ease of turning.
- Any pitch diameter can be obtained within the sheave range. One complete turn of the outer locking ring will result in .233" in pitch diameter.
- Do not open "B" sheaves more than 4 ¾ turns for "A" belts or 6 turns for "B" belts.
- Do not open "C" sheaves more than 9 ½ turns
- Do not open "D" sheaves more than 13 turns.
- Do not open "5V" sheaves more than 6 turns.

- i) Do not open "8V" sheaves more than 8 ½ turns
- j) Tighten BOTH locking screws "A" in the outer locking ring to 100-110 LB-IN.
- k) Verify sheave alignment, replace belts and apply sufficient belt tension to prevent slippage.

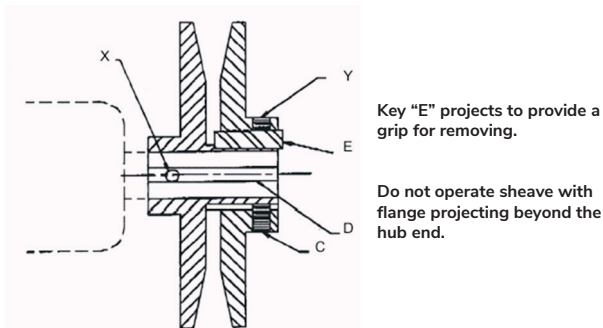
Figure 12-1.



## Single-Groove Variable-Pitch Key-Type Sheaves – Figure 12-2

- a) Loosen setscrews "Y" and "C" in moving parts of sheave and pull out external key "E". (This key projects a small amount to provide a grip for removing.)
- b) Adjust sheave pitch diameter for desired speed by opening moving parts by half or full turns from closed position. Do not open more than five full turns for "A" belts or six full turns for "B" belts.
- c) Replace external key "E" and tighten set screw "Y" over key and set screw "C" into keyway in fixed half of the sheave. Wrench torque 110 in. lbs. min – 130 in. lbs. max.
- d) Verify sheave alignment, install belts and adjust belt tension. (Do not force belts over grooves.)
- e) Future adjustments should be made by loosening the belt tension and increasing or decreasing the pitch diameter of the sheave by half or full turns as required. Readjust belt tension before starting drive.
- f) Be sure that all keys are in place and that all set screws are torqued properly before starting drive. Check set screws and belt tension after 24 hours of service.

Figure 12-2.

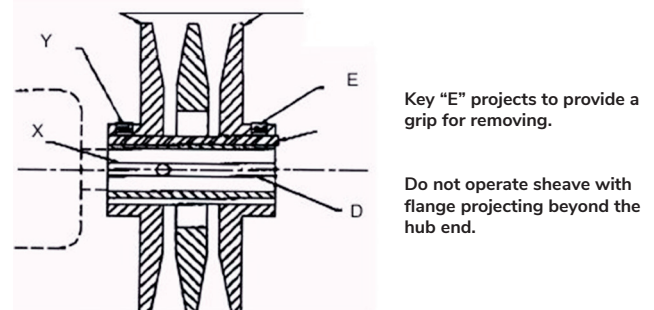


## Two-Groove Variable-Pitch Key-Type Sheaves – Figure 12-3

Each flange of the sheave has a small notch on the O.D. of the flange. This mark is located directly over the keyway on the two adjustable flanges and over one of the keyways on the non-adjustable (center) flange. To obtain proper adjustments:

- a) Loosen setscrews "Y" in moving parts of sheave and pull out external key "E". (This key projects a small amount to provide a grip for removing.)
- b) Tighten both adjustable flanges to their fully closed position.
- c) Locate the file mark over the keyway on the center flange.
- d) Open each adjustable flange until its notch is adjacent to the notch on the center flange. Be certain that neither adjustable flange is opened more than one full turn.
- e) From the position obtained in step 4, open each adjustable flange the same number of full or half turns until the desired flange spacing is obtained. Do not open more than five full turns for "A" belts or six full turns for "B" belts.
- f) Replace external key "E" and tighten setscrews "Y" over key. Wrench torque 110 in. lbs. min. – 130 in. lbs. max.
- g) Verify sheave alignment, install belts and adjust belt tension (Do not force belts over flanges).
- h) Future adjustments should be made by loosening the belt tension and increasing or decreasing the pitch diameter of the sheave by half or full turns as required. Readjust belt tension before starting drive.
- i) Two groove sheaves must have both halves adjusted by the same number of turns from the position established in step 4 to insure the same pitch diameter.
- j) Be sure that all keys are in place and that all set screws are torqued properly before starting drive. Check set screws and belt tension after 24 hours of service.

Figure 12-3.



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### 12.3 Belt Adjustment

Improper belt fitment may cause pulley misalignment, excessive power consumption, reduced belt life, premature bearing wear, and noise. To check belt tension, press the belt firmly at the center of the span to check deflection objective (Figure 12-4). For quiet operation, the drive belts should be as loose as possible without slippage under peak load conditions. If slippage is occurring, the smaller pulley will appear noticeably warmer to the touch than the larger pulley. Readjust the belt tension to achieve uniform pulley temperatures.

Periodically inspect belts for signs of wear, cracking, stretching, glazing, oil/grease contamination, etc. Damaged belts must be replaced. If multiple belts are used, replace all with matched sets.

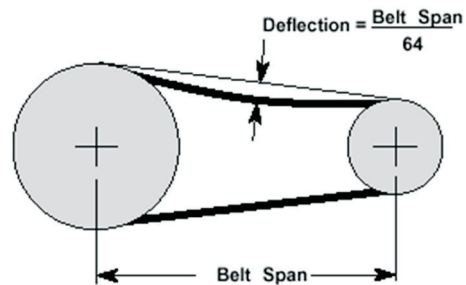
### NOTICE

Do not mix old and new belts.

To replace belts, remove belt guards and loosen motor hold down bolts. Relieve belt tension by loosening belt tension adjustment screw on motor base. This will allow sufficient slack to remove belts with relative ease. Remove the belts and replace them with new belts of the same specification. When re-tensioning belts, be sure to evenly adjust belt tension adjustment bolts to keep motor shaft parallel with fan shaft.

