

FV Preconditioner Series

FV-600

FV-1000

FV-2000

FV-3000

FV-4000

FV-5000

FV-7500

FV-9000



Owner's Manual

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FV Outdoor Air Preconditioners

The SEMCO FV Series of outdoor air preconditioners have been specifically designed to reduce the energy required to heat and cool outdoor air by as much as 80 percent. This unique capability allows both new and existing buildings to benefit from a healthy indoor environment by supplying high amounts of outside air in a very cost-effective manner.

The FV preconditioner also allows HVAC systems to effectively and economically accommodate the increased outdoor air quantities recommended by the American Society of Heating, Refrigerating and Air Conditioning Engineers (ASHRAE) Standard 62. This standard guides the amount of ventilation air that should be introduced to a building to achieve acceptable indoor air quality.

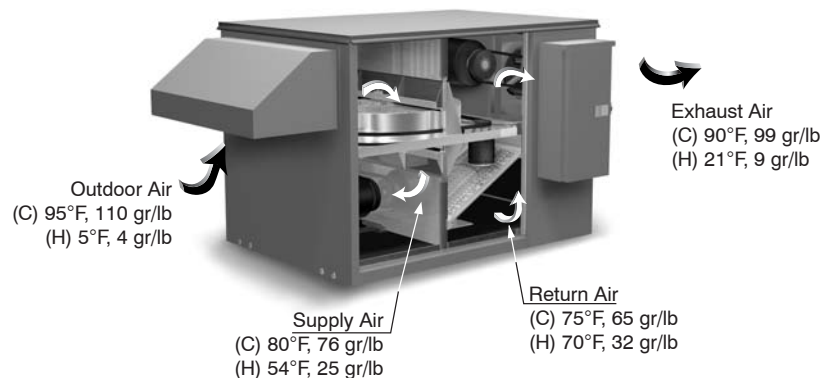
The SEMCO FV system is a packaged system which includes supply and exhaust air fans, outdoor and return air filtration, and SEMCO's EXCLU-SIEVE® total energy recovery wheel. The EXCLU-SIEVE wheel recovers both sensible (temperature) and latent (moisture) energy. Therefore, it cools and dehumidifies the outdoor air during the cooling season, while heating and humidifying the air in the heating season.

The EXCLU-SIEVE wheel utilizes a fluted aluminum sheet which is coated with a fast-acting, adsorbent desiccant. As the transfer media slowly rotates between the outdoor and exhaust airstreams, the higher temperature air gives up its sensible energy to the aluminum. This energy is then given up to the cooler airstream during the second half of the revolution. (See *Figure 1*.)

Just as the temperature is captured and released, so is the moisture. The EXCLU-SIEVE's molecular sieve desiccant coating has a strong attraction to water vapor. Since the opposing airstreams have different temperature and moisture contents, they also have different vapor pressures. This difference provides the driving force that causes the transfer of latent energy.

Through the use of a patented 3Å molecular sieve desiccant coating, EXCLU-SIEVE recovers the moisture from an exhaust airstream without transferring the airborne pollutants contained within the exhaust airstream to the supply airstream. This important and unique feature has been well documented through independent laboratory and field testing. A copy of the report is available upon request.

Figure 1. An inside view of the FV Series Preconditioner with typical operating temperatures during the cooling (C) and heating (H) season respectively.



Model Description

On the front of the FV unit is an identification label. The specifications on the label correspond to the actual unit. The model number (600, 1000, 2000, etc.) refers to the nominal air volume (in cfm) that the FV preconditioner is capable of supplying.

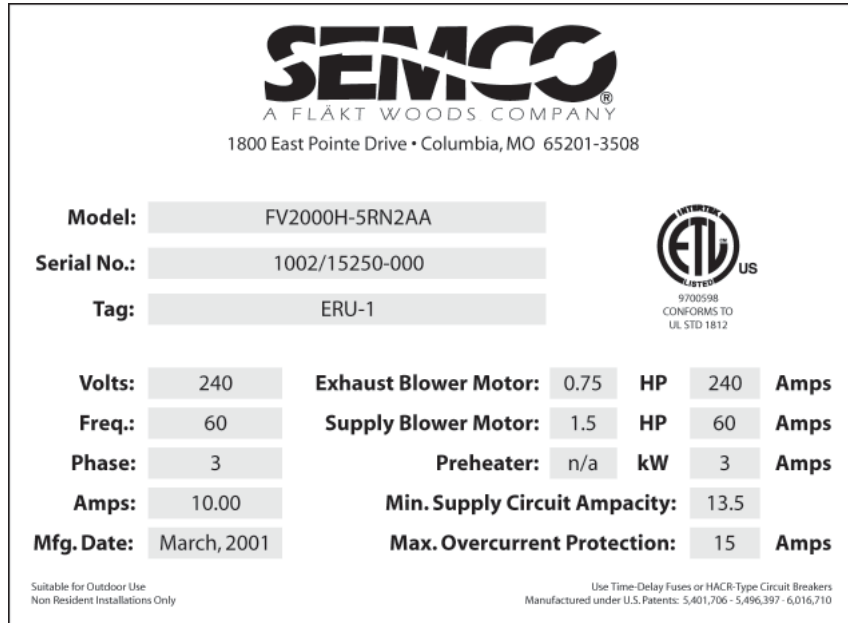


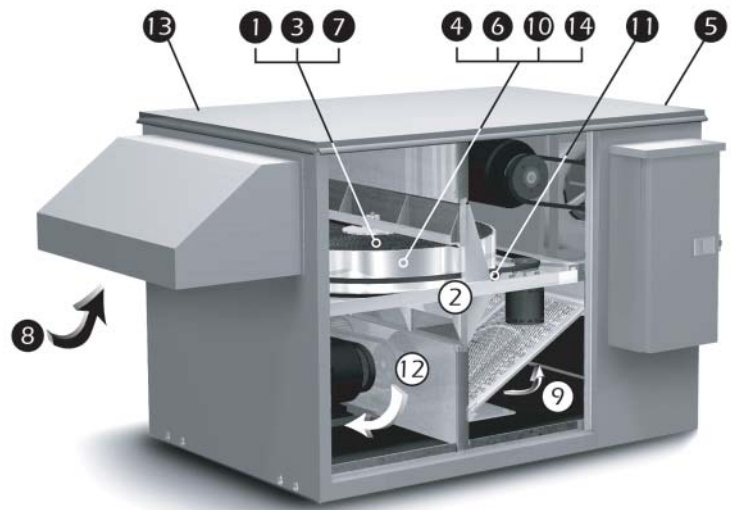
Figure 2. Typical FV nameplate with electrical data.

Definitions

- 1 Adsorption** – The physical bonding of water vapor on the surface of the desiccant.
- 2 Cassette** – The framework supporting the wheel. (See also Wheel.)
- 3 Desiccant** – A naturally occurring or man-made material with a high affinity for water vapor. SEMCO uses a highly selective 3Å molecular sieve desiccant material which minimizes cross contamination.
- 4 Enthalpy wheel** – A common term used to describe all rotating, wheel-shaped heat transfer devices that exchange sensible (temperature) and latent (water vapor) energy from one airstream to another. The word, enthalpy, means heat content or total heat. The term, enthalpy exchanger, may also be used.
- 5 Exhaust air** – The air from indoors that passed through the energy recovery wheel and is being ducted outdoors.

- 6 **Heat wheel** – This generally describes all rotating devices which transfer only sensible energy.
- 7 **Media** – The corrugated material inside the wheel.
- 8 **Outdoor air** – The fresh outside air that is being drawn in the energy recovery wheel. Once it passes through the wheel it becomes the supply air.
- 9 **Return air** – Air from the indoor space that is pulled through the energy recovery wheel. Once it passes through the wheel it is referred to as exhaust air.
- 10 **Rotor** – The media-filled wheel that rotates. It transfers heat energy and water vapor from one ducted airstream to the other. Often, the rotor will be referred to as a wheel.
- 11 **Seal** – The soft material that closely surrounds the rotor to limit the amount of bypass air around the rotor.
- 12 **Supply air** – Air provided to the indoor space. Outside air that passes through the energy recovery wheel becomes supply air.
- 13 **Unit** – Used frequently throughout this manual to mean the EXCLU-SIEVE Energy Recovery Wheel and attendant components such as cabinets, motors, fans and other parts that work together to make an effective energy recovery product.
- 14 **Wheel** – Refers to the rotating wheel containing the coated media. The stationary framework supporting the wheel is the wheel cassette.

Figure 3. Typical FV unit with components highlighted per definitions above.



Receiving & Inspection

Upon delivery, confirm that the quantity and model(s) received matches the Bill of Lading. If there is any discrepancy, immediately notify SEMCO.

Inspect the skidded FV(s) for signs of damage. If damage is suspected, sign the Bill of Lading “damaged”. If no visible damage is apparent, the unit should be properly lifted and stored until installation.

While skidded, the FV can be lifted by a forklift using the skid. Once removed from the skid, lifting must only be performed with spreader bars, cable and hooks. Do not attempt to lift the FV by grasping the hoods.

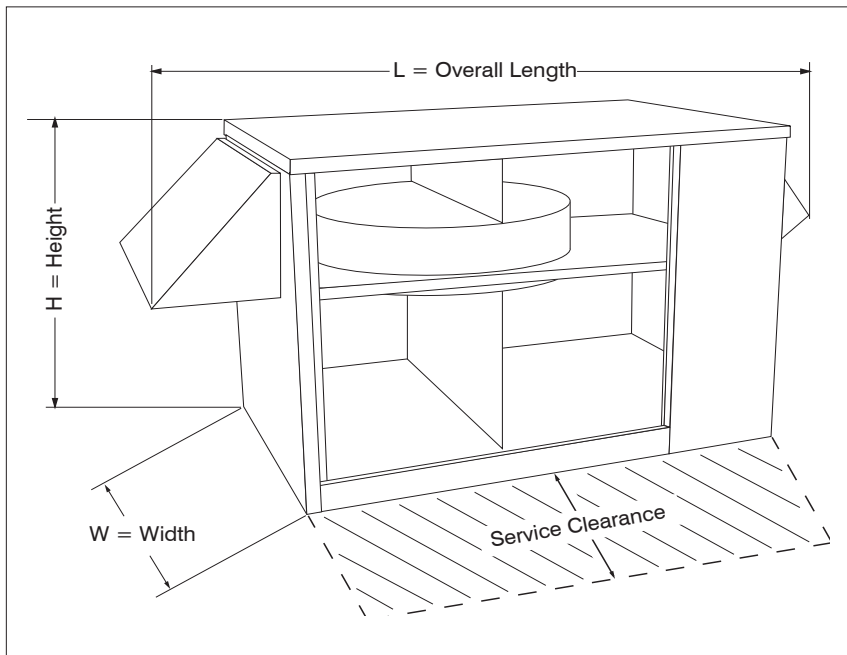
Note: In the table of weights on the right, the package weighs approximately 100 lbs. more than the net weight.

Model	Net Weight (lbs)
FV-600	450
FV-1000	500
FV-2000	550
FV-3000	1,000
FV-4000	1,150
FV-5000	1,150
FV-7500	1,800
FV-9000	1,800

Storage

If the FV is to be stored for any time before installation, it must be protected from the weather. Indoor storage is recommended. The unit has openings provided for ducting. These openings make the internal equipment (motors, belts, fans and insulation) vulnerable to inclement weather conditions (prior to installation) and can cause standing water to accumulate inside the enclosure. This is to be absolutely avoided.

Overall Dimensions



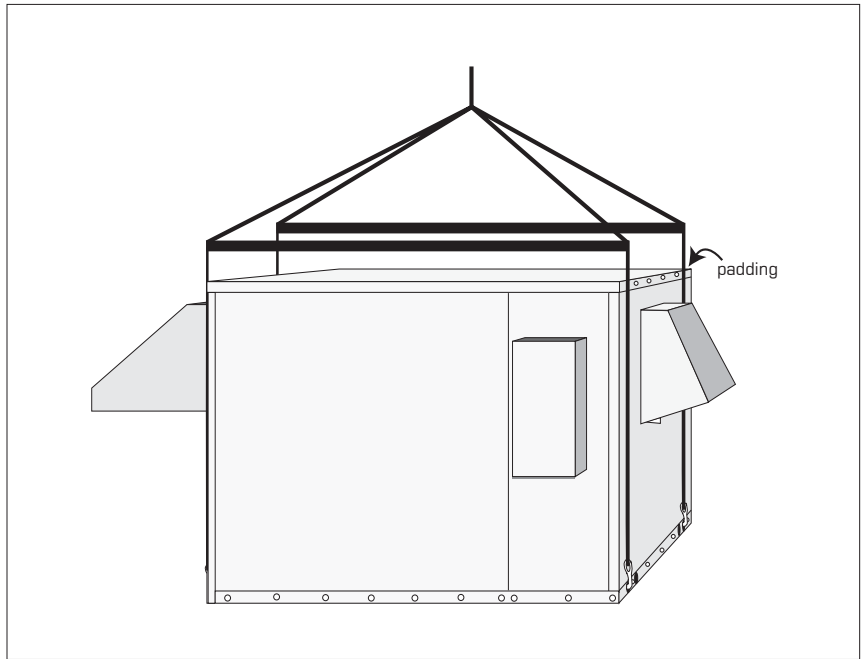
Unit	L	H	W
Dimensions in inches			
FV-600	69.5	31.0	29.0
FV-1000	69.5	31.0	29.0
FV-2000	80.6	32.4	37.0
FV-3000	96.0	47.7	45.0
FV-4000	126.5	51.5	54.0
FV-5000	126.5	51.5	54.0
FV-7500	143.5	58.6	64.6
FV-9000	143.5	58.6	64.6

Service clearance is equal to the width of the unit.

