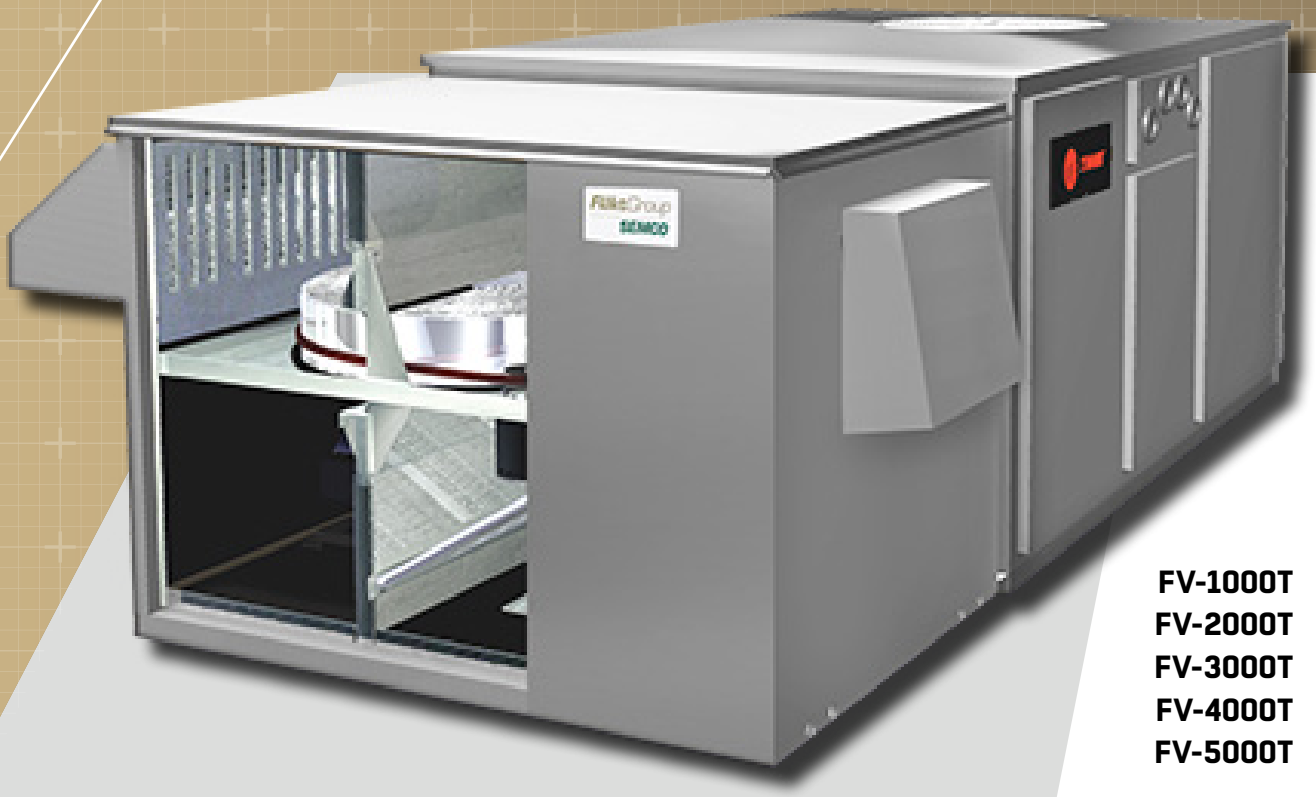
FläktGroup
SEMCO

SPECIALIZED
HEALTHY
AIR SOLUTIONS

SEMCO FV-T

ENERGY RECOVERY MODULE

TECHNICAL GUIDE



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THE FLÄKTGROUP® SEMCO® FV-T RECOVERY MODULE

The FläktGroup® SEMCO® FV-T recovery module, is the only member of the FläktGroup SEMCO FV Series, which has been designed to be mounted to a Trane® Voyager® rooftop air conditioner system. Mounting a FläktGroup SEMCO FV-T recovery module to a Trane® Voyager® unit, not only increases a building's air quality, but it has many economic and environmental benefits as well. In fact, often times, first cost premiums are recouped within the first year of operation.