Following belt installation, slide the motor back to original position. Tighten the motor hold down bolts. Use the motor adjustment screws to achieve proper deflection and re-tighten when deflection requirements are satisfied. Belts become seated in pulley grooves after a period of operation, usually within a 24 hour period. Check belt tension after the first 8 hours of operation and adjust as necessary. Check at least twice more during the 24 hour period. To align pulleys, locate the motor pulley on the motor shaft. Adjust the pulley along the motor shaft or by moving the entire motor along the motor mounting bracket. Use a carpenter's square to achieve pulley alignment. Rest the shorter leg of the square along the case of the motor. Use the square's longer leg or use a straight edge or string to determine that the pulleys are aligned and then secure the fixing bolts.

Figure 12-4.



### 12.4 Sheave Installation and Alignment

- Remove the protective coating from the end of the fan shaft and check that it is free of nicks and burrs.
- Check fan and motor shafts for parallel and angular alignment.
- Slide sheaves on shafts – do not drive sheaves on, this may result in bearing damage.
- Align fan and motor sheaves with a straight-edge and tighten.
- Place belts over sheaves. Do not pry or force belts, this could result in damage to the cords in the belts.
- Adjust the tension until the belts appear snug. Run the fan for a few minutes to allow the belts to “Set” properly.
- With the fan off, adjust the belt tension by moving the motor base. (See section 12.3). When in operation, the tight side of the belts should be in a straight line from sheave to sheave with a slight bow on the slack side.

Figure 12-5.

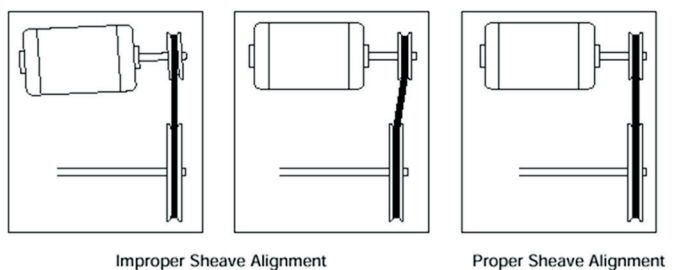
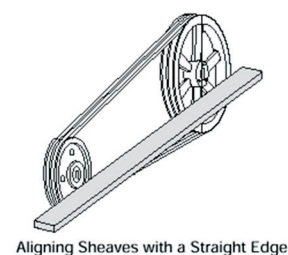


Figure 12-6.



## 12.5 Bearing Lubrication

There is a direct relationship between bearing life and bearing lubrication practices. Lubricating fan bearings at proper intervals will enhance bearing life. Recommended lubrication intervals for belt-driven fans are contained in Tables 12-1 and 12-2. Severe operating conditions such as temperature and/or humidity extremes can require more frequent lubrication. Good maintenance practice dictates that frequent inspections should determine the frequency of lubrication. In most cases the following tables are applicable. To insure longevity in your equipment contact the fan manufacturer to verify the type of lubricant to use. **Do not mix lubricant types.** When lubricating fan bearings, care must be taken to guard against damaging seals. To avoid seal damage, the fan must be rotating when lubricant is being added. Grease must be applied slowly. If seals are damaged due to over lubrication, replace the bearings immediately.

**Table 12-1. Recommended Fan Bearing Lubrication Schedule - Standard Grease**

Lubrication Schedule in Months*								
Fan RPM	Bearing Bore (inches)							
	1/2 - 1	1-1/8 - 1-1/2	1-5/8 - 1-7/8	1-15/16 - 2-3/16	2-7/16 - 3	3-3/16 - 3-1/2	3-15/16 - 4-1/2	4-15/16 - 5-1/2
To 250	12	12	12	12	12	12	10	9
500	12	12	10	10	8	7	5	5
720	12	9	8	7	6	4	3	3
1000	12	7	6	5	4	3	2	1
1250	12	6	5	4	3	2	1	0.75
1500	12	5	4	3	2	1	0.5	X
2000	12	3	2	2	1	0.5	0.25	X
2500	12	2	2	1	0.5	0.25	X	X
3000	12	2	1	0.5	0.25	X	X	X
3500	12	1	0.5	0.25	X	X	X	X
4000	12	0.5	0.25	X	X	X	X	X
5000	12	0.25	X	X	X	X	X	X
# of Shots	4	8	8	10	16	25	41	57

\*Lubrication interval is based upon 12-hours of operation per day and a maximum of 160°F housing temperature. For 24-hours per day of operation, divide interval by half.

\*\*Lubricant should be added with shaft rotating and until clean grease is seen purging from the bearing.

The lubrication interval may be modified based upon condition of the purged grease.

If bearing is not visible to observe purged grease, lubricate with number of shots indicated for bore size.

Consult factory for lubrication intervals under severe operating conditions such as high temperatures, moisture, dirt or excessive vibration.

Lubricant should be a high quality lithium complex grease conforming to NLGI Grade 2.

ClimateCraft recommends **Mobilux EP-2**.

Storage periods of 3-months or longer require monthly shaft rotation and purging of the grease prior to startup.

Do not allow grease on sheaves or belts.

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**Table 12-2. Recommended Fan Bearing Lubrication Schedule - Synthetic Grease**

Fan RPM	Lubrication Schedule in Months*							
	Bearing Bore (inches)							
	1/2 - 1	1-1/8 - 1-1/2	1-5/8 - 1-7/8	1-15/16 - 2-3/16	2-7/16 - 3	3-3/16 - 3-1/2	3-15/16 - 4-1/2	4-15/16 - 5-1/2
To 250	12	12	12	12	12	12	12	12
500	12	12	12	12	12	12	12	12
720	12	12	12	12	12	12	10	8
1000	12	12	12	12	12	9	6	5
1250	12	12	12	12	9	6	4	2
1500	12	12	12	10	7	4	2	X
2000	12	9.5	7	6	6	1.5	0.5	X
2500	12	7	4	4	1	0.5	X	X
3000	12	5	2	2	0.5	X	X	X
3500	12	3	1	0.75	X	X	X	X
4000	12	2	0.25	X	X	X	X	X
5000	12	1	X	X	X	X	X	X
# of Shots	4	8	8	10	16	25	41	57

\*Lubrication interval is based upon 12-hours of operation per day and a maximum of 160°F housing temperature. For 24-hours per day of operation, divide interval by half.

\*\*Lubricant should be added with shaft rotating and until clean grease is seen purging from the bearing.

The lubrication interval may be modified based upon condition of the purged grease.