Lifting Technique

When rigging the FV unit, spreader bars must be used. Padding must be inserted between the straps and the unit to avoid scratching the paint. Lifting holes are provided at four points located on the base perimeter of the FV unit. The weights shown on page 4 may be used as maximum weights for rigging.

Figure 4. Correct lifting technique using spreader bars.



Installation

Installation of the FV is a relatively simple procedure, but should be undertaken in a methodical fashion, following the directions outlined in this manual.

Note: Prior to starting unit, open access door and;
Remove loose parts shipped inside;
Remove wheel shipping restraint (FV-3000 thru FV-9000 only).

The installation location should be chosen to provide easy, convenient access. As with all mechanical equipment, routine maintenance and inspection is necessary. Choose a site from which connecting duct is visible. Avoid locations that are near or downwind of smoke, fumes or exhaust outlets of other equipment. The front access panel should have clearance space equal to the depth of the unit to allow for service.

Once the installation location is determined, the FV should be skidded and closely examined. Any defects or problems should be reported to SEMCO immediately.

Several ducting arrangements are possible. Make sure your duct plans match the FV duct opening arrangement. (See Unit Configuration, p.8).

The FV can be ordered for indoor or outdoor installation. An outdoor unit is identified by the existence of two hoods that are shipped on top of the FV unit. It will be necessary to attach the outdoor air intake hood (larger one with filter rack) and the exhaust air outlet hood (smaller one with damper) on their designated openings (see *Figure 6a-d*). The indoor unit is identified by a rectangular duct shipped on top of the unit. This indoor intake duct must be installed over the outdoor air intake opening (see *Figure 6a-d*). Use the given alignment holes to place the hood or duct in the correct position.

If the unit is a rooftop unit, it may be installed on a curb. If SEMCO supplies the curb, then it will have been shipped separately. The curb must be installed before a rooftop FV can be placed. Proper care should be taken to ensure correct placement of the curb before holes are cut for ducting through the roof itself. Effective waterproofing of the rooftop interface is necessary. That means sealing around the roof curb to prevent any leakage into the building or the air ducts. The curb and FV must be installed and operated in a horizontal position.

If the unit is not installed on the roof, then a concrete or paved pad to support the FV must be provided. The pad must be of sufficient height and located to assure proper water drainage in any weather.

Inspect the interior of the unit for any damage. On the floor inside the unit is the outdoor air metal filter. This filter is to be installed at the outdoor air intake opening after the hood (outdoor FV only) has been attached. On the FV-3000, FV-4000, FV-5000, FV-7500, and FV-9000 remove wheel shipping restraint.

The SEMCO energy recovery wheel is mounted horizontally inside the FV. The motor and belt arrangement that turn the wheel are visible next to the wheel at the access panel opening. The motor wires running to the control panel are attached by a quick release disconnect. The quick disconnect must be separated before sliding out the wheel cassette. The wheel cassette need not be moved for installation or hookup, but it can be pulled out for easy maintenance and inspection purposes.

When the unit has been placed in its permanent location, duct work should be brought up to and attached to the unit. Duct work may be flanged and screwed to the unit face for horizontal connections. Duct work for a vertical unit should be flanged and gasketed level with the curb to allow the unit weight to form the seal. Penetrations through the unit floor must be avoided to prevent any water penetrating into the cabinet.

If the unit has been ordered with electric preheat, it is shipped installed. The main power connection to the unit is made at the electric coil instead of the unit control panel. For the indoor version of the FV, the electric coil should be externally insulated after installation.

On the front right side of the FV is the unit identification tag. It states the electrical requirements for the unit. (If electric preheat option has been ordered, the unit ID tag is located on the heater.) Make sure the power provided to the installation site matches that required by the unit. Note and verify that voltage/phase/capacity needed and provided are the same, and the line voltage must not vary more than $\pm 5\%$.

Curb Mounting

The FV series is generally installed on a curb (unless mounted indoors). The curb ships separately for preinstallation to simplify rigging. The dimensions of the curbs required for the FV units are listed below.

All FV configurations have the same curb dimensions. The curb for an FV unit can be provided by SEMCO or purchased from a curb manufacturer provided it is designed to support the weight of the FV unit specified in this manual and conforms to the dimensions listed in the table below.

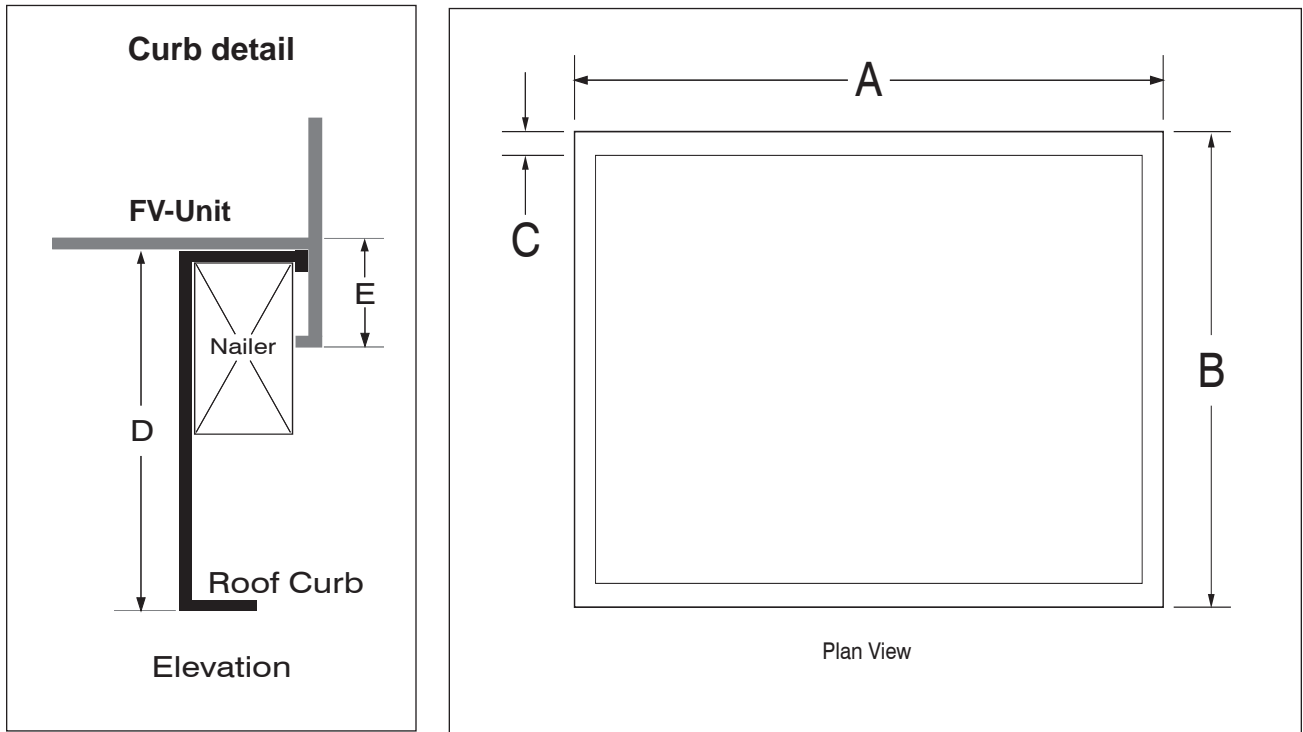


Figure 5. Curb dimensions.

Model	A	B	C	D	E
FV-600	40.1	25.0	1.7	14.0	3.0
FV-1000	40.1	25.0	1.7	14.0	3.0
FV-2000	47.4	33.0	1.7	14.0	2.0
FV-3000	60.6	41.0	1.7	14.0	3.0
FV-4000	74.6	49.9	1.7	14.0	3.0
FV-5000	74.6	49.9	1.7	14.0	3.0
FV-7500	91.0	60.3	1.7	14.0	3.0
FV-9000	91.0	60.3	1.7	14.0	3.0

All dimensions in inches.

Unit Configuration

The FV preconditioner can be installed in one of four possible configurations depending on the arrangement of the supply and return air openings.

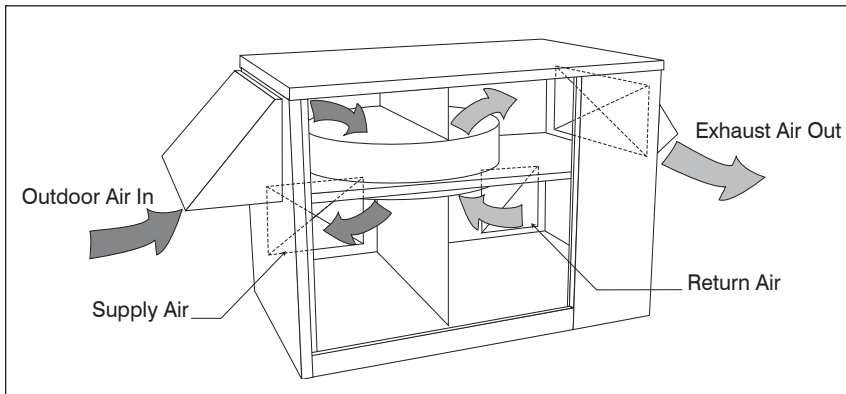


Figure 6a. H Series configuration with horizontal supply air and horizontal return air duct arrangement.

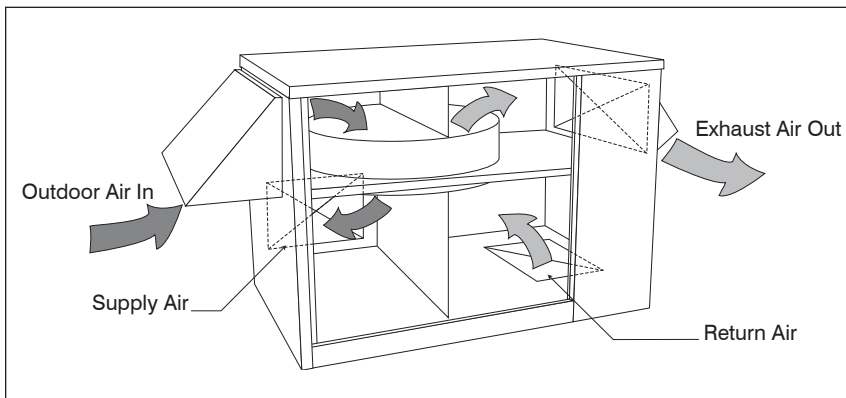


Figure 6b. HS Series configuration with horizontal supply air and vertical return air duct arrangement.

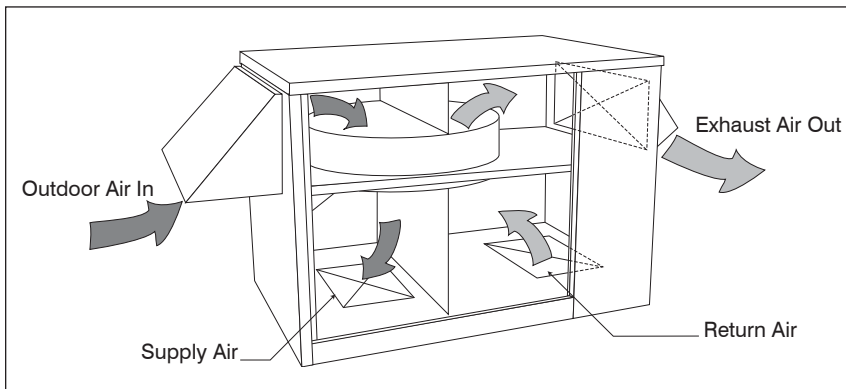


Figure 6c. V Series configuration with vertical supply air and vertical return air duct arrangement.

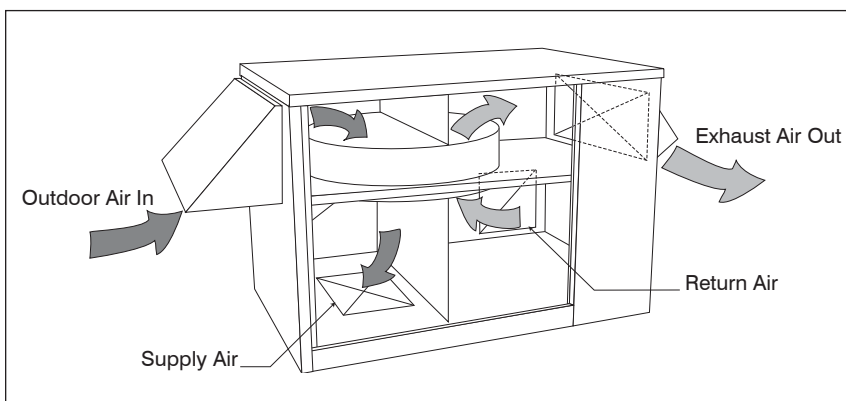


Figure 6d. VS Series configuration with vertical supply air and horizontal return air duct arrangement.

Supply & Exhaust Airflow Dampers

All outdoor FV units have airflow dampers on the supply air intake and exhaust air outlet that are field adjustable. FV units installed indoors do not have an exhaust airflow damper and one must be provided in the ductwork.

