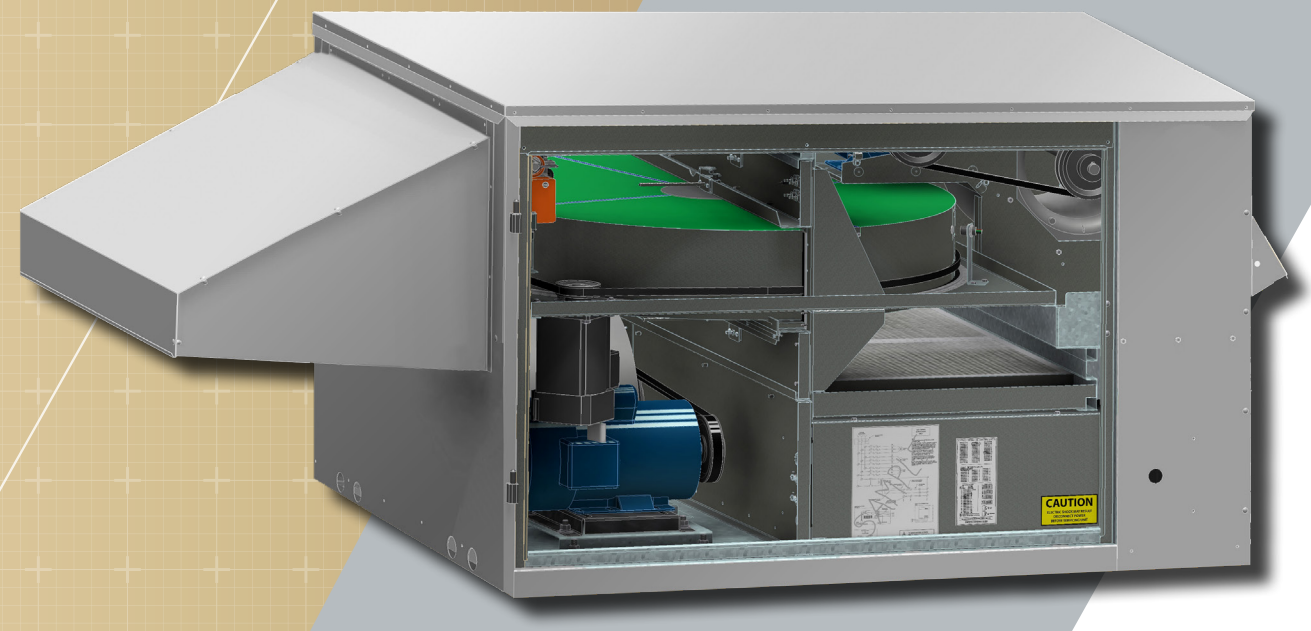
FläktGroup SEMCO

SPECIALIZED HEALTHY AIR SOLUTIONS

FV PRE-CONDITIONER SERIES

TECHNICAL GUIDE



FV-1000
FV-2000
FV-3000
FV-4000
FV-5000
FV-7500
FV-9000

TABLE OF CONTENTS

FV OUTDOOR AIR PRE-CONDITIONER

The FläktGroup® SEMCO® FV (Fresh Air Ventilator) Series of outdoor air pre-conditioners has been specifically designed to reduce the energy required to heat or cool outdoor air by up to 80 percent. The FV pre-conditioner allows the HVAC system to effectively and economically accommodate the three-to-four-fold increase in outdoor air quantities, which is recommended by the ASHRAE Standard 62, Ventilation for Acceptable Indoor Air Quality. This unique capability allows both new and existing buildings to benefit from a healthy indoor environment.

A FläktGroup SEMCO FV pre-conditioner will significantly reduce the operating cost of the HVAC system of a facility designed in accordance with the ASHRAE IAQ standard. It will also improve humidity control when combined with unitary heating and cooling equipment. Because the FV unit pre-conditions the incoming air to the packaged equipment, the required refrigeration capacity may be reduced by as much as 50 percent. Thus, the cost of the FV pre-conditioner and its installation is typically offset by the reduced size of the conventional HVAC system.

In existing facilities, retrofitting the HVAC system with an FV pre-conditioner allows the outdoor air quantity to be increased significantly without raising energy costs, losing humidity control or changing the size of the current HVAC unit.

HOW IT WORKS

The FläktGroup SEMCO FV system is a packaged system, which includes supply and exhaust air fans, outdoor and return air filters and FläktGroup SEMCO's Fusion 3Å total energy recovery wheel. The Fusion 3Å wheel recovers both sensible (temperature) and latent (moisture) energy; it cools and dehumidifies the outdoor air during the cooling season, while heating and humidifying the outdoor air in the heating season.

The Fusion 3Å wheel utilizes a honeycomb-like media having an aluminum substrate, which is carefully coated with a fast-acting, adsorbent desiccant surface. 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. Fusion 3Å's molecular sieve desiccant coating has an enormous internal surface area and a strong attraction to water vapor. Since the opposing airstreams have different temperature and moisture contents, their vapor pressures differ. This difference causes the transfer of latent energy.

The desiccant used in the Fusion 3Å wheel is a highly selective, adsorbent, 3Å molecular sieve. It recovers the moisture from an exhaust airstream without adsorbing the airborne pollutants contained within the airstream. This important and unique feature has been well documented through independent laboratory and field-testing. Please contact FläktGroup SEMCO for a copy of the independent performance verification of FläktGroup SEMCO total energy recovery wheels.

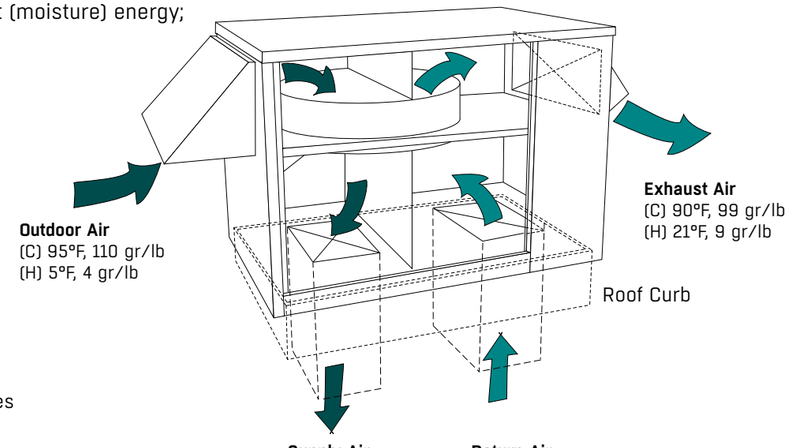


FIGURE 1. An inside view of the FV-V Series Pre-conditioner with typical operating temperatures during the cooling (C) and heating (H) season, respectively.

INDOOR AIR QUALITY

PRE-CONDITIONING

ASHRAE Standard 62 defines the minimum outdoor air ventilation rate required to achieve acceptable indoor air quality. This standard, which is incorporated in the three major U.S. building codes (BOCA, Southern and Uniform), recommends that outdoor air quantities be increased from 5 CFM per person to 15 to 20 CFM per person to avoid adverse health effects. The increased ventilation air rates concern many owners, architects and engineers with regard to their impact on humidity control, operating costs and construction costs.

By recovering up to 80 percent of the total energy normally exhausted from facilities, the FläktGroup SEMCO FV system provides an effective solution to the ASHRAE Standard 62 dilemma. When an FV system is combined with a conventional HVAC system, it allows for a four-fold increase in the outdoor air quantity (5 to 20 CFM/person) without an increase in operating costs.

If a facility is designed to include unitary packaged HVAC equipment or heat pumps, the addition of an FV unit is especially beneficial. In addition to reducing the cost of operation, the FV system greatly improves humidity control; something that is important for providing acceptable indoor air quality.

HUMIDITY CONTROL

Unitary air conditioners and heat pump units are controlled by temperature. When space conditions are satisfied, the cooling coil or heating source is cycled off. Since the ASHRAE Standard 62 recommends a continuous supply of outdoor air, warm/humid (cooling mode) or cool/dry (heating mode), outdoor air is typically dumped directly into the occupied space during those times.

As the outdoor air load changes, humidity levels can fluctuate significantly with unitary HVAC equipment and heat pumps. To achieve an acceptable indoor environment, space humidity conditions should be maintained between 30 and 60 percent relative humidity. The probability of microbial problems (i.e. mold) is greatly enhanced at 70 percent relative humidity and above.

APPLYING THE FV UNIT

The FläktGroup SEMCO FV series units are offered in four basic configurations depending on the locations of the supply air and return air discharge openings:

- H - horizontal supply air discharge and horizontal return air in the back of the unit
- HS - horizontal supply air discharge in the back of the unit with vertical return air in the floor of the unit
- V - vertical supply air discharge and vertical return air in the floor of the unit
- VS - vertical supply air discharge in the floor of the unit with horizontal return air in the back of the unit

Please consult **FIGURES 13-16** on **PAGE 13** and dimensional drawings on **PAGES 28-39** for additional information.

FV-H SERIES APPLICATION

The FV-H series has been designed to compliment conventional rooftop air-conditioners (see **FIGURE 2**). In a typical application, it provides preconditioning of outside air to a rooftop unitary air-conditioner. At the same time, it draws return air from the rooftop unit. Here, the FV unit effectively shields the rooftop unit from the operating conditions normally experienced throughout the year. Consequently, the rooftop air-conditioner works within a narrow, more optimal zone of operating conditions. The end result is that the refrigeration capacity of the rooftop unit is generally increased by at least 30 percent. For example, a combination of an FV-1000H model with a nominal 5-ton rooftop air-conditioner effectively increases the refrigeration capacity of the rooftop unit to 7 to 8 tons or more.

The key benefits of the FV-H series are:

- The FV-H series allows for easy integration with rooftop or other types of air-conditioners. By reducing the outside load by 75% or more, it effectively increases the capacity of the air-conditioner by 30 or more percent. Conversely, it reduces the amount of required refrigeration capacity to meet a mandated amount of ventilation air. Depending on the climate the reduction in refrigeration capacity may be up to 50 percent!
- Because the FV-H series preheats the incoming outside air in wintertime, heating requirements on the conventional equipment can be dramatically reduced as well. By tying in to the air-conditioning system, no additional distribution duct work is need. In most applications, the distribution duct work in the conditioned space can be downsized since the overall refrigeration capacity has been reduced and the required total airflow is smaller.
- The H series allows for easy retrofit of existing air-conditioning systems, allowing a significant increase in the amount of outside air without increasing the operating costs.

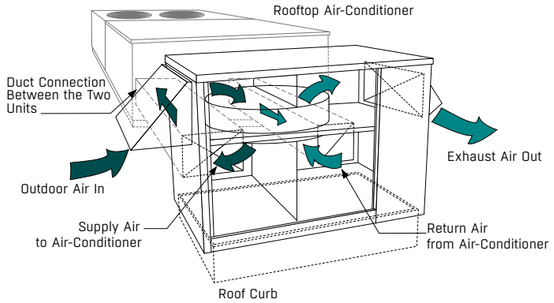


FIGURE 2. FV-H Series Pre-conditioner typical installation.

V SERIES APPLICATION

The FV-V series is typically installed on a roof curb with supply and return air connections on the bottom of the unit (see **FIGURE 3**). In such an installation, the unit commonly delivers supply air to conditioned space below. Supply air can also be provided to an HVAC system installed indoors. In another variation, supply air is distributed via ducts to two or more conditioned zones within a building.

The major benefits of this installation are:

- The FV unit can serve several air-conditioning systems, which now can be configured to run in 100 percent re-circulation mode. The FV unit meets all the outdoor air requirements.
- The FV system can run independently of all other air-conditioning systems. During occupied modes it can run continuously, while during the unoccupied periods in can provide space pressurization to reduce infiltration of unwanted humidity to the building.
- Control requirements are very simple and there is no tie-in with any other air-conditioning system required.

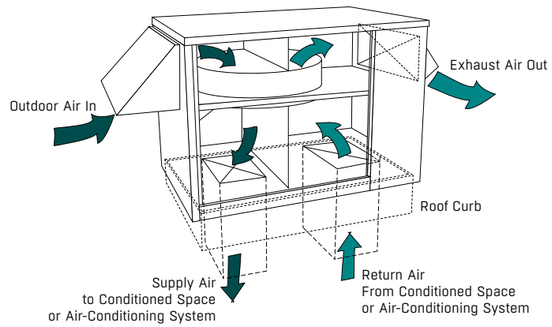


FIGURE 3. FV-V series pre-conditioner typical installation.

STANDARD FEATURES

1) NOVEL SYSTEM DESIGN

Efficient and economical design meeting the needs of the conventional HVAC market.

- Compact, low profile design to conform to typical architectural requirements.
- Easy access to all internal components through a large hinged access door(s) and removable roof panel.
- Outdoor air inlet and exhaust air outlet located at opposite ends of unit for maximum separation.

2) THE FUSION 3Å TOTAL ENERGY WHEEL

- Certified total energy (both sensible and latent) recovery performance.
- Patented 3Å molecular sieve desiccant coating to avoid cross-contamination.
- Easily removable wheel cassette module.
- Surpasses NFPA-90A requirements having a smoke and flame spread rating of 0 and 0, vs. 50 and 25 allowed by the standard.
- Self-adjusting air seals.
- Acid resistant face coating.

FläktGroup SEMCO SPECIALIZED HEALTHY AIR SOLUTIONS

3) CABINET CONSTRUCTION

- Galvanized steel cabinet construction with enamel finish.
- Entire cabinet insulated with closed cell elastomeric foam with Microban® antimicrobial technology to minimize energy loss and provide resistance to mold, fungi and bacteria.
- Hinged doors for easy access. Hinges are lift-off - no tools required.
- Floor of the unit built as a pan to ensure watertight design.

4) SUPPLY AND EXHAUST AIR FANS

- Sized for quiet and efficient operation.
- Mounted and balanced.
- Multiple motor/sheave selections for efficient adjustment of airflow.

5) FILTER SECTIONS

- Filtration provided for both the outdoor air and return air.
- Standard aluminum mesh filters

6) HOODS AND DAMPERS

- Intake hood with a cleanable filter to limit rain and snow introduction on outdoor units
- Indoor filter assembly (see **PAGE 34**) with pleated filters on indoor units
- Exhaust air back draft damper on outdoor units only
- Outdoor air manually adjustable damper

7) ELECTRICAL PACKAGE WITH SINGLE POINT CONNECTION

- All motors wired to starters.
- Accepts contact inputs for supply fan start/stop, wheel start/stop and unit start/stop.
- Multiple options on input voltage to units:

FV-1000:	208, 240V 1Ø 208, 480V 3Ø
FV-2000:	208, 240V 1Ø 208, 480, 575*V 3Ø
FV-3000:	208, 240V 1Ø 208, 480, 575*V 3Ø
FV-4000:	208, 240V, 1Ø 208, 480, 575*V 3Ø
FV-5000:	208, 240V, 1Ø 208, 480, 575*V 3Ø
FV-7500:	208, 480, 575*V 3Ø
FV-9000:	208, 480, 575*V 3Ø

*Available with limited configurations and options.

OPTIONAL FEATURES

1) GALVANIZED UNPAINTED FINISH

2) Fan VFDs for 3Ø Applications - FV-2000-FV-9000 only

- VFDs are factory installed and wired, located in an enclosure mounted on the exterior of the unit. The VFDs are preset at the factory to run at constant speeds when enabled, or can be field set for control by others (see **FIGURE 4**).

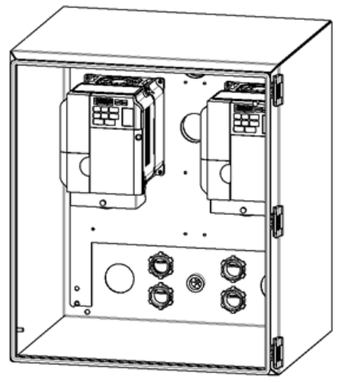


FIGURE 4: VFD Enclosure

3) DISCONNECT

- Safety, non-fused, shipped loose for field installation

4) OUTDOOR ELECTRIC PREHEAT COIL

- An electric preheat coil can be provided to avoid frosting conditions for installations in cold climates, which have high indoor humidity design conditions.

5) MOTORIZED OUTDOOR AIR DAMPER

- 2-position non-spring return actuator

6) MOTORIZED EXHAUST AIR DAMPER

- 2-position spring return actuator

7) DUAL WALL CONSTRUCTION

- Interior of FV Pre-conditioner is lined with 22 gauge galvanized sheet metal.

8) ROOF CURB

- Units will be provided with a non-insulated roof curb sized to fit just inside of the unit's self flashing base. Curb will be fourteen inches tall and will have a wood nailer on the perimeter for attaching unit.

WHEEL CONTROL OPTIONS

STOP/JOG ECONOMIZER

- Allows the wheel to be stopped automatically during mild outdoor temperatures with periodic brief rotation to maintain the self-cleaning feature of the heat exchanger (Not applicable with variable speed wheel control package. See selection software.).

ON/OFF FROST CONTROL

- Thermostatic frost control allows the FV unit to be turned off at a predetermined outdoor temperature (when electric preheat is not desired). Protects the wheel from accumulating frost (Not applicable with variable speed wheel control package. See selection software.).

ROTATION DETECTOR

- The energy recovery wheel is equipped with a rotation detector. If there is a lack of wheel rotation for more than 10 minutes when the wheel is called to run, an alarm is generated (Included with stop/jog economizer or variable speed wheel control package. See selection software).

REMOTE INDICATING PANEL

- The remote indicating panel provides a convenient and attractive option for monitoring the FV Pre-conditioner. Remote mounted Indicating panel provides status indicators for: (1) Unit Power; (2) Wheel Rotation; (3) Dirty Outside Air Filter; and (4) Dirty Return Air Filter
- Field wiring is only required from the remote panel to a low voltage terminal strip factory mounted on the FV unit. Remote indicating panel includes a junction box and plaster ring for recessed or surface mounting.
- **NOTE:** Stop/jog Control Package Option must also be selected. Not applicable with variable speed wheel control package.

VARIABLE SPEED WHEEL CONTROL PACKAGE

NOTE: Control Package available on FV-2000-FV-9000 units, 3 phase only (see **FIGURE 5**).

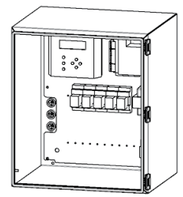


FIGURE 5: Variable speed controls.

STANDARD FEATURES:

- I/O Zone 583 controller & BACview5 keypad/display, unit on/off switch & unit alarm lamp
- BAS integration available via BACnet MS/TP, Modbus, N2
- Factory mounted & programmed wheel VFD (see **FIGURE 6**)

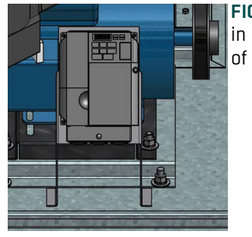


FIGURE 6: Wheel VFD, place in supply air compartment of FV.

- Temperature based wheel speed control with frost control wheel speed modulation
- Temperature sensors: outdoor air, supply air, return air, exhaust air
- Filter pressure switches for outdoor and return air filters with alarms
- Wheel rotation detector with alarm
- Outdoor air damper actuator, 2-position
- Controller provides modulating control signal to electric wheel preheat when needed (optional)

NON-VARIABLE SPEED WHEEL CONTROLS

BASIC PACKAGE

The basic FläktGroup SEMCO FV unit ships without 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 24VAC power at 3.5 amps, except for the FläktGroup SEMCO FV-1000 which handles 24VAC at 2 amps. (See appropriate 1Ø or 3Ø circuit diagram on **PAGES 43, 45** and **46**). It is strongly recommended that a remote unit start/stop relay (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 psychometric 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 (See **FIGURE 12** on **PAGE 11**).

OPTIONAL VARIABLE SPEED WHEEL CONTROL PACKAGE

- Digital reading of temperatures
- Proportional heating control
- Automatic summer/winter changeover

OPTIONAL STOP/JOG ECONOMIZER AND WHEEL FROST PROTECTION (GENERAL PURPOSE ROTATION DETECTOR)

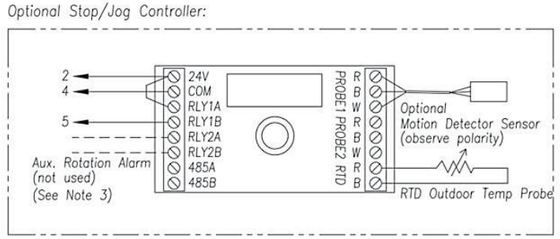
The stop/jog economizer option is used during moderate outdoor air temperatures to stop the recovery wheel. The jog function is included to allow the wheel to rotate periodically to self-clean.

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 set-points, the timer relay operates the wheel for approximately 30 seconds in every 30 minutes.

The general purpose rotation detector (GPRD) 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.

GPRD controller as installed on the electric panel.

Optional Stop/Jog Controller:



OPTIONAL ROTATION DETECTOR SENSOR FOR A GPRD CONTROLLER

The GPRD stop/jog economizer board is supplied with a motion detector to monitor the rotation of the energy recovery wheel (see **FIGURE 7**). 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 10 minutes - it energizes the alarm relay of the GPRD board. This can be used for remote indication of the alarm. The sensor will not create a false alarm when the GPRD controller is in stop/jog mode.

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

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.

Default Stop/Jog Device Parameters

Press and "double click" dial to enter parameter menu.
Rotate dial to view parameters. Press & click dial to select parameter for editing. Value will flash when parameter is selected.
Adjust setting by rotating dial, then press & click dial to lock in new setting. After 10secs with no activity, parameter menu will exit.
Alarms can be cleared by pressing and holding the dial for 3 seconds.

Parameter	Default Setting
MODE	3
MOTION ALARM	10
REVERSE ALARM	OFF
S-J ENABLE	On
S-J LOW TEMP	55
S-J HI TEMP	75
S-J On TIME	30
S-J OFF TIME	30
S-J FROST ENABLE	OFF
S-J FROST TEMP	0
TEMP UNITS	F
RELAY 1	4
RELAY 2	1
DISPLAY	2

FIGURE 7 GPRD Controller settings.

BENEFITS PROVIDED

ECONOMICAL COMPLIANCE WITH ASHRAE STANDARD 62.1

To achieve acceptable indoor air quality, ASHRAE Standard 62.1 recommends a three-to-four-fold increase in the amount of outdoor air provided to most facilities. In addition, ASHRAE recommends that this increased outdoor air quantity be introduced continuously while spaces are occupied. By recovering up to 80 percent of the total energy normally exhausted from facilities, FV preconditioning allows conventional HVAC systems to effectively handle this increase in outdoor air load without increasing the size of the heating/cooling capacity while decreasing energy consumption.