If bearing is not visible to observe purged grease, lubricate with number of shots indicated for bore size.

Consult factory for lubrication intervals under severe operating conditions such as high temperatures, moisture, dirt or excessive vibration.

Lubricant should be a high quality lithium complex synthetic grease conforming to NLGI Grade 2.

ClimateCraft recommends **Mobilith SHC-100**.

The use of non-synthetic grease will decrease lubrication intervals by approximately 3 times.

Storage periods of 3-months or longer require monthly shaft rotation and purging of the grease prior to startup.

Do not allow grease on sheaves or belts.

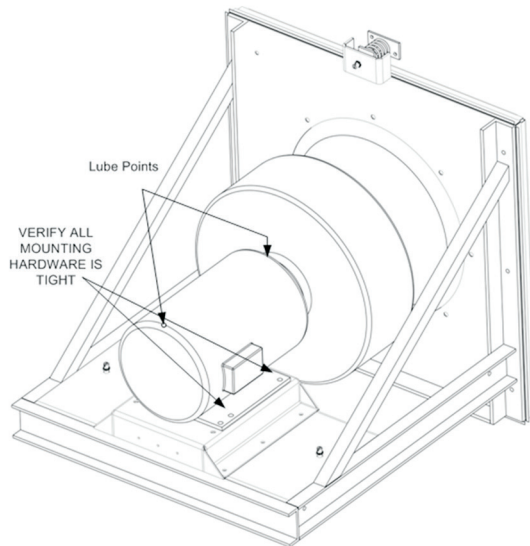
### Motor Bearing Lubrication

Motor maintenance generally requires only cleaning and lubrication. Cleaning should be limited to exterior surfaces. Removing dust and grease on the motor housing assists cooling. Never wash-down a motor with high pressure spray. Greasing motors is only intended when fittings are provided. Many fractional motors are permanently lubricated for life and require no further lubrication. Motors supplied with grease fittings should be greased in accordance with the manufacturer's recommendations. When motor ambient temperature does not exceed 104°F (40°C), the grease should be replaced after 2000 hours of running time.

### 12.6 FanMatrix™ Maintenance

ClimateCraft FanMatrix™ air handling units require less maintenance than air handling units with belt-driven fans, but they are not without maintenance requirements.

1. Remove accumulation of dirt and oil buildup on or around the motor bearings.
2. Verify all mounting hardware is tight.
3. Verify fan is floating freely and not restricted in movement.
4. Inspect isolation springs for loose or broken springs and replace.



For your FanMatrix™ motor to run reliably a relubrication schedule must be established and maintained. Please use the following guidelines to build your FanMatrix™ maintenance program:

Recommended Grease: **Polyrex EM (Mobil)**

Compatible Greases: Texaco Polystar, Rykon Premium #2, Penzoi Pen 2 Lube, Chevron SRI

**Table 12-3. Relubrication Interval**

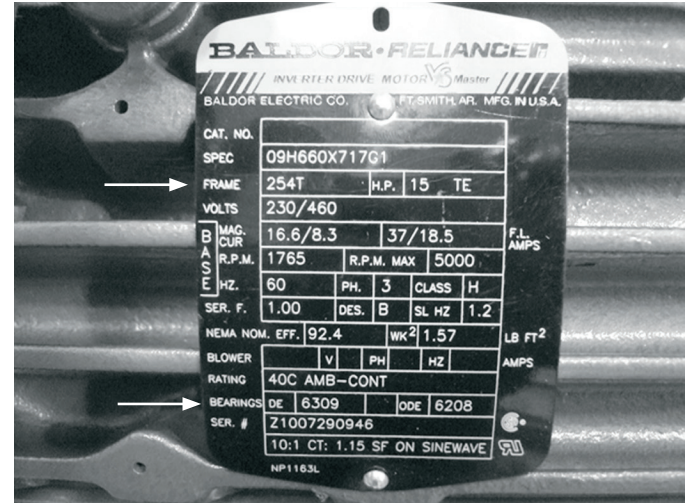
NEMA (IEC) Frame Size	Rated Speed (RPM)			
	3600	1800	1200	900
up to 210 including (132)	5500 hrs	12000 hrs	18000 hrs	22000 hrs
Over 210 to 280 including (180)	3600 hrs	9500 hrs	15000 hrs	18000 hrs
Over 280 to 360 including (225)	2200 hrs*	7400 hrs	12000 hrs	15000 hrs
Over 360 to 5000 including (300)	2200 hrs*	3500 hrs	7400 hrs	10500 hrs

\*Relubrication intervals are for ball bearings

\*\*For operation at speeds >3600RPM, contact ClimateCraft for relubrication recommendations

Locate motor frame size and bearing number on motor nameplate as shown in Figure 12-7.

**Figure 12-7.**



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**Table 12-4. Service Conditions**

Severity of Service	Hours per day of Operation	Ambient Temperature Maximum	Atmospheric Contamination	Service Interval Multiplier
Standard	8	104°F (40°C)	Clean, little corrosion	1.0
Severe	16+	122°F (50°C)	Moderate dirt, corrosion	0.5
Extreme	16+	122°F (50°C)* or Class H Insulation	Severe dirt, abrasive dust, corrosion, heavy shock, vibration	0.1
Low Temperature		<-20°F (<-29°C)**		1.0

\*Special high temperature grease recommended (Dow Corning DC44). Dow Corning DC44 is **NOT COMPATIBLE** with other grease types. Thoroughly purge and clean bearing and cavity before using.

\*\*Special low temperature grease recommended (Aeroshell 7).

**Table 12-5. Bearing Sizes and Types**

NEMA Frame Size	Bearing Description [Large bearings (Shaft End) in each frame size]			
	Bearing	Weight of Grease to Add in oz (gm)	Volume of Grease to Add	
			in <sup>3</sup>	Teaspoons
56 to 140	6203	0.08 (2.4)	0.15	0.5
140	6205	0.15 (3.9)	0.20	0.8
180	6206	0.19 (5.0)	0.30	1.0
210	6307	0.30 (8.4)	0.60	2.0
250	6309	0.47 (12.5)	0.70	2.5
280	6311	0.61 (17.0)	1.20	3.9
320	6312	0.76 (20.1)	1.20	4.0
360	6313	0.81 (23.0)	1.50	5.2
400	6316	1.25 (33.0)	2.00	6.6
440	6319	2.12 (60.0)	4.10	13.4
5000 to 5800	6328	4.70 (130)	9.20	30.0
5000 to 5800	NU328	4.70 (130)	9.20	30.0
360 to 449	NU319	2.12 (60.0)	4.10	13.4

**NOTE:** Not all bearing sizes are listed. For intermediate bearing sizes, use the grease volume for the next larger size bearing.