Supply

To adjust the Supply / Outside Air flow damper, turn the FV unit off without shutting off main power.

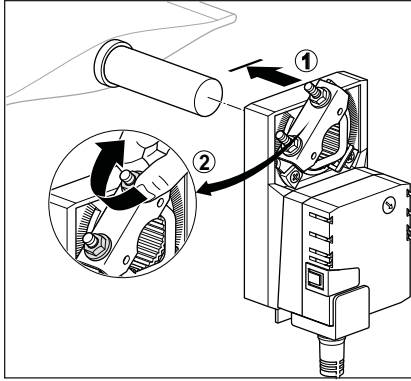


Figure 7a.

Open the access door and observe the damper, allow it to finish moving through its stroke to the full closed position, then turn off main power to the unit

Confirm the damper is now fully closed, but the actuator is 5° from fully closed, (1/16" to 1/8" between stop and clamp), See *Figure 7c*. This is called “pre-loading” the actuator. When the actuator is powered and sent to the closed position: it will put its full torque on the shaft compressing the edge and blade seals. The actuator is electronically protected from overload and will not be damaged.

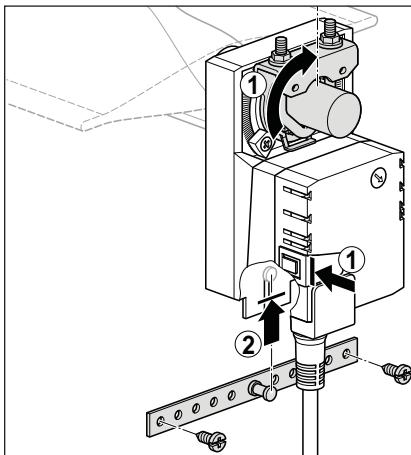


Figure 7b.

If “pre-load” setting requires adjustment follow the two step procedure listed below, if “pre-load” is correct skip these two steps.

1. Press the manual override and turn the damper shaft until the blades are fully closed.

2. Loosen the nuts on the universal clamp. Press the manual override button and rotate the clamp to about 5° from the closed position (1/16" to 1/8" between stop and clamp).

Tighten the two nuts on the universal clamp with a 10 mm wrench (See *Figure 7c*).

You have now confirmed or adjusted correctly the fully closed position of the damper.

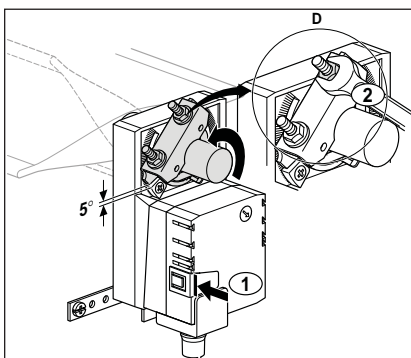


Figure 7c.

The factory-set open damper position, is fully open against the mechanical limit screw in the frame of the damper. This limit screw must be left in place to prevent the damper blade from contacting the energy recovery wheel.

Testing the Installation

1.(a) Without Power, Disengage the gear train with the manual override button (1) and move the shaft from closed to open to closed. Ensure that there is no binding and that the damper goes fully open and closes with 5° of actuator stroke left.

2.(b) Correct any problems and retest.

To adjust the exhaust airflow damper, turn the unit off and remove the nut/bolt stops on both sides of exhaust hood. Reposition the nut/bolt stops in the desired adjusting holes and retighten. Be sure to use matching adjusting hole on both sides of the exhaust hood. Readjust the stops as necessary to obtain the desired airflow. The exhaust airflow damper will automatically open to the set position when the exhaust fan is on, and close when the exhaust fan is off.

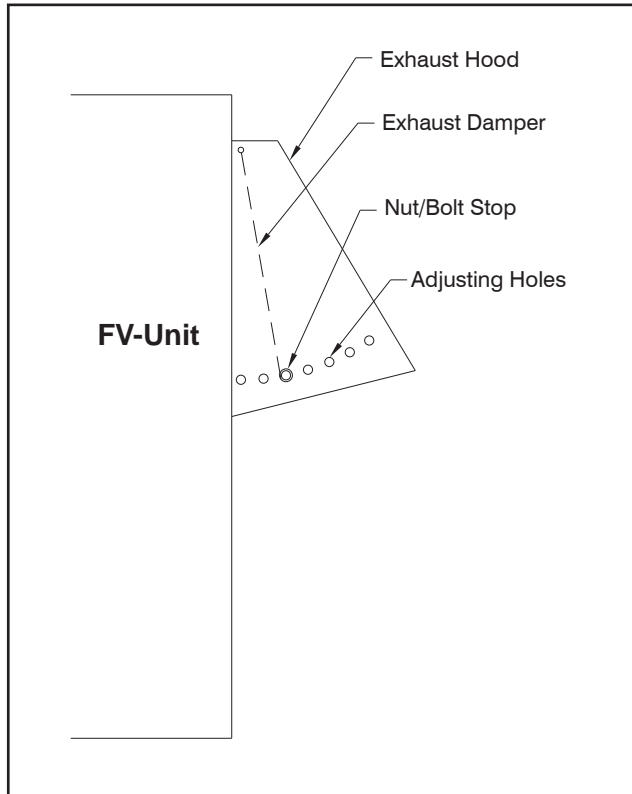


Figure 8. *Diagram of exhaust hood damper.*

Controls

Basic Package

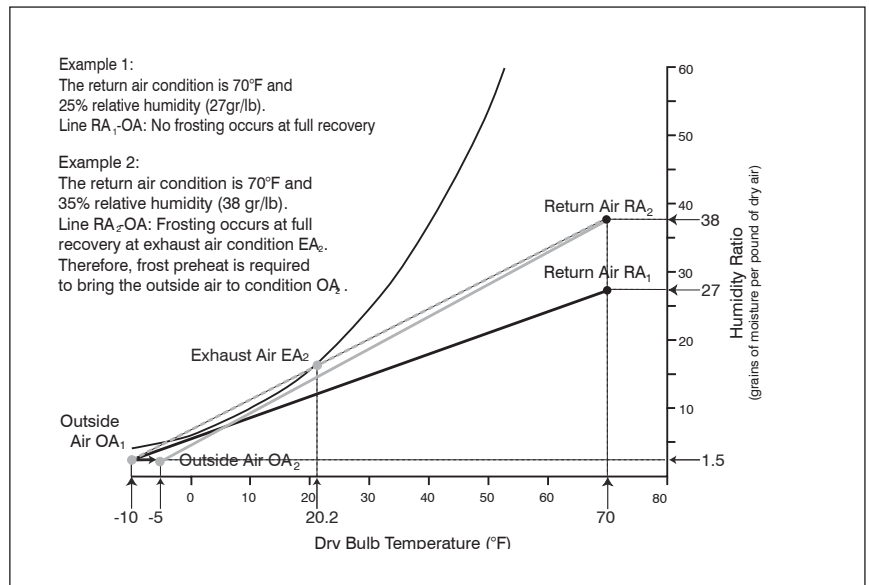
The basic FV unit ships with no controls. The standard wiring package provides connections for the starting/stopping of the complete unit, supply fan and the energy wheel. The connections are shipped with factory jumpers installed. Remote control of any of these options can be achieved by removing the correct factory jumper and installing a contact in its place. The contact should be capable of handling 24V power at 2 amps. (See appropriate 1Ø or 3Ø circuit diagram on pages 14-18). It is strongly recommended that a remote unit start/stop contactor (supplied by others) be used to turn the unit on and off. This allows the outdoor air damper to fully close when the unit is off.

Optional Electric Preheat Frost Control

For applications where the outdoor conditions do not exceed -10°F and where the indoor design conditions do not exceed 70°F and 25 percent RH, the energy wheel can operate at full capacity and will not frost. For colder design conditions or buildings with higher humidity levels, frosting of the wheel can be prevented by providing a modest amount of preheat to the outdoor air. The amount of preheat required is small and is not intended to raise the outdoor air temperature above the freezing point. It is only necessary to keep the exhaust air temperature above the dew point. This prevents condensation on the wheel so that all the moisture transfer occurs in the vapor phase.

The preheat control option includes a finned tube electric coil mounted on the outdoor air intake of the unit, an SCR controller and a temperature sensor mounted in the outdoor air plenum. The temperature for the controller is set to the minimum temperature of the outdoor air required to prevent condensation at the design indoor temperature and humidity. This is done by plotting a line on the psychrometric chart from the indoor design condition down to the coldest temperature that does not cause the operating line to intersect the saturation curve on the chart. As stated above, for inside conditions of 70°F and 25 percent RH, this temperature is about -10°F .

Figure 9. Using the psychrometric chart to determine the need for preheat frost control.



Optional Stop/Jog Economizer And Wheel Frost Protection (SMX70 Controller)

The stop/jog economizer option is used during moderate outdoor air temperatures to stop the recovery wheel. The jog function is included to allow the wheel to rotate periodically to self-clean.

When the outdoor temperature is between 55°F (the cooling coil supply air temperature) and 75°F (the space return air temperature) the wheel will raise the outdoor air temperature which will add slightly to the space sensible load. At the same time, if the outdoor humidity level is higher than the space humidity level, the recovery wheel will dehumidify the fresh air slightly reducing the space latent load. If the local climate is such that these intermediate temperature days occur mostly at moderate humidity conditions, the stop/jog economizer can eliminate the heating of the outdoor air and provide some free cooling to the space.

The stop/jog economizer consists of a temperature sensor and a circuit board with dip switch selection of temperature and stop/jog times. When the outdoor temperature is in the range between the two setpoints, the timer relay operates the wheel for approximately 30 seconds in every 30 minutes.

The SMX-70 board also has the ability to put the wheel in stop/jog mode when the outdoor air temperature drops below a preset value. This is a lower cost option than the electric preheat. It also has the disadvantage in supplying untreated outdoor air into the ventilation system whenever the stop/jog activates.

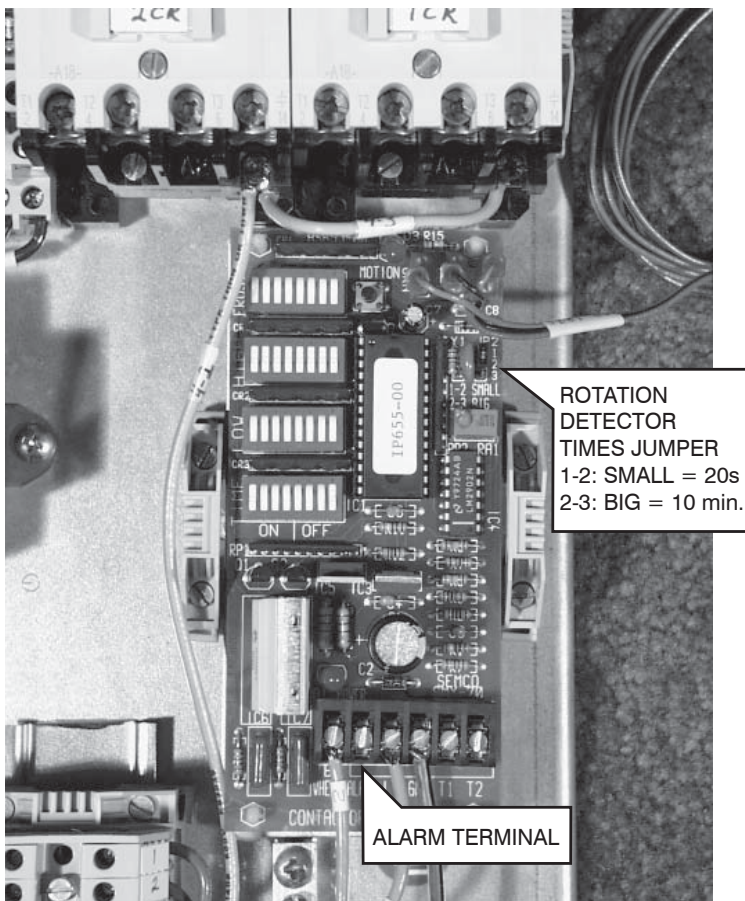


Figure 10. SMX70 controller as installed on the electric panel.

Optional Rotation Detector Sensor

The SMX70 stop/jog economizer board can be supplied with a motion detector to monitor the rotation of the energy recovery wheel. The sensor is a hall effect device that senses the passage of a small magnet on the perimeter of the rotor. When the sensor fails to register any wheel rotation - it requires a signal every 20 seconds or 10 minutes depending on the mode of operation - it energizes the alarm terminal (24 VAC, .3 amp max) of the SMX70 board. This can be used to operate a relay (to be supplied by others) for remote indication of the alarm. The sensor will not create a false alarm when the SMX70 controller is in stop/jog mode.

The alarm resets itself once the wheel begins to turn or the system is shut off and restarted.

Please note that the triac output for the alarm signal requires a load, such as a contactor coil, to operate. This output may not register on a digital multimeter without the load, or may cause a lamp with no limiting resistor to light dimly.

Figure 11. SMX70 Controller settings.

