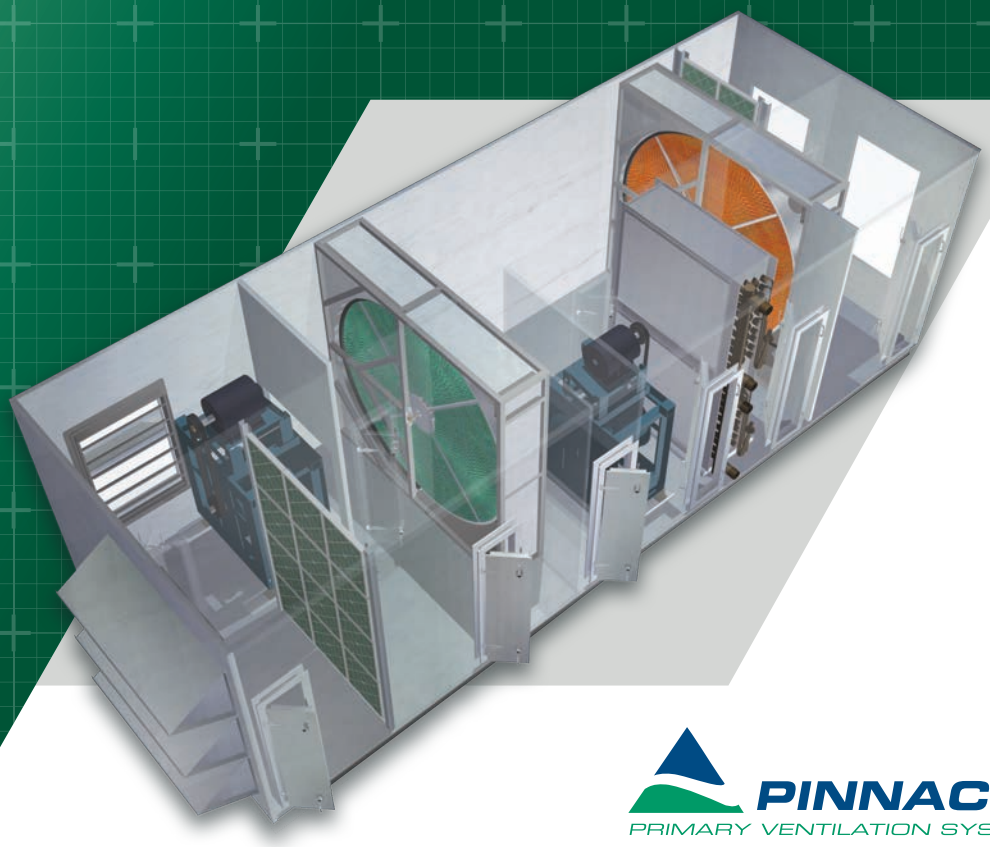
FläktGroup

SEMCO

PINNACLE®

PRIMARY VENTILATION SYSTEM

OWNER'S MANUAL



PINNACLE®
PRIMARY VENTILATION SYSTEM

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INTRODUCTION

This manual describes how to erect, store, clean and maintain a SEMCO Pinnacle Series Primary Ventilation System.

Each section provides information to guide the installation and maintenance of all components that may be included in the system, except for the True 3Å Energy Recovery wheel that is detailed in a separate manual. However, some individuals may desire more information about one or more items of equipment installed in the system. If so, consult the manufacturer's manual that accompanies the equipment or is included with our submittal.

It should also be noted that a section or sections of this manual might not apply to your system; for example, it may not include a humidifier or an evaporative cooler. The manual has been prepared to cover the basic system as well all-optional components, that may be included in a Pinnacle Series Primary Ventilation System.

THE PINNACLE SYSTEM

The Pinnacle System economically provides high quantities of outdoor air and controls indoor humidity levels at the same time. It accomplishes this by dehumidifying the supply air to very low dew points in an energy efficient manner, without the use of a regeneration heating source. It continuously delivers the outdoor air to the occupied space while simultaneously controlling humidity levels at the conditions recommended by ASHRAE, even at part-load conditions. The Pinnacle system is capable of providing a very high degree of latent cooling using only a minimum amount of conventional cooling input.

The Pinnacle approach utilizes the strengths of passive total energy recovery, conventional cooling technology and a new class of desiccant product, the passive dehumidification wheel, to provide the best possible outdoor air preconditioning system.

The system is comprised of a supply fan, an exhaust fan, a total energy wheel, a cooling coil and a passive dehumidification wheel. The total energy wheel is used to precondition fresh air using the exhausted building air. The cooling coil and passive dehumidification wheel then work in concert to further treat this fresh air stream to produce room temperature air at a much reduced humidity level.

SYSTEM INSTALLATION

How to handle the system upon delivery to the project site.

Lifting

To off load each of the system's modules, lift only with the lugs located at the base of each module (See **Figure 1**). Do NOT lift with a forklift. Spreader bars must be used to hoist sections to avoid damaging the enclosure (See **Figure 2**).

Chokers need to be adjustable so that the unit is level when it is picked up and, more importantly, set down. Setting the unit down on one corner could cause the unit to rack. Lever chain pullers are useful for this purpose.

Inspection

In addition to inspecting modules and equipment visually for possible shipping damage, be sure to consult "Inspection" instructions described later in this manual for each optional component.

FIGURE 1. Lift modules only with lugs located at the base of each module. Do not use a forklift. Note: Chain hoists used to level unit.

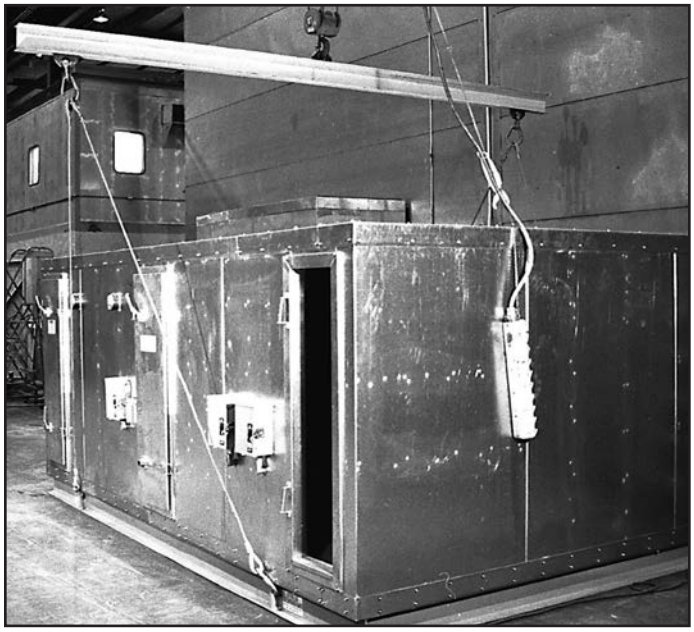


FIGURE 2. Spreader bars must be used for hoisting modules to avoid damaging the enclosure.

Receiving

1) A packing list is supplied with each shipped system and can be found inside the electric box. The list should be compared with arriving shipments to ensure that all modules and equipment have been delivered in good condition. Visible damage should be noted on the trucker's bill of lading when receiving the unit.

2) Prior to leaving the plant, each system has been tested. You will find the quality assurance label on the inside of the electric box cover along with the wiring schematic.

3) If the modules are to be stored for more than three days prior to installation, a visual inspection of all equipment is necessary. Report missing or damaged equipment to FläktGroup SEMCO immediately. Freight claims are difficult to justify long after delivery has been completed. If the modules are to be stored, see the following section.

4) Modules accumulate dust, dirt and corrosive matter (like salt) during shipment to the installation site on open trailers, and are exposed to still more grime on the construction site. Therefore, it is imperative that the exterior of each module be washed down with soap and water soon after it arrives. Abrasives and solvents should not be used without first consulting FläktGroup SEMCO.

5) The interior of each module should also be cleaned thoroughly and all equipment should be lubricated before storing or beginning operation. See other sections for specific lubrication instructions.

Storage

If the system, or parts thereof, must be stored before installation, indoor storage is preferred. If not possible, modules should be located on a hard surface with adequate drainage so that water cannot accumulate under the modules. A solid paved surface would be appropriate. Modules must be stored on blocks or timbers that raise modules at least four inches above the ground.

If stored indoors, modules should be protected from damage. If stored outdoors, modules must be covered with well-anchored canvas tarps. Heavy-mil plastic tarps should be used with caution as they can trap moisture against the unit.

Moisture must not be allowed to enter the modules. Whether stored indoors or outdoors, all openings must be closed tightly and piping penetrations must be capped. However, drain connections should be left open.

As noted previously, modules must be washed to remove corrosive materials and dirt before storage.

During the storage period, modules should be opened and inspected every 30 days. Fans must be inspected and rotated a few times by hand and stopped in a position other than the original position. Fans should also be lubricated as prescribed on the fan label.

If moisture is found in any module, it must be removed immediately. The source of the moisture must be determined and corrected immediately.

During storage, modules should not be stacked on top of each other.

Boxes containing bolts, gaskets and other items should be stored inside the modules. They can be found in a box located in the supply air compartment along with a packing list.

Installation

1) Prepare the installation site by cleaning it of all debris. Supports, which the modules will be installed on, should be level. The unit base is designed either for mounting on a concrete pad or onto a roof curb (See pages 8 and 9).

2) Consult drawings and submittal provided to determine the location of each module. Plan to lift modules in the order required for your Installation and within the limitations of your lifting equipment (see "Lifting" on page 2).

3) Adjoining ends of modules are covered with plywood and/or plastic sheets during transport. This must be removed prior to hoisting the modules in place. (See **Figure 3**).

4) Remove shipping restraints at roof joint (not shown).

5) Hoist the first module in place. Spreader bars and hoisting lugs must be used on each module for hoisting. Do not use forklifts. (See **Figures 1 and 2** on page 2).

6) After positioning the module correctly, install continuous gasket material on field joint flange as indicated in **Figure 4.**

7) Hoist the second module by its lifting lugs (continue to use spreader bars), and position it close to the first module. After aligning with the first module, move the second module against the first module.

8) Insert bolts that join the first two modules in the unit base and tighten. The large bolts in the unit base may be used to help pull the two modules against each other. Do not use any of the internal field joints to pull the units together (See **Figure 5**).

9) Verify that the two modules are straight, square and level. Use metal shims if necessary to level.

10) Hoist and set succeeding modules as described in steps 5-7.

11) If installation requires that some modules be placed on top of base or bottom modules, install continuous gaskets between upper and lower modules as indicated in drawings and submittals.

12) Do not torque connecting bolts until all upper modules are installed. Experience suggests installing bolts in the following manner. First, attach bolts that join the centers of connecting modules. Then work outward from the center and attach remaining bolts, which will assure proper alignment. Bolts should only be tightened by hand until all upper modules are in place. Then they should be torqued to 25 ft-lbs.

13) Complete field joint assembly by applying polyurethane caulk to the exterior of the joint and then cover with butt strap as shown in **Figure 4**.

14) Modules produced for outdoor locations are manufactured with a galvanized steel standing seam roof. A section of roof is shipped loose for field installation at each field job.