### Relubrication Procedure:

1. Verify grease being added is compatible with the grease already in the motor.
2. Remove grease outlet plug.
3. With motor stopped, clean all grease fittings with clean cloth.
4. Add recommended amount of grease (Table 12-5).
5. Operate motor for 15 minutes with grease plug removed. This allows excess grease to purge.
6. Reinstall grease outlet plug.



## CAUTION

Over-Lubrication can cause excessive bearing temperatures, premature lubrication breakdown and bearing failure. Do Not over-lubricate motor.

### 12.7 ECM Fan Adjustments and Maintenance

ClimateCraft's ECM Fan Arrays require little adjustment or maintenance, however; there are a few items to consider.

- a. Electronics are internal to the motor, so little maintenance is required. ECM or Electronically Commutated Motors are external rotor DC motors fitted with permanent magnets to provide a very efficient, quiet and compact design.
- b. Integrated power electronics for efficient fan speed and control operation. This is done without an external variable frequency drive.

**Warning! ECM motors can store and carry dangerous current/voltages during and after ECM motor shutdown. Please adhere to the warnings and cautions in the next paragraph.**



#### **Danger due to electric current!**

- It is generally forbidden to carry out work on electrical live parts. Protection class of the device when open is IP00! It is possible to touch hazardous voltages directly.
- The rotor is not protected against indirect contact neither by supplementary or reinforced insulation nor by connection to safety-earth in accordance with EN60204-1, therefore the motor/fan must be installed so that it is not touchable.
- When the motor runs independently due to air flowing through or if it continues to run down after being turned off, dangerous voltages of over 50 V can arise on the motor internal connections through operation of the generator.
- The safe isolation from the supply must be checked using a **two-pole** voltage detector.
- Even after disconnecting the main voltage, life-threatening charges can appear between the protective ground "PE" and the voltage supply.
- The protective earth is conducting high discharge currents (dependent on the switching frequency, current-source voltage and motor capacity). Earthing in compliance with EN specifications shall therefore be observed even for testing and trial conditions (EN 50 178, Art. 5.2.11). Without earthing, dangerous voltages can be present on the motor housing.
- Maintenance work may only be carried out by suitably qualified personnel.

#### **Waiting period at least 3 minutes!**

- Through use of capacitors, danger of death exists even after switching off the device through directly touching the energized parts or due to parts that have become energized due to faults.

- The controller housing may only be removed or opened when the power line has been switched off and a period of three minutes has elapsed since switching it off.



#### **Attention, automatic restart!**

- The fan/motor may switch on and off automatically for function reasons.
- After power failure or main disconnection an automatic restart of the fan takes place after voltage return!
- Wait for the fan to come to a complete standstill before approaching it!
- The exterior rotor turns during operation of the external rotor motor!



#### **Danger of being sucked in!**

Do not wear loose or hanging clothing, jewelry, etc., tie together long hair and cover it.



#### **Attention, hot surface!**

Temperatures of above 85°C can occur on the motor surfaces, especially on the controller housing!

### 12.8 ECM Fan Disposal

Fan assembly disposal must be done by properly trained personnel in an environmentally acceptable method that complies with all governmental codes, laws, and regulations that have jurisdiction. This may require separation of different material types and the use of a recycling/disposal contractor.

### 12.9 UV Light System Maintenance

This custom air handling unit may contain UV-C lamps mounted to the downstream side of a hydronic coil or direct expansion evaporative coil. ClimateCraft installs UV light kill switches on all doors entering into a unit section that contains UV lamps. Prior to cleaning, replacing or any maintenance on the UV-C Light system or in a section that contains UV-C Lighting, ensure that power is disconnected from the unit and the UV-C system is not energized. Precaution needs to be taken when replacing UV-C emitters and starters. Unintended use of the equipment or damage to the unit housing may result in the escape of dangerous UV-C radiation.

UV-C exposure may, even in small doses cause harm to the eyes or skin. Units that are obviously damaged must not be operated or energized. The appliance must be disconnected from supply power before replacing the UV-C bulbs. Do not disable or bypass the kill switches on any unit entry doors.



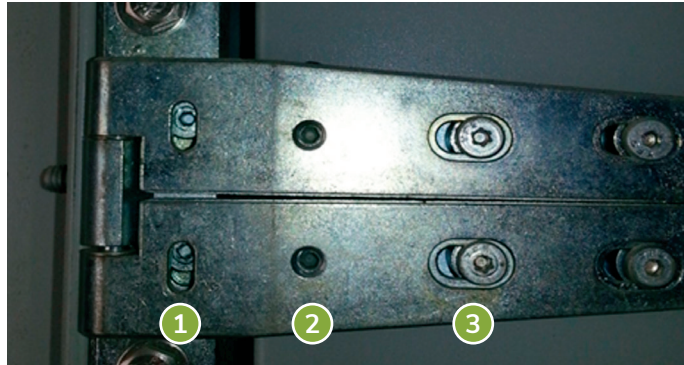
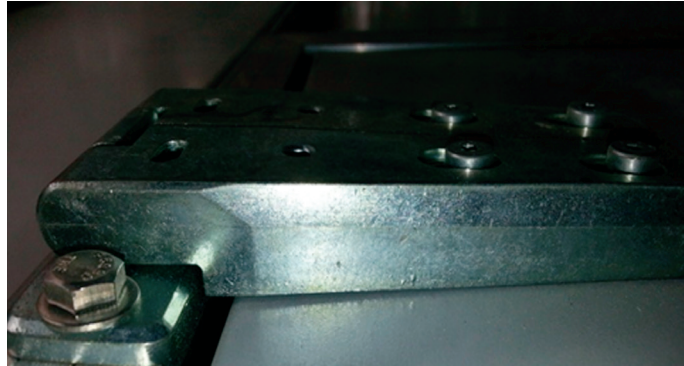
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## 12.10 Door Adjustment