STOP/JOG TEMPERATURE SETPOINTS (DEG. F)		
DDDDDDDD 40	DUUUUUDD 54	DDUUUUDD 68
UUUUUUDD 41	UUUUUUDD 55]LOW	UDUUUUDD 69
DUUUUUDD 42	DDUUUUDD 56	DUUUUUDD 70
UUUUUUDD 43	UUUUUUDD 57	UUUUUUDD 71
DDUUUUDD 44	DUUUUUDD 58	DDUUUUDD 72
UDUUUUDD 45	UUUUUUDD 59	UUUUUUDD 73
DUUUUUDD 46	DDUUUUDD 60	DUUUUUDD 74
UUUUUUDD 47	UDUUUUDD 61	UUUUUUDD 75]HIGH
DDUUUUDD 48	DUUUUUDD 62	DDUUUUDD 76
UUUUUUDD 49	UUUUUUDD 63	UDUUUUDD 77
DUUUUUDD 50	DDUUUUDD 64	DUUUUUDD 78
UUUUUUDD 51	UUUUUUDD 65	UUUUUUDD 79
DDUUUUDD 52	DUUUUUDD 66	DDUUUUDD 80
UDUUUUDD 53	UUUUUUDD 67	

FROST SETPOINTS (DEG.F)		
DDDDDDDD]DISABLED		UUUUUUDD 2
UUUUUUDD -14	UUUUUUDD -6	DUUUUUDD 3
DUUUUUDD -13	DUUUUUDD -5	UUUUUUDD 4
UUUUUUDD -12	UUUUUUDD -4	DDUUUUDD 5
DDUUUUDD -11	DUUUUUDD -3	UDUUUUDD 6
UDUUUUDD -10	UUUUUUDD -2	DUUUUUDD 7
DUUUUUDD -9	DUUUUUDD -1	UUUUUUDD 8
UUUUUUDD -8	UUUUUUDD 0	DDUUUUDD 9
DDUUUUDD -7	DDUUUUDD 1	UUUUUUDD 10

OFF/ON TIME*	
ON TIME (SECONDS)	OFF TIME (MINUTES)
5	DDDD DDDD 0.1 (TEST)
10	UUDD UUDD 10
15	DUDD DUDD 20
20	UUDD UUDD 30
25	DDUD DDUD 40
30	UUUD UUUD 50
35	DUUD DUUD 60
40	UUUD UUUD 70
45	DDUD DDUD 80
50	UUUD UUUD 90
55	DUUD DUUD 100
60	UUUD UUUD 110
65	DUUD DUUD 120
70	UUUD UUUD 130
75	DUUD DUUD 140
80	UUUD UUUD 150

*ON TIME IS SWITCH POSITION 1,2,3,4
*OFF TIME IS SWITCH POSITION 5,6,7,8

FROST	1	2	3	4	5	6	7	8
WHEEL ONLY FROST PROTECTOR Typically Disabled								
UPPER STOP/JOG ECONOMIZE SETPOINT (Typically 75°F)								
LOWER STOP/JOG ECONOMIZE SETPOINT (Typically 55°F)								
STOP/JOG TIMES (Typically 30s on, 30 minutes off.)								

UP
 DOWN

SMX70 CONTROLLER

Thermostat Frost Protection

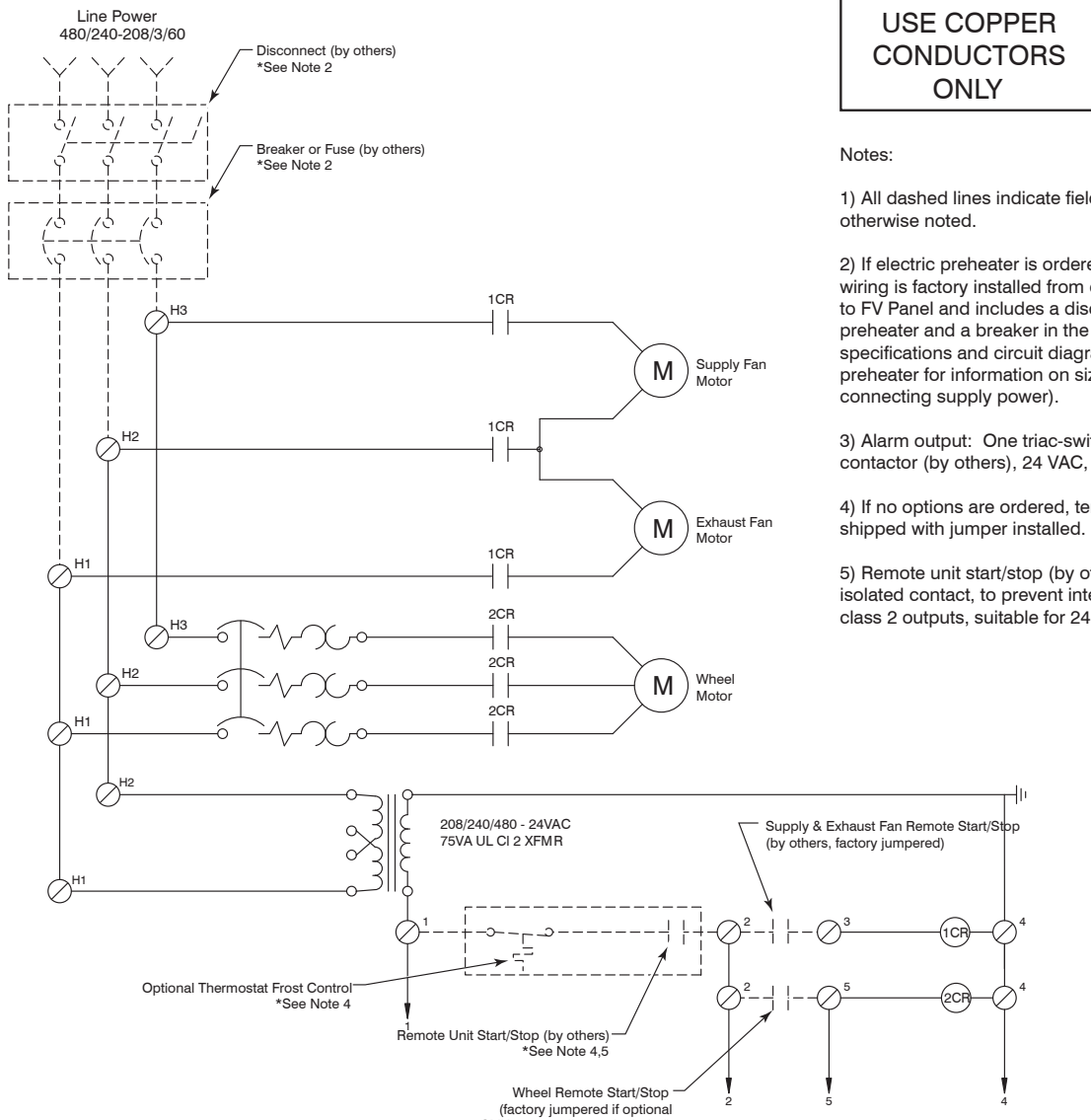
A lower cost solution to frost protection is to use a thermostat to turn the entire ventilation unit off during periods when the air is below the calculated frosting temperature. This should only be used in non-critical ventilation applications as no outdoor air will be supplied when the unit is switched off by the thermostat.

3Ø Circuit Diagram, FV-600

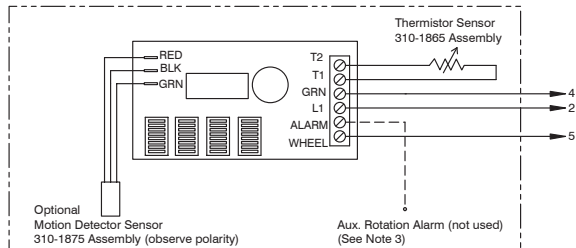
USE COPPER CONDUCTORS ONLY

Notes:

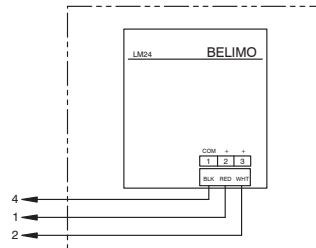
- 1) All dashed lines indicate field wiring unless otherwise noted.
- 2) If electric preheater is ordered, the power wiring is factory installed from electric preheater to FV Panel and includes a disconnect at the preheater and a breaker in the FV Panel. (See specifications and circuit diagram on electric preheater for information on sizing and connecting supply power).
- 3) Alarm output: One triac-switch to drive a contactor (by others), 24 VAC, 0.3 amps max.
- 4) If no options are ordered, terminals 1 & 2 are shipped with jumper installed.
- 5) Remote unit start/stop (by others) may be any isolated contact, to prevent interconnection of class 2 outputs, suitable for 24 VAC @ 2 amps.



Optional Stop/Jog Controller: Model SMX70



Optional Outdoor Air Damper Actuator: Belimo LM24

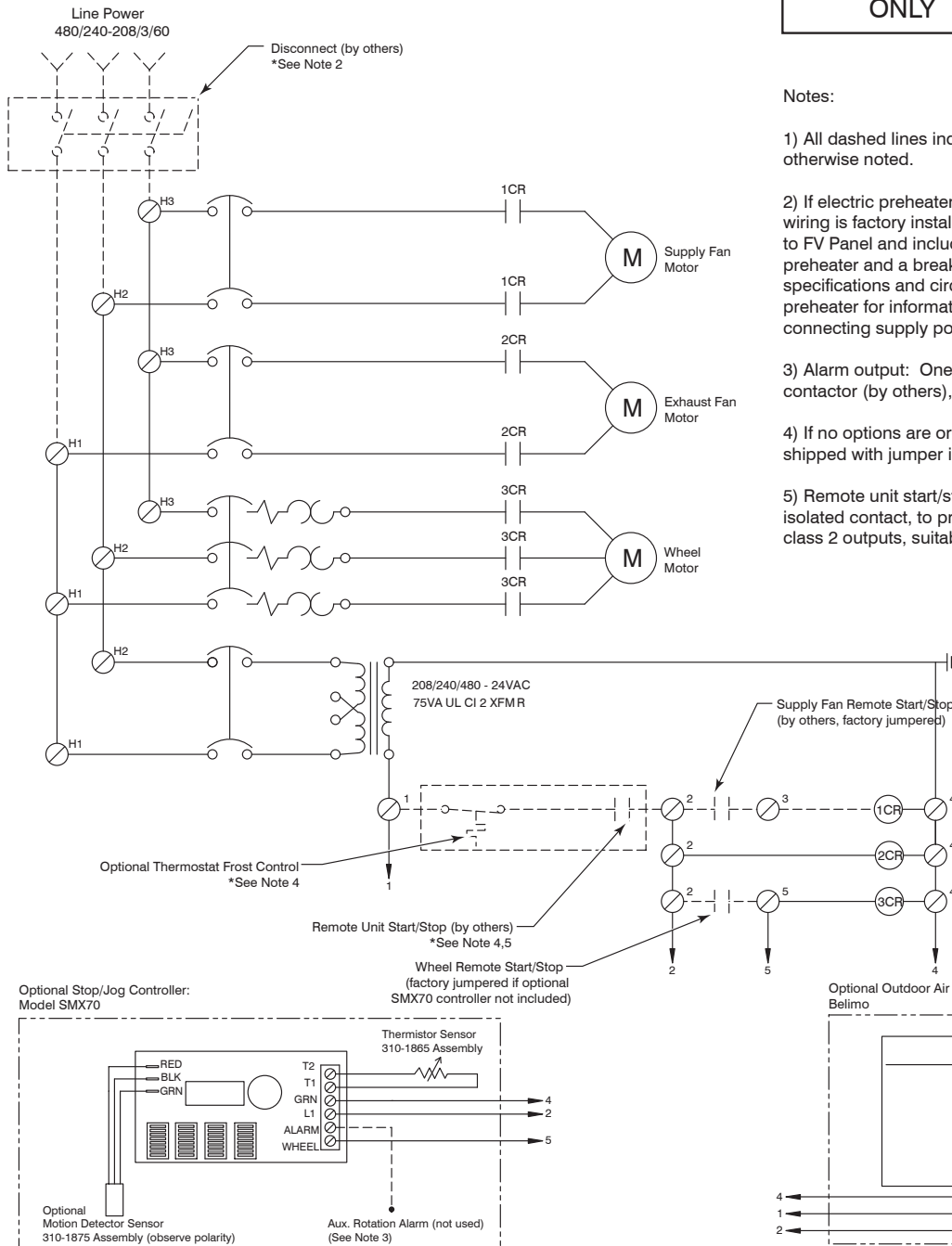


Tightening Torque for Slotted Screws	
AWG Size	IN-LB
18-10	20
8	25
6-3	35

To avoid possible contactor failure, place start/stop relays inside the electrical enclosure.

3Ø Circuit Diagram, FV-1000

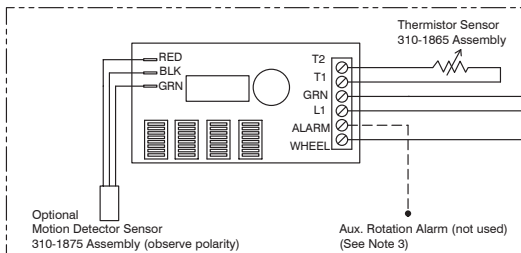
USE COPPER CONDUCTORS ONLY



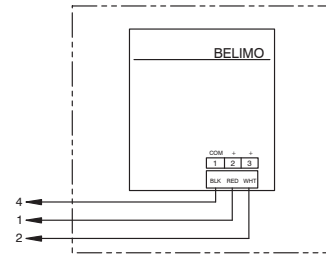
Notes:

- 1) All dashed lines indicate field wiring unless otherwise noted.
- 2) If electric preheater is ordered, the power wiring is factory installed from electric preheater to FV Panel and includes a disconnect at the preheater and a breaker in the FV Panel. (See specifications and circuit diagram on electric preheater for information on sizing and connecting supply power).
- 3) Alarm output: One triac-switch to drive a contactor (by others), 24 VAC, 0.3 amps max.
- 4) If no options are ordered, terminals 1 & 2 are shipped with jumper installed.
- 5) Remote unit start/stop (by others) may be any isolated contact, to prevent interconnection of class 2 outputs, suitable for 24 VAC @ 2 amps.