Once the FläktGroup SEMCO FV-T is mounted to the Trane® Voyager® unit, the FläktGroup SEMCO FV-T helps the Trane® Voyager® run more effectively by pre-conditioning the incoming outdoor air, reducing the amount of energy needed to effectively heat or cool the incoming air by 80%. Pre-conditioning incoming air also greatly improves a building's humidity control, and can reduce the amount of refrigeration capacity by as much as 70%.

Mounting a SEMCO FV-T to a Trane® Voyager® also allows the Trane® Voyager® to triple or quadruple its outdoor air intake all without raising energy costs. Tripling and quadrupling air intake allows the Trane® Voyager® to comply with ASHRAE Standard 62, ventilation for acceptable indoor air quality.

The SEMCO FV-T recovery module can easily be mounted to new Trane® Voyager® units or be retrofitted to current units, without changing the size of the current unit.

HOW IT WORKS

The FläktGroup SEMCO FV-T, is a pre-engineered and factory assembled energy recovery module, designed to be mounted to the Trane® Voyager® rooftop air conditioner system. The FläktGroup SEMCO FV-T comes equipped with supply and exhaust fans, outdoor and return air filters, as well as a FläktGroup SEMCO Fusion Series total energy recovery wheel. As with the rest of the FläktGroup SEMCO FV Series, the FläktGroup SEMCO FV-T offers the ultimate performance in equal transfer of, latent and sensible heat, and is capable of treating a building's exhaust and incoming air supply.

At the heart of the FläktGroup SEMCO'S FV-T is the Fusion wheel. FläktGroup SEMCO's Fusion wheel is designed to pre-cool and dehumidify the outdoor air during the cooling season as well as preheat and humidify the outdoor air during the heating season. Ultimately, the outdoor air quantity can be increased from 5 to 20 CFM per person without increasing the total energy costs. The FläktGroup SEMCO Fusion wheel delivers the highest total energy recovery performance and recovery efficiency ratios (RER) of any certified 200 mm deep recovery wheels available today. The composition of the Fusion wheel creates the perfect environment for transferring latent and sensible heat due to its fluted aluminum substrate, which is uniformly coated with a fast-acting adsorbent desiccant. The desiccant, which has a strong attraction to water vapor, covers a large internal surface area. As the Fusion wheel slowly rotates in the FläktGroup SEMCO FV-T, between the outdoor and exhaust air streams, the warmer air's sensible energy is absorbed by the aluminum substrate. and the moisture is absorbed by the desiccant coating. Then on the second half of the wheel's rotation, the sensible energy absorbed from the warmer air is transferred to the cooler air-stream. Since the opposing air-streams have different moistures and temperatures, their vapor pressures also differ, causing the transfer of latent energy. (See **FIGURE 1**)

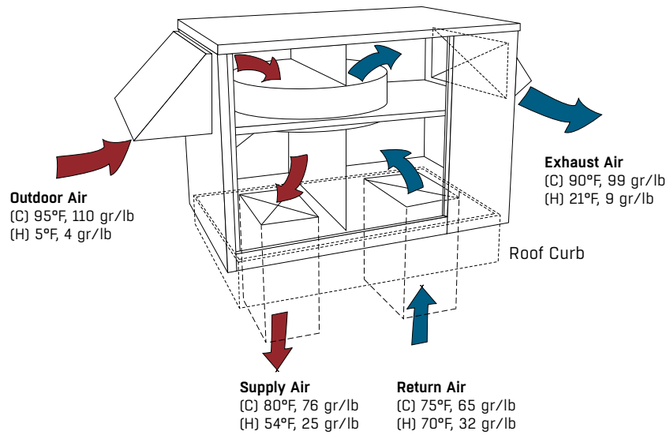


FIGURE 1 An inside view of the FläktGroup SEMCO FV-T series pre-conditioner with typical operating conditions during the cooling (C) and heating (H) season respectively.