REDUCED EQUIPMENT FIRST COST

Without the addition of effective energy recovery, the capacity of HVAC systems must be increased significantly to handle the greater outdoor air loads associated with higher ventilation rates. Increasing equipment size often requires the addition of reheat and sophisticated control sequences to control humidity as well as temperature. The FV pre-conditioner often reduces project first cost by allowing smaller HVAC units and duct systems to be used, without the need for reheat or complex controls.

IMPROVED COOLING SEASON HUMIDITY CONTROL

A thermostat governs operation of conventional HVAC systems, i.e., in response to the conditioned space temperature only. When the cooling coil is cycled off, the outside air fan is typically shut-off as well. Thus, no ventilation is provided to the conditioned space until the thermostat calls for cooling. If the outside air fan is allowed to run while the cooling coil is off, then warm, humid air is directed to the space. In both of these cases, indoor space humidity levels will increase above guideline levels, i.e., 60 percent relative humidity.

Since the FV pre-conditioner dehumidifies and cools the incoming outdoor air, the supply air conditions are close to the return air conditions. This effectively produces a buffer against high outdoor latent loads resulting in acceptable indoor humidity levels.

HELPS REDUCE HUMIDIFICATION REQUIREMENTS DURING THE HEATING SEASON

Supplying 15 to 20 CFM/person of cold, dry outdoor air to a facility during the heating season can result in unacceptably low indoor relative humidity. The HVAC system effectively maintains space temperature by heating the air, yet few facilities are humidified. It is now well documented that many wintertime illnesses come as a result of the body's inability to fight off infection due to "dry airways." The FV unit captures the moisture generated within the space to provide free humidification during the heating season, therefore maintaining a healthier indoor environment.

IMPROVES THE IAQ OF EXISTING FACILITIES

The compact yet versatile design of the FV unit allows for easy installation in existing facilities and eliminates additional ductwork and disruption of the occupied space below. It can either be used as a stand-alone unit serving multiple HVAC units or as a dedicated pre-conditioner ducted directly to a single unitary HVAC system (see **FIGURES 2** and **3** on **PAGE 3**).

IMPROVES THE COMFORT OF OCCUPIED SPACES

As the outdoor air is supplied to the space, the heating/cooling source is cycled on and off to maintain temperature. When it is cycled off, very cold or very warm/humid air can be "dumped" on the occupants, causing wide temperature fluctuations, which makes for a very uncomfortable environment. FV preconditioning solves this problem by providing moderated supply air conditions — even as the heating/cooling source is cycled on and off.

SELECTION PROCEDURE

1) CHOOSE A UNIT SIZE

Use the unit capacity/wheel face area (see **FIGURE 8**) to determine the appropriate unit size based on the larger amount of fresh air that needs to be supplied to or return air exhausted from the facility. In the case where two units will provide the desired airflow, the smaller unit will provide the more economical selection and is generally the appropriate choice.

EXAMPLE: Two thousand (2000) CFM of supply air and 1800 CFM of exhaust air is required. Select model FV-2000 based on the 2000 CFM flow volume.

2) SELECT FAN MOTOR

Using the fan tables on **PAGES 14-27** for the unit selection, locate the intersection of the desired supply external static pressure and supply airflow quantity for the supply fan. This intersection gives the brake horsepower and fan speed. The fan table shading gives the appropriate standard motor.

After obtaining the supply fan motor information, repeat the same steps using the exhaust fan tables for the chosen unit.

EXAMPLE: For an FV-2000, the supply air at 2000 CFM and 0.5 in. wg. external static is met with a 2 hp motor and fan operating at 1803 rpm. Exhaust air at 1800 CFM and 0.75 in. wg. external static is met with a 2 hp motor and fan operating at 2004 rpm.

3) DETERMINE SUPPLY AIR RECOVERY EFFICIENCY

Enter the data in **FIGURE 8** for the chosen unit to determine the recovery wheel face area per airstream. Divide the smaller volume of the supply and return airstreams by the wheel area obtained from **FIGURE 8** to determine face velocity. Enter the data provided in **FIGURE 9** for the face velocity of the smaller airstream to determine the unit base effectiveness. If the airstreams are equal the base effectiveness is the same as the wheel effectiveness.

If the airflows are not equal, then divide the supply air volume by the return air volume to determine the airflow ratio. Using the base effectiveness determined from **FIGURE 9** and the calculated airflow ratio, enter **FIGURE 10** (**PAGE 10**) to obtain the corrected supply air efficiency for unequal airflow applications.

EXAMPLE: From the table in **FIGURE 8**, the FV-2000 wheel area per side is 2.60 sq. ft. Dividing 1800 CFM (the smaller of the two airstreams) by 2.60, provides a face velocity of 692 ft/min. From **FIGURE 9** the base effectiveness is 70 percent. Using the base effectiveness and an airflow ratio of 1.11 (2000cfm/1800cfm) from **FIGURE 10** determines the supply side efficiency to be 68%.

MODEL	AIRFLOW RANGE (SCFM)	WHEEL FACE AREA (FT^2/SIDE)
FV-1000	415-1245	1.42
FV-2000	800-2000	2.60
FV-3000	1800-3000	4.13
FV-4000	2600-4000	5.00
FV-5000	2600-6200	6.27
FV-7500	4500-9000	9.10
FV-9000	6000-10000	9.10

FIGURE 8. Airflow Range and Energy Wheel Area.

WHEEL FACE VELOCITY (FPM)	BASE RECOVERY EFFECTIVENESS (%)
300	80.3
400	77.8
500	75.3
600	72.8
700	70.3
800	67.8
900	65.3
1000	62.8
1100	60.3

FIGURE 9. Unit effectiveness vs. wheel face velocity.

RATIO OF SUPPLY AIR FLOW RATE TO RETURN AIR FLOW RATE	BASE EFFECTIVENESS						
	68	70	72	74	76	78	80
0.7	82.6	84.0	85.5	87.0	88.5	90.0	91.4
0.8	78.0	79.8	81.5	83.2	84.9	86.7	88.4
0.9	73.2	75.1	77.0	78.9	80.8	82.7	84.7
1.0	68.0	70.0	72.0	74.0	76.0	78.0	80.0
1.1	66.1	67.9	69.6	71.4	73.1	74.8	76.6
1.25	62.4	63.8	65.2	66.6	68.0	69.4	70.8
1.4	58.5	55.9	60.7	61.8	62.9	63.9	65.1

FIGURE 10. Unequal airflow efficiency correction.

4) CALCULATE THE SUPPLY AIR CONDITIONS

Once the design conditions are known and the supply side efficiency is determined, then the temperature and humidity content of the air supplied to the space after the wheel can easily be calculated by using **FIGURE 11**. Using dry bulb temperatures in **FIGURE 11** provides the supply air temperature. The supply air humidity level is also determined in **FIGURE 11** by using grains of moisture or humidity content (lb. moisture/lb. dry air.) The enthalpy of the supply air can be calculated in the same manner. Do not use **FIGURE 11** to calculate the wet bulb temperature.

FIGURE 11 Calculating supply temperatures and moisture content.

$$X_{SA} = \{X_{OA} - (Efficiency_{SA}) (X_{OA} - X_{RA})\}$$

Where

X = dry bulb temperature in °F
-Or- humidity content in gr/lb
-Or- enthalpy in Btu/lbs.

Indices

SA = supply air
OA = outside air
RA = return air

EXAMPLE: Summer outdoor air design conditions are 90°F, 110 gr/lb with a return condition of 75°F, 65 gr/lb. Winter outdoor air design conditions are 5°F, 4 gr/lb with a return air condition of 70°F, 32 gr/lb. Using **FIGURE 11**, the summer supply temperature and humidity is calculated as follows:

- TSA = 90°F - .68 (90 - 75)°F = 79.8°F
- wSA = 110 gr/lb - .68 (110 - 65)gr/lb = 79 gr/lb

The winter supply air temperature and humidity level is calculated in the same fashion to give a condition of 49.2°F, 23 gr/lb.

5) DETERMINE IF FROST PROTECTION IS REQUIRED

Plotted on a psychrometric chart, the performance of an enthalpy recovery wheel will form a straight line between the outdoor air and return air conditions (see **FIGURE 12**). If this line does not pass through the saturated line on the psychrometric chart or if the leaving exhaust air condition of the wheel is not below freezing, the wheel will not frost. In general, if the space is not humidified above 30% relative humidity on extreme winter days and the outdoor design is above 0°F, then frost protection is probably not required.

Should frost protection be required, three different methods of frost protection are available on the FV modules.

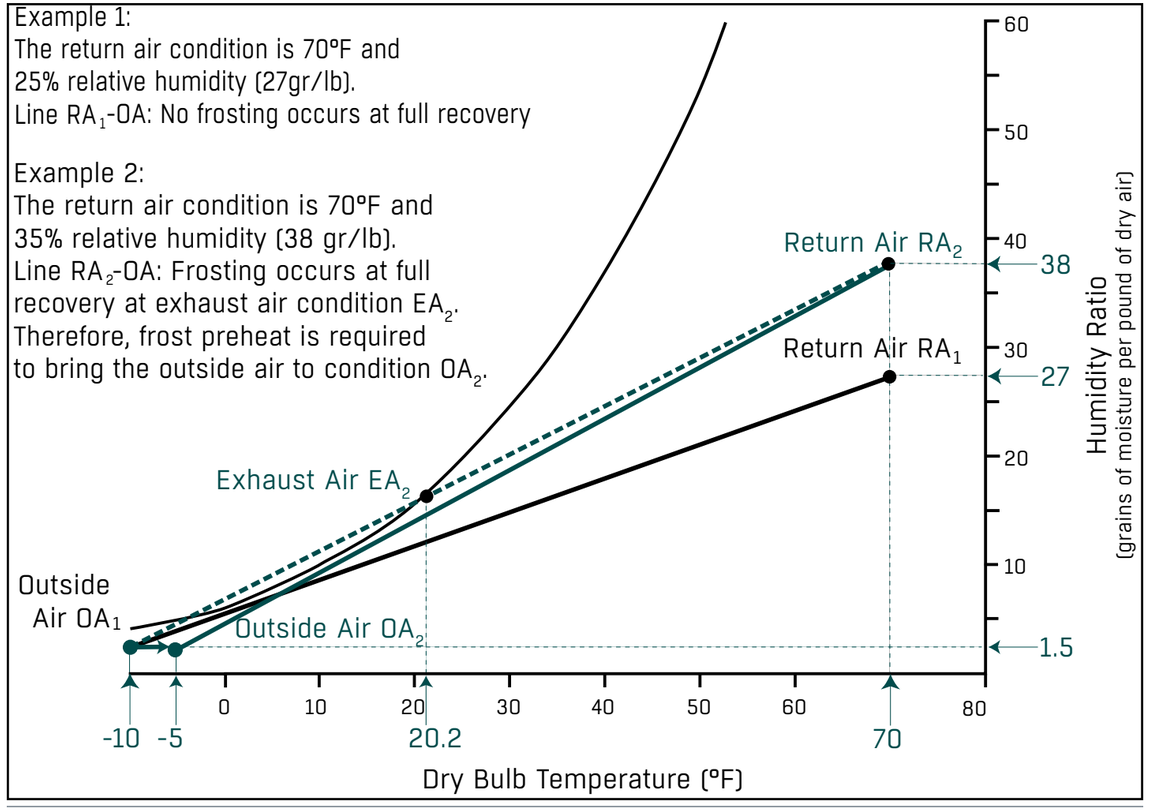
- Preheat is used as the primary method of frost protection for the energy wheel in FV units. This employs an electric heater on the outdoor air intake to raise the incoming air temperature

such that the operating line of the wheel no longer hits saturation. This is the preferred method since it requires usually only about 10°F of preheat to avoid frosting and the wheel continues to operate at full capacity even at the extreme conditions.

- The stop/jog economizer can be programmed to stop the wheel rotation below a preset outdoor air temperature. This has the disadvantage of introducing untreated, cold outdoor air to the HVAC unit or occupied space.
- A frost protection thermostat which turns the FV unit off below a preset outdoor air temperature is the third available option. This is generally considered the least attractive solution since it results in the unit supplying no outdoor air during low temperature periods.

EXAMPLE: Since the outdoor air winter design temperature for this example is 5°F and the space humidity is 30%, preheating is not required.

FIGURE 12. Using the psychrometric chart to determine the need for preheat frost control.



6) DETERMINE DIMENSIONAL DATA

The FV pre-conditioner can be installed in one of four possible configurations depending on the arrangement of the supply and return air openings (See **FIGURES 13-16** on **PAGE 13**

The FV-V configuration is selected when the FV unit is mounted on a curb and ducted vertically. It provides preconditioned air either directly to the occupied space or to a HVAC unit located inside the facility. The FV-H configuration is selected when the FV unit is mounted adjacent to a rooftop unit, or for other applications requiring a side connection for the supply and return air ducts.

The dimensional data for the various FV units is provided on **PAGES 28-39**. When noting dimensional information, only the supply and return outlet locations change between the configurations. All other dimensions remain the same.

EXAMPLE: Since the FV-2000 unit for this example will be roof mounted to serve several indoor HVAC units, the FV-2000-V pre-conditioner is selected.

7) DETERMINE ELECTRICAL DATA

The electrical data is determined on **PAGE 55**, **FIGURES 32 AND 33**. Since the electrical requirements are a function of the power source, the desired power source (voltage and phase) must be known before determining this information. If an electrical preheater is required, the electrical data should be increased appropriately by the information given in **FIGURE 35**, **PAGE 57.**

EXAMPLE: If 240V/1Ø power is available then the required minimum circuit ampacity and maximum overcurrent protection are determined as follows. For the FV-2000 with the motors selected in step 2 and no electric preheat, the minimum circuit ampacity is calculated using **FIGURE 32** on **PAGE 55**.

1.25 * FLA largest fan motor	=	15.0 (1.25*12)
+ FLA other fan motor	=	12.0
+ FLA wheel drive	=	2.2
MCA	=	28.25

The maximum circuit overcurrent protection is calculated using **FIGURE 33** on **PAGE 55**.

2.25 * FLA largest fan motor	=	27.0 (2.25*12)
+ FLA other fan motor	=	12.0
+ FLA wheel drive	=	2.2
MOP	=	41.

UNIT CONFIGURATIONS

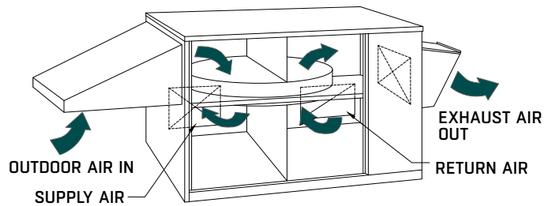


FIGURE 13. H configuration with horizontal supply air and horizontal return air duct arrangement.

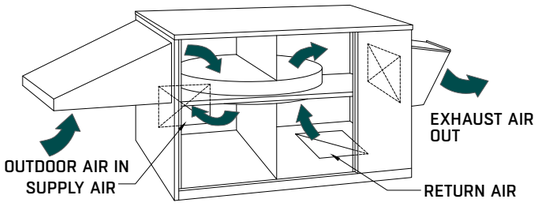


FIGURE 14. HS configuration with horizontal supply air and vertical return air duct arrangement.

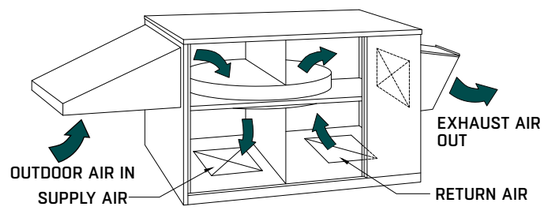


FIGURE 15. V configuration with vertical supply air and vertical return air duct arrangement.

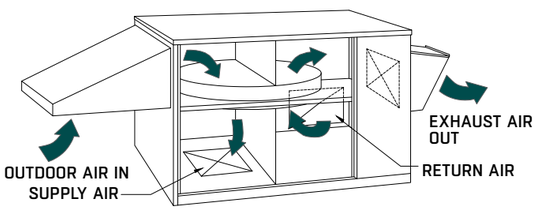
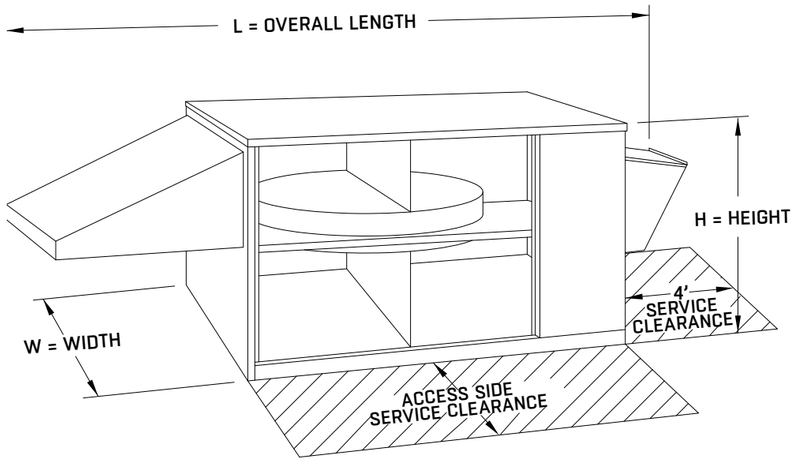


FIGURE 16. VS configuration with vertical supply air and horizontal return air duct arrangement.

DIMENSIONS

CONFIGURATIONS H, HS, VS: The service clearance is a minimum of 4 ft. around the unit with the exception of the access side. The access service side is equal to the width of the unit.

CONFIGURATION V: service clearance is a minimum of 4 ft. around the unit with the exception of the backside. The back service side is equal to 6 in..



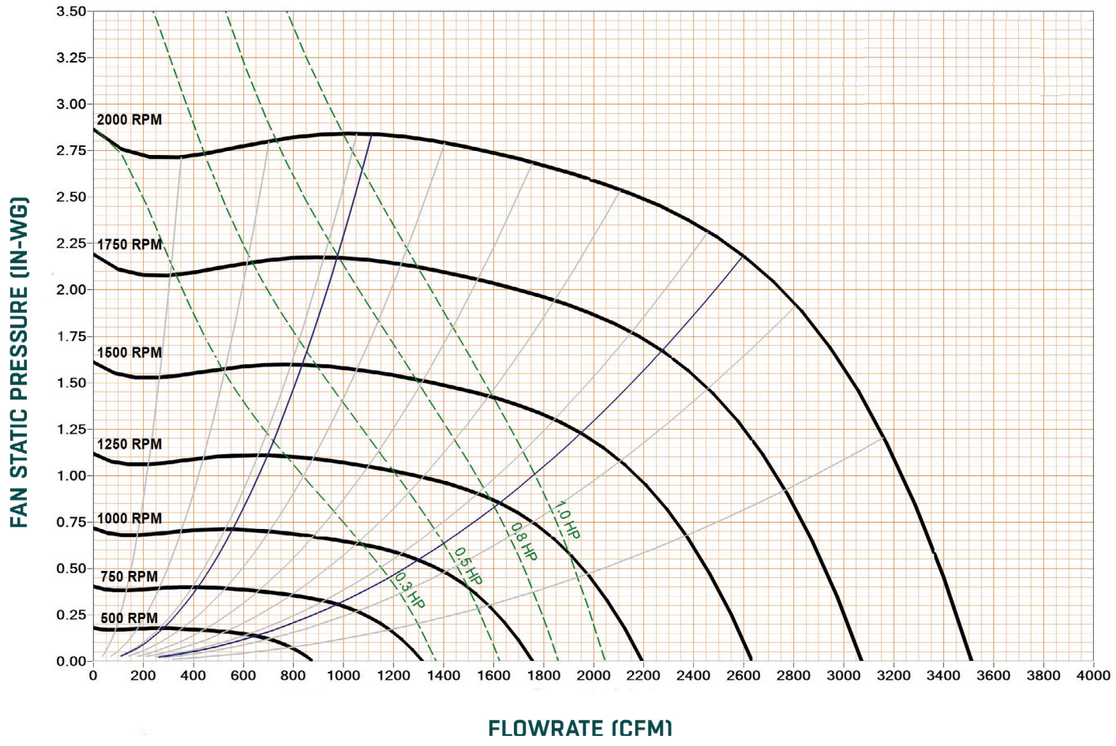
UNIT	L	H	W
(DIMENSIONS IN INCHES)			
FV-1000	77.5	31.1	29.1
FV-2000	88.5	32.6	37.0
FV-3000	102.7	47.8	45.0
FV-4000	133.8	51.9	54.0
FV-5000	133.8	51.9	54.0
FV-7500	150.3	59.0	64.6
FV-9000	150.3	59.0	64.6

FIGURE 17. Overall unit dimensions.

FV-1000: FAN TABLES & CURVES

FV-1000 EXHAUST FAN ALL MOTORS 3/4HP, 1,625 RPM	EXTERNAL STATIC PRESSURE (IN.WG.)*								
	-0.3	-0.1	0.1	0.3	0.5	0.75	1.0	1.25	1.5
AIRFLOW (SCFM)	1255	1150	1040	925	805	645	480	300	-

FV-1000 SUPPLY FAN ALL MOTORS 3/4HP, 1,625 RPM	EXTERNAL STATIC PRESSURE (IN.WG.)*								
	-0.3	-0.1	0.1	0.3	0.5	0.75	1.0	1.25	1.5
AIRFLOW (SCFM)	1245	1180	1115	1045	970	865	750	605	415



NOTE: For power draw of motors, see **FIGURE 34** on **PAGE 56**. When sizing fan motors, it is not required to add purge air or seal leakage as these corrections are reflected in the fan charts.

* Positive statics reference external static pressures that work against the FV unit fan. Negative statics would work with the FV unit fan. For example, an FV pre-conditioner that is blowing into a mixing section of another air handling unit (AHU) with a -0.3" static pressure in the AHU mixing section would have an FV supply fan static of -0.3" and an exhaust fan static of +0.3". All statics internal to the FV unit are already included in the selection.