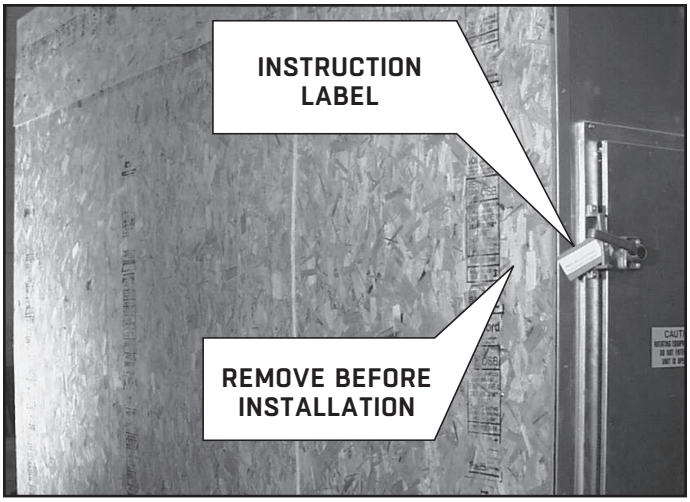


FIGURE 3. Module sides which are to be joined at time of installation are covered with plywood and/or plastic sheets for protection during transport. Throughout the unit you will find instruction labels indicating which steps MUST be performed for proper installation.

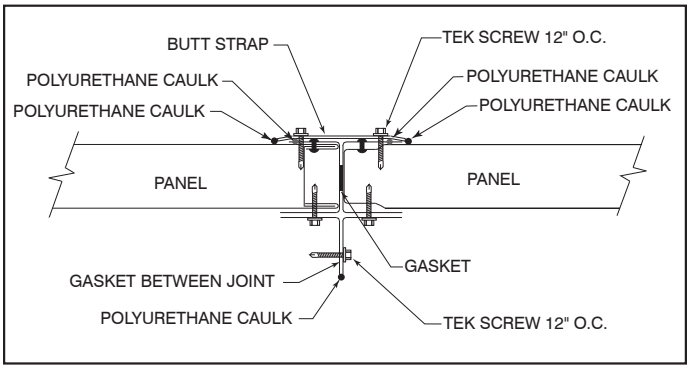


FIGURE 4. Detail of field joint located on side.

FIGURE 5. Field joint located on base. Use only these bolts to pull the modules together.

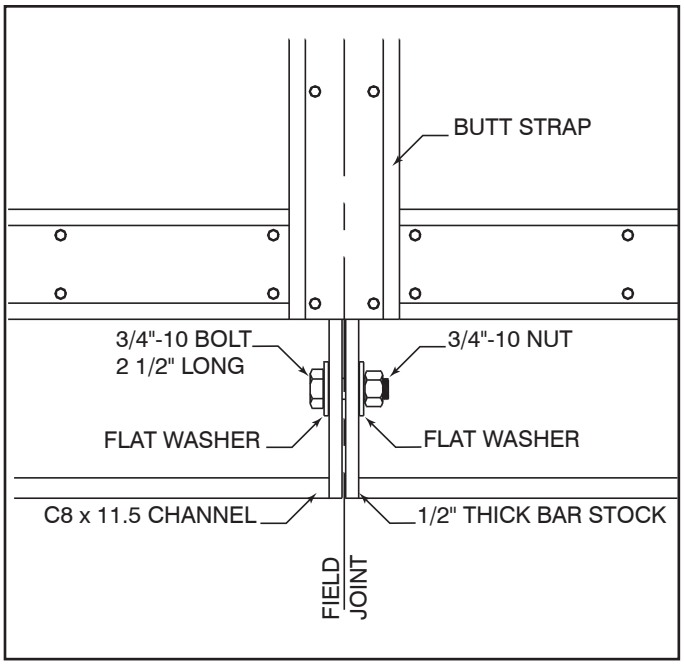


FIGURE 6. Detailed drawing of field joint.

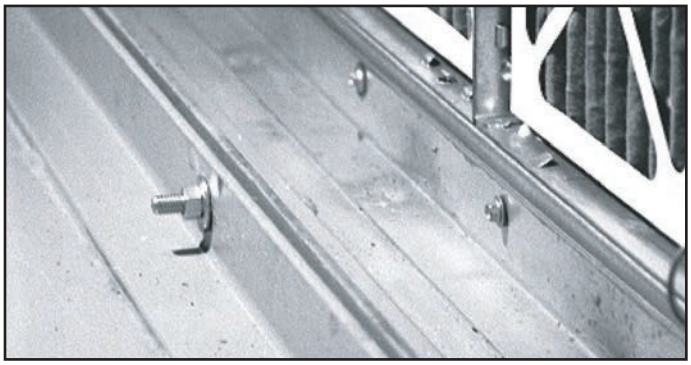


FIGURE 7. Field joint located at floor.

15) Apply polyurethane caulk along the underside of the roof butt strap and center over the joint between the two modules. Using #12 TEK screws at approximately 12" centers, screw the butt strap to the roof.

16) Apply caulk at high and low point of roof and add first foam panel.

17) Apply second foam panel. See Step 17 picture for caulking instructions.

18) Insert one edge of roof panel as shown and rotate into place (See Step 18 picture).

19) Crimp roof lips with crimping tool.

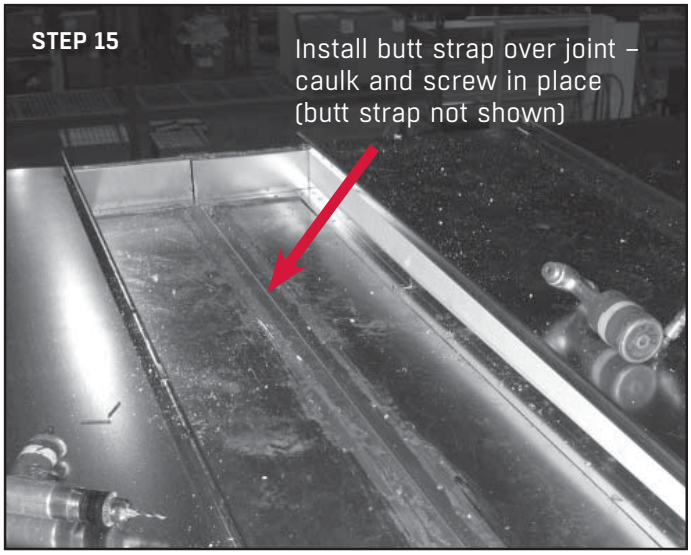
20) Finish high side of roof with rain cap. Screw in place similar to factory cap.

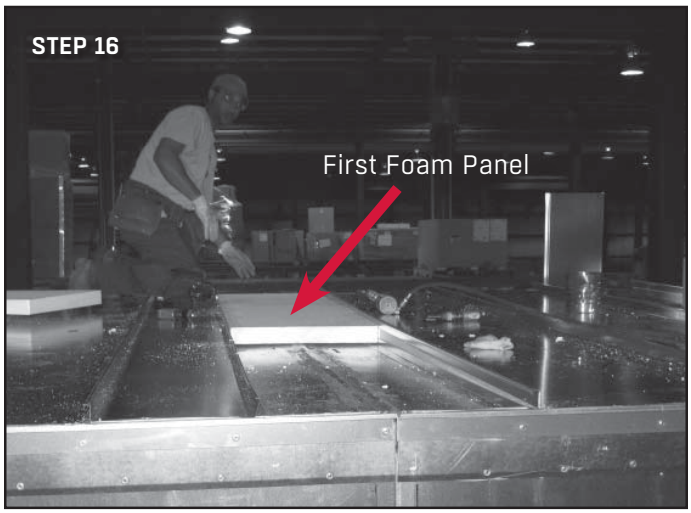
21) Holes for conduit, piping, etc., are normally precut in module panels at the factory. However, if it is necessary to change the location of a hole or to cut a new one, these guidelines must be observed:

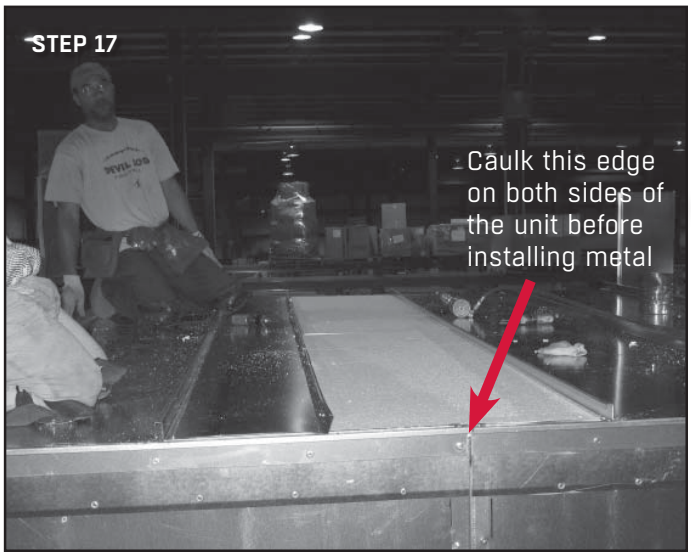
- Every hole represents a potential leak. Avoid adding new holes to the enclosure if possible.
- If it is necessary to add a new hole or to move the location of a hole already in the unit, select a location as close as possible to hookup inside the enclosure.
- Cut holes through panels. DO NOT cut through structural members.

22) Removable panels are furnished for large items such as coils. Adequate service space in front of these panels should be provided in case the item or items will have to be removed at some future time (See **Figure 8**).

23) Complete electrical and control connections across field joints. Use coded wires or terminal strips in junction boxes and the flex connections provided. Wiring diagrams are attached to the inside of the electrical panel.







24) Complete service connections to piping and power. Be certain to check specific requirements for electrical power to the energy recovery unit, fans, dampers and other electrical devices.

25) For components, please reference instructions in the following sections of this manual before proceeding.