Optional Stop/Jog Controller: Model SMX70



Optional Outdoor Air Damper Actuator: Belimo



Tightening Torque for Slotted Screws	
AWG Size	IN-LB
18-10	20
8	25
6-3	35

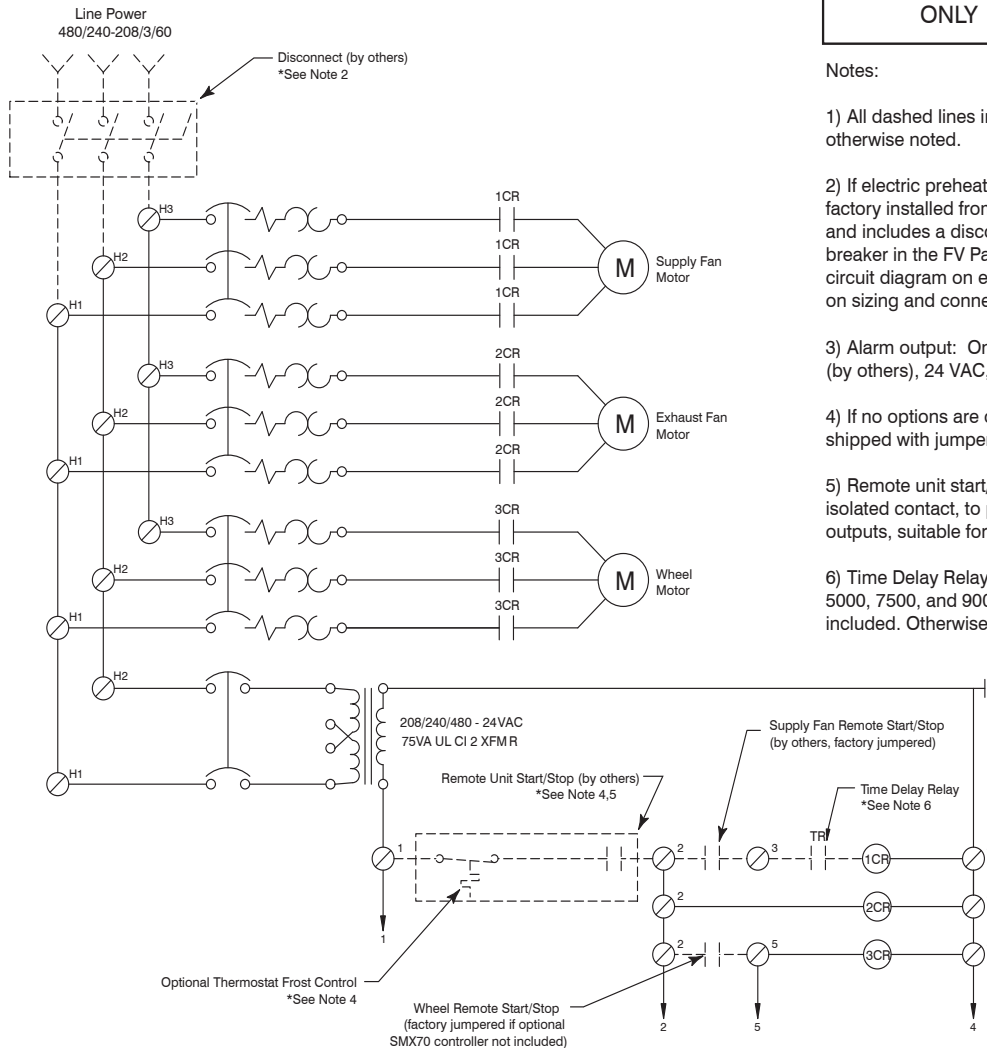
To avoid possible contactor failure, place start/stop relays inside the electrical enclosure.

3Ø Circuit Diagram, FV-2000 through FV-9000

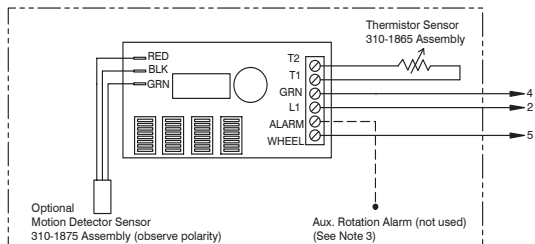
USE COPPER CONDUCTORS ONLY

Notes:

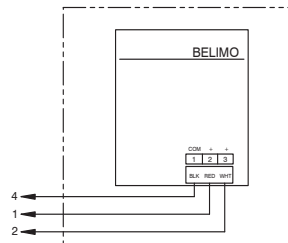
- 1) All dashed lines indicate field wiring unless otherwise noted.
- 2) If electric preheater is ordered, the power wiring is factory installed from electric preheater to FV Panel and includes a disconnect at the preheater and a breaker in the FV Panel. (See specifications and circuit diagram on electric preheater for information on sizing and connecting supply power).
- 3) Alarm output: One triac-switch to drive a contactor (by others), 24 VAC, 0.3 amps max.
- 4) If no options are ordered, terminals 1 & 2 are shipped with jumper installed.
- 5) Remote unit start/stop (by others) may be any isolated contact, to prevent interconnection of class 2 outputs, suitable for 24 VAC @ 2 amps.
- 6) Time Delay Relay included on FV-3000, 4000, 5000, 7500, and 9000 if optional air damper is included. Otherwise, terminal 3 wired to 1CR.



Optional Stop/Jog Controller: Model SMX70



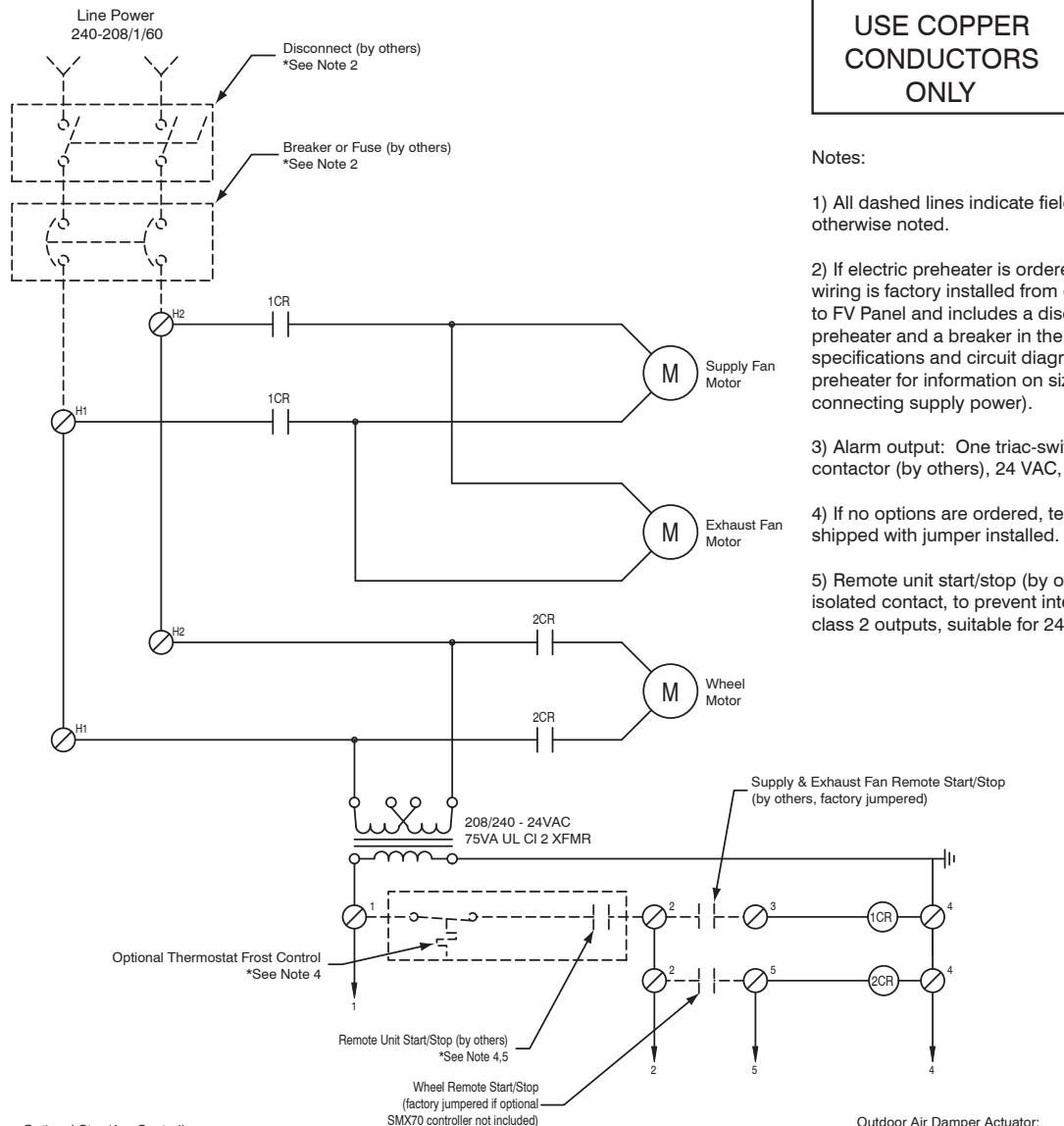
Optional Outdoor Air Damper Actuator: Belimo



Tightening Torque for Slotted Screws	
AWG Size	IN-LB
18-10	20
8	25
6-3	35

To avoid possible contactor failure, place start/stop relays inside the electrical enclosure.

1Ø Circuit Diagram, FV-600



USE COPPER CONDUCTORS ONLY

Notes:

1) All dashed lines indicate field wiring unless otherwise noted.

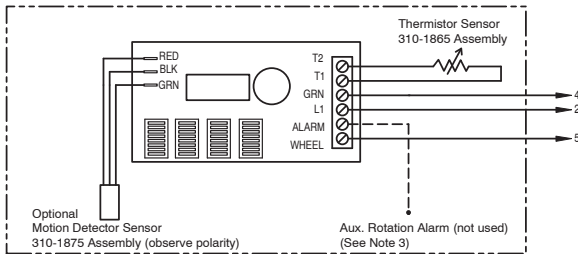
2) If electric preheater is ordered, the power wiring is factory installed from electric preheater to FV Panel and includes a disconnect at the preheater and a breaker in the FV Panel. (See specifications and circuit diagram on electric preheater for information on sizing and connecting supply power).

3) Alarm output: One triac-switch to drive a contactor (by others), 24 VAC, 0.3 amps max.

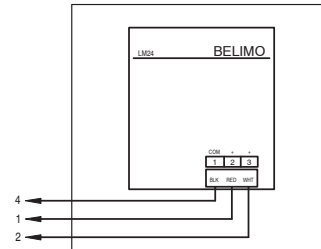
4) If no options are ordered, terminals 1 & 2 are shipped with jumper installed.

5) Remote unit start/stop (by others) may be any isolated contact, to prevent interconnection of class 2 outputs, suitable for 24 VAC @ 2 amps.

Optional Stop/Jog Controller: Model SMX70



Outdoor Air Damper Actuator: Belimo LM24



Tightening Torque for Slotted Screws	
AWG Size	IN-LB
18-10	20
8	25
6-3	35

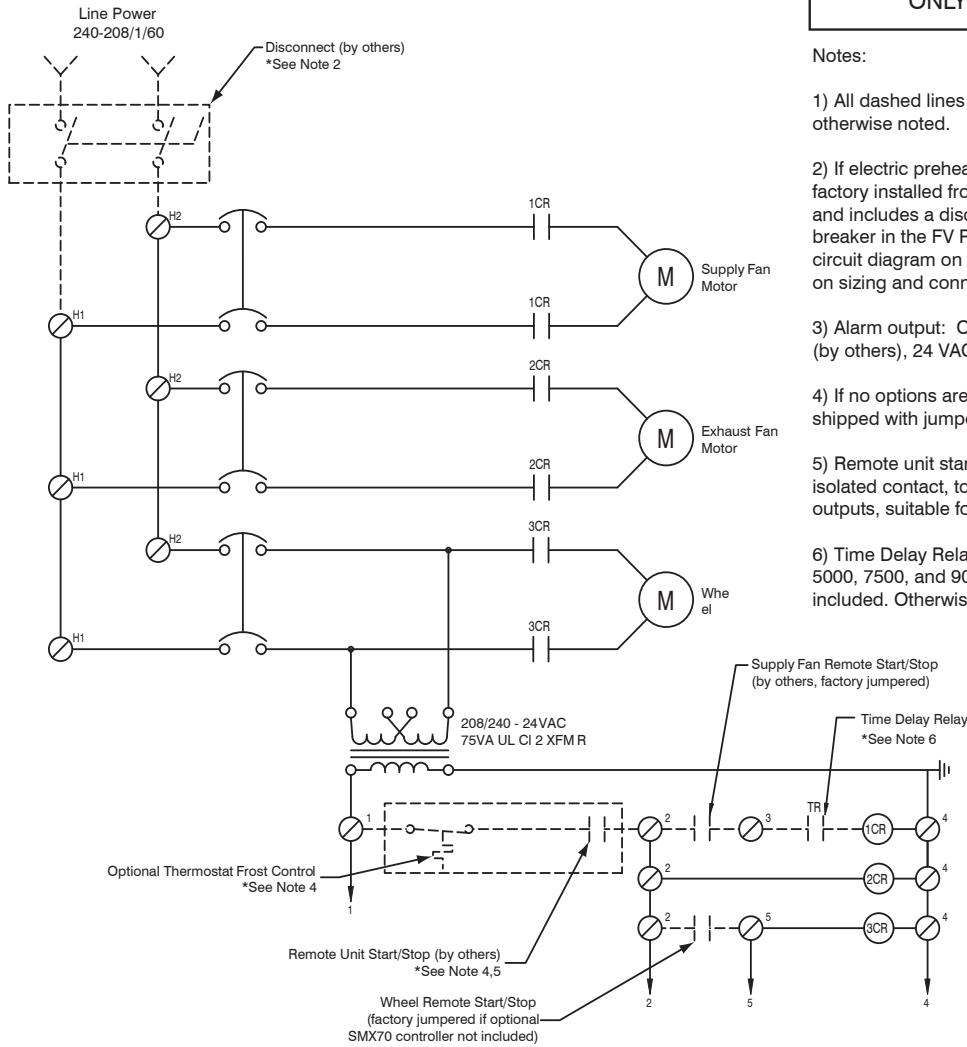
To avoid possible contactor failure, place start/stop relays inside the electrical enclosure.