FV-2000: FAN TABLES & CURVES

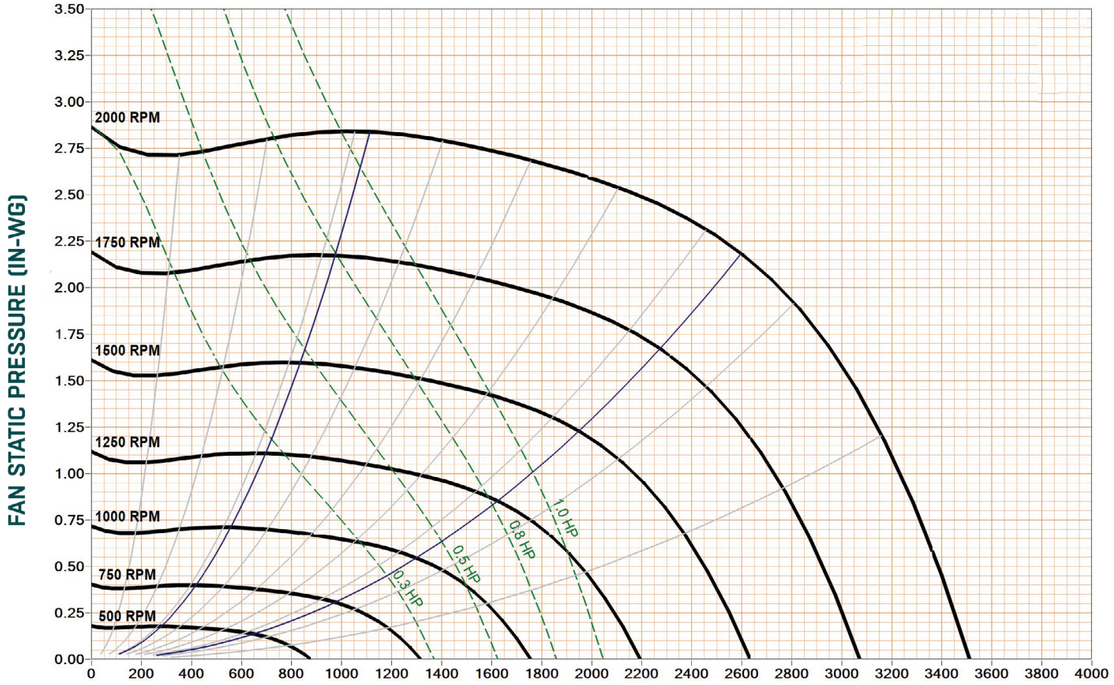
FV-2000 SUPPLY FAN DATA

AIRFLOW (SCFM)	EXTERNAL STATIC PRESSURE (IN.WG.)*								
	-0.3	-0.1	0.1	0.3	0.5	0.75	1.0	1.25	1.5
	MOTOR BRAKE HORSEPOWER/RPM								
800	.10/438	.10/627	.10/815	.17/986	.24/1138	.31/1282	.38/1404	.44/1517	.52/1617
1000	.10/611	.13/783	.21/950	.28/1105	.35/1239	.44/1369	.52/1495	.61/1601	.68/1707
1200	.17/779	.25/934	.33/1086	.42/1227	.50/1336	.60/1472	.70/1586	.80/1699	.89/1798
1400	.31/938	.39/1084	.50/1222	.59/1335	.69/1447	.80/1571	.93/1691	1.04/1799	1.14/1876
1600	.47/1096	.58/1227	.70/1340	.81/1454	.92/1558	1.07/1684	1.19/1799	1.32/1884	1.45/1969
1800	.69/1239	.82/1353	.94/1466	1.07/1573	1.20/1679	1.36/1801	1.52/1893	1.67/1985	1.78/2078
2000	.96/1371	1.09/1482	1.24/1592	1.38/1703	1.54/1803	1.72/1902	1.89/2001	-	-

SUPPLIED MOTOR: 0.33 HP, 1725 RPM | 0.75 HP, 1725 RPM | 1.50 HP, 1725 RPM | 2.00 HP, 1725 RPM

FV-2000 EXHAUST FAN DATA

AIRFLOW (SCFM)	EXTERNAL STATIC PRESSURE (IN.WG.)*								
	-0.3	-0.1	0.1	0.3	0.5	0.75	1.0	1.25	1.5
	MOTOR BRAKE HORSEPOWER/RPM								
800	.10/462	.10/718	.16/954	.23/1127	.31/1289	.41/1480	.51/1603	.58/1724	.66/1821
1000	.10/664	.18/914	.27/1084	.35/1252	.46/1415	.57/1568	.68/1694	.77/1803	.87/1896
1200	.21/882	.31/1058	.41/1226	.53/1397	.65/1536	.78/1669	.88/1789	1.00/1887	1.11/1985
1400	.37/1050	.48/1215	.61/1390	.76/1536	.88/1648	1.00/1779	1.14/1882	1.28/1986	1.39/2089
1600	.56/1219	.71/1394	.88/1542	1.02/1662	1.15/1775	1.30/1883	1.47/1991	1.59/2100	1.74/2208
1800	.83/1411	1.01/1558	1.18/1687	1.33/1798	1.48/1890	1.67/2004	1.82/2118	-	-
2000	1.17/1584	1.37/1726	1.55/1831	1.72/1927	1.89/2023	-	-	-	-



NOTE: For power draw of motors, see **FIGURE 34** on **PAGE 56**. When sizing fan motors, it is not required to add purge air or seal leakage as these corrections are reflected in the fan charts.

* Positive statics reference external static pressures that work against the FV unit fan. Negative statics would work with the FV unit fan. For example, an FV pre-conditioner that is blowing into a mixing section of another air handling unit (AHU) with a -0.3" static pressure in the AHU mixing section would have an FV supply fan static of -0.3" and an exhaust fan static of +0.3". All statics internal to the FV unit are already included in the selection.

FV-3000: FAN TABLES & CURVES

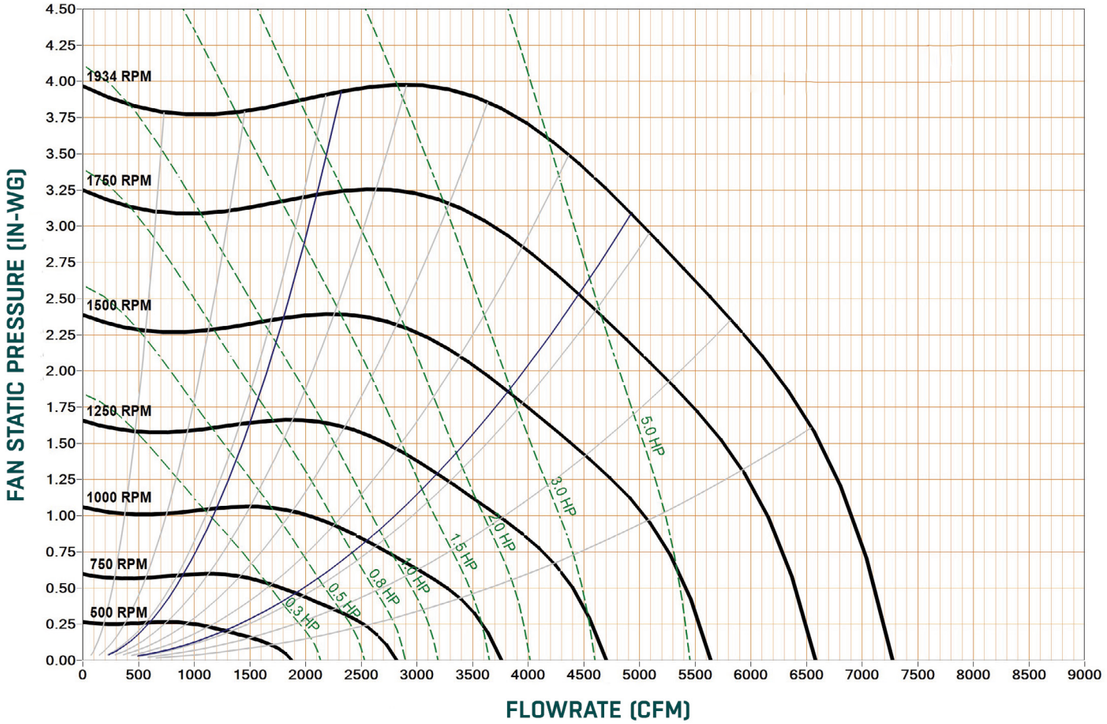
FV-3000 SUPPLY FAN DATA

AIRFLOW (SCFM)	EXTERNAL STATIC PRESSURE (IN.WG.)*								
	-0.3	-0.1	0.1	0.3	0.5	0.75	1.0	1.25	1.5
	MOTOR BRAKE HORSEPOWER/RPM								
1800	.15/799	.23/912	.43/1021	.62/1124	.77/1203	.91/1302	1.10/1394	1.21/1473	1.24/1552
2000	.30/891	.50/1000	.70/1110	.88/1189	.99/1268	1.13/1366	1.28/1449	1.38/1531	1.50/1613
2200	.59/986	.78/1097	.98/1180	1.10/1258	1.20/1337	1.35/1427	1.49/1512	1.65/1598	1.80/1678
2400	.88/1090	1.07/1175	1.21/1254	1.31/1333	1.43/1408	1.59/1497	1.79/1587	1.95/1670	2.08/1736
2600	1.17/1175	1.32/1254	1.43/1334	1.56/1411	1.69/1486	1.93/1579	2.12/1666	2.26/1730	2.36/1794
2800	1.43/1259	1.55/1340	1.69/1419	1.87/1497	2.07/1576	2.30/1666	2.45/1728	2.57/1791	2.69/1853
3000	1.67/1351	1.84/1433	2.06/1516	2.28/1598	2.48/1669	2.65/1731	2.80/1793	-	-

SUPPLIED MOTOR: 0.75 HP, 1725 RPM | 1.50 HP, 1725 RPM | 2.00 HP, 1725 RPM | 3.00 HP, 1725 RPM (3 PHASE ONLY)

FV-3000 EXHAUST FAN DATA

Airflow (scfm)	External Static Pressure (in.wg.)*								
	-0.3	-0.1	0.1	0.3	0.5	0.75	1.0	1.25	1.5
	Motor Brake Horsepower/RPM								
1800	.15/689	.31/887	.50/1018	.68/1140	.85/1232	1.06/1347	1.29/1441	1.46/1527	1.64/1612
2000	.24/854	.49/983	.67/1112	.87/1206	1.04/1298	1.29/1407	1.51/1500	1.71/1593	1.94/1661
2200	.50/959	.68/1085	.89/1185	1.07/1277	1.27/1369	1.53/1471	1.77/1572	2.02/1653	2.20/1709
2400	.69/1066	.90/1170	1.11/1261	1.30/1352	1.54/1440	1.80/1547	2.08/1643	2.33/1703	2.47/1764
2600	.92/1161	1.14/1251	1.35/1341	1.59/1431	1.82/1520	2.10/1631	2.42/1696	2.59/1762	2.76/1827
2800	1.19/1246	1.41/1334	1.65/1425	1.89/1517	2.13/1609	2.48/1688	2.71/1759	2.89/1831	-
3000	1.47/1333	1.71/1423	1.97/1515	2.21/1607	2.49/1677	2.80/1755	-	-	-



NOTE: For power draw of motors, see **FIGURE 34** on **PAGE 56**. When sizing fan motors, it is not required to add purge air or seal leakage as these corrections are reflected in the fan charts.

* Positive statics reference external static pressures that work against the FV unit fan. Negative statics would work with the FV unit fan. For example, an FV pre-conditioner that is blowing into a mixing section of another air handling unit (AHU) with a -0.3" static pressure in the AHU mixing section would have an FV supply fan static of -0.3" and an exhaust fan static of +0.3". All statics internal to the FV unit are already included in the selection.

FV-4000: FAN TABLES & CURVES

FV-4000 SUPPLY FAN DATA

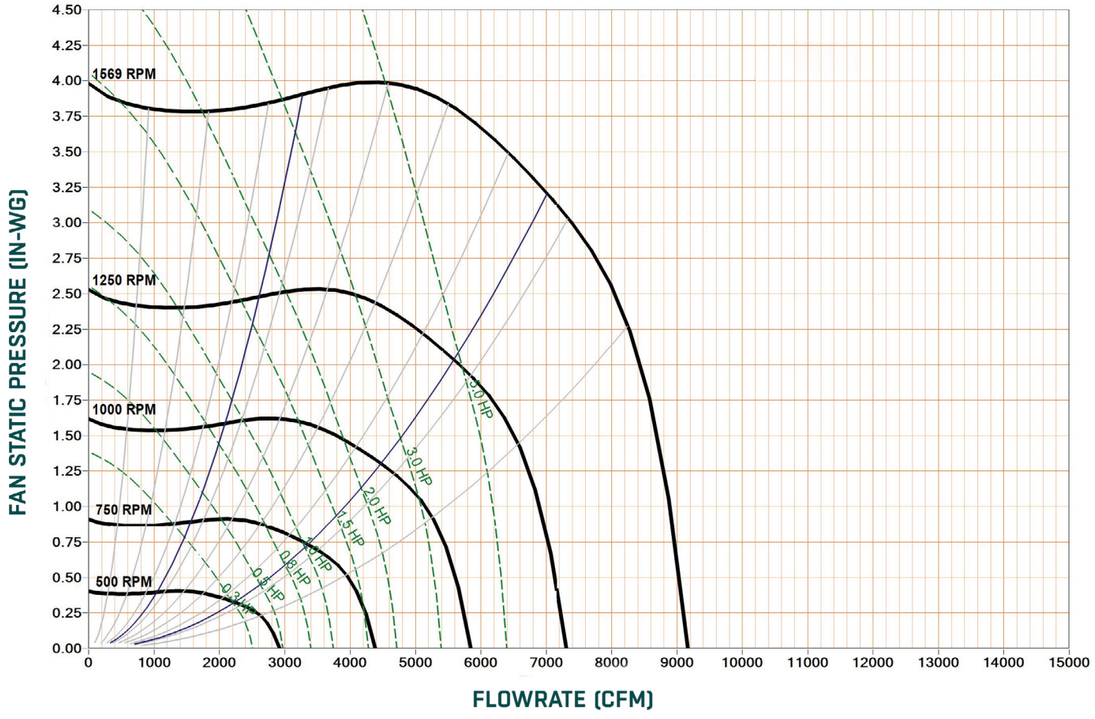
AIRFLOW (SCFM)	EXTERNAL STATIC PRESSURE (IN.WG.)*								
	-0.3	-0.1	0.1	0.3	0.5	0.75	1.0	1.25	1.5
	MOTOR BRAKE HORSEPOWER/RPM								
2600	.40/590	.52/666	.63/742	.74/817	.87/887	1.01/964	1.14/1040	1.31/1116	1.48/1200
2800	.54/648	.66/717	.77/786	.89/854	1.02/917	1.16/993	1.31/1069	1.49/1145	1.68/1229
3000	.69/700	.81/762	.93/824	1.06/886	1.18/948	1.33/1025	1.50/1102	1.69/1180	1.91/1260
3200	.85/746	.97/801	1.09/857	1.23/919	1.35/981	1.52/1060	1.72/1138	1.92/1214	2.16/1290
3400	1.03/784	1.15/834	1.27/889	1.41/954	1.54/1019	1.74/1100	1.95/1177	2.17/1248	2.42/1319
3600	1.21/816	1.33/860	1.46/927	1.60/994	1.75/1061	1.99/1146	2.22/1214	2.45/1281	2.70/1348
3800	1.40/843	1.52/898	1.66/969	1.83/1040	2.01/1112	2.27/1186	2.50/1249	2.75/1313	3.00/1376
4000	1.59/867	1.71/943	1.89/1020	2.08/1096	2.31/1164	2.58/1224	2.81/1284	3.06/1343	3.31/1403

SUPPLIED MOTOR:

0.75 HP, 1725 RPM	1.50 HP, 1725 RPM	2.00 HP, 1725 RPM	3.00 HP, 1725 RPM (3 PHASE ONLY)	5.00 HP, 1725 RPM (3 PHASE ONLY)

FV-4000 EXHAUST FAN DATA

AIRFLOW (SCFM)	EXTERNAL STATIC PRESSURE (IN.WG.)*								
	-0.3	-0.1	0.1	0.3	0.5	0.75	1.0	1.25	1.5
	MOTOR BRAKE HORSEPOWER/RPM								
2600	.46/632	.60/728	.74/822	.90/903	1.01/974	1.17/1062	1.35/1149	1.51/1202	1.64/1254
2800	.60/688	.75/778	.90/867	1.05/940	1.17/1012	1.36/1101	1.56/1174	1.69/1225	1.84/1277
3000	.76/741	.91/827	1.08/906	1.22/981	1.36/1055	1.57/1148	1.76/1201	1.90/1252	2.05/1304
3200	.93/791	1.09/872	1.26/950	1.41/1028	1.58/1106	1.82/1179	1.98/1231	2.14/1284	2.30/1336
3400	1.11/838	1.29/919	1.46/1002	1.63/1084	1.84/1159	2.08/1213	2.23/1267	2.40/1321	2.57/1374
3600	1.32/887	1.50/976	1.69/1065	1.91/1152	2.14/1197	2.33/1253	2.51/1309	2.69/1365	2.87/1422
3800	1.54/949	1.75/1046	1.97/1144	2.24/1195	2.45/1242	2.63/1302	2.82/1362	3.02/1421	3.21/1481
4000	1.79/1029	2.04/1138	2.33/1196	2.60/1248	2.76/1299	2.97/1364	3.18/1428	3.40/1493	3.62/1557



NOTE: For power draw of motors, see **FIGURE 34** on **PAGE 56**. When sizing fan motors, it is not required to add purge air or seal leakage as these corrections are reflected in the fan charts.

* Positive statics reference external static pressures that work against the FV unit fan. Negative statics would work with the FV unit fan. For example, an FV pre-conditioner that is blowing into a mixing section of another air handling unit (AHU) with a -0.3" static pressure in the AHU mixing section would have an FV supply fan static of -0.3" and an exhaust fan static of +0.3". All statics internal to the FV unit are already included in the selection.

FV-5000: FAN TABLES & CURVES

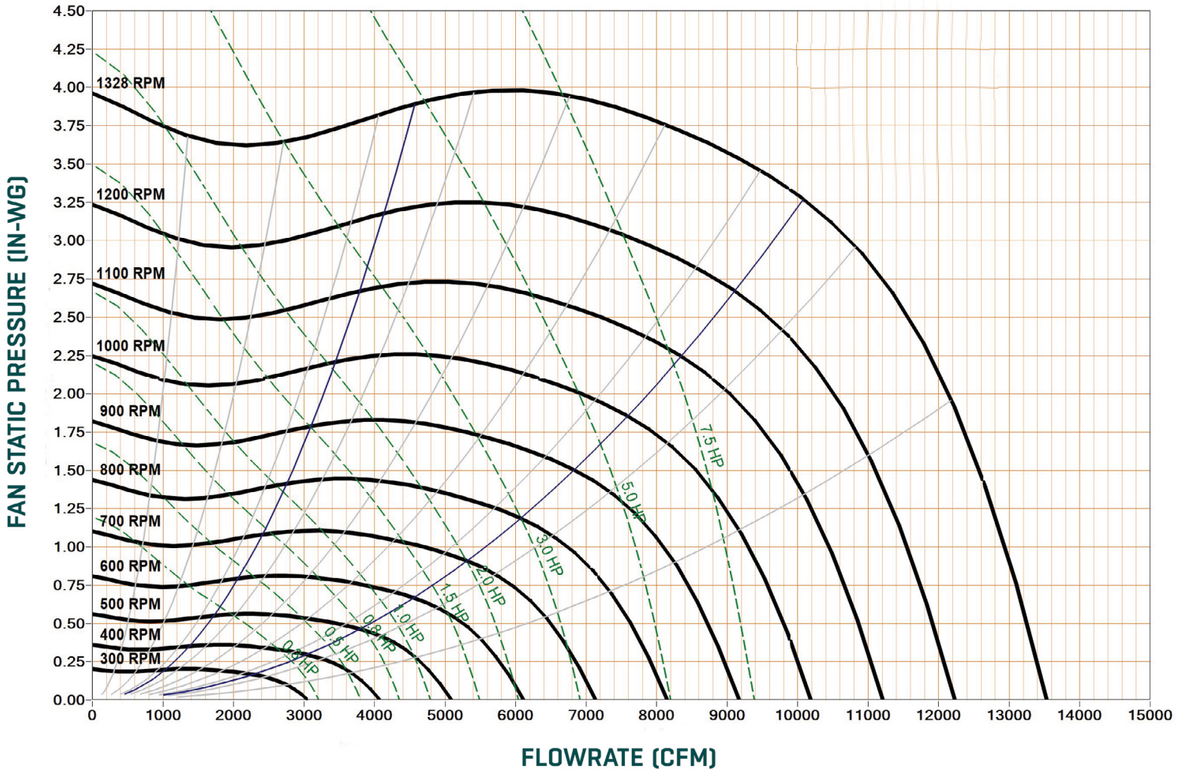
FV-5000 SUPPLY FAN DATA

AIRFLOW (SCFM)	EXTERNAL STATIC PRESSURE (IN.WG.)*								
	-0.3	-0.1	0.1	0.3	0.5	0.75	1.0	1.25	1.5
	MOTOR BRAKE HORSEPOWER/RPM								
2600	.23/433	.37/537	.52/637	.66/708	.80781	.99/857	1.15/921	1.32/986	1.50/1044
3000	.42/525	.59/629	.75/701	.90/773	1.07/838	1.26/904	1.44/969	1.62/1031	1.83/1084
3400	.66/629	.86/700	1.02/772	1.21/837	1.39/890	1.59/957	1.78/1022	2.01/1076	2.22/1131
3800	.99/706	1.16/776	1.37/841	1.57/895	1.75/949	1.97/1017	2.21/1073	2.45/1130	2.71/1186
4200	1.34/786	1.56/849	1.79/905	1.98/961	2.18/1017	2.44/1075	2.71/1133	2.99/1191	3.29/1227
4600	1.79/862	2.03/920	2.25/979	2.47/1033	2.71/1082	3.01/1142	3.32/1202	3.64/1237	3.87/1268
5000	2.31/943	2.56/1005	2.81/1057	3.08/1107	3.34/1156	3.68/1216	4.04/1257	4.30/1297	4.49/1338
5400	2.92/1036	3.20/1087	3.51/1139	3.80/1190	4.11/1237	4.49/1291	-	-	-
5800	3.68/1126	4.01/1179	4.33/1233	-	-	-	-	-	-
6200	4.59/1229	-	-	-	-	-	-	-	-

SUPPLIED MOTOR:					
	0.75 HP, 1725 RPM	1.50 HP, 1725 RPM	2.00 HP, 1725 RPM	3.00 HP, 1725 RPM (3 PHASE ONLY)	5.00 HP, 1725 RPM (3 PHASE ONLY)

FV-5000 EXHAUST FAN DATA

AIRFLOW (SCFM)	EXTERNAL STATIC PRESSURE (IN.WG.)*								
	-0.3	-0.1	0.1	0.3	0.5	0.75	1.0	1.25	1.5
	MOTOR BRAKE HORSEPOWER/RPM								
2600	.28/474	.45/607	.63/698	.79/784	.98/861	1.19/948	1.41/1029	1.63/1089	1.84/1149
3000	.49/588	.71/689	.88/775	1.09/854	1.29/925	1.53/1014	1.78/1077	2.01/1139	2.26/1202
3400	.80/686	.99/771	1.22/851	1.45/923	1.66/995	1.95/1067	2.20/1132	2.48/1198	2.78/1258
3800	1.13/773	1.38/852	1.63/925	1.87/998	2.11/1058	2.41/1127	2.72/1197	3.05/1263	3.39/1327
4200	1.56/857	1.83/930	2.09/1003	2.36/1066	2.64/1126	2.98/1200	3.35/1270	3.74/1339	4.15/1408
4600	2.06/939	2.35/1013	2.64/1078	2.96/1143	3.27/1209	3.69/1282	4.13/1355	4.59/1428	-
5000	2.64/1025	2.95/1097	3.32/1169	3.68/1237	4.06/1297	4.56/1373	-	-	-
5400	3.31/1125	3.72/1208	4.16/1270	4.61/1332	-	-	-	-	-
5800	4.19/1246	4.71/1307	-	-	-	-	-	-	-
6200	-	-	-	-	-	-	-	-	-



NOTE: For power draw of motors, see **FIGURE 34** on **PAGE 56**. When sizing fan motors, it is not required to add purge air or seal leakage as these corrections are reflected in the fan charts.