Occasionally due to racking occurring in transit or uneven storage or placement, the service doors may require adjustment. The following is a step-by-step process for adjustment of the air handler service doors:

<p>To adjust the ClimateCraft Door vertically or horizontally only one tool is required; a 1/8" Allen Wrench (tool shown in photo).</p> <p>To tighten the door handles use two 9/16" wrenches.</p>	
<p>On inward opening doors a T-27 is needed to adjust the location of the roller cam. Using the same T-27 to tighten the set bolt on the roller cam to lock in location desired for proper operation.</p> <p><b>A T-27 is a torque drive socket not to be confused with a star drive.</b></p>	
<p>Using an 1/8" Allen Wrench:</p> <ol style="list-style-type: none"><li>1. Vertical Adjustment</li><li>2. Hinge Pressure Adjustment</li><li>3. Horizontal Adjustment</li></ol>	
<p>The Hinge Pressure Adjustment will allow additional pressure to be placed on the hinge side of the door to eliminate any leaks.</p>	

### 12.11 Field Penetration for Electrical Wiring

<p>Determine size and location of penetration from outside of air handling unit.</p>	
<p>Drill, then hole-saw desired hole in proper location first from outside of unit.</p> <p>Repeat process on interior skin from inside unit.</p>	
<p>Make continuous putty ring on two reducing washers. One for outside of unit and one for inside of unit.</p>	

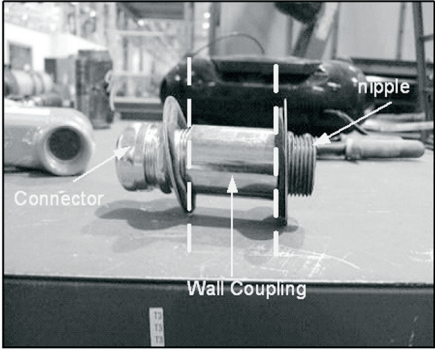

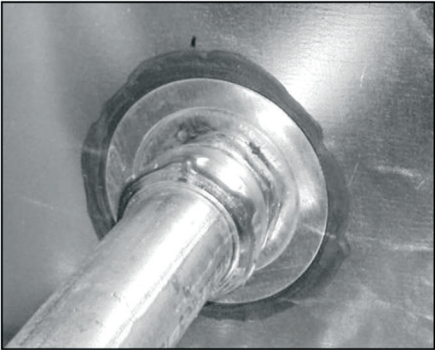
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Continued from previous page.

<p>When finished, assembled coupling will appear as shown.</p>	
<p>Insert wall coupling into panel from outside of unit with appropriately sized nipple.</p> <p>Slide reducing washer over nipple and attach a second wall coupling to nipple.</p>	
<p>Attach connector to wall coupling from inside unit with a reducing washer between connector and wall panel.</p> <p>NOTE: Connector will vary depending on type of conduit used.</p>	

### 13.0 Cleaning Guide - Unit with 2" Recessed Floor Units Only

Proper cleaning procedures must be followed to ensure all water, dirt and debris are successfully removed from the AHU. Cleaning the AHU properly is to assure that no standing water, dirt, and debris are left behind that may create conditions for mold or micro-bacterial growth within the AHU. Refer to NADCA ACR-2005, Assessment, Cleaning and Restoration of HVAC systems 2001

#### 13.1 Cleaning Materials

Cleaning materials can consist of brushes, sponges, mops, cloths, vacuum, and a spray hose to clean the interior of the AHU. High pressure sprayers are not recommended as high-water pressure spray can damage coils and enter areas between walls, component supports and air-seals that may create mold or bacterial growth. While cleaning, take care to keep water away from any material that may be damaged or cause damage such as air filters, electrical circuits including supply and exhaust fan motors, electronics, circuit boxes, breakers, actuators etc.

#### 13.2 Cleaning Solutions

Cleaning solutions may consist of a simple unscented soap and water solution such as Dawn or Tide, unscented germicidal cleaners such as Botaniclean, Zep or Fabuloso.

Heavy duty degreasers such as Simple Green, Mean Green, Purple Power and others are not recommended. Using bleach is also not recommended. Use of cleaning agents should adhere to federal, state, and local codes before using any cleaning detergent, germicidal or antimicrobial agents. Cleaning agents should be registered with the EPA and used per the manufacturer's recommendations.

#### 13.3 Floor and Walls

ClimateCraft's washable unit consists of a 2" recessed floor base of either smooth aluminum or aluminum treadplate construction. The 2" recessed floor is designed to collect water, dirt, debris, cleaning solutions and properly drain those solutions through the drains provided in the units sunken floor base and condensate drains. Disposal and drainage of debris and cleaning solutions should adhere to federal, state, and local codes.

High pressure water spray into the seams of the walls is not recommended. Use of vacuum collection devices to remove dirt and debris is recommended, however; to eliminate the possibility of building air stream contamination, vacuum devices should be equipped with a minimum efficiency HEPA filter.

#### 13.4 Fans, Motors, Filters

Direct water spray or application of cleaning solution onto motors, damper actuators, electrical boxes, electronics, and air filters is not recommended. Cleaning of motors and fans must be done with light wipe down performed with damp cleaning cloths and without rinsing with water. Filter racks can be cleaned with cleaning solution and water if filter media is removed prior to cleaning. Dampers and air blenders can be cleaned with cleaning solution and water taking care not to expose damper actuators to water.

**NOTE: It is advisable to assure all junction boxes are sealed with caulk at unused knockout locations and any blast gates be sealed before cleaning the unit.**

**NOTE: Please pay attention to all warning labels related to components or areas of the AHU that should not be washed down or sprayed directly with cleaning solutions or water!**

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### 14.0 Troubleshooting Guide