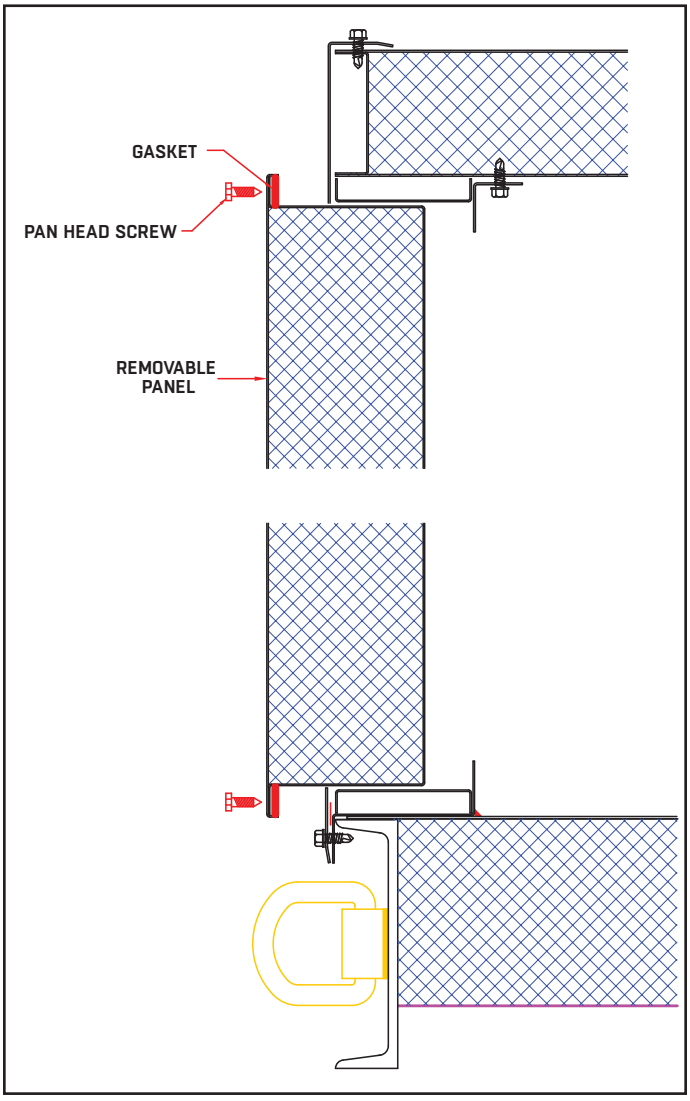
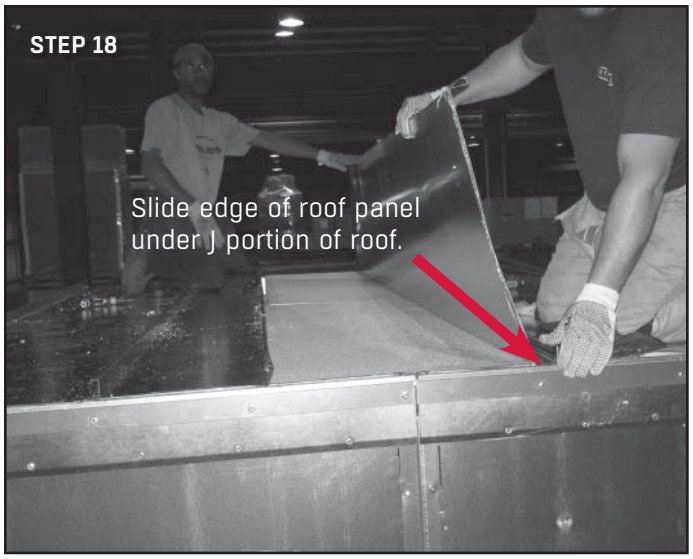
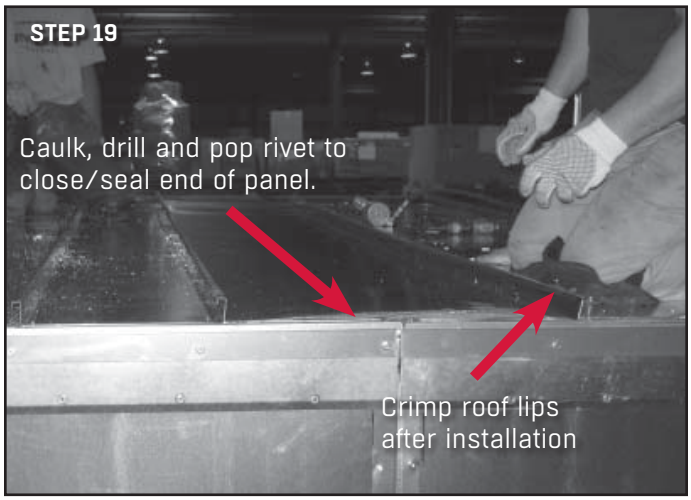
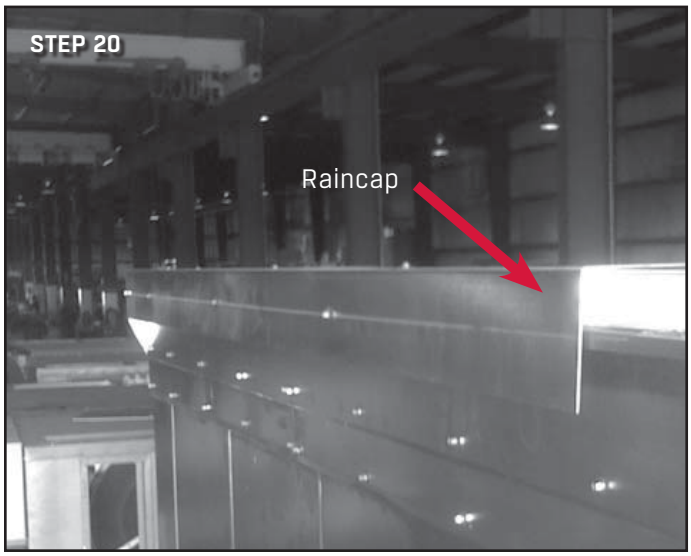


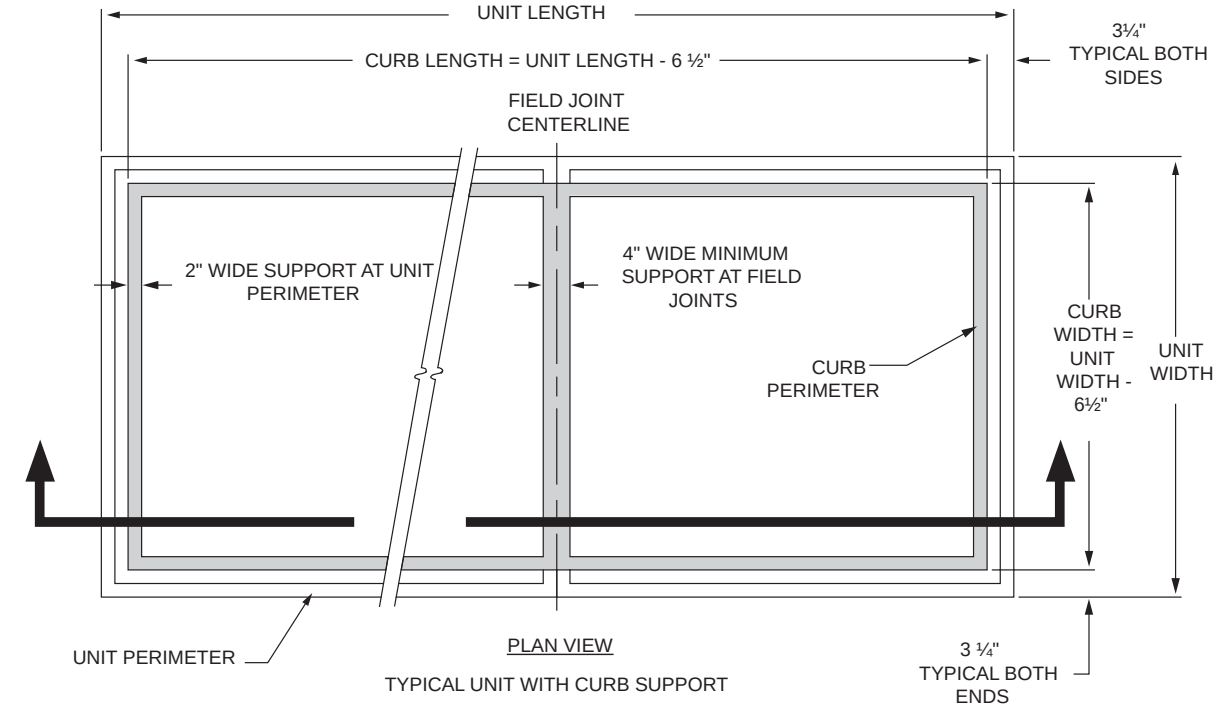
FIGURE 8. Detailed drawing of removable panel installation.