* Positive statics reference external static pressures that work against the FV unit fan. Negative statics would work with the FV unit fan. For example, an FV pre-conditioner that is blowing into a mixing section of another air handling unit (AHU) with a -0.3" static pressure in the AHU mixing section would have an FV supply fan static of -0.3" and an exhaust fan static of +0.3". All statics internal to the FV unit are already included in the selection.

FV-7500: FAN TABLES & CURVES

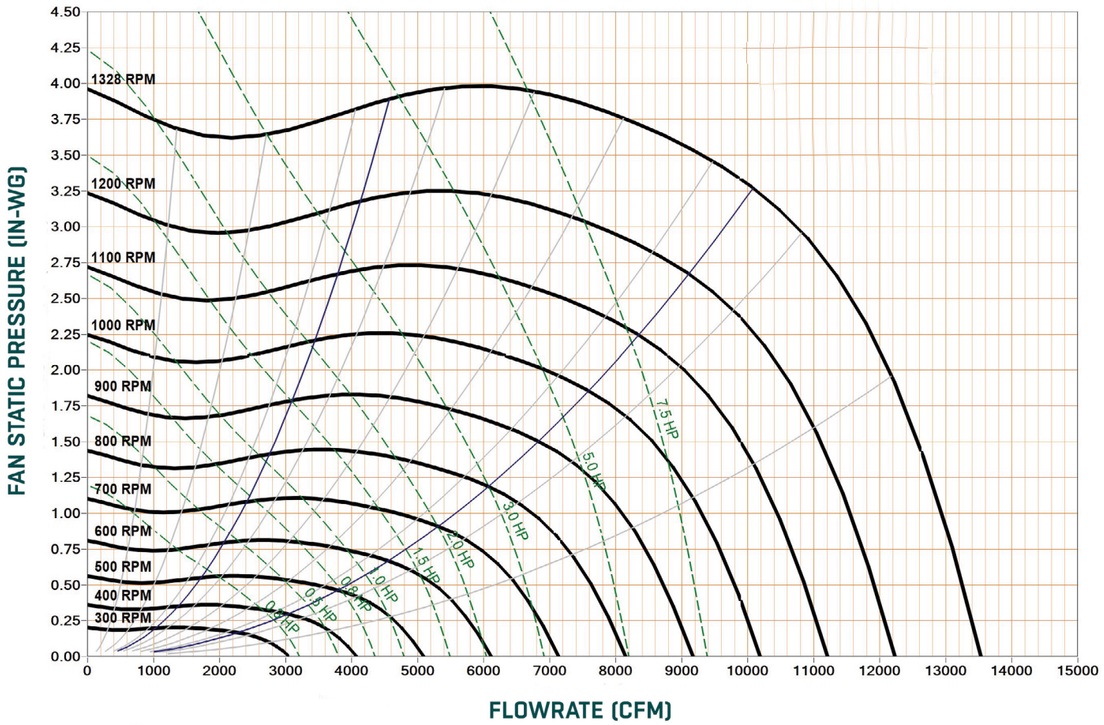
FV-7500 SUPPLY FAN DATA

AIRFLOW (SCFM)	EXTERNAL STATIC PRESSURE (IN.WG.)*								
	-0.3	-0.1	0.1	0.3	0.5	0.75	1.0	1.25	1.5
	MOTOR BRAKE HORSEPOWER/RPM								
4500	.99/585	1.16/647	1.34/708	1.53/770	1.74/818	1.97/877	2.20/935	2.42/991	2.65/1042
5000	1.35/647	1.55/707	1.75/766	1.99/815	2.18/861	2.43/918	2.68/975	2.92/1025	3.19/1076
5500	1.79/710	2.01/767	2.26/815	2.47/860	2.69/905	2.97/962	3.24/1013	3.51/1064	3.82/1114
6000	2.30/773	2.56/819	2.79/864	3.04/909	3.28/954	3.58/1006	3.87/1056	4.20/1106	4.53/1156
6500	2.91/826	3.16/871	3.43/916	3.70/961	3.96/1003	4.28/1053	4.63/1103	4.99/1154	5.35/1210
7000	3.57/883	3.86/928	4.16/974	4.46/1014	4.74/1055	5.11/1105	5.50/1156	5.88/1215	6.29/1277
7500	4.35/945	4.68/989	5.01/1030	5.31/1071	5.64/1112	6.06/1164	6.48/1229	6.91/1296	7.46/1330
8000	5.27/1009	5.63/1051	5.96/1093	6.33/1135	6.70/1180	7.14/1253	7.61/1316	8.23/1351	8.76/1386
8500	6.33/1078	6.70/1122	7.10/1165	7.51/1227	7.88/1292	8.41/1339	9.11/1379	-	-
9000	7.54/1157	7.98/1222	8.40/1296	8.80/1333	-	-	-	-	-

SUPPLIED MOTOR:				
2.00 HP, 1725 RPM	3.00 HP, 1725 RPM (3 PHASE ONLY)	5.00 HP, 1725 RPM (3 PHASE ONLY)	7.50 HP, 1725 RPM (3 PHASE ONLY)	10.00 HP, 1725 RPM (3 PHASE ONLY)

FV-7500 EXHAUST FAN DATA

AIRFLOW (SCFM)	EXTERNAL STATIC PRESSURE (IN.WG.)*								
	-0.3	-0.1	0.1	0.3	0.5	0.75	1.0	1.25	1.5
	MOTOR BRAKE HORSEPOWER/RPM								
4500	1.09/624	1.34/719	1.64/792	1.83/843	2.03/895	2.27/957	2.49/1015	2.73/1073	3.00/1131
5000	1.48/698	1.80/782	2.07/835	2.29/888	2.51/941	2.78/1005	3.05/1068	3.37/1132	3.71/1207
5500	1.97/774	2.32/828	2.57/883	2.83/938	3.08/994	3.39/1064	3.77/1135	4.16/1214	4.65/1293
6000	2.60/823	2.87/879	3.16/936	3.45/998	3.75/1061	4.19/1139	4.65/1222	5.19/1306	5.79/1389
6500	3.18/878	3.52/936	3.85/1006	4.21/1075	4.63/1145	5.17/1233	5.77/1321	6.44/1410	7.17/1454
7000	3.90/939	4.28/1017	4.71/1095	5.21/1172	5.72/1247	6.39/1340	7.14/1427	7.96/1471	8.56/1516
7500	4.74/1034	5.25/1122	5.85/1203	6.46/1283	7.07/1363	7.90/1442	8.80/1493	-	-
8000	5.84/1155	6.57/1240	7.28/1326	7.97/1411	8.72/1461	-	-	-	-
8500	7.38/1285	8.18/1377	8.98/1447	-	-	-	-	-	-
9000	9.17/1430	-	-	-	-	-	-	-	-



NOTE: For power draw of motors, see **FIGURE 34** on **PAGE 56**. When sizing fan motors, it is not required to add purge air or seal leakage as these corrections are reflected in the fan charts.

* Positive statics reference external static pressures that work against the FV unit fan. Negative statics would work with the FV unit fan. For example, an FV pre-conditioner that is blowing into a mixing section of another air handling unit (AHU) with a -0.3" static pressure in the AHU mixing section would have an FV supply fan static of -0.3" and an exhaust fan static of +0.3". All statics internal to the FV unit are already included in the selection.

FV-9000: FAN TABLES & CURVES

FV-9000 SUPPLY FAN DATA

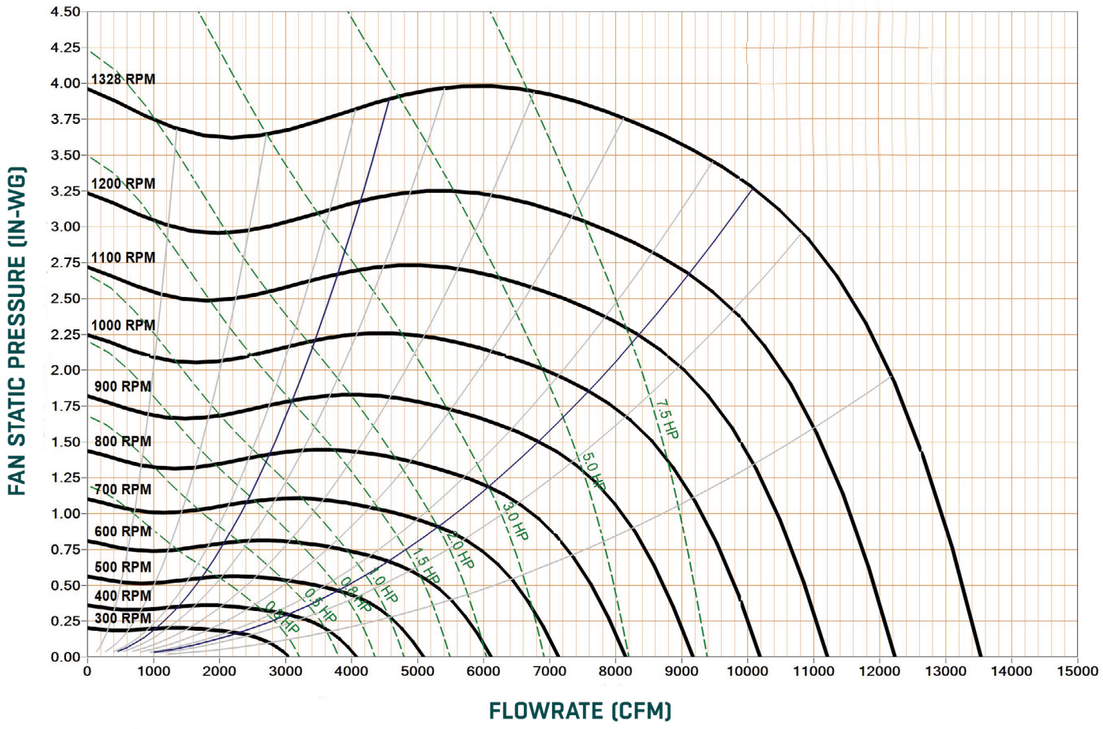
AIRFLOW (SCFM)	EXTERNAL STATIC PRESSURE (IN.WG.)*								
	-0.3	-0.1	0.1	0.3	0.5	0.75	1.0	1.25	1.5
	MOTOR BRAKE HORSEPOWER/RPM								
6000	2.30/772	2.56/818	2.79/864	3.03/909	3.29/955	3.59/1007	3.88/1057	4.21/1107	4.54/1156
6500	2.91/825	3.15/870	3.43/917	3.70/962	3.97/1004	4.28/1054	4.64/1104	4.99/1154	5.35/1209
7000	3.56/882	3.86/927	4.17/974	4.46/1015	4.74/1055	5.12/1106	5.50/1157	5.89/1214	6.28/1277
7500	4.35/944	4.68/990	5.01/1031	5.32/1072	5.65/1113	6.07/1165	6.48/1228	6.90/1295	7.45/1329
8000	5.26/1010	5.62/1052	5.97/1094	6.34/1136	6.70/1179	7.15/1252	7.60/1315	8.22/1350	8.76/1385
8500	6.32/1079	6.71/1121	7.11/1164	7.51/1225	7.89/1290	8.40/1338	9.10/1378	9.64/1418	9.97/1458
9000	7.55/1157	7.99/1221	8.41/1295	8.79/1332	9.33/1364	10.13/1403	10.63/1442	11.05/1481	11.50/1520
9500	8.98/1308	9.40/1335	9.90/1361	10.63/1388	11.26/1414	11.73/1447	12.20/1480	-	-
10000	10.52/1357	11.36/1377	12.12/1398	12.49/1418	-	-	-	-	-

SUPPLIED MOTOR:

3.00 HP, 1725 RPM (3 PHASE ONLY)	5.00 HP, 1725 RPM (3 PHASE ONLY)	7.50 HP, 1725 RPM (3 PHASE ONLY)	10.00 HP, 1725 RPM (3 PHASE ONLY)	15.00 HP, 1725 RPM (460V, 3 PHASE ONLY)

FV-9000 EXHAUST FAN DATA

AIRFLOW (SCFM)	EXTERNAL STATIC PRESSURE (IN.WG.)*								
	-0.3	-0.1	0.1	0.3	0.5	0.75	1.0	1.25	1.5
	MOTOR BRAKE HORSEPOWER/RPM								
6000	2.59/824	2.86/880	3.16/937	3.46/999	3.75/1062	4.20/1140	4.66/1224	5.19/1305	5.80/1388
6500	3.19/877	3.53/937	3.86/1007	4.22/1077	4.63/1146	5.18/1234	5.78/1320	6.43/1408	7.16/1454
7000	3.91/941	4.29/1019	4.71/1096	5.22/1173	5.73/1248	6.41/1339	7.13/1426	7.95/1471	8.56/1516
7500	4.74/1036	5.26/1123	5.86/1205	6.48/1283	7.08/1361	7.89/1441	8.79/1494	9.43/1545	9.91/1596
8000	5.85/1157	6.58/1239	7.29/1324	7.99/1410	8.71/1461	9.71/1519	10.39/1577	10.98/1634	11.56/1691
8500	7.39/1283	8.19/1375	8.99/1446	9.82/1495	10.74/1546	11.44/1608	12.14/1670	-	-
9000	9.16/1429	10.08/1480	11.05/1531	11.93/1584	12.57/1635	13.38/1698	-	-	-
9500	9.88/1512	10.77/1562	11.65/1614	-	-	-	-	-	-
10000	10.52/1585	11.36/1633	-	-	-	-	-	-	-

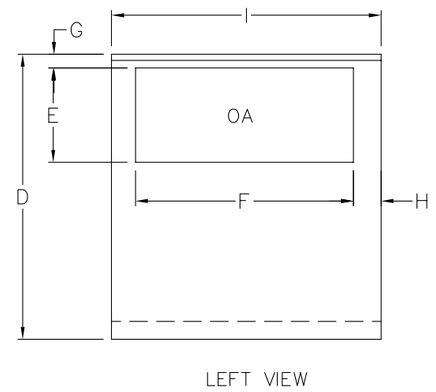


NOTE: For power draw of motors, see **FIGURE 34** on **PAGE 56**. When sizing fan motors, it is not required to add purge air or seal leakage as these corrections are reflected in the fan charts.

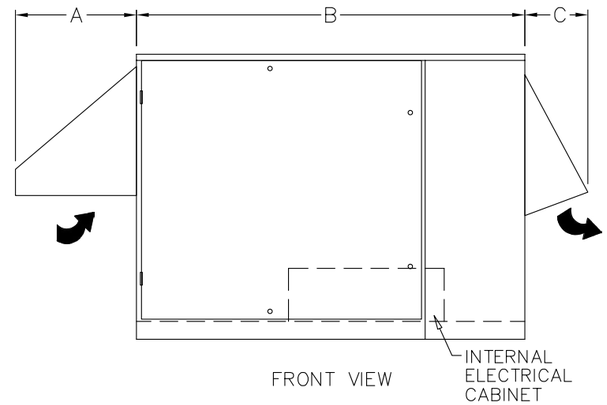
***** Positive statics reference external static pressures that work against the FV unit fan. Negative statics would work with the FV unit fan. For example, an FV pre-conditioner that is blowing into a mixing section of another air handling unit (AHU) with a -0.3" static pressure in the AHU mixing section would have an FV supply fan static of -0.3" and an exhaust fan static of +0.3". All statics internal to the FV unit are already included in the selection.

DIMENSIONAL DATA - OUTDOOR ARRANGEMENT H

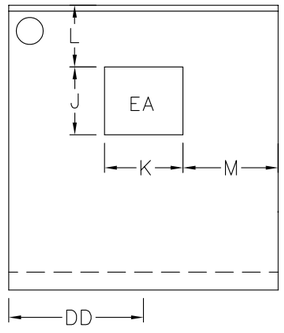
See **FIGURES 18 and **19** on **PAGE 29** for corresponding dimensions*



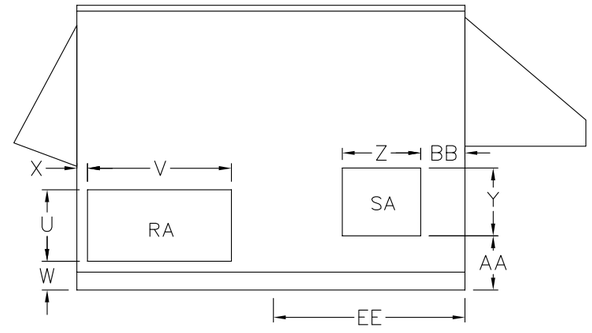
LEFT VIEW



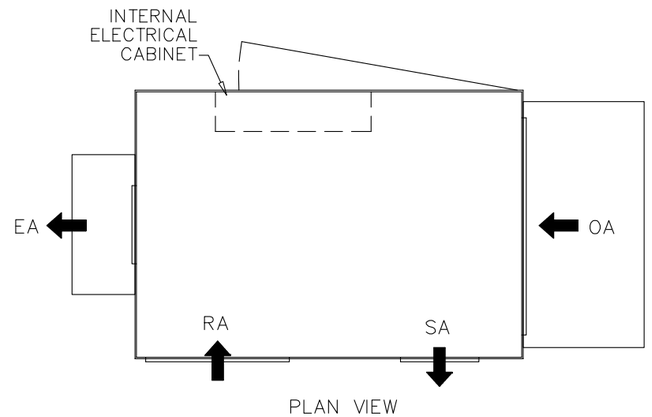
FRONT VIEW



RIGHT VIEW



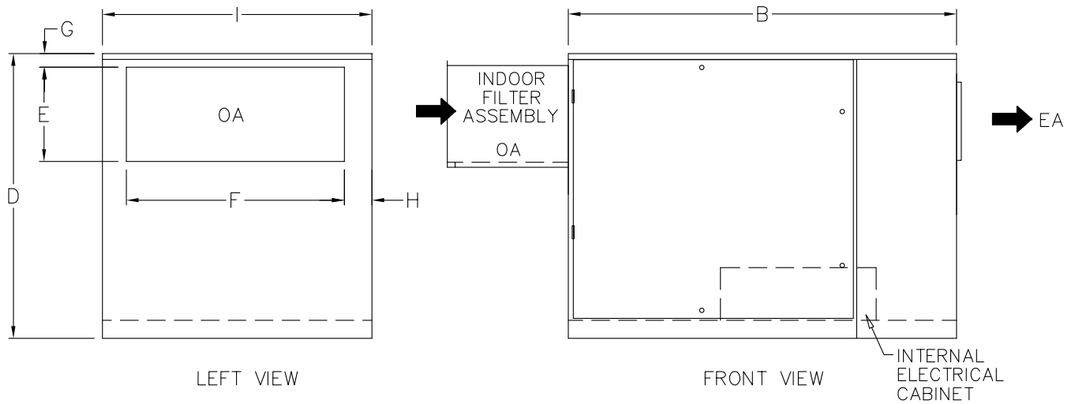
BACK VIEW



PLAN VIEW

DIMENSIONAL DATA - INDOOR ARRANGEMENT H

See **FIGURES 18 and **19** on **PAGE 29** for corresponding dimensions*



MODEL	NET WT. (LBS.)	DIMENSIONS (INCHES)								
		A	B	C	D	E	F	G	H	I
FV-1000H	500	16.5	44.3	16.7	31.1	7.6	22.6	2.6	4.1	29.1
FV-2000H	550	20.4	51.4	16.7	32.6	9.1	28.5	2.5	4.5	37.0
FV-3000H	1000	20.4	64.8	17.5	47.8	15.8	36.4	2.3	5.0	45.0
FV-4000H	1150	32.7	78.8	22.3	51.9	15.8	44.3	2.5	4.8	54.0
FV-5000H	1150	32.7	78.8	22.3	51.9	15.8	44.3	2.5	4.8	54.0
FV-7500H	1800	32.7	95.3	22.3	59.0	20.8	54.1	2.7	5.2	64.6
FV-9000H	1800	32.7	95.3	22.3	59.0	20.8	54.1	2.7	5.2	64.6

FIGURE 18

MODEL	NET WT. (LBS.)	DIMENSIONS (INCHES)													
		J	K	L	M	U	V	W	X	Y	Z	AA	BB	DD	EE
FV-1000H	500	10.2	9.2	4.2	9.9	7.0	16.0	3.8	8.0	10.2	9.3	5.8	5.0	13.6	21.3
FV-2000H	550	10.2	11.7	4.3	7.3	7.8	23.0	3.2	2.7	10.1	11.7	4.9	4.3	17.4	24.7
FV-3000H	1000	11.4	13.1	10.6	16.0	12.0	24.0	4.8	1.8	11.4	13.1	9.1	7.4	21.2	31.1
FV-4000H	1150	13.4	14.6	11.8	19.6	20.0	19.0	4.3	2.4	13.4	14.6	10.2	7.1	25.4	37.8
FV-5000H	1150	15.9	18.6	9.5	17.6	20.0	19.0	4.3	2.4	15.9	18.6	11.4	5.2	25.4	37.8
FV-7500H	1800	15.9	18.6	11.6	23.0	16.5	47.2	4.3	7.4	15.9	18.6	11.6	8.0	30.4	45.7
FV-9000H	1800	15.9	18.6	11.6	23.0	16.5	47.2	4.3	7.4	15.9	18.6	11.6	8.0	30.4	45.7

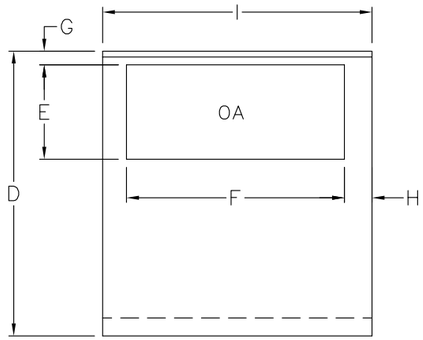
FIGURE 19

NOTE: Dimensions DD & EE represent approximate unit center of gravity.