Symptom	Source	Condition	Solution
Vibration	Drive Assembly	Fan and motor pulleys not aligned	Align pulleys per Section 12.4 of this manual.
		Fan and motor shafts not parallel	Align motor shaft with fan shaft by adjusting the motor position and/or installing shims.
		Belt slippage	<ul style="list-style-type: none"> <li>Replace worn or stretched belts or pulleys.</li> <li>Clean dirty belts with soap and water.</li> <li>Do not use a belt dressing of any kind. If belts are usable, check tension and adjust as required.</li> <li>Inspect the belts to determine if belt wear is uniform and if the belt lengths are equal. If not, replace the belts.</li> <li>Check the motor and fan to determine if all hold down bolts are secure.</li> <li>Check the belt model number to ensure proper size.</li> </ul>
		System not balanced	<ul style="list-style-type: none"> <li>Check alignment of shaft, motor and pulleys.</li> <li>Adjustable pitch pulleys with motors over 15 hp motors are especially prone to unbalance. Check wheel balance, rebalance if necessary.</li> </ul>
		Belts loose	Adjust belt tightness. Replacement belts should be matched set.
		Pulley wobble	<ul style="list-style-type: none"> <li>Check the integrity and tightness of the bushing. Tighten or replace as needed.</li> <li>On pulleys without bushings, make sure set screws are properly tightened.</li> </ul>
		Worn pulley	Replace pulleys.
	Bearings	Lack of lubrication	<ul style="list-style-type: none"> <li>Lubricate as required.</li> <li>Increase the lubrication frequency and inspect the seals for excessive leaking.</li> <li>Make sure the lubricant is appropriate for application.</li> <li>Inspect the lubricant for contaminant-induced friction causing excessive lubricant evaporation. Purge system per this manual and replace with fresh lubricant. (Cleaning bearings may be necessary).</li> <li>Make sure bearings are securely on shaft.</li> </ul>
		Bearing wear	Frequently inspect the bearings for degree of wear and replace bearings as required.
	Imbalance	Improper belt tension	<ul style="list-style-type: none"> <li>Check belt condition.</li> <li>Replace worn or cracked belts.</li> <li>Adjust the belt tension per this manual to achieve proper deflection.</li> </ul>
		Dirt on impeller	<ul style="list-style-type: none"> <li>Clean dirt from impeller and shaft.</li> <li>Inspect impeller for pit corrosion.</li> <li>Make sure shaft is properly aligned.</li> </ul>
Noise	Vibration	See previously identified conditions	Refer to Vibration symptoms above.
	Inlet Ring	Impeller hitting inlet ring	<ul style="list-style-type: none"> <li>Center impeller on inlet ring.</li> <li>Repair or replace damaged impeller.</li> </ul>
	Housing	Debris in housing	<ul style="list-style-type: none"> <li>Remove debris.</li> <li>Tighten loose parts.</li> </ul>
	Motor	Hum	<ul style="list-style-type: none"> <li>Check motor bearings and correct as required.</li> <li>Verify lead-in cable is secure.</li> <li>Verify correct motor phasing.</li> </ul>
	Air Velocity	Duct leaks, damaged fins, coil leaks	Repair or replace as required.
		Registers or grills too small for application	Enlarge registers/grills as required.
		Compressed air leak	Repair or replace pneumatic lines, fittings, actuators, controls or gauges as needed.
		Coil has insufficient face area for application	Restrict application or select a new coil as required.
		Duct too small for application	Correct as required.
	Obstruction	Dampers	Verify proper damper adjustment and operation.
		Duct expansion	Eliminate sudden expansion/contraction of duct.
	Pulsation/surge	Restricted system	Eliminate restrictions.
		Fan pulsations and ducts vibrating at same frequency	<ul style="list-style-type: none"> <li>Verify fan speed.</li> <li>Reorient duct work to change operating frequency.</li> </ul>

Continued from previous page.

Symptom	Source	Condition	Solution
CFM too low	Filters	Clogged, filter selection	<ul style="list-style-type: none"> <li>Verify filter is correct for application.</li> <li>Replace clogged filters.</li> </ul>
	Coil	Dirt clogged	Clean coil
	Fan	Fan running backward	<ul style="list-style-type: none"> <li>Reverse fan rotation.</li> <li>Swap two leads of a three phase motor.</li> </ul>
		Fan speed too low	Adjust pulley pitch diameter.
		Cut-off missing or not properly installed	Inspect cut-off installation and install per vendor instructions.
		Fan inlet obstruction	<ul style="list-style-type: none"> <li>Re-sheave fan/motor to increase fan speed.</li> <li>Correct obstructions.</li> </ul>
		Impeller not centered on inlet collar	Adjust as required.
	Duct System	Closed dampers	Open dampers and inspect operators.
		Closed registers	Open registers, check adequacy of lining material. Correct as required.
		Leaks in supply	Repair as needed.
		System more flow restricted than expected	Re-sheave fan/motor to increase fan speed.
	Unit	Leaks in fan airseal	Inspect for leaks around fan outlet through cabinet bulkhead and repair as required.

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## 14.1 Surge

Surge is caused when the pressure on the fan is high relative to the airflow at the speed it is running. Increasing the flow and keeping the pressure constant will move a fan out of its surge area. Reducing the pressure and keeping the flow constant will also move a fan out of its surge area. Setting the VFD to a lower setting will not keep a fan out of surge. It will reduce both the flow and the pressure and is more likely to make the problem worse than better.

Surge can be identified by observing the fan. If the fan is shaking visibly it is most likely in surge. This shaking is often mistaken for fan vibration due to fan balance. It usually takes instrumentation to determine whether or not a fan is out of balance, so if you can see the fan shaking, it is in surge. A fan in surge also produces pressure pulsations which can often be identified by feeling the ductwork or the outside of the air handler cabinet. If pulsations can be felt with your hand on the outside of the cabinet, the fans could be in surge. The pulsations will be more noticeable on the inside of the cabinet. It is more difficult to feel the pressure pulsations on low pressure fans than it is on fans running at high pressure (>5" WC).

Fans should not be allowed to run in surge as damage to the motors and bearings can occur from long term operation in surge. Damage to the motors and bearings of your ClimateCraft air handling unit resulting from operation in surge is not covered by the ClimateCraft Limited Warranty. The fans also produce excessive noise and the pressure pulsations can produce objectionable noise and vibrations in other building elements.

Variable air volume systems will usually go into surge under low airflow operation. Depending on the design of the air distribution system, the duct static pressure set point and the selection of the fan, the minimum airflow that the fans can deliver before going into surge will be 30% to 50% of the design airflow.

Surge is often noticed when a building is under commissioning and not occupied. Under those conditions the building demand for air is low and the system may want to operate below the minimum which will result in fan surge. When the building is occupied and has internal loads the problem often goes away.