1Ø Circuit Diagram, FV-1000 through FV-5000

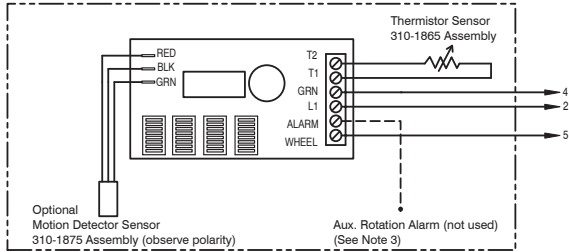
USE COPPER CONDUCTORS ONLY

Notes:

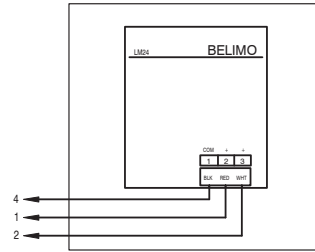
- 1) All dashed lines indicate field wiring unless otherwise noted.
- 2) If electric preheater is ordered, the power wiring is factory installed from electric preheater to FV Panel and includes a disconnect at the preheater and a breaker in the FV Panel. (See specifications and circuit diagram on electric preheater for information on sizing and connecting supply power).
- 3) Alarm output: One triac-switch to drive a contactor (by others), 24 VAC, 0.3 amps max.
- 4) If no options are ordered, terminals 1 & 2 are shipped with jumper installed.
- 5) Remote unit start/stop (by others) may be any isolated contact, to prevent interconnection of class 2 outputs, suitable for 24 VAC @ 2 amps.
- 6) Time Delay Relay included on FV-3000, 4000, 5000, 7500, and 9000 if optional air damper is included. Otherwise, terminal 3 wired to 1CR.



Optional Stop/Jog Controller: Model SMX70



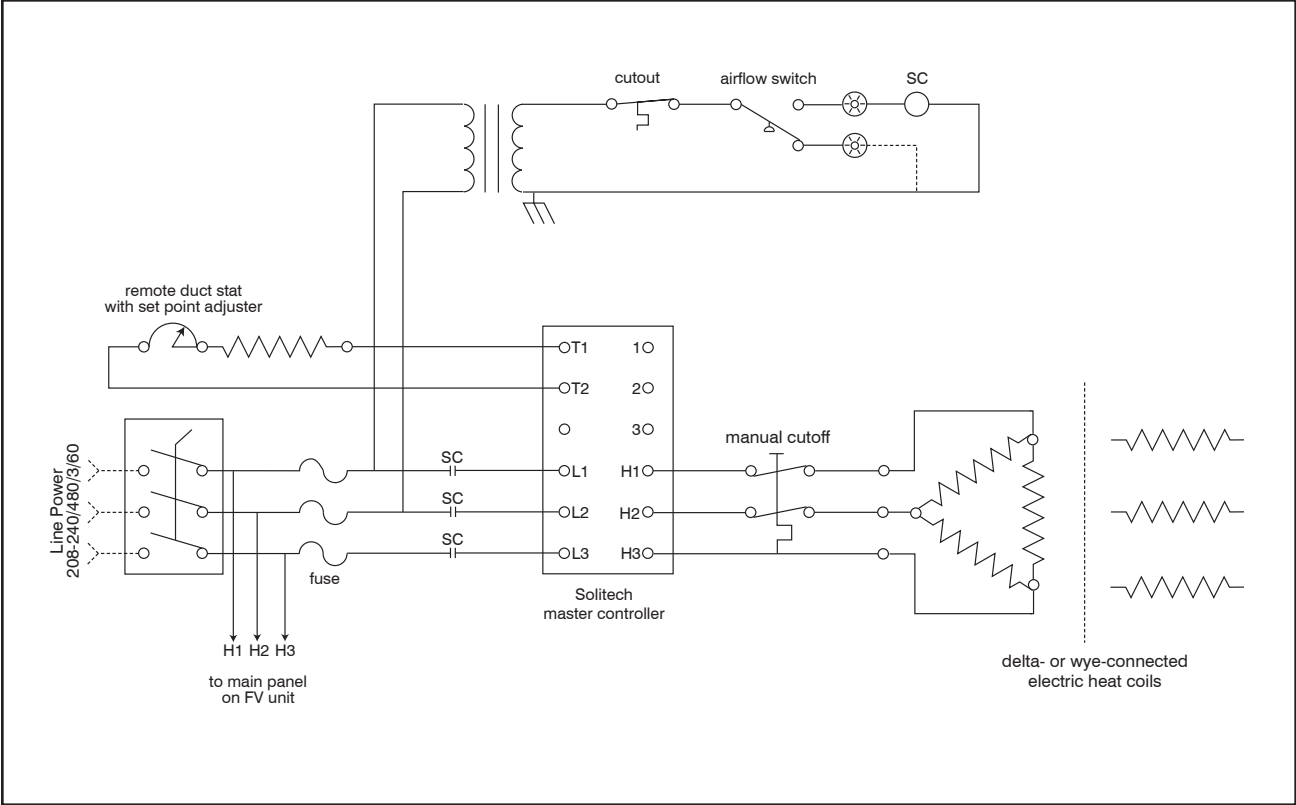
Outdoor Air Damper Actuator: Belimo LM24



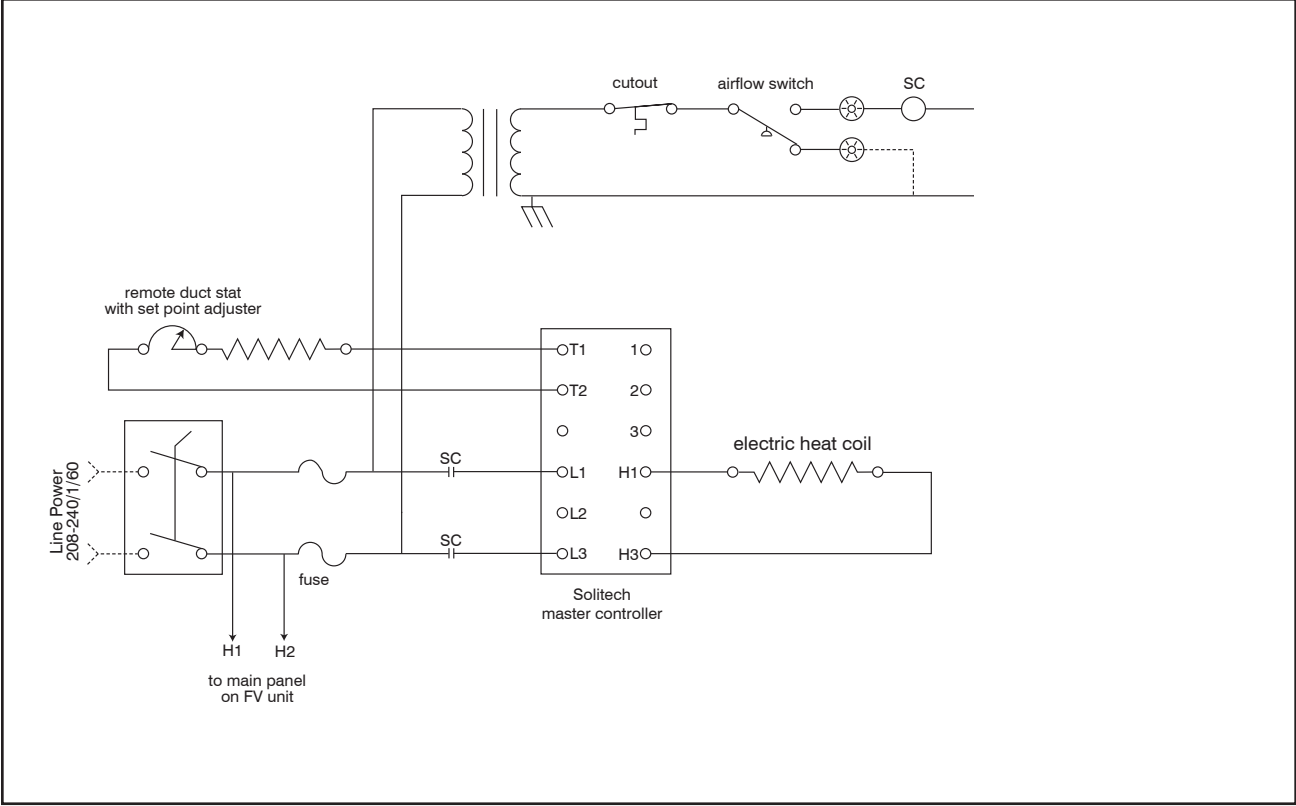
Tightening Torque for Slotted Screws	
AWG Size	IN-LB
18-10	20
8	25
6-3	35

To avoid possible contactor failure, place start/stop relays inside the electrical enclosure.

3Ø Electric Preheat Frost Control Circuit Diagram



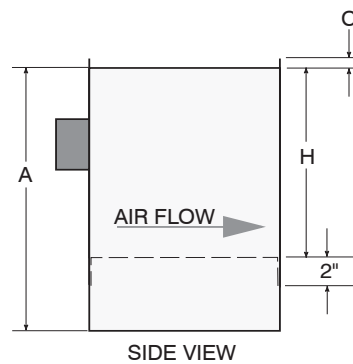
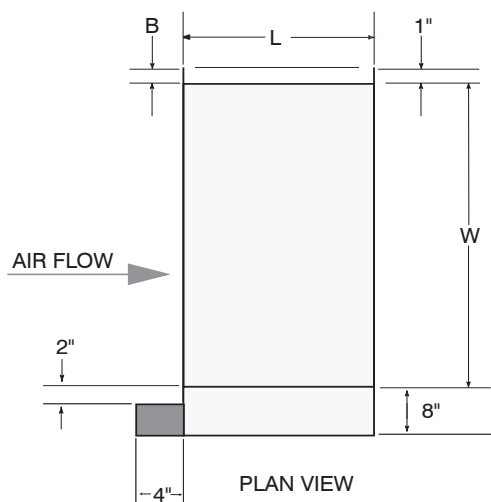
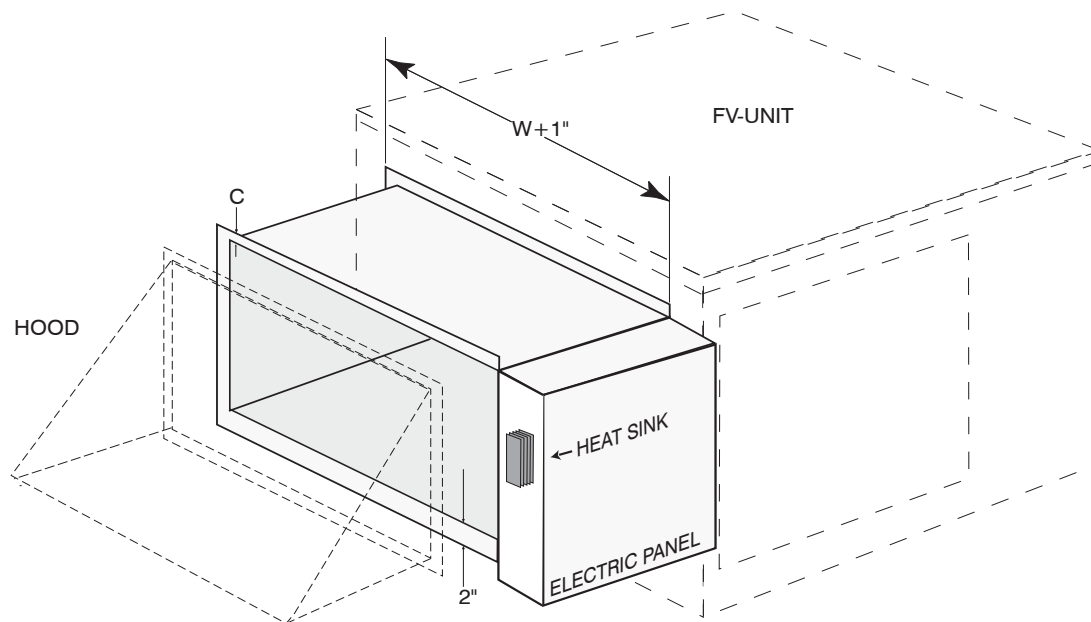
1Ø Electric Preheat Frost Control Circuit Diagram