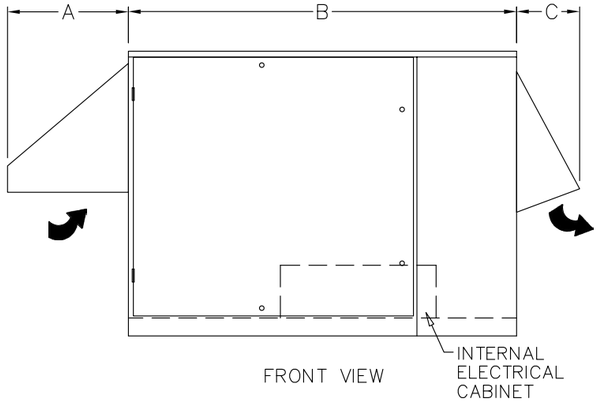
FläktGroup SEMCO SPECIALIZED HEALTHY AIR SOLUTIONS

DIMENSIONAL DATA - OUTDOOR ARRANGEMENT HS

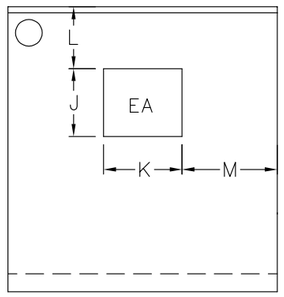
See **FIGURES 20 and **21** on **PAGE 32** for corresponding dimensions*



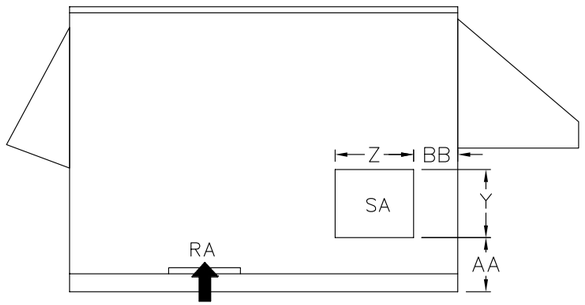
LEFT VIEW



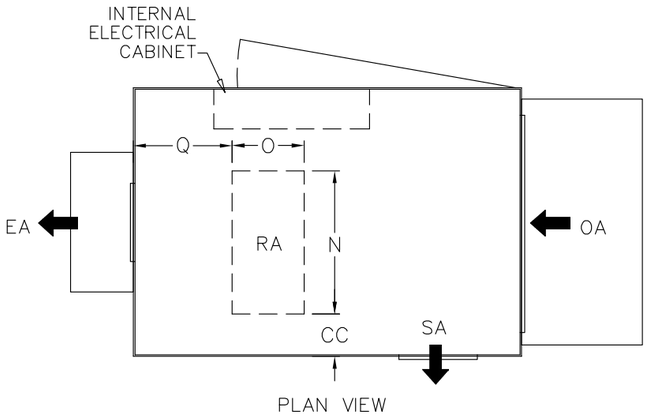
FRONT VIEW



RIGHT VIEW



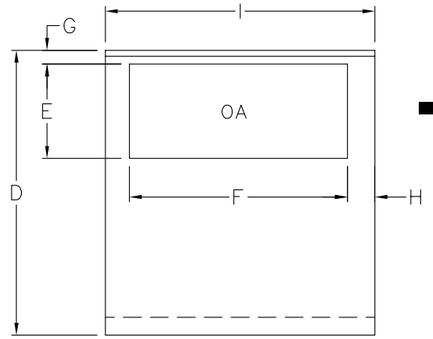
BACK VIEW



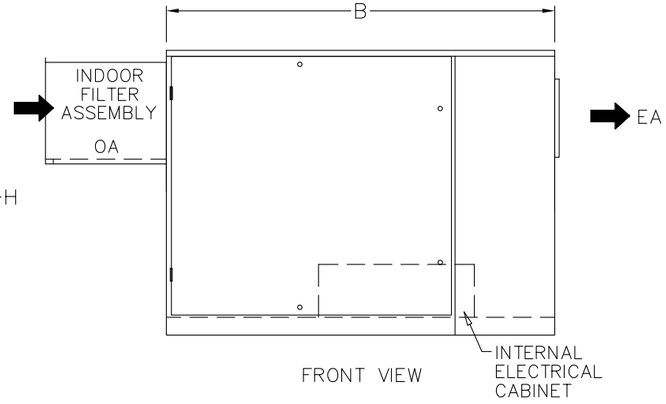
PLAN VIEW

DIMENSIONAL DATA - INDOOR ARRANGEMENT HS

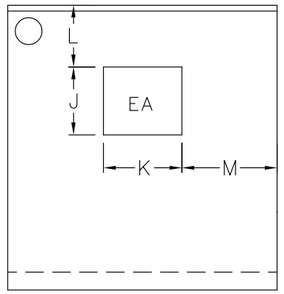
See **FIGURES 20 and **21** on **PAGE 32** for corresponding dimensions*



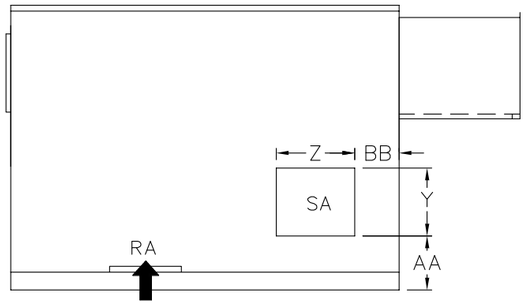
LEFT VIEW



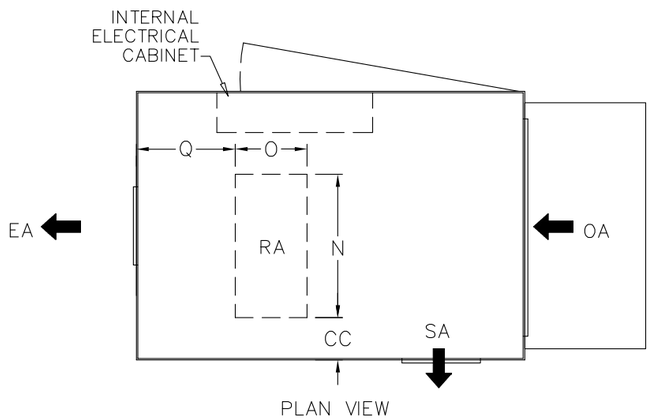
FRONT VIEW



RIGHT VIEW



BACK VIEW



PLAN VIEW

FläktGroup SEMCO SPECIALIZED HEALTHY AIR SOLUTIONS

MODEL	NET WT. (LBS.)	DIMENSIONS (INCHES)								
		A	B	C	D	E	F	G	H	I
FV-1000HS	500	16.5	44.3	16.7	31.1	7.6	22.6	2.6	4.1	29.1
FV-2000HS	550	20.4	51.4	16.7	32.6	9.1	28.5	2.5	4.5	37.0
FV-3000HS	1000	20.4	64.8	17.5	47.8	15.8	36.4	2.3	5.0	45.0
FV-4000HS	1150	32.7	78.8	22.3	51.9	15.8	44.3	2.5	4.8	54.0
FV-5000HS	1150	32.7	78.8	22.3	51.9	15.8	44.3	2.5	4.8	54.0
FV-7500HS	1800	32.7	95.3	22.3	59.0	20.8	54.1	2.7	5.2	64.6
FV-9000HS	1800	32.7	95.3	22.3	59.0	20.8	54.1	2.7	5.2	64.6

FIGURE 20

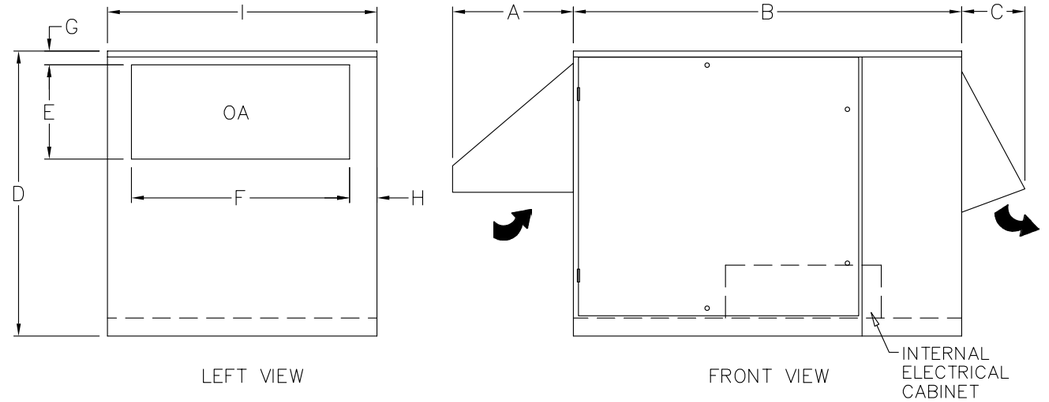
MODEL	NET WT. (LBS.)	DIMENSIONS (INCHES)												
		J	K	L	M	N	O	Q	Y	Z	AA	BB	CC	DD	EE
FV-1000HS	500	10.2	9.2	4.2	9.9	11.1	10.0	12.6	10.2	9.3	5.8	5.0	9.0	13.6	21.3
FV-2000HS	550	10.2	11.7	4.3	7.3	19.7	9.1	17.9	10.1	11.7	4.9	4.3	7.9	17.4	24.7
FV-3000HS	1000	11.4	13.1	10.6	16.0	24.0	12.0	16.6	11.4	13.1	9.1	7.4	7.0	21.2	31.1
FV-4000HS	1150	13.4	14.6	11.8	19.6	20.0	19.0	20.7	13.4	14.6	10.2	7.1	11.9	25.4	37.8
FV-5000HS	1150	15.9	18.6	9.5	17.6	20.0	19.0	20.7	15.9	18.6	11.4	5.2	11.9	25.4	37.8
FV-7500HS	1800	15.9	18.6	11.6	23.0	47.2	16.5	25.2	15.9	18.6	11.6	8.0	4.0	30.4	45.7
FV-9000HS	1800	15.9	18.6	11.6	23.0	47.2	16.5	25.2	15.9	18.6	11.6	8.0	4.0	30.4	45.7

FIGURE 21

NOTE: Dimensions DD & EE represent approximate unit center of gravity.

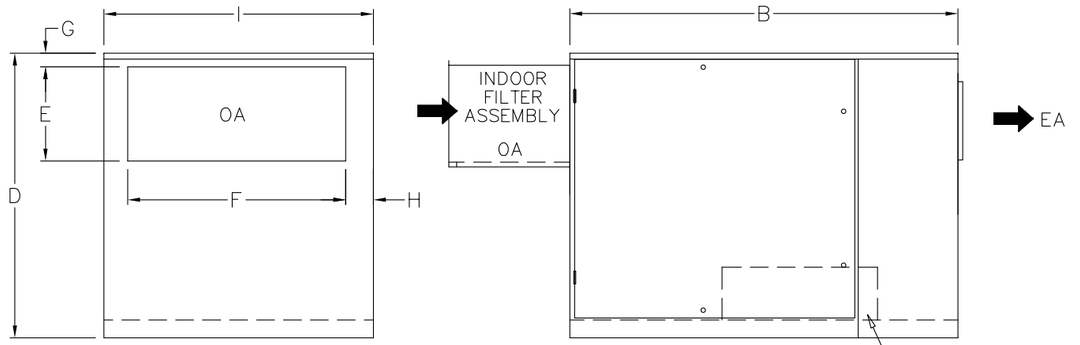
DIMENSIONAL DATA - OUTDOOR ARRANGEMENT V

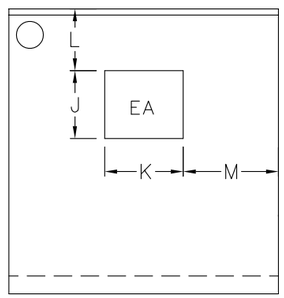
See **FIGURES 22 and **23** on **PAGE 35** for corresponding dimensions*

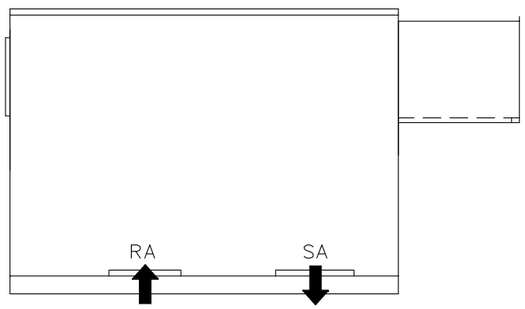


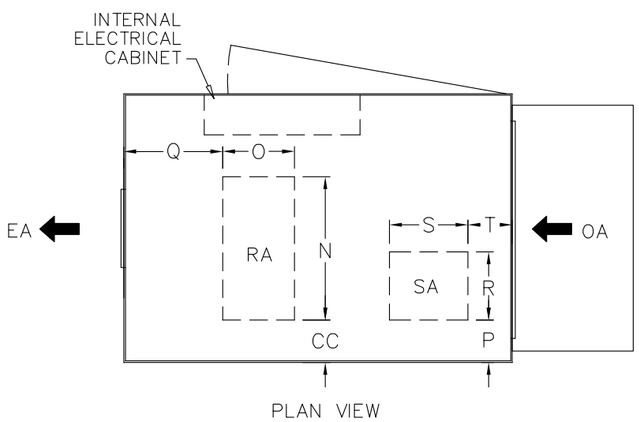
DIMENSIONAL DATA - INDOOR ARRANGEMENT V

See **FIGURES 22 and **23** on **PAGE 35** for corresponding dimensions*









MODEL	NET WT. (LBS.)	DIMENSIONS (INCHES)								
		A	B	C	D	E	F	G	H	I
FV-1000V	500	16.5	44.3	16.7	31.1	7.6	22.6	2.6	4.1	29.1
FV-2000V	550	20.4	51.4	16.7	32.6	9.1	28.5	2.5	4.5	37.0
FV-3000V	1000	20.4	64.8	17.5	47.8	15.8	36.4	2.3	5.0	45.0
FV-4000V	1150	32.7	78.8	22.3	51.9	15.8	44.3	2.5	4.8	54.0
FV-5000V	1150	32.7	78.8	22.3	51.9	15.8	44.3	2.5	4.8	54.0
FV-7500V	1800	32.7	95.3	22.3	59.0	20.8	54.1	2.7	5.2	64.6
FV-9000V	1800	32.7	95.3	22.3	59.0	20.8	54.1	2.7	5.2	64.6

FIGURE 22

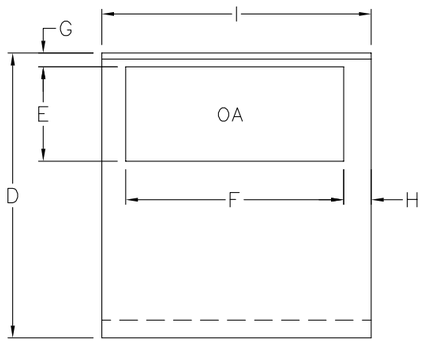
MODEL	NET WT. (LBS.)	DIMENSIONS (INCHES)												
		J	K	L	M	N	O	P	Q	R	S	T	CC	DD	EE
FV-1000V	500	10.2	9.2	4.2	9.9	11.1	10.0	7.0	12.6	10.2	9.3	5.0	9.0	13.6	21.3
FV-2000V	550	10.2	11.7	4.3	7.3	19.7	9.1	5.9	17.9	10.3	11.8	4.1	7.9	17.4	24.7
FV-3000V	1000	11.4	13.1	10.6	16.0	24.0	12.0	7.1	16.6	11.4	13.1	7.4	7.0	21.2	31.1
FV-4000V	1150	13.4	14.6	11.8	19.6	20.0	19.0	7.3	20.7	13.5	14.7	7.1	11.9	25.4	37.8
FV-5000V	1150	15.9	18.6	9.5	17.6	20.0	19.0	8.9	20.7	15.9	18.6	5.2	11.9	25.4	37.8
FV-7500V	1800	15.9	18.6	11.6	23.0	47.2	16.5	9.0	25.2	15.9	18.6	7.9	4.0	30.4	45.7
FV-9000V	1800	15.9	18.6	11.6	23.0	47.2	16.5	9.0	25.2	15.9	18.6	7.9	4.0	30.4	45.7

FIGURE 23

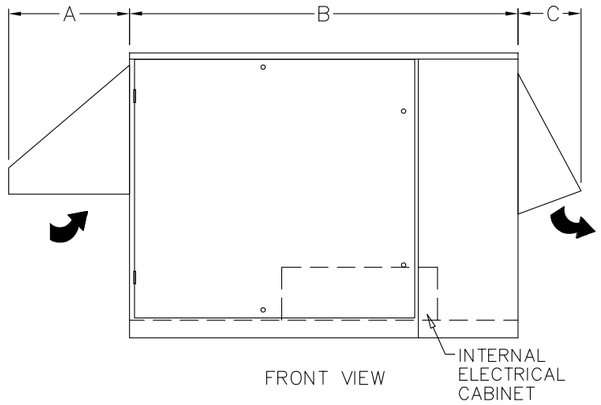
NOTE: Dimensions DD & EE represent approximate unit center of gravity.

DIMENSIONAL DATA - OUTDOOR ARRANGEMENT VS

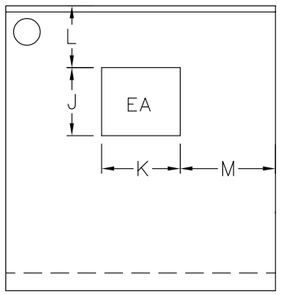
See **FIGURES 24 and **25** on **PAGE 38** for corresponding dimensions*



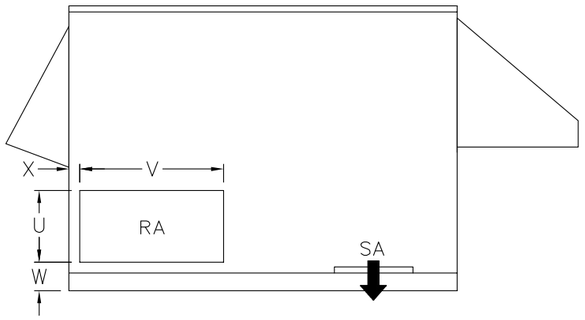
LEFT VIEW



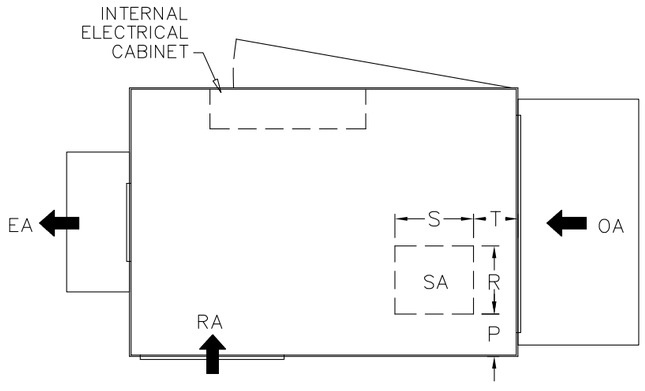
FRONT VIEW



RIGHT VIEW



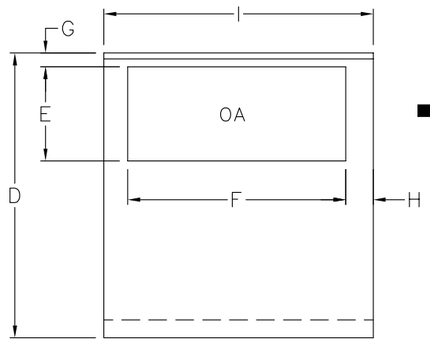
BACK VIEW



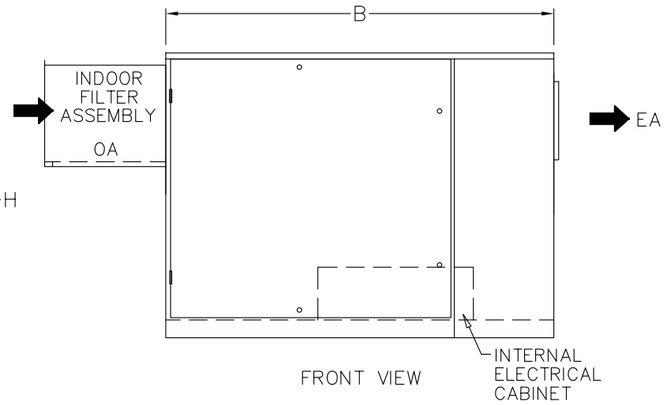
PLAN VIEW

DIMENSIONAL DATA - INDOOR ARRANGEMENT VS

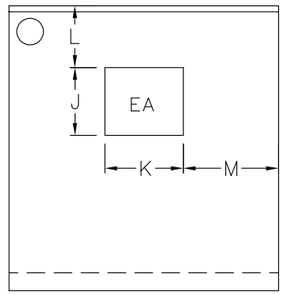
See **FIGURES 24 and **25** on **PAGE 38** for corresponding dimensions*