If these conditions exist, ClimateCraft recommends reducing the duct static pressure set point. This will change the relationship between flow and pressure in your system and will often keep the fans out of surge. As the building becomes occupied you can increase the duct pressure set point to make sure you have enough air in the extremes of your duct runs. It is a good idea to keep this set point as low as possible as your fan energy consumption will be lower the lower you keep it. If you have a FanMatrix™ fan system installed in your air handler you can also shut one or more of the fans off until the building become occupied.

If the problem persists after the building is occupied you may have a design or construction problem with the system. Consult your building design professional and ClimateCraft for solutions to the problem.

Continued on next page.

## 14.2 Dwyer Digihelic DHII Programming

Digihelic Model DHII-007 (0-10" w.c.)			Digihelic Model DHII-008 (0-25" w.c.)		
Fan Size	Y dim	CFM @ Full Range	Fan Size	Y dim	CFM @ Full Range
12	0.32	3991	12	0.32	6311
15	0.32	3991	15	0.32	6311
16	0.38	4860	16	0.38	1684
18	0.47	5951	18	0.47	9409
20	0.56	7123	20	0.56	11262
22	0.69	8768	22	0.69	13864
24	0.83	10541	24	0.83	16667
27	1.01	12758	27	1.01	20173
30	1.24	15647	30	1.24	24740
33	1.48	18768	33	1.48	26975
36	1.79	22708	36	1.79	35904
40	2.15	27264	40	2.15	43108
44	2.60	32954	44	2.60	52106
49	3.11	39387	49	3.11	32276
54	3.76	47585	54	3.76	75238
60	4.53	57415	60	4.53	90781
66	5.43	68819	66	5.43	108812
73	6.63	84014	73	6.63	132837

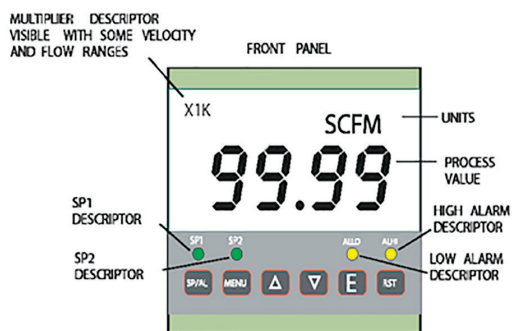
K-Factors (Correction Factor for Altitude)				
Elevation (ASL)	Temperature (°F)			
	50	70	90	110
0	0.981	1.000	1.019	1.037
500	0.990	1.009	1.028	1.047
1000	0.999	1.018	1.037	1.056
1500	1.008	1.027	1.047	1.066
2000	1.017	1.037	1.056	1.076
2500	1.027	1.047	1.066	1.085
3000	1.036	1.056	1.076	1.095
3500	1.045	1.066	1.086	1.105
4000	1.055	1.076	1.096	1.115
4500	1.065	1.086	1.106	1.126
5000	1.075	1.096	1.116	1.136
5500	1.085	1.106	1.127	1.147
6000	1.095	1.117	1.137	1.158
6500	1.106	1.128	1.148	1.169
7000	1.116	1.138	1.160	1.180

1. The fan sizes referenced above are for ClimateCraft FanMatrix™ fans.
2. The "CFM @ Full Range" is a programming parameter used to scale the 4-20mA output signal when interfaced with a building automation system. The values given are for a K-factor of 1. See below for programming instructions.
3. **Do not use 24VDC power to power the DHII if the 4-20mA output signal is to be interfaced to a building automation system. Only use the 100-240VAC power option on the DHII.**
4. Refer to Dwyer Bulletin B-31 for installation and operating instructions of the DHII Digihelic differential pressure controller. This bulletin is available at [www.dwyer-inst.com](http://www.dwyer-inst.com).
5. Refer to diagram for key function.

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### KEY FUNCTIONS

	HOME POSITION FUNCTION	MAIN MENU FUNCTION	SUB MENU FUNCTION
SP/AL	Sequences the display through SET POINT and ALARM settings	Return to home position	Return to home position
MENU	Allows access to the menus	Return to home position	Return to previous menu
UP ARROW		Sequences through menus	Increments a value
DOWN ARROW		Sequences through menus	Decrements a value
ENTER	Displays full scale range of unit	Enter into SUB MENU	Changes a value or setting. Press ENTER and display will blink. Adjust with UP or DOWN arrows. Press ENTER to store. Display will stop blinking.
RESET	Clears or resets an Alarm (alarm set for manual reset)		Peak/Valley SUB MENU resets display to present value.

**To program the DHII to display flow in CFM and set the Y dim (above) and K factor (above) complete the following:**

Press the menu key once. The display should read  $SECr^{MENU}$

Hit the down arrow key once. The display should read  $OPER^{MENU}$

Hit the enter key once. The display should read  $PREs^{INWC}$

Hit the down arrow key twice. The display should read  $FLOr^{SCFM}$

Hit the enter key once and the above display should start blinking.

Hit the enter key again to save this value and set the DHII to read out in flow in SCFM.

Hit the down arrow key once. The display should read  $FLOr^{HI}$

Hit the enter key once and the above display should start blinking.

While the display is blinking, hit the down arrow key once and the display should change to  $FLOr^{LO}$

Now, hit the enter key once to save this setting. The display should stop blinking.

Hit the down arrow key once. The display should read  $1.00^{KFAC}$

Hit the enter key once and the above display should start blinking.

While the display is blinking, hit the down or up arrow key until the display matches the K factor for your application, as listed above.

Now, hit the enter key once to save this setting. The display should stop blinking.

Hit the down arrow key again. The display should read  $ArEA^{CIR}$

Hit the enter key once and the above display should start blinking.

While the display is blinking, hit the down arrow key once and the display should change to  $ArEA^{RECT}$

Now, hit the enter key once to save this setting. The display should stop blinking.

Hit the down arrow key once. The display should read  $1.00^{XDIM}$  (default).

If not at default then hit the enter key once and the above display should start blinking.

While the display is blinking, hit the down or up arrow key until the display reads  $1.00^{XDIM}$

Now, hit the enter key once to save this setting. The display should stop blinking.

Hit the down arrow key once. The display should read  $1.00^{YDIM}$  (default).

Hit the enter key once and the above display should start blinking.

While the display is blinking, hit the down or up arrow key until the display matches the Y dim for your application, as listed above.

Now, hit the enter key once to save this setting. The display should stop blinking.