INDOOR AIR QUALITY

PRE-CONDITIONING

ASHRAE Standard 62, declares that flushing indoor pollutants to the outdoors, with incoming outdoor air, is the most effective way of reducing indoor air contaminant levels. It also states the minimum outdoor air ventilation rate required to achieve acceptable indoor air quality.

While ASHRAE 62.1 allows for 5-10% recirculation of air with heat exchangers depending on class of air (class 1,2, or 3), this recirculated air does not qualify as outdoor air. An energy recovery wheel must have an affective purge or the system outdoor air must be increased to account for the recirculated air.

To help buildings provide the cleanest air possible to its inhabitants, ASHRAE created Standard 62, Per ASHRAE Standard 62. It is recommended that outdoor air quantities be increased from 5 CFM to 20 CFM per inhabitant to avoid poor indoor air quality. As a result, three major United States building codes have ASHRAE Standard 62 incorporated into them (BOCA, Southern, and Uniform).

While ASHRAE Standard 62 may be great news to building inhabitants, many owners, architects, and engineers are concerned about the impact that it my have on humidity control, operating costs, and construction costs.

However, there is no need to worry, because the FläktGroup SEMCO FV-T provides an effective solution. As an energy recovery module, the FläktGroup SEMCO FV-T recovers 80% of the total energy expended by these buildings. Also, when a FläktGroup SEMCO FV-T is combined with the Trane® Voyager® rooftop air conditioner system, it allows for a three to four-fold increase in outdoor air quantity, 5 to 20 CFM per person, without an increase in operating costs.

If a facility is designed to include unitary packaged HVAC equipment, or heat pumps, the addition of a FläktGroup SEMCO FV-T recovery module can be especially beneficial, because it reduces the cost of operation, and greatly improves humidity control; something that is important for providing acceptable indoor air quality.

HUMIDITY CONTROL

Traditionally, unitary air conditioner and heat pump units are regulated by temperature controls. This means that once the space temperature conditions are met, the cooling coil or heating source is cycled off. However, in order to remain in accordance with ASHRAE Standard 62, outdoor air needs to be continuously cycled through at all times. This means that warm/humid air is being brought in when the unit is in cooling mode and cool/dry air is brought in during heating mode.

As the outdoor air load changes, humidity levels can fluctuate significantly with unitary HVAC equipment and heat pumps. Ideally, humidity conditions should be maintained at between 30 and 60 percent relative humidity. The probability of microbial problems, i.e., mold growth, is greatly enhanced at 70 percent relative humidity and above.

Unlike the unitary systems, the FläktGroup SEMCO FV-T comes with a Fusion wheel, which is designed to pre-cool and dehumidify the outdoor air during the cooling season as well as preheat and humidify the outdoor air during the heating season. The Fusion wheel works to make sure that relative humidity levels are always optimal.