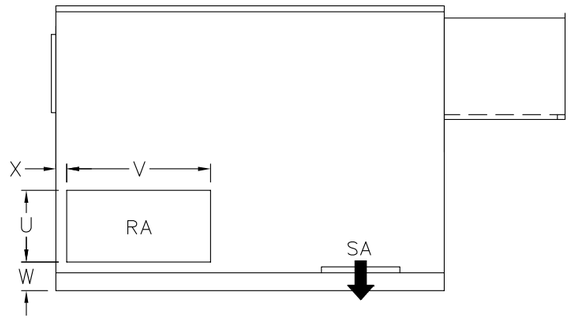
LEFT VIEW



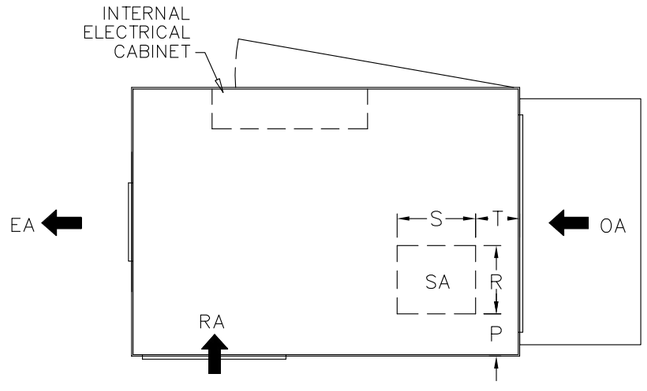
FRONT VIEW



RIGHT VIEW



BACK VIEW



PLAN VIEW

MODEL	NET WT. (LBS.)	DIMENSIONS (INCHES)								
		A	B	C	D	E	F	G	H	I
FV-1000VS	500	16.5	44.3	16.7	31.1	7.6	22.6	2.6	4.1	29.1
FV-2000VS	550	20.4	51.4	16.7	32.6	9.1	28.5	2.5	4.5	37.0
FV-3000VS	1000	20.4	64.8	17.5	47.8	15.8	36.4	2.3	5.0	45.0
FV-4000VS	1150	32.7	78.8	22.3	51.9	15.8	44.3	2.5	4.8	54.0
FV-5000VS	1150	32.7	78.8	22.3	51.9	15.8	44.3	2.5	4.8	54.0
FV-7500VS	1800	32.7	95.3	22.3	59.0	20.8	54.1	2.7	5.2	64.6
FV-9000VS	1800	32.7	95.3	22.3	59.0	20.8	54.1	2.7	5.2	64.6

FIGURE 24

MODEL	NET WT. (LBS.)	DIMENSIONS (INCHES)													
		J	K	L	M	P	R	S	T	U	V	W	X	DD	EE
FV-1000VS	500	10.2	9.2	4.2	9.9	7.0	10.2	9.3	5.0	7.0	16.0	3.8	8.0	13.6	21.3
FV-2000VS	550	10.2	11.7	4.3	7.3	5.9	10.3	11.8	4.1	7.8	23.0	3.2	2.7	17.4	24.7
FV-3000VS	1000	11.4	13.1	10.6	16.0	7.1	11.4	13.1	7.4	12.0	24.0	4.8	1.8	21.2	31.1
FV-4000VS	1150	13.4	14.6	11.8	19.6	7.3	13.5	14.7	7.1	20.0	19.0	4.3	2.4	25.4	37.8
FV-5000VS	1150	15.9	18.6	9.5	17.6	8.9	15.9	18.6	5.2	20.0	19.0	4.3	2.4	25.4	37.8
FV-7500VS	1800	15.9	18.6	11.6	23.0	9.0	15.9	18.6	7.9	16.5	47.2	4.3	7.4	30.4	45.7
FV-9000VS	1800	15.9	18.6	11.6	23.0	9.0	15.9	18.6	7.9	16.5	47.2	4.3	7.4	30.4	45.7

FIGURE 25

NOTE: Dimensions DD & EE represent approximate unit center of gravity.

INDOOR FILTER ASSEMBLY

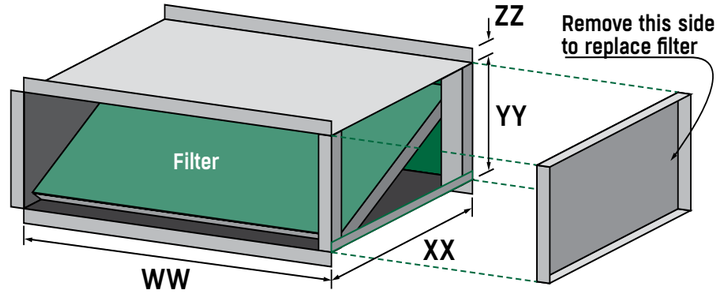


FIGURE 26. Schematic of the indoor filter assembly.

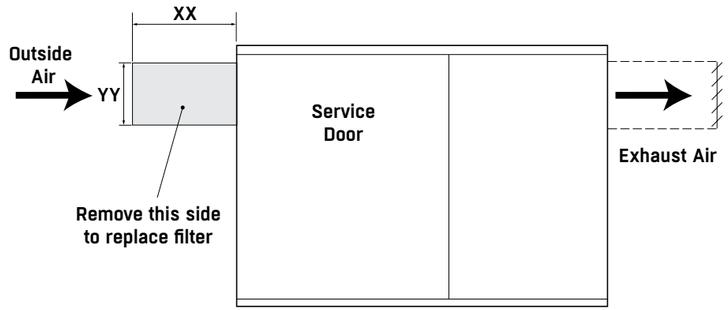


FIGURE 27 Front view of the FV Pre-conditioner with attached indoor filter assembly.

MODEL	DIMENSIONS (INCHES)			
	WW	XX	YY	ZZ
FV-1000	25.5	21.4	9.0	0.8
FV-2000	32.0	24.0	12.1	0.8
FV-3000	40.2	20.3	16.2	0.8
FV-4000	50.0	20.8	18.1	0.8
FV-5000	50.0	20.8	18.1	0.8
FV-7500	59.8	18.8	23.0	0.8
FV-9000	59.8	18.8	23.0	0.8

FIGURE 28. Indoor filter assembly dimensions.

CURB MOUNTING

The FV series is generally installed on a curb (unless mounted indoors). The curb ships separately for pre-installation 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 FläktGroup 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 **FIGURE 30** below.

FIGURE 29. Curb dimensions.

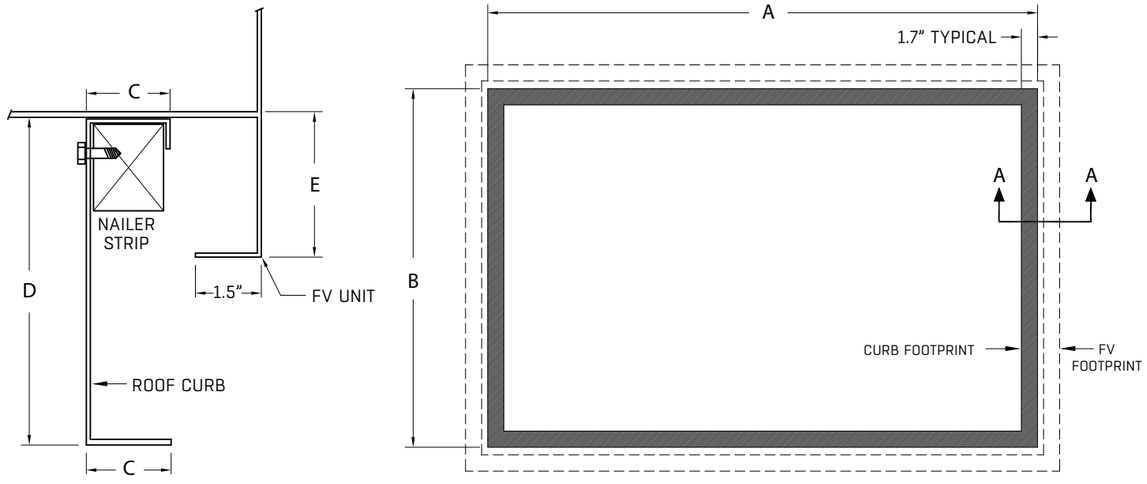


FIGURE 30 Curb dimensions.

MODEL	A	B	C	D	E
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	60.4	1.7	14.0	3.0
FV-9000	91.0	60.4	1.7	14.0	3.0

All dimensions in inches.

Additional Curb Options:

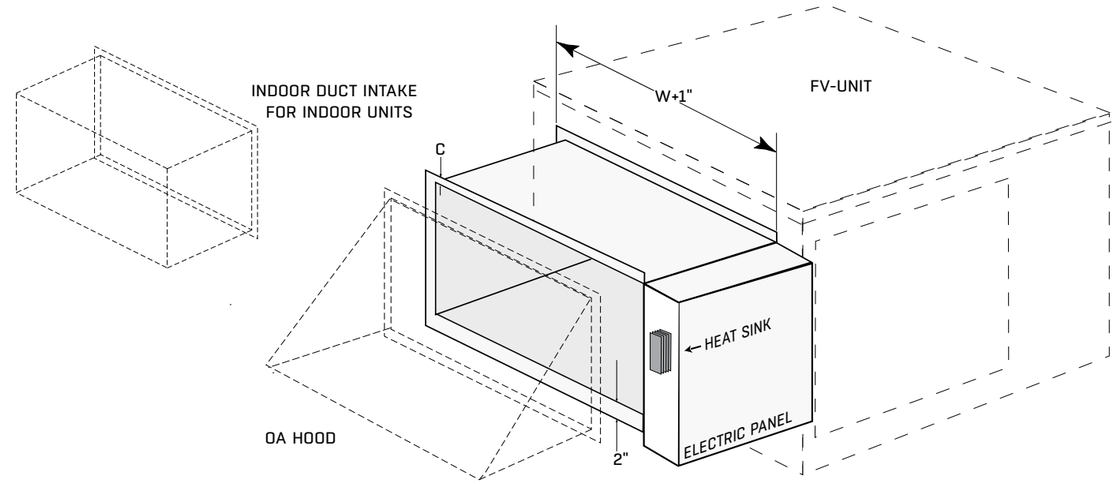
- Height Variations
- Insulated Curbs
- Isolated Curbs / Seismic
- Ducted

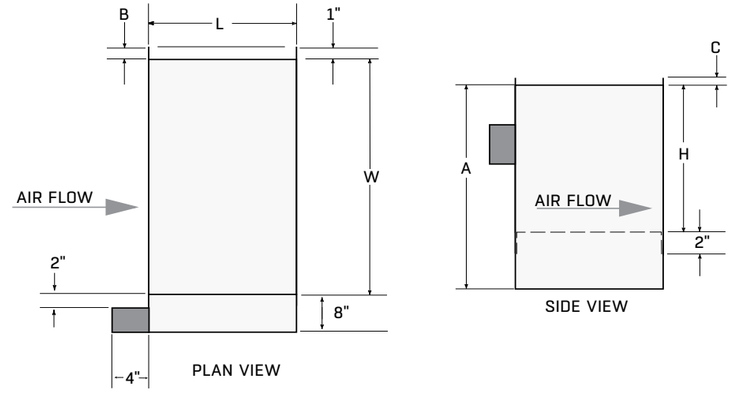
Not in selection program. Contact your sales representative for further details.

ELECTRIC PREHEAT LAYOUT

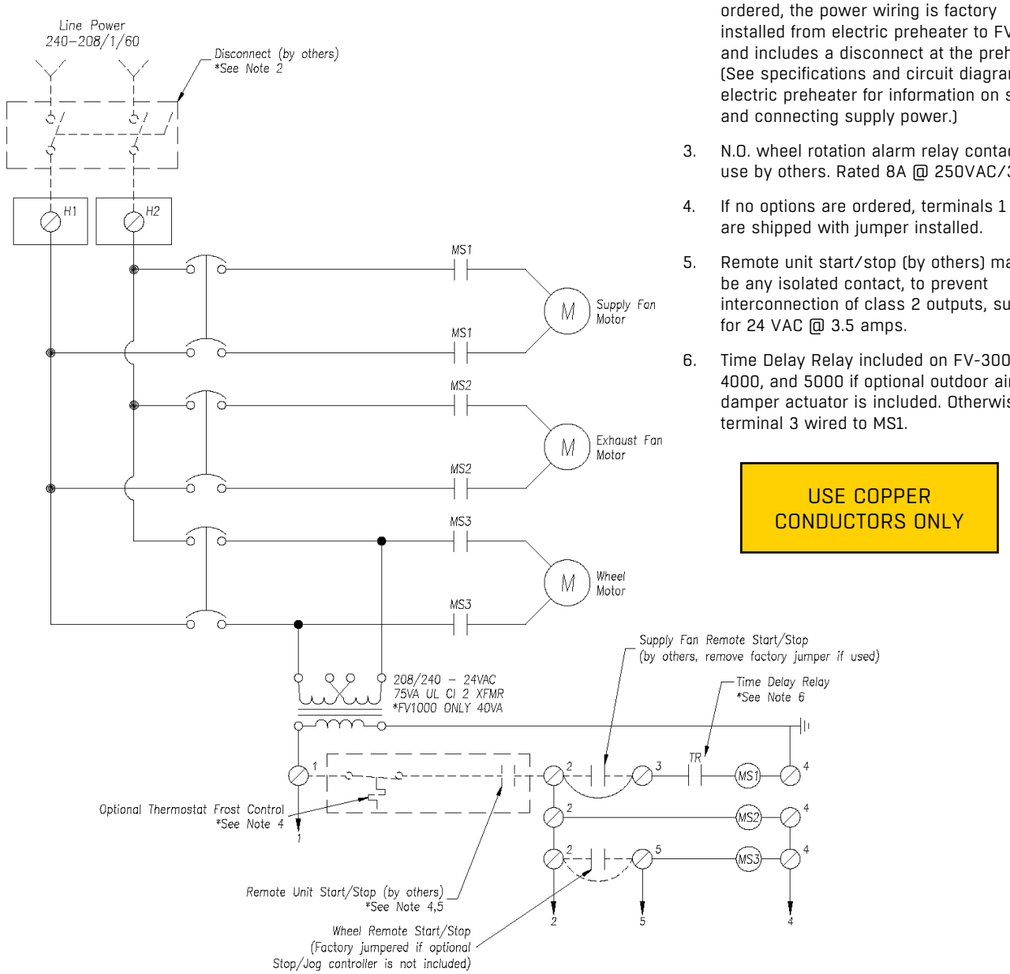
MODEL	W	H	L	A	B	C
FV-1000	24.4	9.0	14.0	20.0	1.0	1.0
FV-2000	31.1	11.0	14.0	20.0	1.0	2.0
FV-3000	39.1	16.0	20.0	40.0	1.0	2.0
FV-4000	49.1	17.0	20.0	40.0	1.0	2.0
FV-5000	49.1	17.0	20.0	40.0	1.0	2.0
FV-7500	56.0	24.0	20.0	40.0	3.0	2.0
FV-9000	56.0	24.0	20.0	40.0	3.0	2.0

All dimensions in inches.





1Ø CIRCUIT DIAGRAM, FV-1000 THROUGH FV-5000

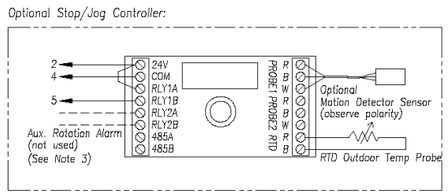


NOTES:

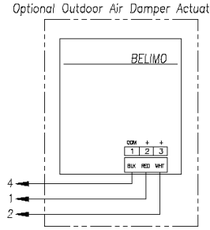
1. All dashed lines indicate field wiring unless otherwise noted.
2. Electric Preheat: If electric preheater is ordered, the power wiring is factory installed from electric preheater to FV Panel and includes a disconnect at the preheater. (See specifications and circuit diagram on electric preheater for information on sizing and connecting supply power.)
3. N.O. wheel rotation alarm relay contact, for use by others. Rated 8A @ 250VAC/30VDC.
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 @ 3.5 amps.
6. Time Delay Relay included on FV-3000, 4000, and 5000 if optional outdoor air damper actuator is included. Otherwise terminal 3 wired to MS1.

USE COPPER CONDUCTORS ONLY

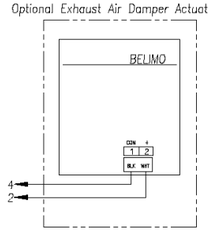
Optional Stop/Jog Controller:



Optional Outdoor Air Damper Actuator:

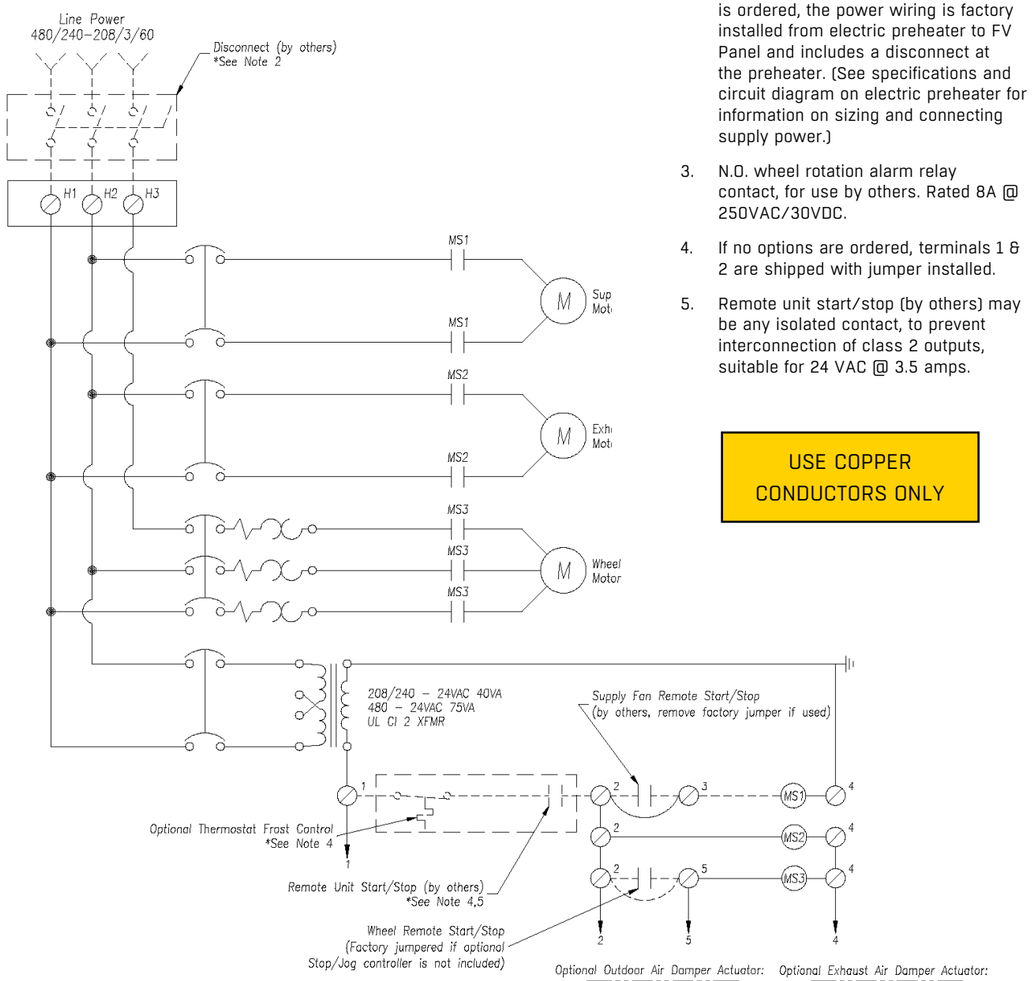


Optional Exhaust Air Damper Actuator:



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

3Ø CIRCUIT DIAGRAM, FV-1000

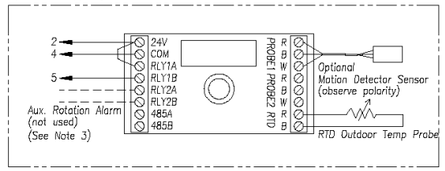


NOTES:

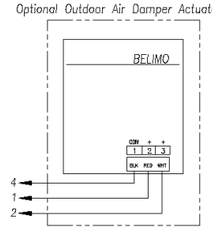
1. All dashed lines indicate field wiring unless otherwise noted.
2. Electric Preheat: If electric preheater is ordered, the power wiring is factory installed from electric preheater to FV Panel and includes a disconnect at the preheater. (See specifications and circuit diagram on electric preheater for information on sizing and connecting supply power.)
3. N.O. wheel rotation alarm relay contact, for use by others. Rated 8A @ 250VAC/30VDC.
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 @ 3.5 amps.