Electric Preheat Layout

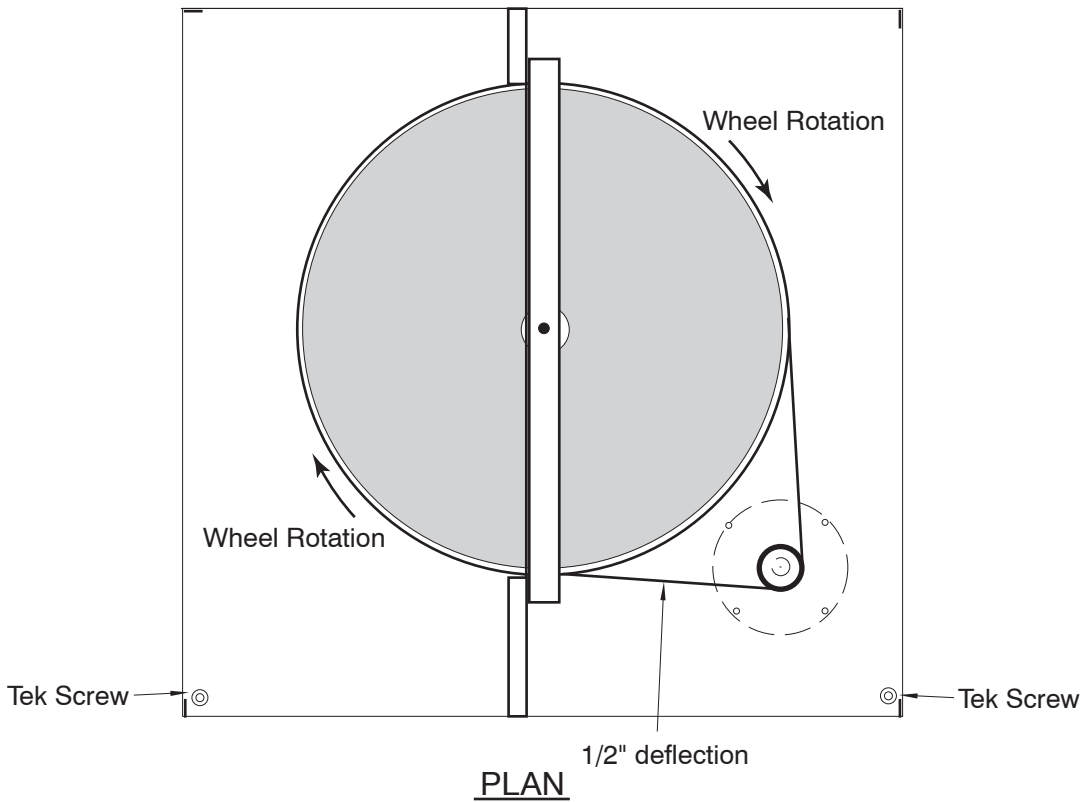
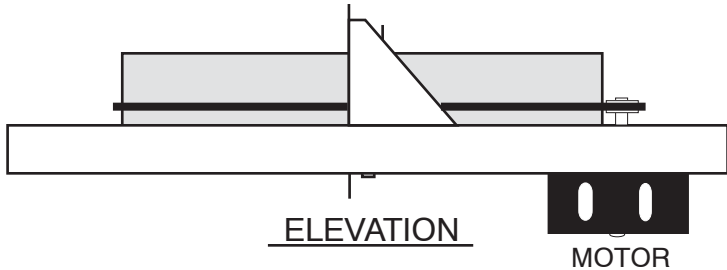
UNIT SIZE	W	H	L	A	B	C
FV-600	24.4	9.0	14.0	20.0	1.0	1.0
FV-1000	24.4	9.0	14.0	20.0	1.0	1.0
FV-2000	31.1	11.0	14.0	20.0	1.0	2.0
FV-3000	39.1	16.0	20.0	40.0	1.0	2.0
FV-4000	49.1	17.0	20.0	40.0	1.0	2.0
FV-5000	49.1	17.0	20.0	40.0	1.0	2.0
FV-7500	56.0	24.0	20.0	40.0	3.0	2.0
FV-9000	56.0	24.0	20.0	40.0	3.0	2.0

All dimensions in inches.



Wheel Cassette

The wheel cassette can be serviced through the front panel. The cassette can be slid out for easy access. To remove the cassette, unplug the leads to the wheel drive motor, then remove the (2) tek screws located near the opening. This will then allow you to pull the cassette out of the unit through the access door. If the unit is equipped with a rotation sensor, it must be removed prior to sliding the cassette out. If the unit is equipped with the AQFlow system, the hoses attached to the cassette must be removed prior to sliding the wheel cassette out.



MODEL	FV-600	FV-1000	FV-2000	FV-3000	FV-4000	FV-5000	FV-7500	FV-9000
LINKBELT TYPE	4L/A"	4L/A"	4L/A"	4L/A"	4L/A"	4L/A"	4L/A"	4L/A"
BELT LENGTH	65"	81"	108"	134"	164"	164"	200"	200"

Service

The FV module has a large access panel on the front of the unit. All maintenance can be performed through this panel. The unit should be installed with clearance in front of the unit at least equal to the unit depth to assure adequate access.

- All key components including fans and wheel cassette are removable through the service panel.
- The rotor is supported by permanently lubricated wheel bearings for minimal maintenance and long life.
- Electrical panels utilize breakers to eliminate the need for fuses.
- Fluted media structure provides for laminar flow through the wheel thereby avoiding media plugging due to dust and debris.
- Intake hood/filter limits snow and rain from entering the unit.

Maintenance

Filters – Indoor FV units utilize a two-inch pleated 30/30 filter for the supply air stream and one-inch deep industrial grade aluminum mesh filter for the return air stream. All outdoor FV units utilize one-inch deep industrial grade aluminum mesh filters for both the supply and return air streams. The aluminum mesh filters can be removed and washed. (See *Figure 12.*) We suggest that the filters be washed or replaced a minimum of once every four months. Replacement filters are readily available through SEMCO, locally through HVAC supply distributors or McMaster-Carr.



Figure 12. Replacing the return air filter.

	Unit Type	Supply Air Filters	Return Air Filters
FV-600	Indoor	(1) 2x16x25	(1) 1x16x25
	Outdoor	(1) 1x16x25	(1) 1x16x25
FV-1000	Indoor	(1) 2x16x25	(1) 1x16x25
	Outdoor	(1) 1x16x25	(1) 1x16x25
FV-2000	Indoor	(2) 2x16x20	(2) 1x16x20
	Outdoor	(2) 1x16x20	(2) 1x16x20
FV-3000	Indoor	(2) 2x20x20	(2) 1x20x20
	Outdoor	(2) 1x20x20	(2) 1x20x20
FV-4000	Indoor	(4) 2x16x25	(3) 1x16x25
	Outdoor	(4) 1x16x25	(3) 1x16x25
FV-5000	Indoor	(4) 2x16x25	(3) 1x16x25
	Outdoor	(4) 1x16x25	(3) 1x16x25
FV-7500	Indoor	(6) 2x16x20	(6) 1x16x20
	Outdoor	(6) 1x16x20	(6) 1x16x20
FV-9000	Indoor	(6) 2x16x20	(6) 1x16x20
	Outdoor	(6) 1x16x20	(6) 1x16x20

All dimensions in inches.

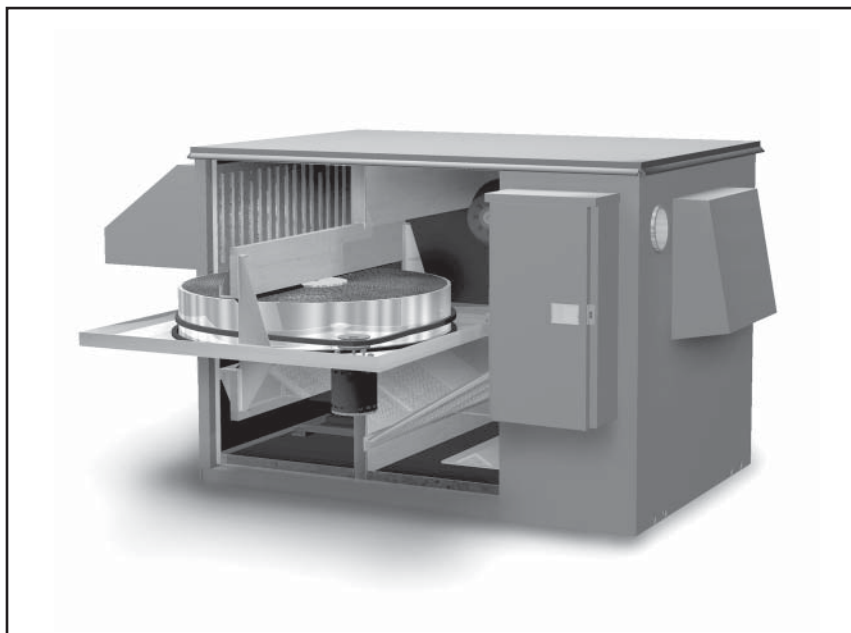
Seals – Surrounding the rim of the wheel is a brush seal. Do not tamper with this seal. No maintenance of the seal is required.

Media – For normal inspection and maintenance, the wheel cassette may be pulled out (like a drawer) of the metal enclosure of the unit. (See *Figure 13*.)

EXCLU-SIEVE wheels use laminar flow technology to resist plugging and the accumulation of dust particles, therefore cleaning is usually not necessary. Constant back flushing occurs due to Supply Air and Return Air streams that move through media flutes to help keep them clean. As the media moves constantly from one air stream to the other most dirt is either passed through or blown away.

Should your application require occasional rotor cleaning, the media may be cleaned with a vacuum, compressed air (at 50 PSI max), low-pressure steam (5 PSI max), or hot water (130 deg F, 30 PSI max). Care should be taken to avoid bending or damaging flutes. The nozzle should be no closer than 6” from the media and should be held at a right angle to the face of the wheel. A soft brush can also be used to loosen any dirt from the face of the wheel. In general, detergents or solvents are not recommended as they may degrade the materials used to bind the desiccant to the aluminum surface in the media. If it is determined that additional cleaning power is required, light duty household cleaners (such as Formula 409®, Simple Green® etc.) can be used.

Figure 13. All key components including fans and wheel cassette are removable through the service panel.



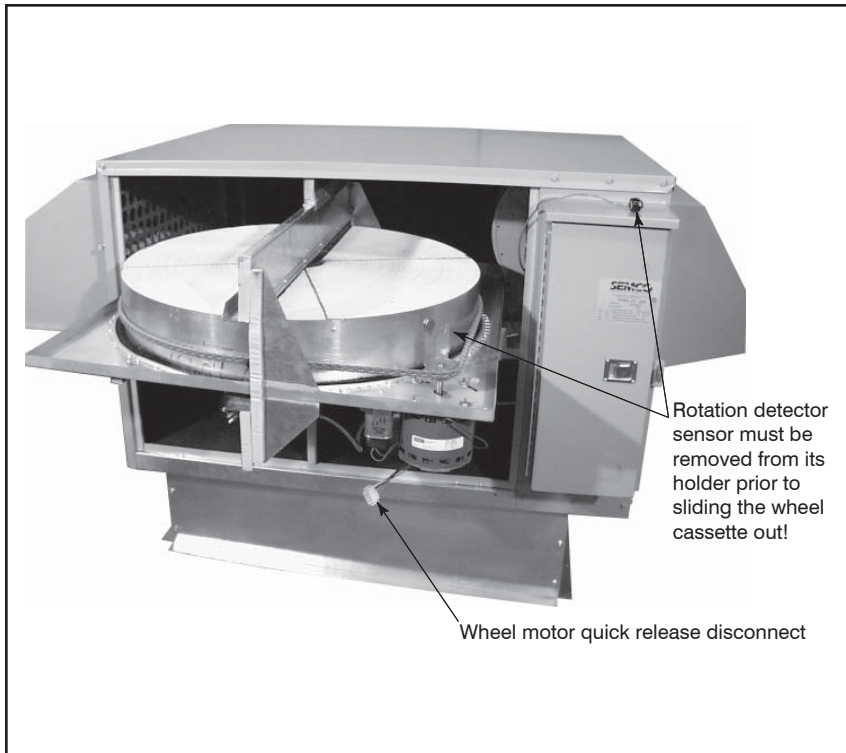


Figure 14. *Prior to sliding out the wheel cassette, the wheel motor quick releases, the rotation detector sensor, and AQFlow hoses must be disconnected.*

Belts – The wheel drive system utilizes a PowerTwist® Plus™ belt. Periodic adjustment of the belt will be necessary. We suggest the belt be checked for sufficient tension at a minimum of once every six months. Take care to follow the directions on the following pages.