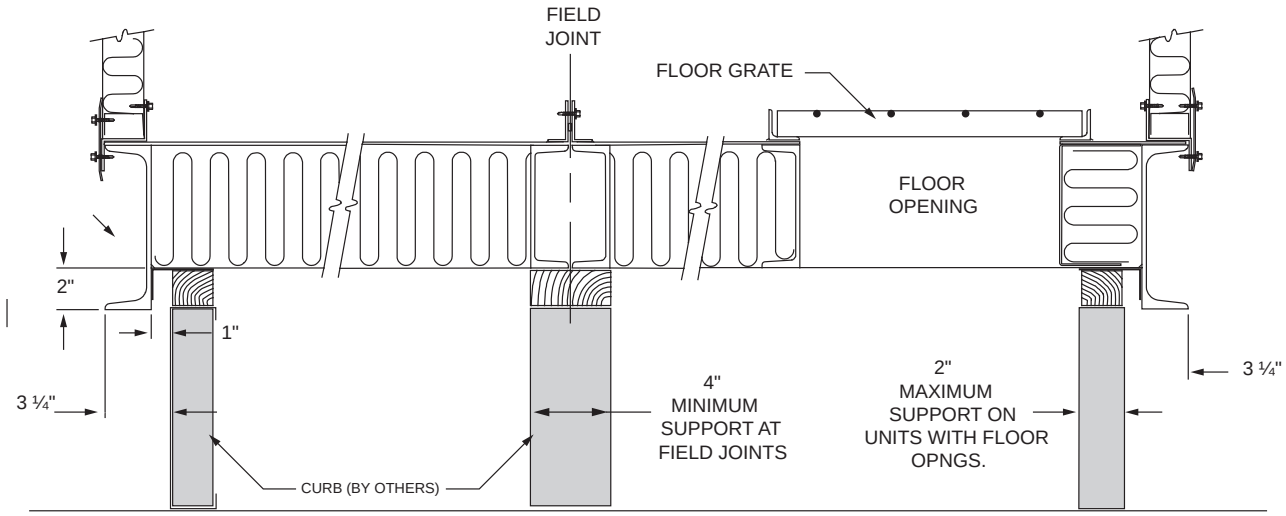


Mounting Details, Curb Support



PLAN VIEW

TYPICAL UNIT WITH CURB SUPPORT



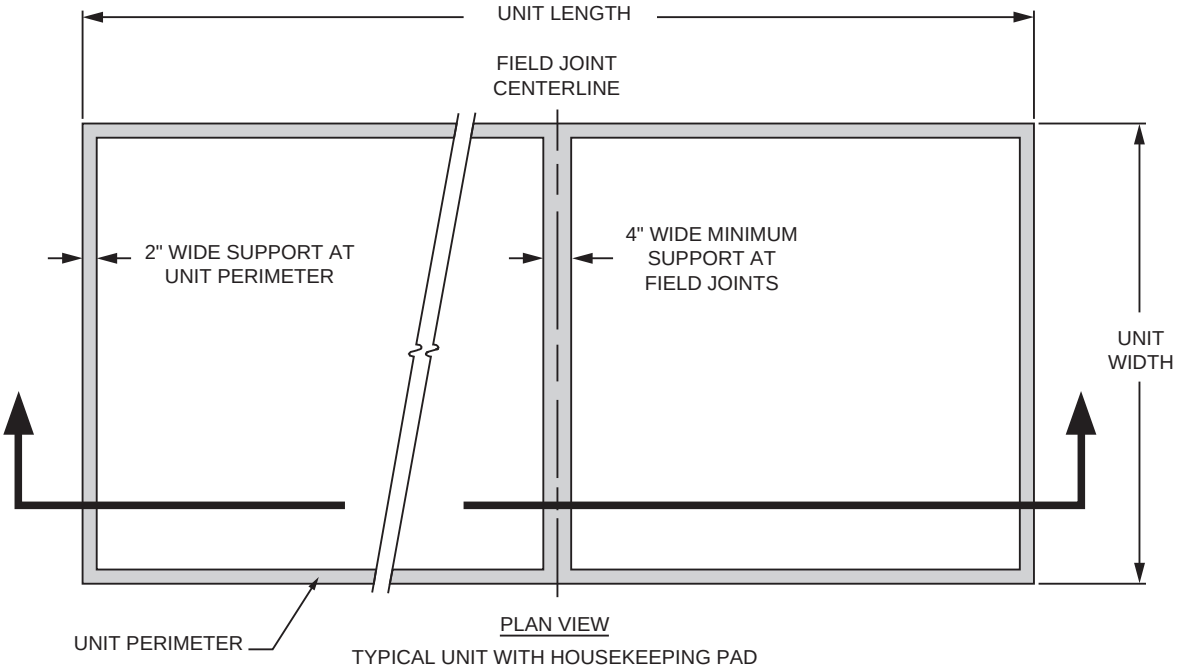
SECTION

SELF FLASHING UNIT BASE
SHOWING CURB SUPPORT REQUIREMENTS

NOTES

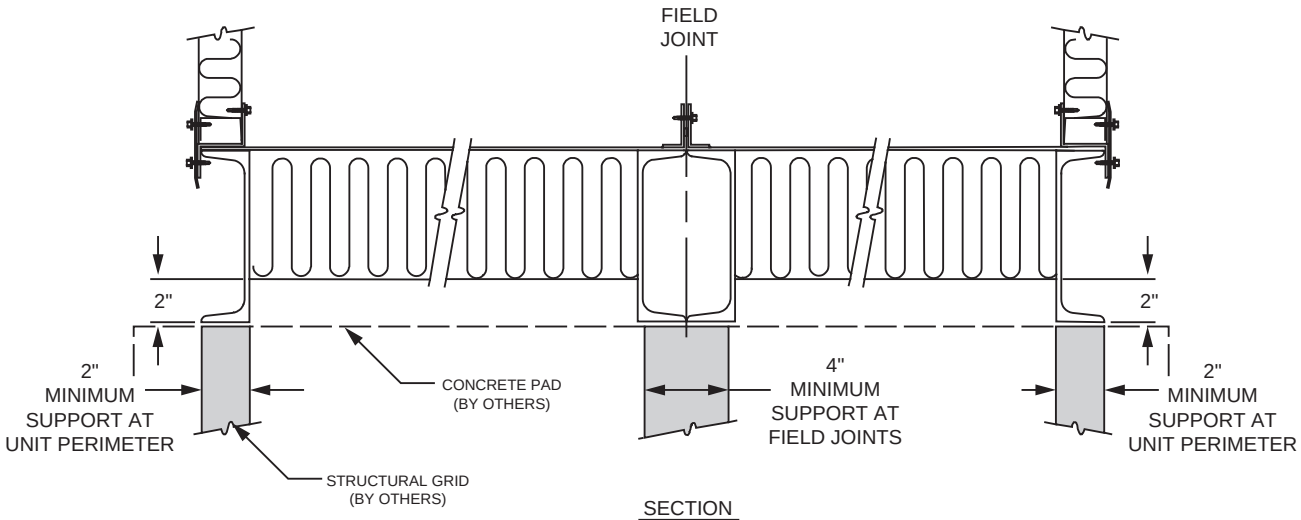
1. ROOF CURB SHOULD BE SIZED TO ALLOW UNIT TO HANG OVER CURB.
2. CURB SIZE:
   WIDTH = UNIT WIDTH - 6.5"
   LENGTH = UNIT LENGTH -6.5"
3. UNIT SUPPORT IS REQUIRED AROUND THE ENTIRE PERIMETER AND ALONG BOTH SIDES OF ANY FIELD JOINTS.
4. WHEN UNITS REQUIRE FIELD JOINTS, SUPPORT SHOULD BE LEVEL TO 1/16" BETWEEN FIELD JOINTS.

Mounting Details, Grid or Pad Support



PLAN VIEW

TYPICAL UNIT WITH HOUSEKEEPING PAD OR STRUCTURAL GRID SUPPORT



SECTION

UNIT BASE WHEN MOUNTING ON PAD OR STRUCTURAL GRID

NOTES

1. UNIT SUPPORT IS REQUIRED AROUND THE ENTIRE PERIMETER AND ALONG BOTH SIDES OF ANY FIELD JOINTS.

2. WHEN UNITS REQUIRE FIELD JOINTS, SUPPORT SHOULD BE LEVEL TO 1/16" BETWEEN FIELD JOINTS.

ENERGY RECOVERY WHEEL

All necessary energy recovery wheel components have been installed at the factory and tested for proper operation prior to shipping. See SEMCO Energy Recovery Wheel Owner's Manual for complete details on wheel start-up and maintenance.

1) Pump grease into the two rotor bearing grease fittings using a high quality NLGI No. 2 grease (See **Figure 9**).

2) Remove shipping restraint located in the supply air side of the wheel near the drive motor. Remove all bolts and discard. The shipping restraint prevents the rotor from turning during shipment (See **Figures 10 and 11**).

3) Turn rotor by hand in the direction indicated by rotation arrows to verify that the rotor does not bind (See **Figure 12**). If binding occurs in a new unit, it is usually caused by the labyrinth seal or freight damage. To adjust the seals, loosen the screws holding the seal clips in place, adjust the seal so it just contacts the surface of the wheel/rim, and then re-tighten the screws.

4) Inspect the rotor visually. It should be well centered in its casing and should not tilt in any one direction. If alignment is not suitable, contact FläktGroup SEMCO.

5) Inspect the bearing bolts, rim bolts, and the Allen screws on the bearing collar to ensure that all are tight (See **Figure 13**). Tighten any loose screws and bolts according to torque values described in the SEMCO Energy Recovery Wheel Owner's Manual.

Seals & Purge Adjustment

Refer to the SEMCO Energy Recovery Wheel Owner's Manual for seal and purge setting procedure and other wheel maintenance information.

A copy of the SEMCO Energy Recovery Wheel Owner's Manual can be found online at www.semcohvac.com.

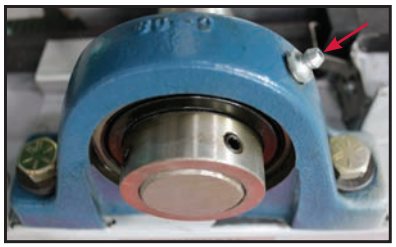


FIGURE 9. Pump grease into two rotor bearing grease points, one on each side of the rotor.

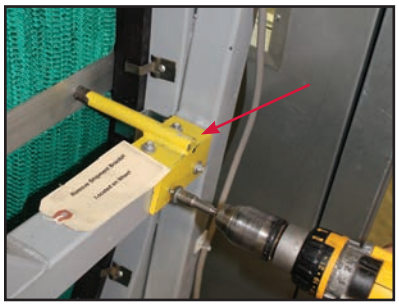


FIGURE 10. Shipping restraint for flat rim wheel.

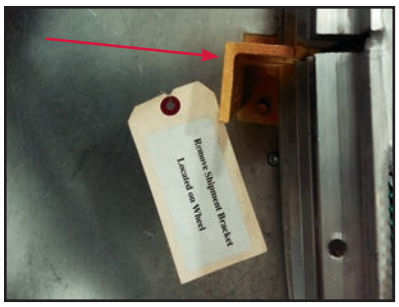


FIGURE 11. Shipping restraint for ribbed rim wheel.

FIGURE 12. Rotate the rotor at least three turns in the direction indicated by the rotation arrow.

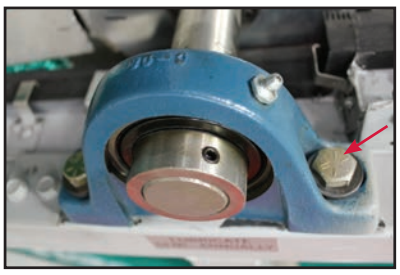


FIGURE 13. Inspect bearing collar to ensure all bolts and screws are tight.

FANS

All necessary system fans and fan motors are installed at the FläktGroup SEMCO factory. However, before attempting to operate them, a pre-startup inspection is recommended.

1) Make sure all power to the fan motors is off.

2) Each fan is restrained in six places using all-thread, (See **Figure 14**). Read Steps 3 and 4 for proper restraint removal before removal.

A) Two restraints at the top of the fan bolting the fan to the fan wall (See **Figure 15**).

B) Two in the fan inlet which bolt the fan to the base rail (See **Figure 16**).

C) Two at the base of the rear of the fan(below the belt guards) which bolt the fan to the base rail (See **Figure 17**).

3) First, remove the restraints from the top of the fan.

A) The nut on the inlet side of the fan wall should be removed first (See **Figure 18**).

B) Then from the fan compartment the restraint can be removed from the lifting eye on the fan, pulled from the wall, and discarded (See **Figure 15**).

C) Do NOT remove the support bar attached to the wall (See **Figure 18**).

4) Next, loosen the restraints at the base of the fan.

A) The nuts should be removed which will relieve the spring pressure.

B) Then each of the remaining pieces of all-thread should be un-threaded from the base and discarded.

C) Remove wooden blocks and discard all shipping restraints (See **Figure 19**).

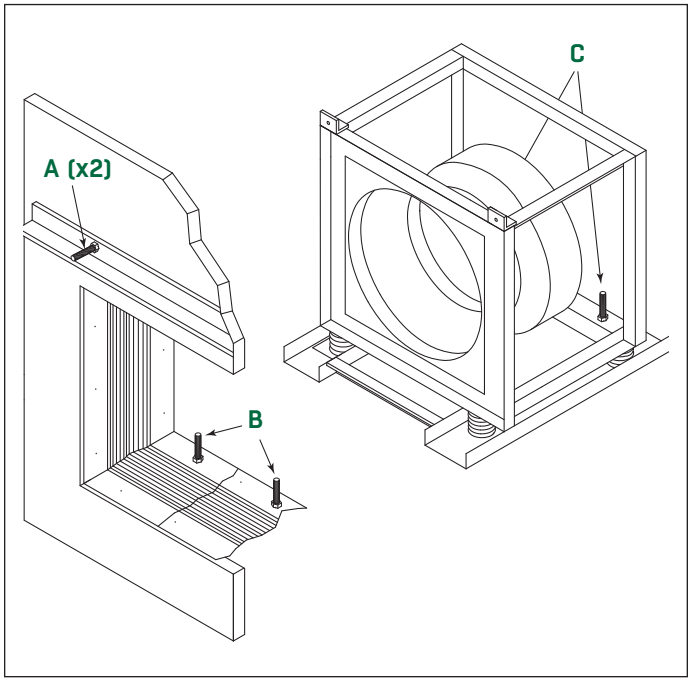


FIGURE 14.. Fan with typical shipping restraints.

FIGURE 15. Two restraints at the top of the fan bolting the fan to the fan wall.

FIGURE 16. Two in the fan inlet which bolt the fan to the base rail.

FIGURE 17. Two at the base of the rear of the fan.