USE COPPER CONDUCTORS ONLY

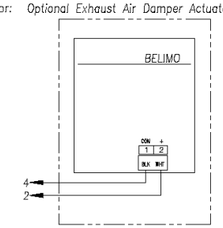
Optional Stop/Jog Controller:



Optional Outdoor Air Damper Actuator:

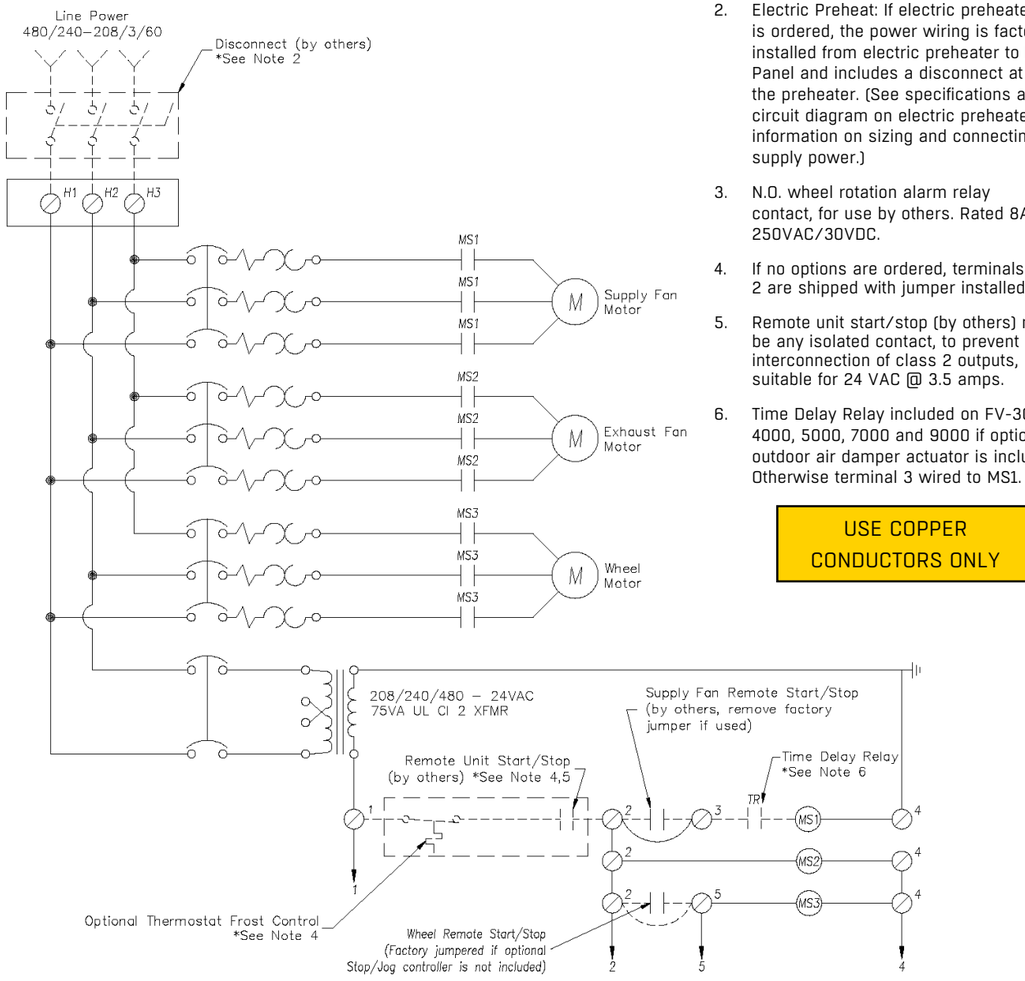


Optional Exhaust Air Damper Actuator:



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

3Ø CIRCUIT DIAGRAM, FV-2000 THROUGH FV-9000

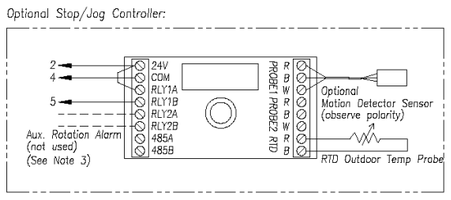


NOTES:

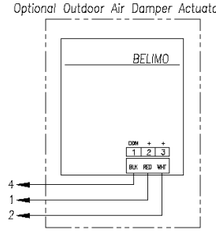
1. All dashed lines indicate field wiring unless otherwise noted.
2. Electric Preheat: If electric preheater is ordered, the power wiring is factory installed from electric preheater to FV Panel and includes a disconnect at the preheater. (See specifications and circuit diagram on electric preheater for information on sizing and connecting supply power.)
3. N.O. wheel rotation alarm relay contact, for use by others. Rated 8A @ 250VAC/30VDC.
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 @ 3.5 amps.
6. Time Delay Relay included on FV-3000, 4000, 5000, 7000 and 9000 if optional outdoor air damper actuator is included. Otherwise terminal 3 wired to MS1.

USE COPPER CONDUCTORS ONLY

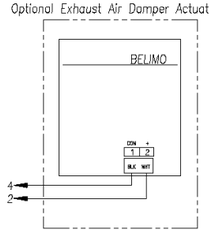
Optional Stop/Jog Controller:



Optional Outdoor Air Damper Actuator:

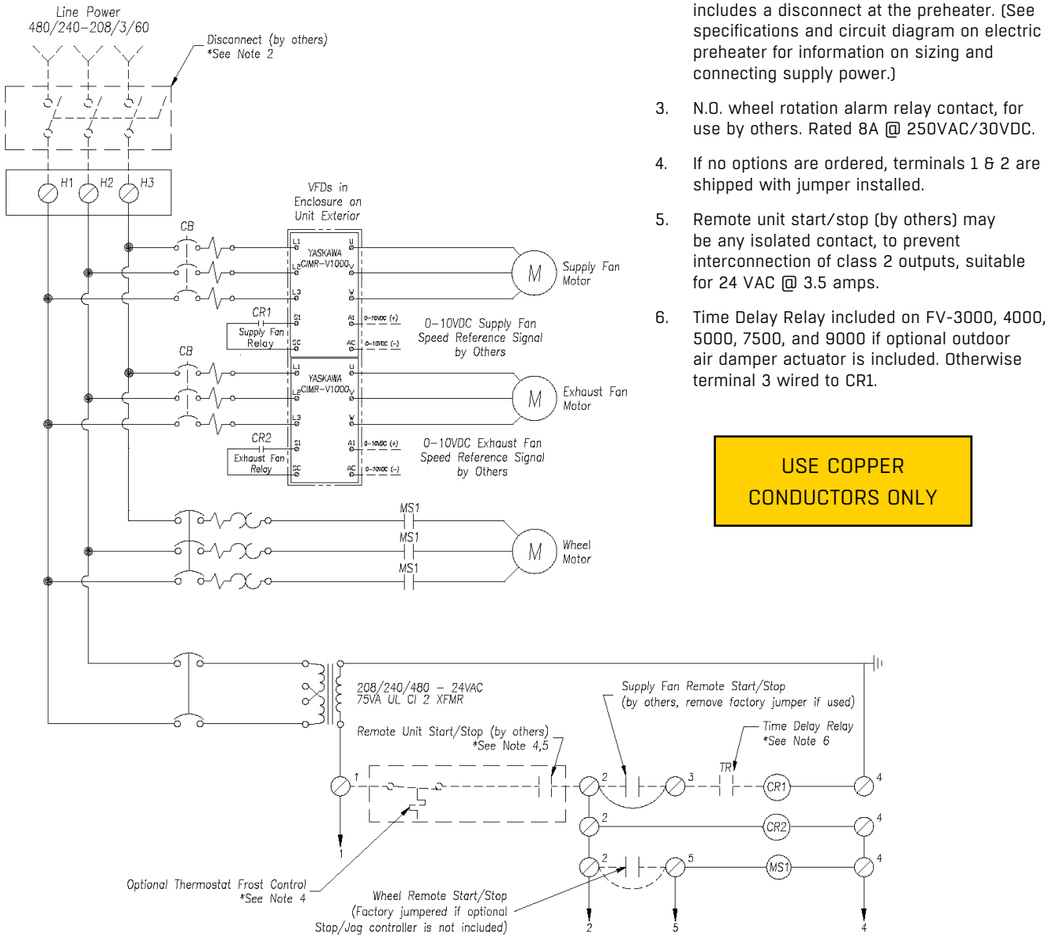


Optional Exhaust Air Damper Actuator:



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

3Ø CIRCUIT DIAGRAM, FV-2000 THROUGH FV-9000 FAN WITH VFDs

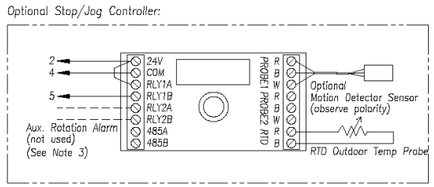


NOTES:

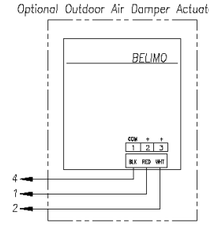
1. All dashed lines indicate field wiring unless otherwise noted.
2. Electric Preheat: If electric preheater is ordered, the power wiring is factory installed from electric preheater to FV Panel and includes a disconnect at the preheater. (See specifications and circuit diagram on electric preheater for information on sizing and connecting supply power.)
3. N.O. wheel rotation alarm relay contact, for use by others. Rated 8A @ 250VAC/30VDC.
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 @ 3.5 amps.
6. Time Delay Relay included on FV-3000, 4000, 5000, 7500, and 9000 if optional outdoor air damper actuator is included. Otherwise terminal 3 wired to CR1.

USE COPPER CONDUCTORS ONLY

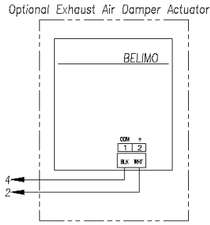
Optional Stop/Jog Controller:



Optional Outdoor Air Damper Actuator:

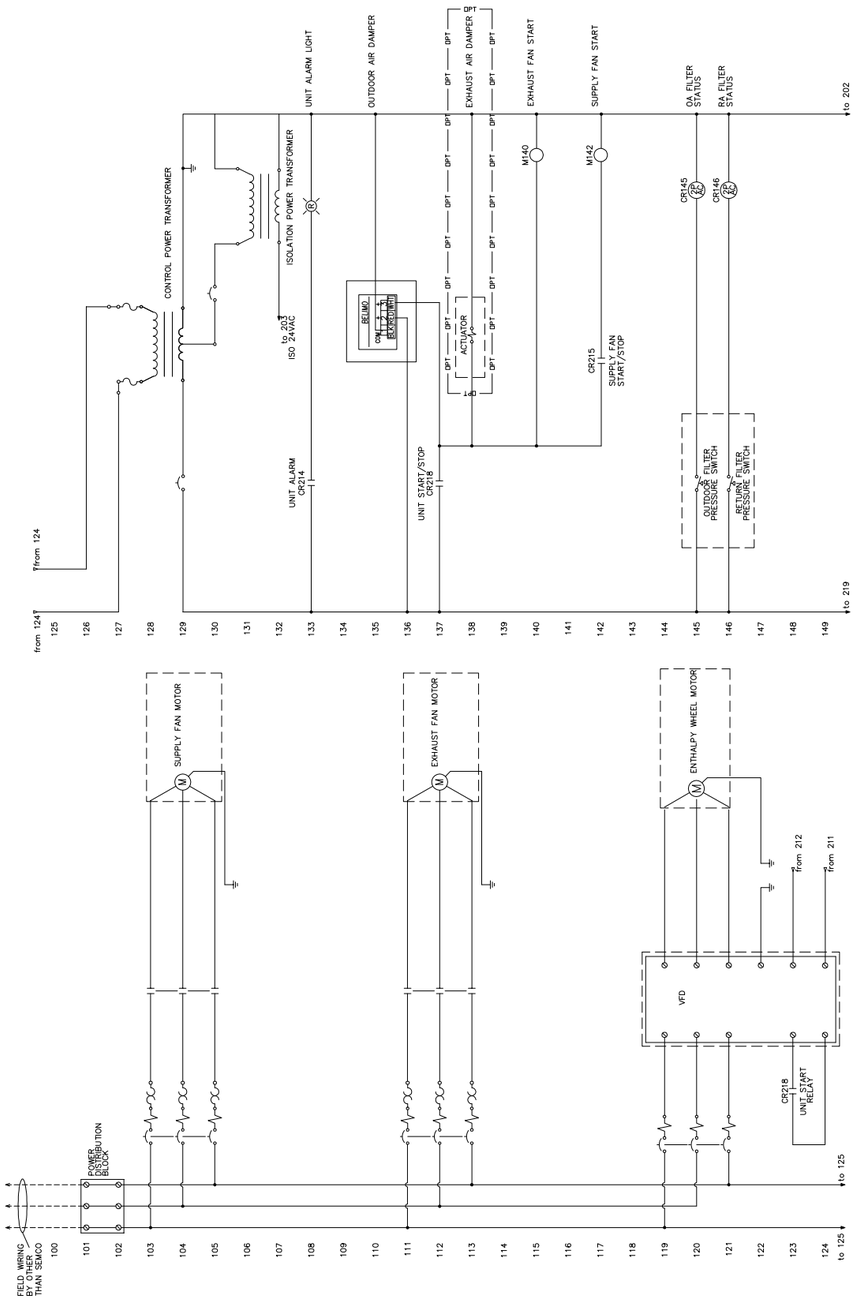


Optional Exhaust Air Damper Actuator:

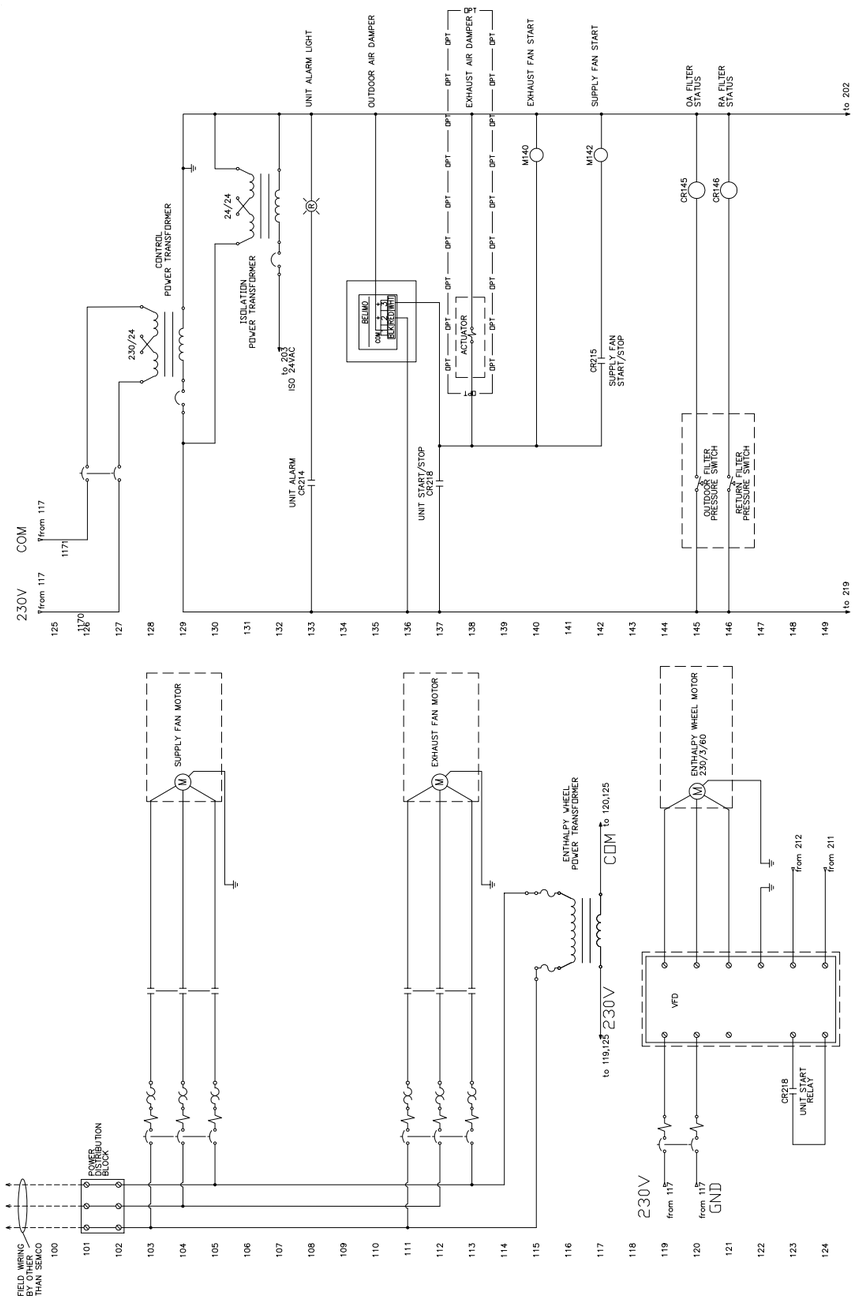


To avoid possible contactor failure, place start/stop relays inside the electrical enclosure.