Hit the menu key twice to back out to the main display. The DHII should now be accurately reading flow in CFM.

## 15.0 Useful Equations

### 15.1 General Equations

**Total Pressure** = Velocity Pressure + Static Pressure

**Velocity Pressure** = (Velocity / 4005)<sup>2</sup>

**CFM<sub>2</sub>** = CFM<sub>1</sub> \* (RPM<sub>2</sub> / RPM<sub>1</sub>)

**Static Pressure<sub>2</sub>** = Static Pressure<sub>1</sub> \* (Velocity<sub>2</sub> / Velocity<sub>1</sub>)<sup>2</sup>

**Hp<sub>2</sub>** = Hp<sub>1</sub> \* (RPM<sub>2</sub> / RPM<sub>1</sub>)<sup>3</sup> = Hp<sub>1</sub> \* (CFM<sub>2</sub> / CFM<sub>1</sub>)<sup>3</sup>

**Evap Cooler Efficiency** = (Edb-Ldb) / (Edb-Ewb)

**Evap Cooler gal/hr** = [CFM \* (Edb-Ldb)] / 10,000

**AHU Leak Class** = [(% Leakage) \* (Supply CFM) \* 100] / [(Area sq. ft) \* (Test Pressure)<sup>0.65</sup>]

**WPD<sub>2</sub>** = WPD<sub>1</sub> \* (GPM<sub>2</sub> / GPM<sub>1</sub>)<sup>2</sup>

**Water Velocity ft/sec** = (GPM \* 0.41) / [(tube diameter)<sup>2</sup>]

**Pump hp** = (GPM \* ft. head) / (3960 \* efficiency)

**Steam lb/hr** = CFM \* (T<sub>2</sub>-T<sub>1</sub>) / 1000

**Total Heat** = 4.5 \* cfm \* (h<sub>2</sub>-h<sub>1</sub>)

**Total heat** = 500 \* GPM \* (T<sub>2</sub>-T<sub>1</sub>)

**Sensible Heat** = 1.085 \* cfm \* (T<sub>2</sub>-T<sub>1</sub>)

**Total Heat** = Mass flow \* Cp \* (T<sub>2</sub>-T<sub>1</sub>)

**Motor Heat** = (bhp \* 2524) / Efficiency

**Fan Heat (Deg F)** = (0.37 \* Static Pressure) / (Motor Eff \* Fan Eff) ≈ 0.58 \* Static Pressure

**fn (natural frequency)** = 188 \* (1/ Spring Deflection)<sup>(1/2)</sup>

**Weight of Water in a Coil (in pounds)** ≈ π \* (½ tube diameter)<sup>2</sup> \* tube length \* number of tubes \* 0.00433 \* 8.3

### 15.2 Fan Law Equations

**New CFM** = (New RPM \* Existing CFM) / Existing RPM

**New sp** = Existing sp \* (New RPM / Existing RPM)<sup>2</sup>

**New bhp** = Existing bhp \* (New RPM / Existing RPM)<sup>3</sup>

**Static Efficiency** = (CFM \* static pressure) / (6356 \* bhp)

**Total Efficiency** = (CFM \* total pressure) / (6356 \* bhp)

### 15.3 Belt and Drive Equations

**Pitch Diameter of Driver** = (Driven Pitch Diameter \* Driven Speed) / Driver Speed

**Pitch Diameter of Driven** = (Driver Pitch Diameter \* Driver Speed) / Driven Speed

**Speed of Driver** = (Driven Pitch Diameter \* Driven Speed) / Driver Pitch Diameter

**Speed of Driven** = (Driver Pitch Diameter \* Driver Speed) / Driven Pitch Diameter

**Belt length(pitch)** =  $2 * C + 1.57 * (D + d) + (D - d)^2 / 4 * C$

where **C** = Center Distance

**D** = Pitch Diameter of Large Sheave

**d** = Pitch Diameter of Small Sheave

**Deflection** = Belt span / 64

**Receiving/Startup Report**



Job Name: \_\_\_\_\_ Unit Serial Number: \_\_\_\_\_

Receiving Date: \_\_\_\_\_ Startup Date: \_\_\_\_\_

A Receiving/Startup Report must be submitted for each unit on the job. For warranty purposes, startup occurs when the air handling unit is started for operation, regardless of whether the building is occupied. Date Completed

**Receiving:**

1. Inspect unit for shipping and/or installation damage.	
2. Check Bill of Lading against material received.	
3. Verify all packing material has been removed from unit.	
4. Unit acceptance at first delivery point.	
5. Unit acceptance at jobsite.	

**Assembly:**

1. Locate all loose parts shipped with unit and verify against Loose Parts List.	
2. Inspect unit demount splits (if applicable) for proper reassembly.	
3. Ensure all gasket is positioned in accordance with ClimateCraft IOM.	

**Pre-Startup:**

1. Remove shipping lock-down bolts as described in ClimateCraft IOM.	
2. Manually rotate fans to ensure freedom of movement.	
3. Verify condensate drain traps are properly installed as per ClimateCraft IOM.	
4. Inspect lighting circuit.	
5. Verify filter installation.	
6. Clean inside of unit of all construction dirt and debris.	
7. Adjust access doors for proper alignment as required in accordance with ClimateCraft IOM.	

**Operational Check:**

**WARNING! DO NOT OPERATE UNIT IS SYSTEM IS NOT PROPERLY BALANCED.**

1. Check damper operation to ensure freedom of movement. (Disconnect actuator or use manual release)	
2. Momentarily start fan motor(s) to ensure correct rotation.	
3. Check belts for tightness if applicable.	
4. Perform VFD startup (if equipped) in accordance with VFD mfg's instructions. (To be performed by authorized VFD startup personnel)	
5. Complete VFD startup form to include all required readings.	
6. During Test & Balance, record unit External Static Pressure (ESP) and Total Static Pressure (TSP).	
7. During Test & Balance, record unit Supply and Return CFM.	
8. During Test & Balance, verify unit is operating at design conditions.	
9. While unit is in operation, verify no excess standing water is present in drain pan.	
10. After 24 hours of operation, re-check set screws on bearing collar and fan hub for tightness.	

Startup Performed by: \_\_\_\_\_ Date: \_\_\_\_\_

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# Custom Air Handling Unit

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## Revision History

Date	Item	Description
11/03/2023	Created	

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