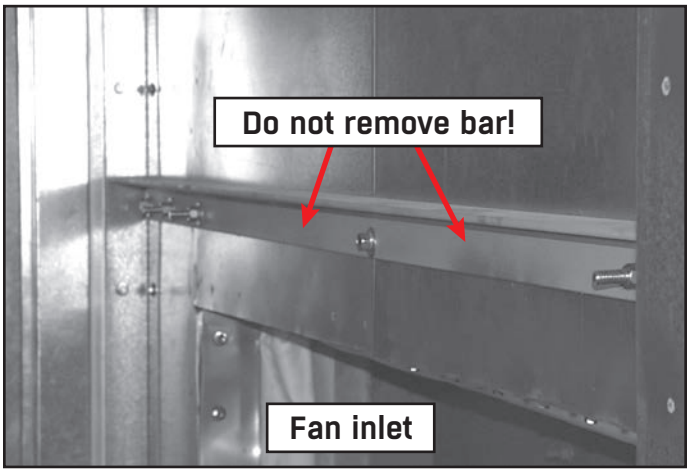


FIGURE 18. Instructions for removing through-wall bolts.

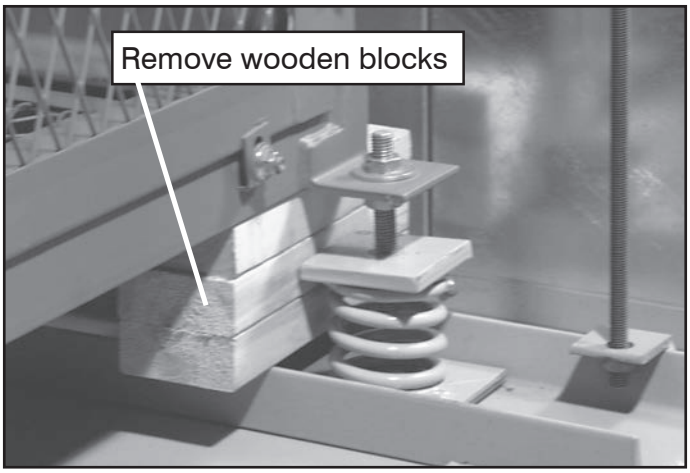


FIGURE 19. Fan shipping restraints located at the base of the fan.

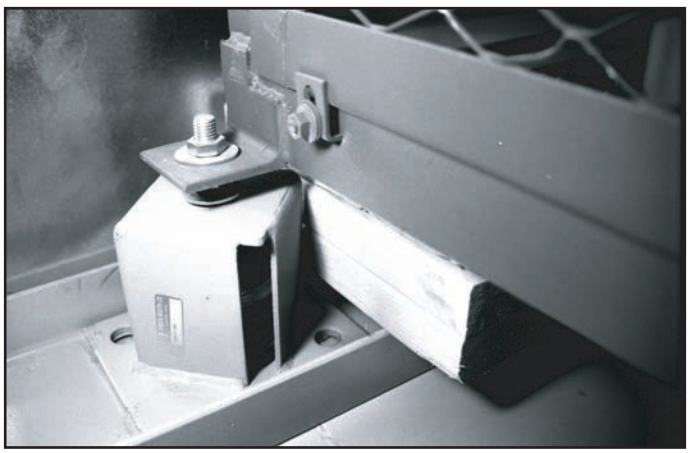


FIGURE 20. As an option, the fans can be mounted on seismic arrest mounts.

Continued on following pages.

5) When checking the fan, be sure to:

A) Check fan bolts and mountings for tightness. Tighten any loose screws and bolts.

B) Rotate the impeller by hand; it should turn freely. If not, check for obstructions and contact FläktGroup SEMCO.

C) Ensure that the fan wheel, drives and fan interiors are clean and free of debris.

D) Remove belt cover and ensure that fan sheaves align properly with motor sheaves following the instructions depicted in **Figure 21**. If sheaves need to be realigned follow the procedure outlined in the maintenance section. It is recommend that at this time you note the sheave model numbers for future reference.

E) Check fan set screw for tightness; retighten if necessary.

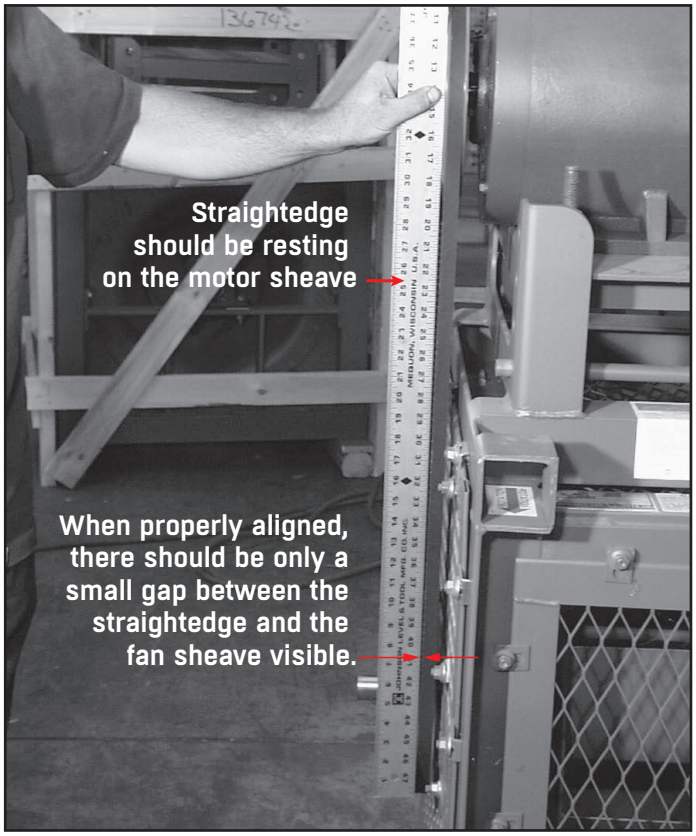


FIGURE 21. Suggested procedure for checking sheave alignment.

6) Belts – Check belt tension with a Belt Tension Checker. If it becomes necessary to adjust the belt tension, please follow the procedure described in section "Belt Tension" on page 23.

7) Grease the fan bearings (See **Figures 22 and 23**).

8) Motors – Be sure that the power supply matches the motor nameplate power.

   Check supply and exhaust fan motor mountings for tightness to ensure that they have not loosened during transit or on-site installation. If necessary, tighten loose mountings. Turn motor shaft by hand to verify that it turns freely.

Operation

1) After completing inspection checks on motors, fans and belts, turn power on then off quickly. Power should be on just long enough to start fan rotation.

2) If fans start rotating in the wrong direction (see arrow on the blower) turn off power immediately. To correct rotation, lock out power to the unit feeder, and switch any two line power wires. To change rotation of only an inverter driven wheel and not the fans, switch any two VFD line power wires.

3) Using an amp probe or amp meter, check the actual operating current of the motor to make sure it is not being overloaded or underpowered. The operating current must not exceed the nameplate current.

4) Allow the assembly to run for about an hour. During this time, listen for any unusual sounds. To correct noise problems, see "Troubleshooting" on page 18.

   Check sheave alignment visually. Correct alignment if necessary after shutting off power.

FIGURE 22. On the fan inlet side, the grease nipple for the fan shaft bearing is mounted on top of the pillow block.

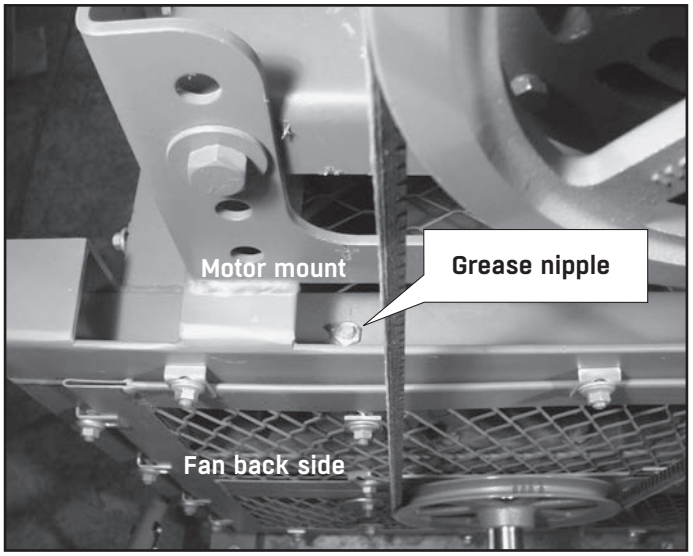


FIGURE 23. Located on the fan back side, is the grease nipple for the fan sheave bearing. It is mounted on top of the fan frame.

DAMPERS

Although the dampers have been installed and checked at the FläktGroup SEMCO factory, a pre-startup inspection is recommended to be sure that nothing has become detached or damaged during shipment or on-site installation.

Inspection

1) Check blade rotation clearance. Verify that blades open and close properly and rotate sufficiently. If they do not, check for obstructions, broken or bent blades, or loose linkage. Correct or repair as necessary (See **Figure 24**).

2) Be sure that actuator arms and bars connecting damper motors to control rods or shafts are tight. (See **Figure 25**).

3) The dampers are controlled by electric motors. Make sure that wiring is complete. Check the wiring diagram on the motor.

4) Turn on power and observe whether or not the controls trigger dampers correctly. Be sure that limit switches close when blades are open and open when blades are closed.

FIGURE 24. Be sure that damper blades open and close properly and have sufficient rotation clearance.

FIGURE 25. Damper actuator.

COILS

Heating and/or cooling coils can be ordered with the energy recovery system. All necessary heating and/or cooling coils have been installed at the FläktGroup SEMCO factory. However, before operating them, a brief pre-startup inspection is recommended.

Inspection

1) Inspect all pipe connections to verify they are tight and that no damage has occurred during transit or on-site installation.

2) Steam coils – Be sure that the unit is level so the coils inside the casing slope toward the header.

3) Hot water coils – Check the freeze protection thermostat for proper operation so that it will function to prevent freeze-ups.

Operation

- Steam coils – Non-freeze steam coils are designed to operate steam pressures up to, and including, 150 psig and temperatures to 350°F.
- During initial operation, make sure that condensate flows back to the headers. Check for leaks.
- Hot water coils are designed to operate at pressures to 150 psig, and temperatures to 366°F. Check for leaks during initial operation.
- Cooling coils are designed to withstand pressures to 200 psig. During initial operation, check for leaks.

HEATCO HM SERIES DUCT HEATER

Heatco duct heaters have been factory installed and run tested. As gas pressures vary according to jobsite, complete Heatco start-up and adjustment instructions must be followed. Please refer to Heatco literature included with unit for details or contact FläktGroup SEMCO for additional copies.

HUMIDIFIERS

FläktGroup SEMCO can provide a wide range of humidification options. Humidifier manufacturer, type, and degree of installation can vary from job to job depending upon job specifications. Consult humidifier manufacturer's literature for details related to installation, start-up, and troubleshooting.

AIR FILTERS

Air filters for the energy recovery system are boxed, tagged and shipped loose inside the system for field installation. This minimizes any risk for filter damage during transit. The air filters must place installed prior to startup or the warranty could be voided.

Throughout the operating life of the system, it will be necessary to replace filters as they accumulate dirt from the air stream.