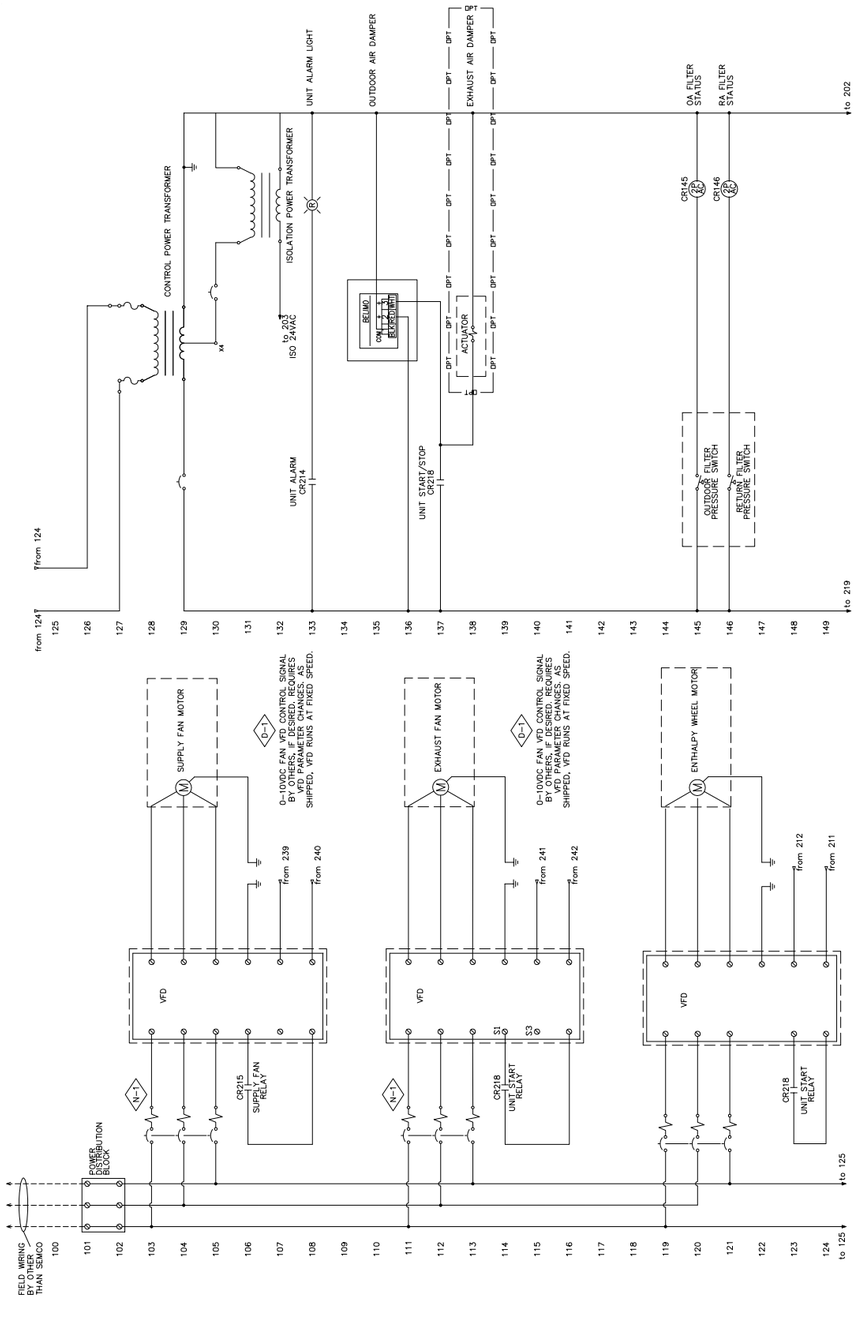
3Ø 208V CIRCUIT DIAGRAM, FV WITH VARIABLE SPEED WHEEL CONTROL, NO FAN VFDs



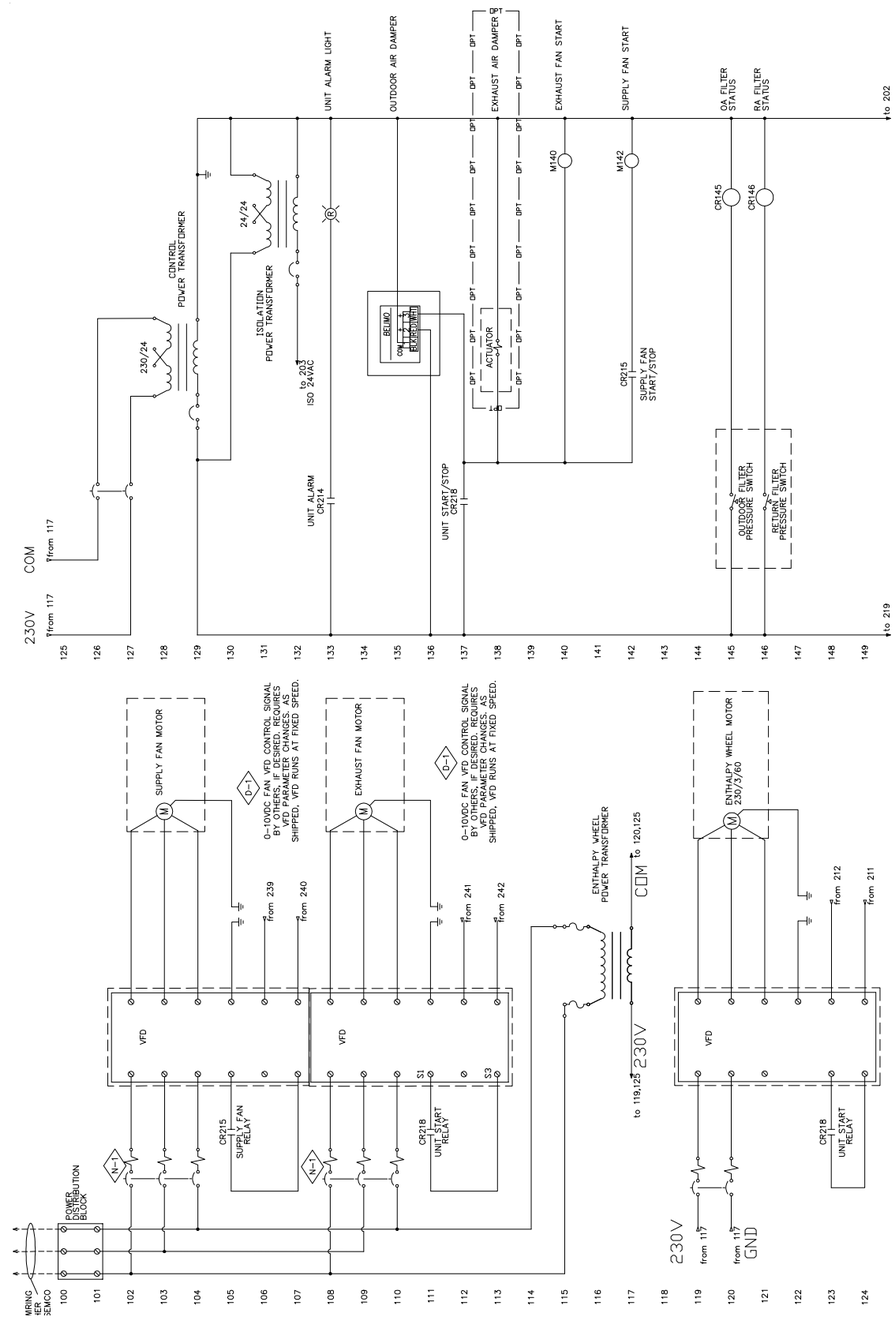
3Ø 480/575V CIRCUIT DIAGRAM, FV WITH VARIABLE SPEED WHEEL CONTROL, NO FAN VFDs



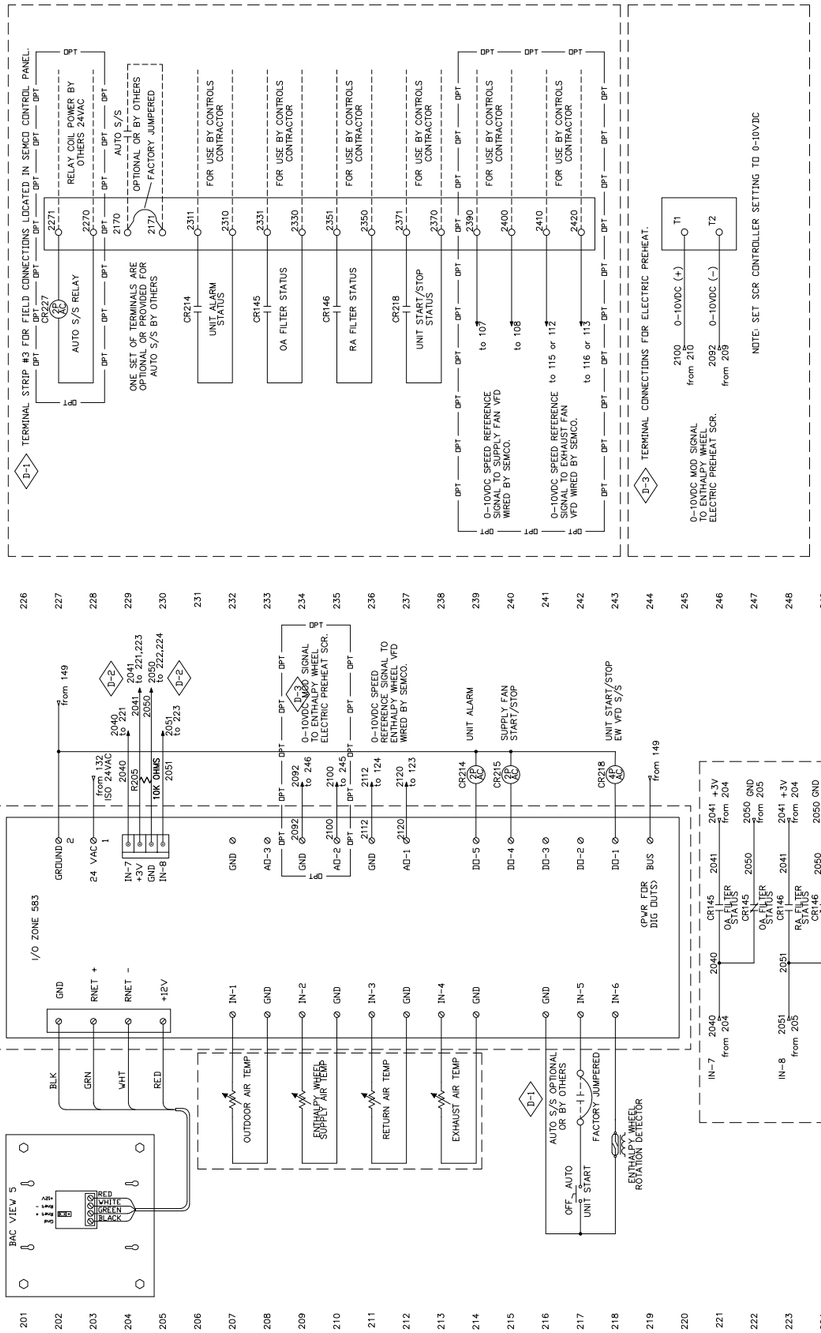
3Ø 208V CIRCUIT DIAGRAM, FV WITH VARIABLE SPEED WHEEL CONTROL, WITH FAN VFDs



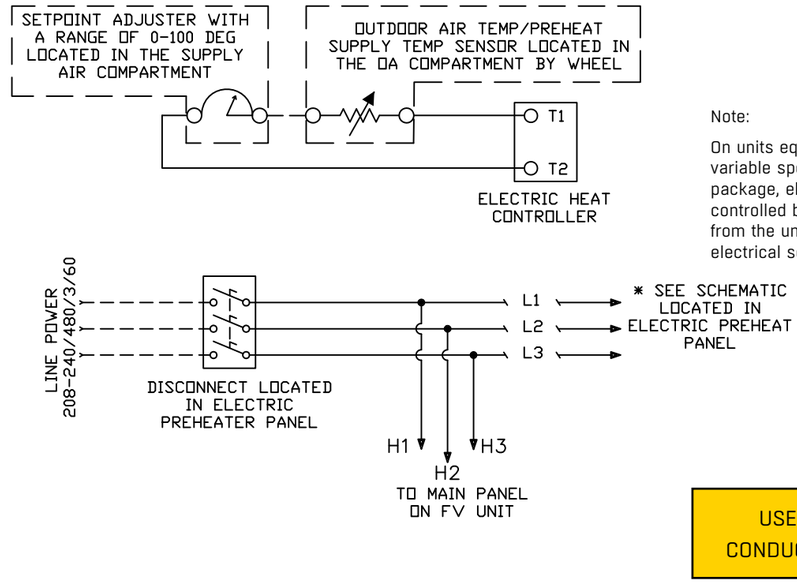
3Ø 480V CIRCUIT DIAGRAM, FV WITH VARIABLE SPEED WHEEL CONTROL, WITH FAN VFDs



FV WITH VARIABLE SPEED WHEEL CONTROL



3Ø ELECTRIC PREHEAT FROST CONTROL CIRCUIT DIAGRAM



Note:

On units equipped with the variable speed wheel control package, electric heat is controlled by analog signal from the unit controller. Refer to electrical schematic for details.

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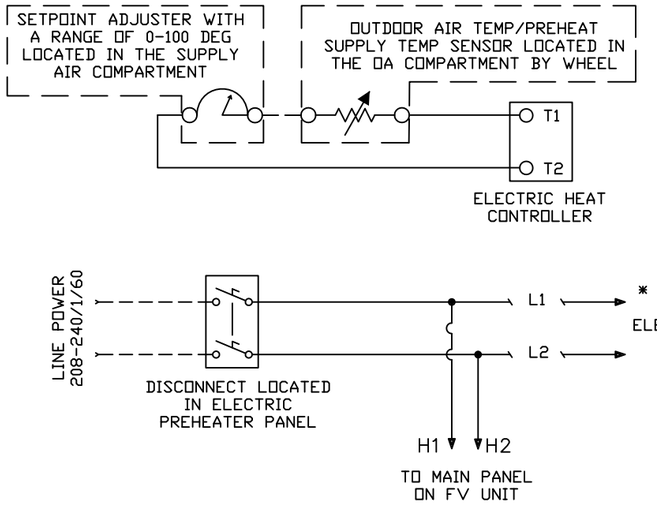
1Ø ELECTRIC PREHEAT FROST CONTROL CIRCUIT DIAGRAM



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ELECTRICAL DATA

Select motors using the fan tables on **PAGES 14-27** For the unit and motors selected, **FIGURE 34** on **PAGE 56** will have the corresponding full load amps (FLA) for each motor/device per UL Standard 1995 Sections 36.14-36.16.

To determine minimum circuit ampacity (MCA):

1.25 * FLA largest fan motor (**FIGURE 34**)
\+ FLA other fan motor (**FIGURE 34**)
\+ FLA wheel drive (**FIGURE 34**)
= MCA

FIGURE 31. Formula to determine minimum circuit ampacity (MCA) without pre-heater and with transformer less than 1 amp. See **FIGURE 34** on **PAGE 56**

To determine minimum circuit ampacity (MCA):

FLA exhaust fan motor (**FIGURE 34**)
\+ FLA supply fan motor (**FIGURE 34**)
\+ FLA wheel drive (**FIGURE 34**)
\+ FLA transformer if ≥ 1 amp
\+ FLA optional preheater (**FIGURE 35**)
* 1.25
= MCA

FIGURE 32. Formula to determine minimum circuit ampacity (MCA) with preheater or with transformer equal to 1 amp or greater. See **FIGURE 34** on **PAGE 56** and **FIGURE 35** on **PAGE 57**

To determine maximum overcurrent protection (MOP):

All FV units:

2.25 * FLA largest fan motor (**FIGURE 34**)
\+ FLA other fan motor (**FIGURE 34**)
\+ FLA wheel drive (**FIGURE 34**)
\+ FLA transformer if ≥ 1 amp
\+ FLA optional preheater (**FIGURE 35**)
= MOP

Using the total above, select the next smaller sized time delay fuse (LOW-PEAK™, FUSETRON or equivalent) or HACR-type circuit breaker, minimum of 15 amps (some exceptions may apply). If the fuses/breakers do not hold, consult the National Electric Code for suitability of larger fuses/breakers.

FIGURE 33. Formula to determine maximum overcurrent protection (MOP.) See **FIGURE 34** on **PAGE 56** and **FIGURE 35** on **PAGE 57**.

FIGURE 34. Electric Unit Data, Full Load Power Draw

FV-1000					
HP	**208/1/60**	**240/1/60**	**208/3/60**	**480/3/60**	**575/3/60**
1/2	5.4	4.9	5.4	2.5	—
3/4	7.6	6.9	7.6	3.5	—
WHEEL (1/6)	2.4	2.2	0.6	0.3	—
TRANSFORMER	0.2	0.2	0.2	0.2	—

FV-2000-9000: FAN MOTOR NO VFD					
HP	**208/1/60**	**240/1/60**	**208/3/60**	**480/3/60**	**575/3/60**
1/3	4.0	3.6	1.4	0.7	0.7
3/4	7.6	6.9	3.5	1.6	1.3
1 ½	11.0	10.0	6.6	3.0	2.4
2	13.2	12.0	7.5	3.4	2.7
3	—	—	10.6	4.8	3.9
5	—	—	16.7	7.6	6.1
7 ½	—	—	24.2	11.0	9.0
10	—	—	30.8	14.0	11.0
15	—	—	46.2	21.0	17.0

FV-2000-9000: FAN MOTOR WITH VFD					
HP	**208/1/60**	**240/1/60**	**208/3/60**	**480/3/60**	**575/3/60**
1/3	—	—	3.9	2.1	—
3/4	—	—	3.9	2.1	—
1 ½	—	—	7.3	4.3	—
2	—	—	10.8	4.3	—
3	—	—	10.8	5.9	—
5	—	—	24	9.4	—
7 ½	—	—	34.7	14.0	—
10	—	—	34.7	20.0	—
15	—	—	50.9	24.0	—

FV-2000-9000: WHEEL MOTOR NO VFD (CONSTANT SPEED OR STOP/JOG)					
HP	**208/1/60**	**240/1/60**	**208/3/60**	**480/3/60**	**575/3/60**
WHEEL (1/6)	2.4	2.2	0.6	0.3	—
TRANSFORMER	0.4	0.3	0.4	0.2	—

FV-2000-9000: WHEEL MOTOR WITH VFD (VARIABLE SPEED WHEEL CONTROL PACKAGE)					
HP	**208/1/60**	**240/1/60**	**208/3/60**	**480/3/60**	**575/3/60**
WHEEL (1/6)	—	—	1.2	0*	0*
TRANSFORMER	—	—	0.7	1.0	0.9
*WHEEL MOTOR POWER INCLUDED WITH TRANSFORMER					

All FV units have SCCR 10k

ELECTRICAL PREHEAT DATA

An electric preheat coil is an available option for all FV units to limit the risk of frost formation for projects that involve high indoor humidity and/or extreme winter design conditions.

Applications involving space conditions that will exceed 30 percent relative humidity when the outdoor air temperature is below 0°F, should be evaluated to see if preheating is necessary. In such cases it is best to contact your local FläktGroup SEMCO representative for assistance.

Most applications that do not involve space humidification will function as desired without preheating. Even in extremely cold climates, 10 to 15 degrees of preheat, which is only operated on extreme days, will usually prove adequate in avoiding frost formation.

FIGURE 35 should be used to select the appropriate size electric pre-heater for a given application. Often it is best to make this selection in conjunction with your local FläktGroup SEMCO representative to assure proper sizing.

FIGURE 35. Electric preheat full load power draw data.

MODEL	OPTIONAL ELECTRIC PREHEATER (KW)	TEMPERATURE RISE @ FULL KW (°F)	FULL LOAD POWER DRAW (KW / AMPS)				
			208V/1Ø	230V/1Ø	208V/3Ø	460V/3Ø	575V/3Ø
FV-1000	3.0	9-19	3.40 / 16.3	3.5 / 14.6	3.0 / 8.3	3.5 / 4.2	—
FV-2000	7.5	12-30	7.65 / 36.8	7.5 / 31.3	7.65 / 21.2	7.5 / 9.0	7.5 / 7.5
FV-3000	13.5	14-24	13.6 / 65.4	13.5 / 56.3	13.5 / 37.5	13.5 / 16.2	13.5 / 13.6
FV-4000	15.0	12-17	15.0 / 72.1	15.0 / 62.5	15.0 / 41.6	15.0 / 18.0	15.0 / 15.1
FV-5000	15.0	9-16	15.0 / 72.1	15.0 / 62.5	15.0 / 41.6	15.0 / 18.0	15.0 / 15.1
FV-7500	23.0	9-16	—	—	22.5 / 62.5	23.0 / 27.7	23.0 / 23.1
FV-9000	23.0	7-12	—	—	—	23.0 / 27.7	23.0 / 23.1

SAMPLE SPECIFICATIONS

CASING

Standard panels shall be 20 gauge galvanized steel. The housing shall be supported by a formed structural base that forms a pan to ensure weather tight construction. Lifting holes shall be provided at the unit base. Units shall have a weatherproof sheet metal roof. Insulation shall be ½" thick closed-cell neoprene for wash down capability and include antimicrobial protection. Insulation shall meet or exceed requirements of UL 181, ASTM G21/C 1338 and ASTM G 22 for resistance to mold, fungi and bacteria. The outdoor air intake opening shall be protected by a galvanized steel sheet metal weather hood and include an automatic rotary blade damper and an electric actuator. The exhaust air discharge shall be covered with a gravity back draft damper and weather hood. The exterior of the unit shall be coated with an epoxy primer and a polyurethane enamel painting system for added protection. Painting system shall be rated to meet a 1,000-hour salt spray test.

OPTIONAL DUAL WALL CONSTRUCTION

Unit shall be equipped with an interior liner of 22 gauge galvanized sheet metal.

ACCESS

Access to components shall be provided through a large, tightly sealed lift-off hinged door. Access doors shall be constructed of the same materials as the unit casing and use FläktGroup SEMCO's standard hardware. The wheel cassette shall be easily removable from the unit. The roof of the unit shall also be removable for access.

UNIT CONFIGURATION

The supply air inlet and exhaust air outlet must be oriented at opposite ends of the Energy Recovery System to maximize the distance between the two airstreams in order to minimize the risk of short circuiting exhaust air into the supply air intake.

FANS

Fans shall be double width double inlet design with forward curve type wheels. The blades shall be designed for maximum efficiency and quiet operation. Impellers shall be statically and dynamically balanced.

Fans shall be driven by direct drive motors located at the fan inlet (FV-1000) or by motors using belts and sheaves (FV-2000 and larger). Motors shall be standard NEMA frame with open drip-proof enclosures. V-belt drives shall be designed for a minimum 1.2 service factor.

OPTIONAL VARIABLE FREQUENCY DRIVES ON FANS

Variable speed fan control is accomplished by the use of a 208/240 or 480 VAC 3 phase inverter. The inverter includes a keypad operator with a status display and is mounted in an enclosure on the exterior of the unit. The drive system will be wired at the factory and loaded with a default program to make it operational.

TOTAL ENERGY WHEEL

The rotor media shall be made of aluminum, which is coated to prohibit corrosion. All surfaces shall be coated with a non-migrating adsorbent specifically developed for the selective transfer of water vapor. Verification in writing shall be presented from the desiccant manufacturer confirming that the internal pore diameter distribution inherent in the desiccant being provided limits adsorption to materials not larger than the critical diameter of a water molecule (2.8 angstroms). In addition, the face of the media shall be coated with an acid resistant coating to provide maximum protection against face oxidation. Equal sensible and latent recovery efficiencies shall be clearly documented through a certification program conducted in accordance with ASHRAE 84-78P and ARI 1060 standards. The media shall be cleanable with low temperature steam, hot water or light detergent, without degrading the latent recovery. Dry particles up to 600 microns shall freely pass through the media. Wheel media shall be independently tested and shown to conform to the requirements of NFPA-90A, documenting a flame spread of less than 25 and a smoke generation rating of less than 50.

The faces of the total energy recovery wheel shall be sealed with a two-part polymer acid resistant coating to limit surface oxidation. The media face coating shall also include a proprietary Teflon-based anti-stick additive shown, by independent testing, to effectively limit the collection of dust or smoke particulate and to aid in the surface cleaning process should cleaning be required.

The entire recovery wheel media face shall be treated with AVRON46®, and shall exhibit effective antimicrobial action, supported by independent test data. Any antimicrobial agent used must, by law, carry an EPA registration for use in duct systems. All desiccant surfaces within the transfer media shall also exhibit bacteria-static properties as supported by independent testing.

ROTOR CASSETTE

The rotor cassette shall be a sheet metal framework, which limits the deflection of the rotor due to air pressure. The cassette shall be made of galvanized steel to prevent corrosion. The rotor cassette shall be easily removable from the Energy Recovery Unit to facilitate rigging (if necessary) and ease of service. The wheel cassette design shall use pillow block bearings for long life. A non-adjustable purge sector shall be included in the cassette.

OPTIONAL VARIABLE SPEED WHEEL CONTROL PACKAGE

Variable speed wheel control is provided and uses a pre-programmed A/C inverter and digital controller. A proportional supply air temperature sensor, differential summer/winter change over sensors and frost prevention sensor are included. A digital readout of temperatures are

provided by a display on the digital controller. Includes DDC control system consisting of an Automated Logic I/O Zone 583 Controller and a BACview-5 two row backlit LCD display to allow setpoints to be adjusted and status points to be viewed. Controller supports remote communications using BACnet over MS/TP, Modbus, or N2 protocols. Pressure switches are provided across the outdoor and return air filters, wired to inputs on the controller. Rotation detector with indicating light is provided to indicate wheel rotation failure or filter loading alarm.

OPTIONAL AIRFLOW MONITOR

Unit shall include an integral airflow monitoring station with the ability to read both ventilation and exhaust airflow expressed in CFM. Monitor gauge to be flush mounted on unit exterior and watertight.

OPTIONAL ROTATION DETECTOR

Unit shall be equipped with a rotation sensor and controller, should the energy recovery wheel not rotate during a signaled run period. The controller shall not initiate an alarm during a stop/jog function.

OPTIONAL STOP/JOG ECONOMIZER

Unit shall be equipped with an outdoor air temperature sensor and controller such that the energy recovery wheel can be stopped during moderate temperature periods. The controller shall perform a stop/jog function for the wheel long enough to promote the self-cleaning features of the wheel but not long enough to induce energy recovery.

OPTIONAL WHEEL STOP/JOG FROST PROTECTION

Unit shall be equipped with an outdoor air temperature sensor and controller such that the energy recovery wheel can be operated in stop/jog mode during very low outdoor air temperature periods to prevent freezing of the wheel while still delivering outdoor air through the unit.

FILTERS

The filters shall be 1 inch thick permanent aluminum washable type mounted in the outside air hood and return air plenum. The filters shall be listed by Underwriters' Laboratories as Class 2. As an option, 2" pleated MERV filters can be added to the outside air hood, and/or replace the 1" filters in the return air plenum.

OUTDOOR AIR DAMPER

The outdoor air damper shall be constructed of galvanized steel; the frame being formed into hat channels for added strength; the blades being single skin and parallel in action. Standard assembly shall include a manual adjustable blade lock with no control, though a two-position actuator for control is available.

OPTIONAL MOTORIZED EXHAUST DAMPER

Units shall be equipped with an exhaust damper, low-leak and galvanized steel in construction; the frame being formed for added strength; the blades being airfoil and parallel in action. Standard assembly shall include a two-position actuator for control.

ROOF CURB

Units will be provided with a non-insulated roof curb sized to fit just inside of the unit's self flashing base. Curb will be fourteen inches tall and will have a wood nailer on the perimeter for attaching unit.

OPTIONAL REMOTE INDICATING PANEL

Panel shall provide remote indication of status of unit power on, wheel rotation alarm, outside air dirty filter and return air dirty filter. Low voltage LED's will be illuminated for power on, wheel stop, and filter pressure switch status. LEDs are factory mounted in a brushed aluminum face plate with identification label and are factory wired to a terminal strip. Panel includes a junction box and plaster ring for either recessed or surface mounting. FV unit will include factory mounted pressure switches and electrical components wired to a terminal strip located in an exterior weatherproof junction box. Field wiring between the FV unit and the remote panel using Belden 5 conductor 8465 (20 gauge) or equivalent.

OPTIONAL ELECTRIC PREHEAT COIL

Coil shall be of the resistance coil type with elements enclosed in a steel sheath with fins and painted with a baked-on aluminum paint for long life in a 100% fresh air stream. Coil shall include thermal cutout protection with automatic primary protection and a secondary manual reset linear thermal cutout. Coil shall have magnetic safety and backup contactors, main disconnect, fusing, control circuit transformer, air flow interlock switch and SCR controller. Coil shall be UL listed and constructed in accordance with NEC requirements. A temperature controller located in the outdoor air section of the unit shall supply the signal to the SCR controller.

OPTIONAL FREEZE PROTECTION THERMOSTAT

Unit shall be equipped with an outdoor air temperature thermostat such that the energy recovery ventilator can be stopped during very low temperature periods. This thermostat shall stop the both the fans and the energy recovery wheel until the outdoor air temperature rises above the set-point, then the unit will restart automatically.

ELECTRICAL

Units shall require a single 60-cycle power connection. See schedule for voltage and phase requirements. The electrical panel shall consist of individual motor contactors, short circuit and overload protection and control power transformer. The electrical panel shall be mounted in the unit with access from the exterior of the unit. Unit shall be ETL listed and labeled.

WARRANTY

Please see the terms and conditions for your order or contact service.semco@flaktgroup.com.

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