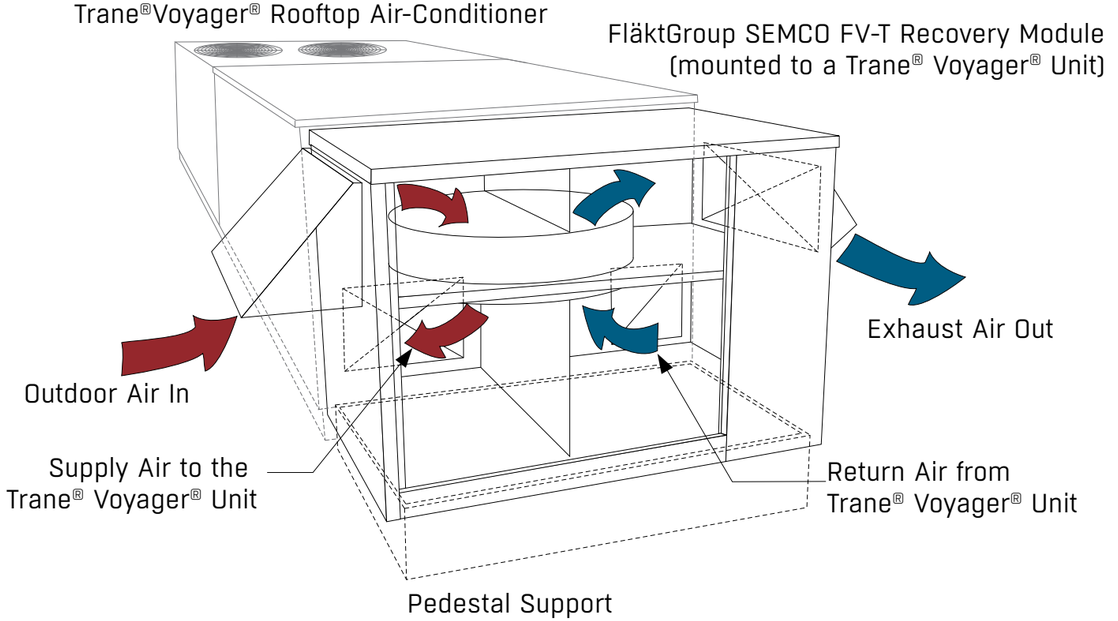
APPLYING THE SEMCO FV-T MODULE TO THE TRANE® VOYAGER® UNIT

The SEMCO FläktGroup FV-T recovery module is specially designed to be mounted to select Trane® Voyager® Series I and II rooftop air-conditioners, via the supply and return connections located on the back of the FläktGroup SEMCO FV-T .

In a typical application the Fläktgroup Semco FV-T module pulls exhaust air directly from the return air section of the Trane® Voyager® unit. Preconditioned outdoor air is then provided directly to the cooling coil, mixing it with the recirculated air-stream. The FläktGroup SEMCO FV-T pre-conditioner and the Trane® Voyager® air conditioner's supply fans run continuously while occupants are in the conditioned space, even when the heating or cooling coils are off. This provides a continuous supply of outdoor air, meeting the ASHRAE Standard 62 guidelines.

A key advantage to this approach is that no additional duct work is required beyond that which is already provided for the Trane® Voyager® air conditioner. This simplifies the installation process and minimizes project first cost. This approach also simplifies retrofit applications where it is desirable to increase the amount of outdoor air supplied to a space without replacing the existing HVAC system.

FläktGroup® SEMCO® FV-T Series typical installation.



BENEFITS PROVIDED

ECONOMICAL COMPLIANCE WITH ASHRAE STANDARD 62

To help buildings provide the cleanest air possible to its inhabitants, ASHRAE created Standard 62, Per ASHRAE Standard 62. It is recommended that outdoor air quantities be increased from 5 CFM to 20 CFM per inhabitant to avoid poor indoor air quality. By recovering up to 80 percent of the total energy normally exhausted from occupied spaces, the FläktGroup SEMCO FV-T pre-conditioner enables the Trane® Voyager® unit to effectively handle this increase in outdoor air load without the need for a larger sized package and without increasing energy consumption.

REDUCED EQUIPMENT FIRST COST

In order to comply with ASHRAE Standard 62, a traditional HVAC system, without an addition of an energy recovery module, has to greatly increase its equipment size to handle the larger amounts of outdoor air being brought in. Increasing equipment size often requires the addition of reheat and sophisticated control sequences to control both humidity and temperature. The FläktGroup SEMCO FV-T pre-conditioner often reduces project first cost by allowing a smaller Trane® Voyager® unit and duct system to be used, without the need for reheat or complex controls.

IMPROVED COOLING SEASON HUMIDITY CONTROL

Operation of conventional HVAC systems is governed by a thermostat, i.e., in response only to the conditioned space temperature. 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 FläktGroup SEMCO FV-T unit 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. Most facilities require humidification, which is costly to operate and maintain. The FläktGroup SEMCO FV-T unit captures the moisture generated within the space to provide free humidification during the heating season, therefore maintaining a healthier indoor environment.

In moderate climates with short heating seasons, this may be sufficient to completely eliminate the need for any humidification equipment.