The system is equipped with two pressure differential gauges. As air filters accumulate dirt, the pressure differential will rise.

The "Pre-filter Capacity and Resistance Table" (**Table 1**) and "Final Filter Capacity and Resistance Table" (**Table 2**) provide data for most pre-filters and final filters used in SEMCO systems. For each filter size, the pressure differential (Resistance at Capacity) using new, clean air filters in air streams is shown. The Capacities columns define airflow in cubic feet per minute. For specific airflows, interpolating and estimating will provide adequate data.

When to Replace Filters

It is recommended that filters be changed when the pressure differential gauge reaches the final resistance rating illustrated in **Table 1** and **Table 2**. Experience with the new system may suggest changing filters at a slightly higher or lower reading. Depending upon the total volume of air required in the building, altering the replacement differential may be necessary. But waiting to change filters when the pressure differential reaches or approaches a higher-than-recommended figure would mean using packed air filters that seriously reduce airflow.

If the system is ordered with final filters, then these will be located behind the pre-filters.

The procedure for removing the old filters and installing new ones is the same as described on pages 12 and 13.

For systems equipped with pre-filter and final filter banks, it is recommended that pre-filter banks be changed twice as often as final filters.

For air filter replacement, a rigid, cell-type filter that matches the specifications shown in the Pre-filter and Final Filter Capacity and Resistance Tables is recommended.

TABLE 1. Pre-filter Capacity and Resistance Data

Pre-filter Capacity and Resistance Data									
Filter Depth	Nominal Size (inches)	Actual Size (inches)			Capacities (cfm)		Resistance @ Capacity (inches w.g).		
		Width	Height	Depth	Medium	High	Medium	High	Final
4"	12x24x4	11.38	23.38	3.88	600	1200	.12	.35	.90
	24x24x4	23.38	23.38	3.88	1200	2400	.12	.35	.90
2"	12x24x2	11.38	23.38	1.88	500	1000	.08	.28	.90
	24x24x2	23.38	23.38	1.88	1000	2000	.08	.28	.90

TABLE 2. 12" Final Filter Capacity & Resistance Data*

12" Final Filter Capacity & Resistance Data*						
Filter Media Efficiency	Nominal Size (inches)	Actual Size(1) (inches)		Airflow Capacity (cfm)	Resistance (in. w.g).	
		Width	Height		Initial	Final(2)
60-65%	12x24	11.38	23.38	1000	.29	1.5
	24x24	23.38	23.38	2000	.29	1.5
80-85%	12x24	11.38	23.38	1000	.50	1.5
	24x24	23.38	23.38	2000	.50	1.5
90-95%	12x24	11.38	23.38	1000	.68	1.5
	24x24	23.38	23.38	2000	.68	1.5

***NOTES:**

1) Actual depth of 12" filter is 11.50"

2) Maximum recommended final resistance. System design may require a lower change-out resistance.

3) Maximum operating temperature limit for the filters is 180°F in continuous operation, and 200°F in intermittent operation.

TABLE 3. Quantity And Size Of Filters In Standard Units.

	Model Size								
	EPXX-3	EPXX-5	EPXX-9	EPXX-13	EPXX-18	EPXX-24	EPXX-28	EPXX-35	EPXX-43
SA Filter Qty - Size (inches)	1 - 24x24	2 - 24x24	4 - 24x24	6 - 24x24	3 - 20x24	12 - 20x24	12 - 24x24	15 - 24x24	20 - 24x24
	2 - 12x24	2 - 12x24	2 - 24x12	-	9 - 20x20	-	3 - 12x24	-	4 - 12x24
RA Filter Qty - Size (inches)	1 - 24x24	2- 24x24	2 - 24x24	3- 24x24	6 - 24x24	8 - 24x24	6 - 20x24	15 - 20x24	15 - 24x24
	2 - 12x24	2 - 12x24	3 - 12x24	3 - 12x24	2 - 12x24	-	9 - 20x20	-	3 - 12x24

TROUBLESHOOTING: FANS, DRIVE BELTS, AND MOTORS

Problem	Possible Causes	Solution
Vibration.	Out of balance fan motor.	Check for dirt. If dirty, clean motor.
		Airfoil blades are usually hollow. Check inside for moisture. If it is accumulating, drill 3/16" drain hole on trailing edge to solve accumulation problem.
	Loose mounting bolts.	Tighten bolts.
	Misaligned drive belt sheaves.	Realign sheaves.
	Bent fan shaft.	Check shaft with dial indicator. If bent, replace shaft immediately.
	Damaged belt or belts.	Replace entire belt set.
	Fan operating in stall or unstable flow.	Make sure system is operating at design static pressure and design flow rates.
	Loose or improperly tensioned belts.	Tension belts correctly.
Noise, squealing.	Belts loose, misaligned or tight.	Tension belts correctly.
Noise, howling/screeching/ clicking.	Improperly lubricated or worn bearings.	Lubricate immediately.
		Replace bearing immediately if worn or if noise continues after the bearings have been greased.
Noise, high-pitched sqealing.	Misaligned bearing seals.	Realign face of bearing so that it's perpendicular to the shaft.
Noise, motors.	Supply voltage is high or inconsistent.	Check supply voltage with voltmeter.
		Correct supply voltage if necessary.
Overheating bearings.	Overgreasing.	Let bearing run and purge excess grease. Adjust lubrication schedule.
	Improper grease.	Only use a grease recommended on the fan lubrication decal. Don't change from one grease brand to another. Use same brand consistently.
	Wearing, failing bearings.	Replace bearings.
	Loose or too tight belts.	Tension belts correctly.
Short belt life.	Spin burns from belt slipping on driver sheave under stalled load conditions or when starting.	Tension belt.
	Gouges or extreme cover wear caused by belt rubbing on drive guards or other objects.	Eliminate obstruction or realign drive to provide clearance.
	High ambient temperature.	Use gripnotch belts. Provide ventilation. Shield belt.
	Grease or oil on belt.	Check for leaky bearings. Clean belt and sheaves.
	Underdesigned drive.	Redesign drive.
	Worn sheaves.	Replace sheaves.
Belts turn over in groove.	Damaged cord section in belts. Frayed or gouged belts.	Replace belts.
	Excessive vibration.	Tension belts. Replace belts if damaged. Use banded belts.
	Worn sheaves.	Replace sheaves.
	Sheave misalignment.	Realign drive.
Belt breakage.	Foreign material in drive.	Provide drive guard.
	Belt damaged during installation.	Follow belt installation instructions.
	Shock or extreme overload.	Eliminate overload cause or redesign drive.

Problem	Possible Causes	Solution
Belt stretches beyond takeup.	Worn sheaves.	Replace sheaves.
	Underdesigned drive.	Redesign and replace drive.
	Takeup slipped.	Reposition takeup.
	Drive excessively tensioned.	Properly tension drive.
	Damaged cord section during installation.	Replace belt and install properly.
Belt too long at installation.	Insufficient takeup.	Use shorter belts.
	Drive improperly set up.	Recheck drive and driven machine set-up.
	Wrong belt size.	Use correct belt size.
Belt too short at installation.	Wrong belt size.	Use correct belt size.
	Drive improperly set up.	Recheck drive and driven machine set-up.
Poor air performance.	Incorrect fan rotation.	Rotation can be changed on 3-phase motors by reversing any 2 motor leads.
	Abrupt turn in duct close to fan discharge or air prespin caused by elbows at fan inlet.	Install turning vanes or elbow splitters in duct. If more change is needed, discharge position may have to be changed.
	If fan has inlet volume control, is it properly installed?	Inlet volume control must be installed with prespin of the air in direction of wheel rotation when control is partially closed.
	Devices for air modulation closed or plugged.	Open or unplug.
	Clogged filters.	Replace filters.
	Improperly mounted fan wheel, or off-center wheel.	Center fan between inlet cones to avoid overloading one side and starving the other side. Correct wheel mounting.
	Fan power draw unexpectedly low.	• Correct air prespin into fan inlet. • Fan drive sheaves may be set for too low fan speed; correct if necessary. • Resistance to air flow is much higher than calculated; check for closed damper or other duct obstructions; recheck duct layout.
	Fan power draw unexpectedly high.	• Fan speed may be too high. Fan may operate without duct work at low resistance so too much air flows. • Fan may be handling ambient air instead of intended hot, less dense air. • Fan may be running backward; check and correct if necessary.
	Incorrect purge setting.	Adjust per Energy Recovery Wheel Owner's Manual.
	Wheel seals need adjustment.	Consult Energy Recovery Wheel Owner's Manual.
	Damaged or dirty fan or system.	Clean fan or system, or replace damaged parts.
Motor problems.	Incorrect wiring.	Correct.
	Fan speed too high.	Check fan speed against submittal.
	Parts improperly installed or binding.	See "Inspection" at beginning of this section. Re-check and correct if necessary.
	Bearings improperly lubricated.	See motor lubrication instruction in this section. Do not overlubricate.
	Protection devices may be improperly sized.	Check against submittal.

MAINTENANCE

Daily Maintenance

It is recommended that the unit be visually inspected daily. Taking a few moments each day to make sure that the unit is functioning will save many future hours, dollars and headaches. Each day, ensure that:

- The rotor is rotating under power;
- The motor is running;
- All devices are on and operating (the variable frequency controller, temperature controller, and rotation detector).

All other maintenance activity should be conducted monthly, quarterly, semiannually or annually as described in this manual. All essential maintenance services are summarized in the Maintenance Schedule below.

Maintenance Schedule			Month				
Component	Service	Startup	1	3	6	9	12
WHEEL (See Energy Recovery Wheel Owner's Manual for details.)	Rotor bearing lubrication	x			x		x
	Bearing bolts tightness	x					
	Bearing set screw tightness	x	x		x		x
	Motor and gear reducer bolt tightness	x	x		x		x
	Check seals	x	x		x		x
	Check/clean variable frequency controller						x
	Drive System	X			X		X
FAN	Check/clean shaft and wheel	x		x	x	x	x
FAN MOTORS	Clean motors				x		x
	Inspect motor connections				x		x
	Check operating current				x		x
	Check motor bolt tightness				x		x
	Lubricate motor bearings						x
DAMPERS	Check rotor blade clearance	x					
	Inspect damper for dirt and foreign matter			x	x	x	x
	Inspect dampers seals for deterioration			x	x	x	x
FILTERS	Replace based on pressure differential						

Maintenance: System

The system enclosure requires very little maintenance since it is constructed of strong, weather-resistant materials. Equipment contained within the enclosure requires regular maintenance to keep the system operating smoothly. You will find maintenance instructions for every component in this section.

Inspect the enclosure periodically:

- Check for air leaks in the casing
- Ensure modules remain level
- Make sure that doors do not bind
- Check around all penetrations and roof joints to be sure that seals remain tight and do not leak

Maintenance: Wheel

The True 3Å Energy Recovery Wheel Unit will operate efficiently and reliably for many years with minimum maintenance and service. Most maintenance activities require little more than checking various devices and parts to make sure they are tight or functioning properly.

Daily Maintenance – It is recommended that the unit be visually inspected daily. Taking a few moments each day to make sure that the unit is functioning will save many future hours, dollars and headaches. Each day, ensure that:

- the rotor is rotating under power;
- the motor is running;
- and all devices are on and operating (the variable frequency controller, temperature controller and rotation detector.)