Fan Bearings (FV-7500 & FV-9000 only) – The fan bearings for the FV-7500 and FV-9000 require lubrication at a regular interval. Hours of operation, temperature and surrounding conditions will affect the lubrication frequency required. Therefore, when applying grease, observe the condition of the grease expelled from the bearings and note the amount of grease used. Both observations will suggest whether or not the lubrication schedule should be increased or decreased. Start with an initial monthly interval, and use a high quality NLGI No. 2, lithium soap grease with petroleum oil.

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

AQFlow[®] Balancing Instructions

AQFlow is a flow measuring system calibrated to convert differential pressure across the total energy wheel into an airflow rate expressed in cubic feet per minute (CFM). It determines outdoor and return airflow rates needed for properly balancing an air handling system. You can monitor either outdoor or return air at any given time, depending on the routing of the connection hoses. The hose connections are located on the center partition of the unit.

Exhaust Airflow Balance

1. With the connection hoses attached to the exhaust air side and the unit operating, adjust the balancing damper on the exhaust fan outlet until the desired exhaust airflow rate has been attained. (See *Figures 15 and 16.*)
2. Place the damper positioning bolts in the next hole above the desired damper position. This will allow the damper to close without airflow and to open with airflow to a position no greater than the positioning bolt location. (See *Figure 16.*)

Figure 15. *Diagram of hose connection instructions.*

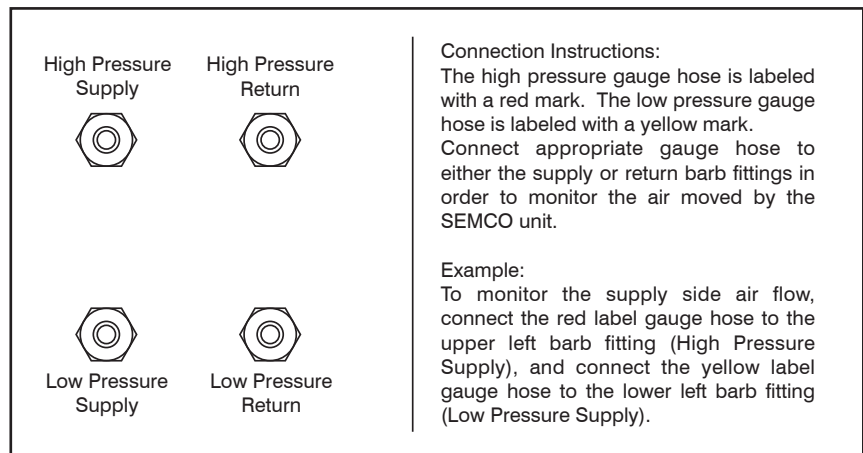
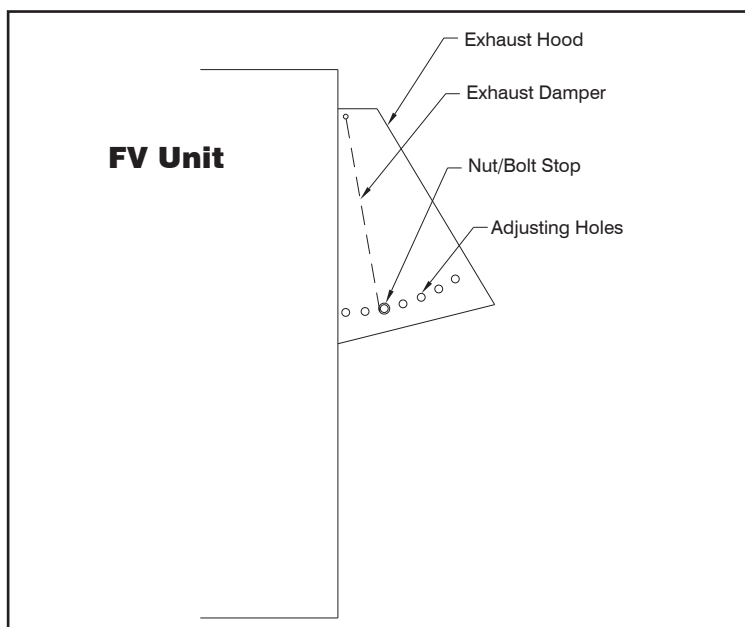


Figure 16. *Diagram of exhaust hood damper.*



Supply Airflow Balance

1. Turn the unit off, and reroute the hoses from the exhaust air side to the supply air side. (See *Figure 15*.)
2. Set the outside air damper to 50% open by pushing and holding the manual override button on the damper actuator and manually rotating the damper into the desired position. Place the upper set screw on the actuator to limit the damper open area to this setting. Position the lower set screw such that it allows the damper to fully close. Restart the unit and read the airflow rate. (See *Figures 17 and 18*.)
3. If airflow adjustment is required, turn the unit off and manually adjust the outside air damper open or closed by 50% of the current open area. Adjust the set screws as noted above.
4. Restart the unit and read the airflow rate. Repeat the adjustment process as needed until the desired airflow is reached.

Note: Leaving the connection hoses attached to the supply air side allows for continuous monitoring of the supply air and quick detection of problems such as when filter maintenance is necessary.

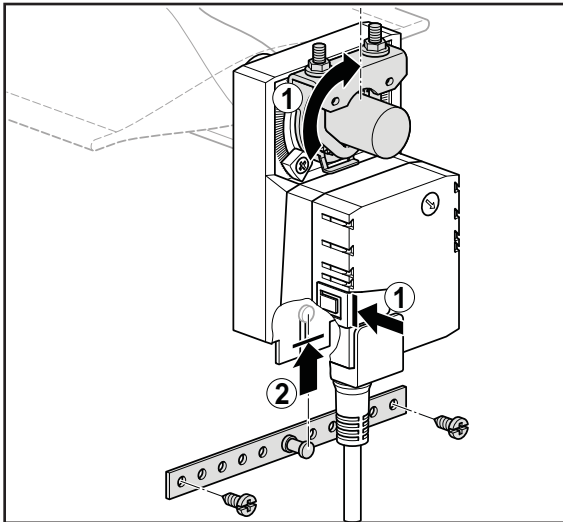


Figure 17. Installation of the outside air damper and actuator.

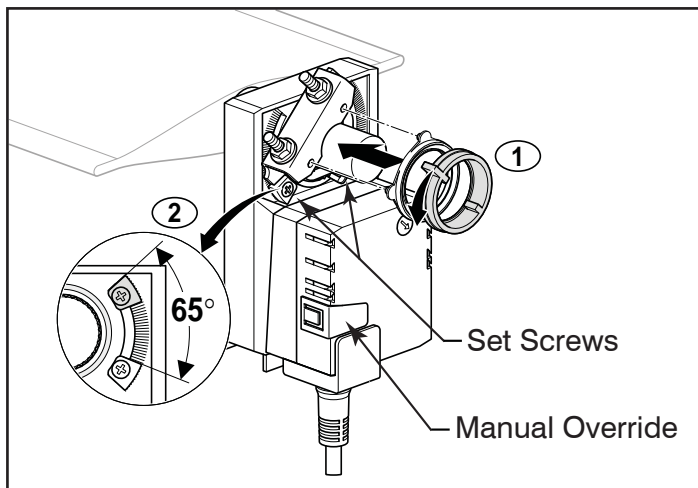


Figure 18. View of actuator.

How to Measure, Assemble and Install PowerTwist® Plus™ V-Belts

Measuring the Belt

- Pull belt tight around sheaves to check hand tight length, overlapping the last two tabs with two holes in matching links as shown in Figure 19.

- Count the number of links and remove one link for every 24 of O/3L, A/4L and B/5L sections and one link for every 20 of C section.

This gives the correct installed belt length and will ensure optimum belt tension when running. Note: Every tenth link is designated with an arrow.

For multiple belt drives, ensure that each belt has the same number of links.

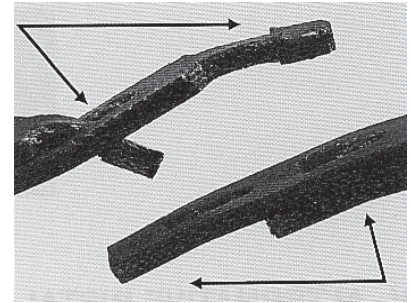
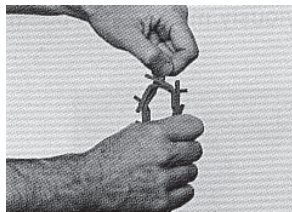
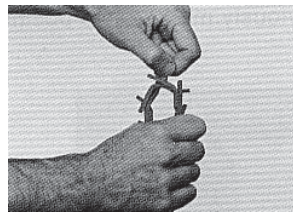


Figure 19.

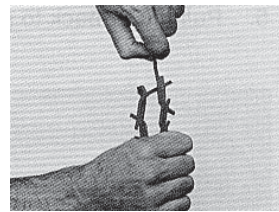
Disassembly



1. Hold belt upside down. Bend back as far as possible: hold with one hand. Twist one tab 90° parallel with slot.



2. Pull end of link over tab.

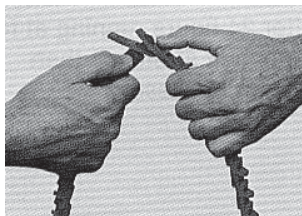


3. Rotate belt end with tab 90°.

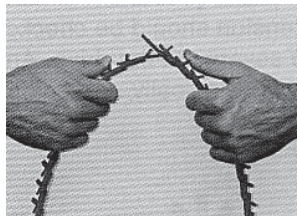


4. Pull belt end through two links.

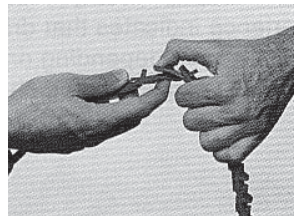
Assembly



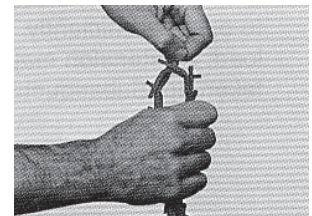
1. Hold belt with tabs pointing outward.



2. Place end tab through two links at once.



3. Flex belt further and insert second tab through end link by twisting tab with thumb.

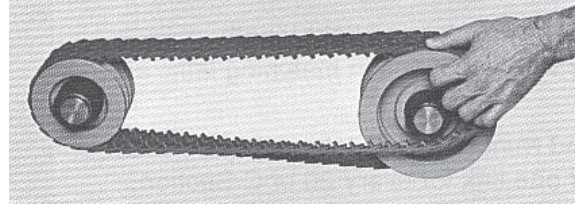


4. Ensure tab returns to position across belt. Reverse belt so tabs run inside.

Note: Turn belt inside out (as shown above) to ensure easy assembly and disassembly.

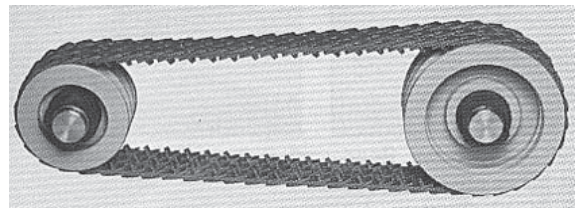
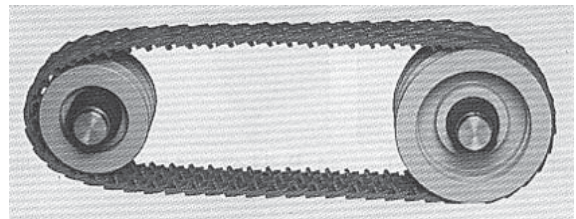
Installation

- 1 Turn belt with tabs to the inside before installing.
- 2 Determine direction of drive rotation.
- 3 Align belt directional arrow with drive rotation.
- 4 Fit belt in nearest groove of smaller sheave.
- 5 Roll belt onto larger sheave, turning the drive slowly. Belt may seem very tight; this is okay. DO NOT jog motor.
- 6 Check to see all tabs are still in their correct position and are not twisted out of alignment.
- 7 For multiple belt drives, work belt from groove to groove. On particularly wide drives, it may be easier to install half the belts from the inboard side and half from the outboard. Note: With drive ratios around 1:1, it may be necessary to add back one link to allow belts to be rolled on. This does not apply if using Alternative Installation Method.



Alternative Installation Method

- 1 Set motor to mid-position of adjustment range and mark base clearly.
- 2 Determine required belt length as in “Measuring Belt Length”.
- 3 Push motor forward to minimum center distance.
- 4 Install belts as in “Installation”.
- 5 Pull motor back to previously marked mid-position.



Retensioning

Like all high performance V-belts, PowerTwist® Plus™ V-Belts require the maintenance of correct drive tension to operate efficiently. Experience indicates that drive tension should be checked after 24 hours running at full load. A retension may be necessary depending on the severity of the drive. Any initial belt stretch is then taken up. Subsequently, belt tension should be checked periodically and adjusted when necessary.

How To Reach SEMCO

You can reach SEMCO by phone, fax or e-mail.

SEMCO LLC
1800 East Pointe Drive
Columbia, MO 65201-3508
888-4SEMCOINC (888-473-6264)
(573) 443-1481
Fax: (573) 886-5408
e-mail: sales.semco@flaktwoods.com

For information about SEMCO, its products and services, please point your web browser to www.semcohv.com. There, you also will find the latest news from SEMCO and examples of how SEMCO's energy recovery systems are being applied on a daily basis.

How To Reach Fenner Drives



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Manheim, PA 17545-1010

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FAX 717-665-2649



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