All other maintenance activity should be conducted monthly, quarterly, semiannually or annually as described in the SEMCO Energy Recovery Wheel Owner's Manual.

Media Cleaning

Semi-annually, or more frequently if pressure drop across the wheel increases at a given airflow, clean wheel media by air blowing at 100 psi while using a vacuum or other device to collect any dust or debris that may exit the other side. Extra care should be taken to ensure that the air nozzle or vacuum/other device does not touch or damage the rotor surface. See "SEMCO Energy Recovery Wheel Cleaning Procedure" in the Energy Recovery Wheel Owner's Manual.

Maintenance: Fan Motors

- Motors will operate effectively for years if operated by proper current and kept clean, dry and properly lubricated.
- Clean motors every six months. Use moderate air pressure (25-30 psi) to blow away dirt from vent fins and other accessible areas.

  NOTE: Keep areas surrounding the motors clear so air can circulate freely through the motor to cool it.
- Inspect connections every six months. Watch for frayed or exposed wiring and loose connections. Repair or tighten as necessary.
- Check operating current every six months. Make sure that motors continue to operate at faceplate current or below.
- Check for vibration and for mounting-bolt tightness every six months. Tighten any loose mounting bolts. Make sure that motor runs smoothly without vibrating.
- Lubricate motor bearings with one or two squirts of high grade, lithium-based grease annually (Chevron SRI #2 or similar recommended). Do not over lubricate! Consult motor manufacturer for detailed lubrication instructions.

Maintenance - Fan Drive Belts

- V-belts and drives should be inspected daily during the first week of operation, and every month thereafter. Worn and frayed belts should be replaced.

  CAUTION: Always replace an entire belt set when replacing belts. Do not replace just one belt within a set.
- Inspect sheaves for burrs and/or dirt buildup, groove wear, sheave run out, alignment, and set screw tightness.

  Sheaves and belts can be cleaned with detergent, water and a clean rag. Wipe dry after cleaning. Burrs can usually be removed with an emery cloth.

  Sheave groove sidewalls should be straight, not dished out. The bottom of the groove should show no sign of belt contact. Misalignment of sheaves and excessive tension are usually the causes of groove wear and run out. Adjustments will reduce wear. On occasion, excessively worn sheaves will require replacement. See “Troubleshooting,” page 18.
- Tighten loose sheave set screws.
- Check belts for wear, heat buildup and dirt. As noted previously, belts and sheaves can be cleaned with detergent and water. Be alert to mismatched belt sets. All belts in a multiple belt drive should have the same slight bow. If not uniformly bowed, replace the entire belt set.

  Contact temperatures for belts should not exceed 180°F, and ambient temperatures should not exceed 140°F. Belts should be ventilated.

  If belts show wear or fraying on one side of the belt only, the sheaves may be misalign. Correct by adjusting sheave alignment and if necessary, replace belts.

  If belts have a slick, glazed look, then they are slipping. To correct, check drive capacity and belt tension. Replace belts that are badly glazed.
- To replace V-belts, see “How to Replace V-belt Drives,” page 26. As noted previously, never replace a single belt in a set. Always replace a complete belt set. After replacing the set, be sure to tension the new belts correctly. (See “How to Check Belt Tension,” on the following page.)

How to Replace V-Belt Drives

1) Make sure that equipment **power is turned off and locked** out where possible. Add a warning sign at the switches to make sure that no one else turns on the machinery while you are working on it.

2) Inspect all drive components. Clean oil and grease from sheaves and check sheaves carefully for damage or worn grooves. If banded belts are to be installed, check groove spacing. Remove rust and burrs.

3) Always use a matched set of new belts from the same manufacturer. Be sure to use belts with the correct cross section for the sheaves.

4) Loosen motor mounts to allow belts to be placed in grooves without forcing.

   The SEMCO energy recovery system features three different styles of fan motor mounts depending on the size of the unit and the options ordered. **Figures 26 through 28** show the three different mounts.

   - Fan motors 10 hp or less are mounted on a fixed base (See **Figure 26**). When adjusting the fixed mount base and after the desired belt tension has been achieved, recheck the sheave alignment.
   - Low mounted fans feature a sliding base (See **Figure 27**).
   - Fan motors 15 hp and larger are mounted on a pivoting style base (See **Figure 28**).

5) Adjust motor mounts until belts are snug.

6) Check sheave mounting and alignment.

7) Tension drive according to "How to Check Belt Tension," page 25.

8) Never use belt dressing. It covers problems temporarily, but does not solve them.

9) Check new belts during the first day of operation, at the end of the first week, and monthly thereafter. Readjust tension as necessary.

NOTE: Store spare belt sets in a clean, cool, and dark place.

FIGURE 26. Fixed fan motor mount base.

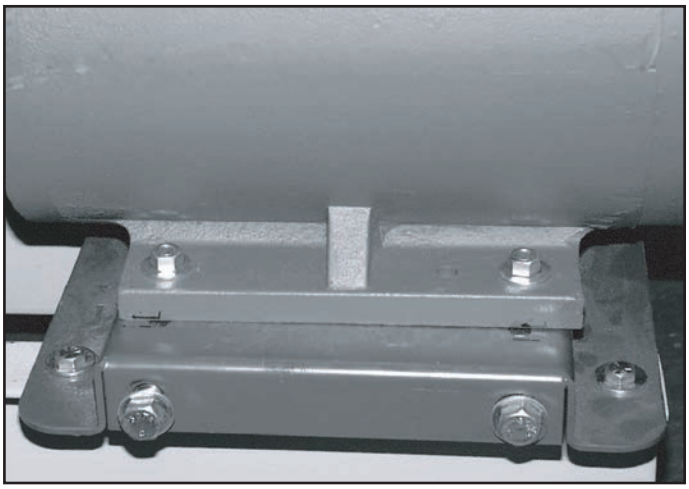


FIGURE 27. Sliding type fan motor mount base.

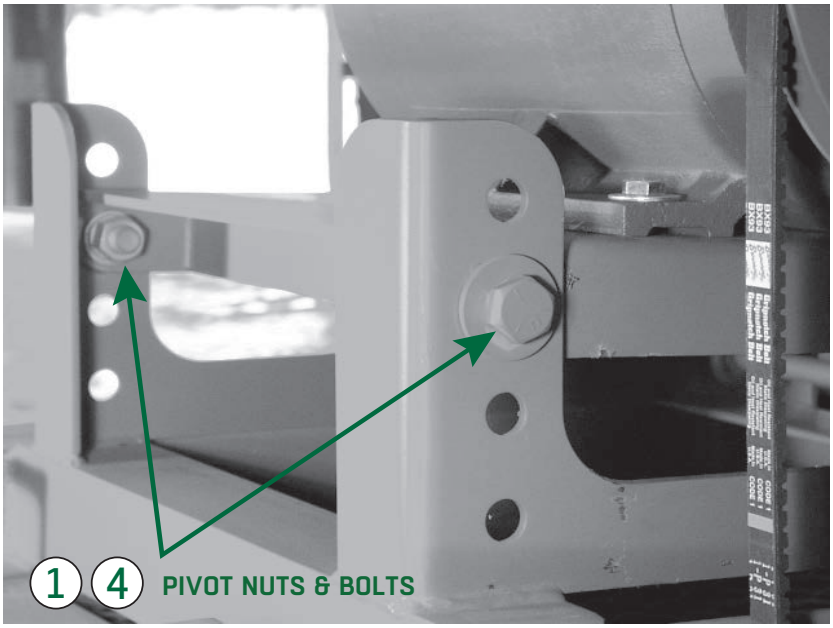
FIGURE 28. Pivoting style fan motor mount base.

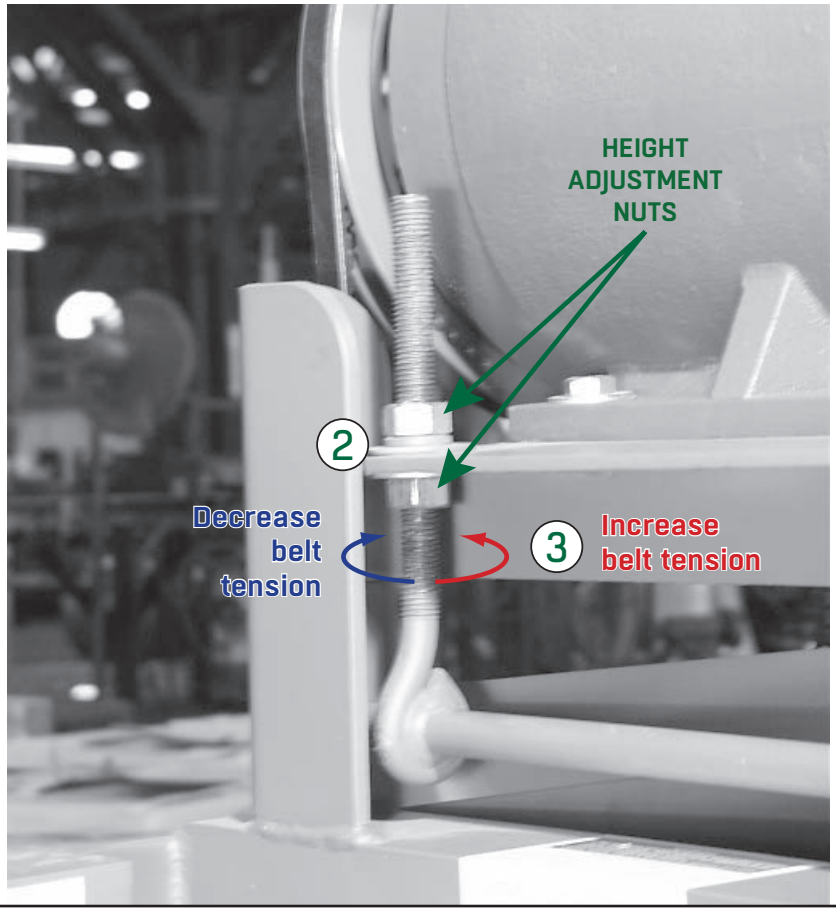
1) Loosen the pivot nuts and bolts (2 typical)

2) Loosen the height adjustment nuts (2 typical)

3) To increase belt tension, turn bottom nut counterclockwise. Once the required belt tension has been reached, fix position by tightening the top nut against the fan mount.

4) Retighten the nuts and bolts.





How to Check Belt Tension

Correct belt tension is extremely important to the effective, efficient and quiet operation of the energy recovery system. Over or under tensioning will cause excessive belt wear, sheave wear, noise and a variety of other problems.

A belt tension checker is recommended to adjust belt tension and to tension belts after replacement. The steps below describe how to check belt tension with one of several available belt tension checkers.

1) Measure the belt span.

2) Divide belt span by 64 to determine the belt deflection needed to check the tension.

3) Using the belt deflection number obtained in Step 2, set the large "O" ring on the Span Scale to the required deflection number (See **Figure 29**).

4) Set the small "O" ring at zero on the Force Scale (plunger.)

5) Place the scale end of the Tension Checker squarely on one belt at the center of the belt span as shown in **Figure 30**. Apply force on the plunger until the bottom of the large "O" ring is even with the top of the next belt, or until it is even with a straight edge laid across the sheaves.

6) Read the force scale under the small "O" ring to determine the force required to give the needed deflection.

7) Compare the force scale reading in Step 6 with the correct value for the belt style and cross section used as shown in the Standard V-Belt and Cogged V-Belt Table (See **Table 4**). The force scale reading should be between the minimum and maximum values shown.

8) If the deflection value is below the minimum, tighten the belts. If the deflection value is above the maximum, loosen the belts.

The tension on new belts should be checked during the first day's operation, at the end of the first week and monthly thereafter.

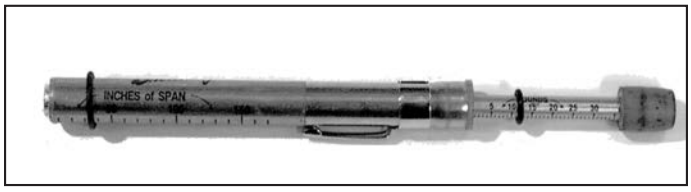


FIGURE 29. Belt tension checker.

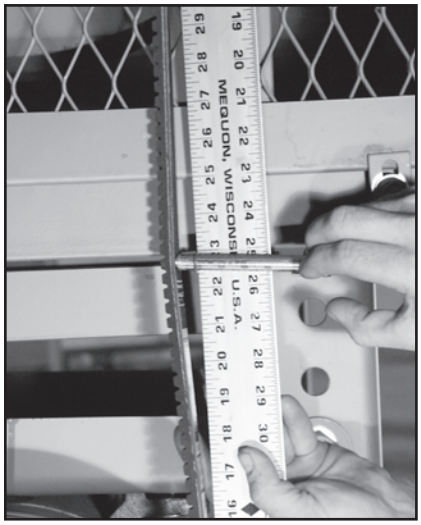


FIGURE 30. Checking the belt tension with a belt tension checker and a straightedge.

TABLE 4. Standard V-Belt and Cogged V-Belt Table

Belt Cross Section	Small Sheave Diameter Range	Deflection Force (lbs.)			
		Standard V-Belt		Cogged V-Belt	
		MIN	MAX	MIN	MAX
3V	2.65-3.65 4.12-6.9	3½ 4¾	5 6⅞	3⅞ 5¼	5½ 7⅞
5V	4.4-6.7 7.1-10.9 11.8-16.0	- 10½ 13	- 15¾ 19½	10 12⅞ 15	15 18¾ 22
8V	12.5-17.0 18.0-22.4	27 30	40½ 45	- -	- -

Belt Cross Section	Small P.D. Range	Deflection Force (lbs.)			
		Standard V-Belt		Cogged V-Belt	
		MIN	MAX	MIN	MAX
A	3.0-3.6 3.8-4.8 5.0-7.0	3 3½ 4	4¼ 5 5½	3⅞ 4½ 5	5½ 6¼ 6⅞
B	3.4-4.2 4.4-5.6 5.8-8.6	4 5⅛ 6⅜	5½ 7⅛ 8¾	6¾ 6½ 7⅜	8 9⅛ 10⅛
C	7.0-9.4 9.6-16.0	11¼ 14½	14⅜ 18½	13¾ 15¼	17⅞ 20¼
D	12.0-16.0 16.0-27.0	23⅝ 29¾	20¼ 39½	23¾ 30⅛	30½ 39¾

Example: Checking Belt Tension

1) Belt span = 64 inches (small sheave is 6.0 P.D. with BP Super Gripbelts.)

2) 64 inches / 64 inches = 1 inch deflection needed.

3) Set large "O" ring at 1 inch on span scale and small "O" ring at zero on plunger.

4) Press down on plunger until bottom of large "O" ring is even with the top of the next belt in the set or with the bottom of the straight edge.

5) Check the pounds of force registered on the force scale for a 1 inch deflection on the belt.

6) Belt cross section "B" used with a 6.0 inch P.D. small sheave should have a deflection force between 6⅞ lbs. and 8¾ lbs according to **Table 4**.

7) Increase or decrease tension on belts until the deflection force ranges between 6⅞ lbs. and 8¾ lbs.

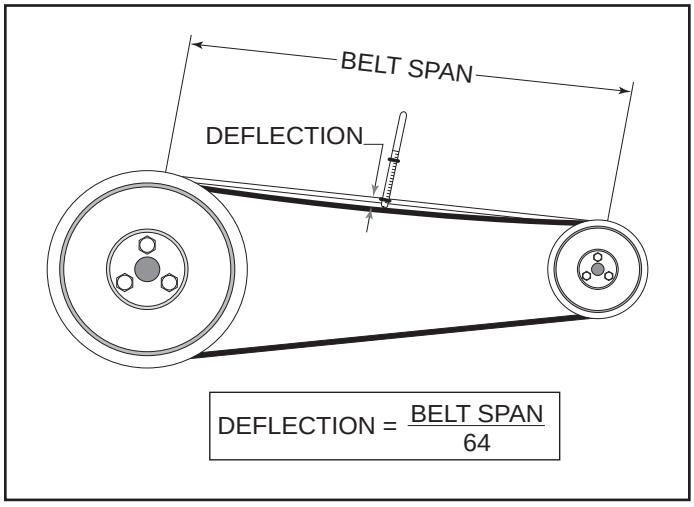


FIGURE 35. Schematic of how to determine the required belt tension.

Maintenance: Fans

- Check shafts and fan wheels every three months for dirt buildup, corrosion and cracks, and other signs of stress or fatigue. Clean as necessary, and apply new coatings when appropriate.

  NOTE: After applying new coatings and/or applying welds to the fan, be sure to check the assembly's balance. The application of welds and coatings can cause an imbalance.

- Lubricate fan bearings according to label decals that describe lubrication intervals and suggested lubricants.

  All fans installed are labeled with similar decal instructions (See **Figures 36 and 37**).

- When applying grease, observe the condition of the grease expelled from the bearings. Also note the amount of grease used. Both observations will suggest whether or not the lubrication schedule should be increased or decreased.

  Also note that all bearings are originally filled with grease at the factory. When the fans are started, the bearings may discharge excess grease through the seals for a short period of time. If so, it is not necessary to replace this initial discharge.

FIGURE 36. All fans installed in SEMCO systems are labeled with lubrication instructions that should be followed. On smaller fans the label can be found on the fan frame.

FIGURE 37. The lubrication label for larger fans is located on the fan inlet housing.

TABLE 5. Twin City Blower decal for ball bearing pillow blocks.

Relubrication Schedule (Months)* Ball Bearing Pillow Blocks									
Shaft Diameter (inches)	Speed (RPM)								
	500	1000	1500	2000	2500	3000	3500	4000	4500
½ thru 1 11/16	6	6	5	3	3	2	2	2	1
1½ thru 2 7/16	6	5	4	2	1	1	1	1	-
2 11/16 thru 2 15/16	5	4	3	2	1	1	1	-	-
3 7/16 thru 3 15/16	4	3	2	1	1	1	-	-	-

1. Lubricate with a high quality NLGI No. 2 or No. 3 multipurpose ball bearing grease having rust inhibitors and antioxidant additives. Some greases having these properties are:
- Shell - Alvania No. 2
- Gulf - Gulfcrown No. 2
- Mobil - Mobilgrease 532
- American - Rykon Premium 2

2. Lubricate bearings prior to extended shutdown or storage and rotate shaft monthly to aid corrosion protection.

TABLE 6. Twin City Blower decal for spherical roller bearings in solid pillow blocks.

Relubrication Schedule (Months)* Spherical Roller Bearings - Solid Pillow Blocks									
Shaft Diameter (in.)	Speed (RPM)								
	500	1000	1500	2000	2500	3000	3500	4000	4500
1 3/16 thru 1 7/16	6	4	4	2	1	1	1	1	½
1 11/16 thru 2 3/16	4	2	1½	1	½	½	½	½	½
2 7/16 thru 3 7/16	3	1½	1	½	½	-	-	-	-
3 15/16 thru 4 15/16	2½	1	½	-	-	-	-	-	-

1. Lubricate with a multipurpose roller bearing NLGI grade 2 grease having rust inhibitors, antioxidant additives and a minimum oil viscosity of 500 SSU at 100°F. Some greases having these properties are:
- Shell - Alvania No. 2
- Texaco - Premium
- Mobil - Mobilgrease 532
- American - Rykon Premium 2

2. Lubricate bearings prior to extended shutdown or storage and rotate shaft monthly to aid corrosion protection.

* Suggested initial greasing interval; relubricate while running, if safety permits, until some purging occurs at seals. Adjust lubrication frequency depending on condition of purged grease. Hours of operation, temperature and surrounding conditions will affect the relubrication frequency required.

Maintenance: Dampers

- Every 3 months, inspect dampers, arms, bars, and control rods and shafts for dirt and other foreign matter that would impede normal movement and prevent blades and seals from seating properly. Clean as necessary.
- Inspect seals every three months to be sure that none have pulled loose or deteriorated. If replacement is required and the seal can be replaced, remove it and replace with a new seal of the same shape, design and material used originally. Do not use a different size or shape. In some instances, the seal may not be replaceable and it may be necessary to replace the entire blade.
- No lubrication required. Damper shafts utilize non-lubricating bearings.

Maintenance: Coils

Heating and cooling coils function at peak efficiency when clean and free of foreign matter. Frequent visual inspections should be made, and any built up dirt and foreign matter should be removed. A fin comb may be required to remove matter entangled in fins or coils (See **Figure 43**), but flushing with water under normal local pressure will remove most particulates.

- An acid or alkaline coil cleaner is recommended every 1 or 2 years, depending upon the degree of oxidation, to thoroughly clean and brighten coils and fins.
- Local water conditions may make it necessary to treat chilled water systems, hot water systems and steam systems to control corrosion, sludge and/or metal oxides. In some water supplies, scale removers and inhibitors may also be required.
- Cooling coils – If water in the system will be exposed to outdoor temperatures that are below freezing, either drain the system before temperatures dip below 32°F, or add glycol to the system to prevent freezing.

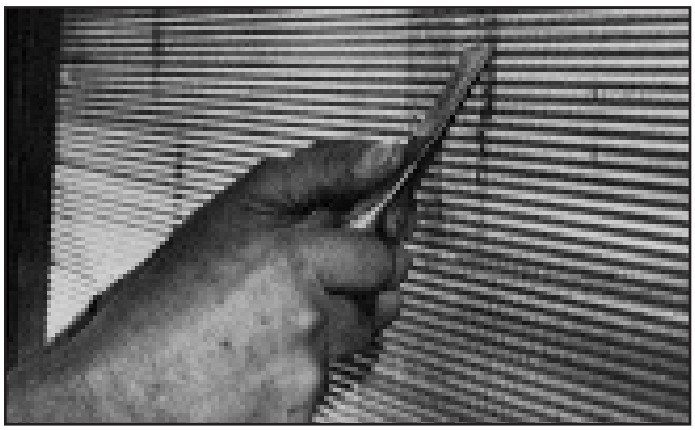


FIGURE 43. A fin comb may be used to remove matter entangled in fins, as well as to straighten fins. But normally, flushing coils with water under normal pressure will remove most matter.

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