IMPROVES THE COMFORT OF OCCUPIED SPACES

As 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. The FläktGroup SEMCO FV-T module solves this problem by providing moderated supply air conditions, even as the Trane® Voyager® unit is cycled on and off.

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 and removable roof panel.
- Outdoor air inlet and exhaust air outlet located at opposite ends of unit for maximum separation.

2) THE FUSION TOTAL ENERGY WHEEL — (TEC)

- Certified total energy (both sensible and latent) recovery performance.
- 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

3) CABINET CONSTRUCTION

- Galvanized steel cabinet construction with enamel finish.
- Entire cabinet insulated with closed cell elastometric foam with Microban® antimicrobial technology to minimize energy loss and provide resistance to mold, fungi, and bacteria.
- Hinged doors for easy access.
- 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 speed motors or multiple motor/sheave selections for efficient adjustment of airflow.

5) FILTER SECTIONS

- Filtration provided for both the outdoor air and return air.

6) HOODS AND DAMPERS

- Airflow balancing dampers
- Unit provided with an intake hood with cleanable filter to limit rain and snow introduction.
- Exhaust air back draft damper.

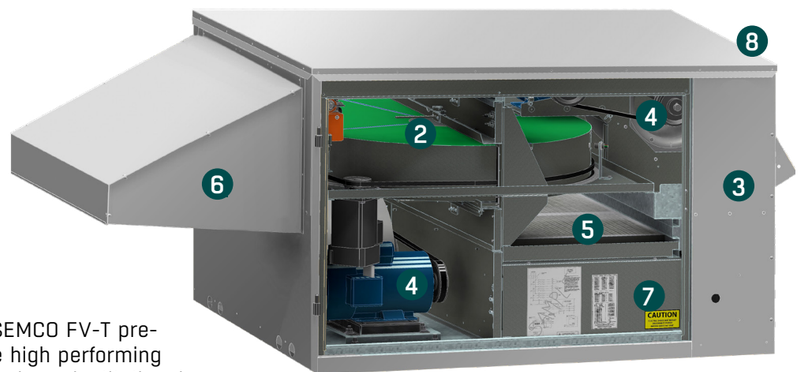


FIGURE 2 The FläktGroup SEMCO FV-T pre-conditioner uses the same high performing wheel technology proven in large institutional and industrial applications.

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:

FLÄKTGROUP SEMCO FV-1000T:	208, 240V 1Ø 208, 240, 480V 3Ø
FLÄKTGROUP SEMCO FV-2000T:	208, 240V 1Ø 208, 240, 480V 3Ø
FLÄKTGROUP SEMCO FV-3000T:	208, 240V 1Ø 208, 240, 480V 3Ø
FLÄKTGROUP SEMCO FV-4000T:	208, 240V 1Ø 208, 240, 480V 3Ø
FLÄKTGROUP SEMCO FV-5000T:	208, 240V 1Ø 208, 240, 480V 3Ø

OPTIONAL FEATURES

ELECTRIC PREHEAT

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

THERMOSTAT FROST PROTECTION

- Thermostatic frost control allows the FläktGroup SEMCO FV-T unit to be turned off at a predetermined temperature when electric preheat is not desired.

CONTROL OPTIONS

STOP/JOG ECONOMIZER

The board 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.

WHEEL FROST PROTECTION

This allows the wheel only to be stopped by the stop/jog economizer board at a predetermined outdoor temperature in applications where a preheat coil or thermostat shut-off of the FläktGroup SEMCO FV-T unit is not desired.

ROTATION DETECTOR SENSOR

It can provide an alarm signal through the stop/jog economizer board indicating failure of the wheel rotation.

REMOTE INDICATING PANEL

- FläktGroup SEMCO remote indicating panel provides a convenient and attractive option for monitoring the FläktGroup SEMCO FV-T Pre-conditioner.
- Remote mounted Indicating panel provides status indicators for the following:
    - Unit Power On
    - Wheel Rotation Alarm
    - Dirty Outside Air Filter
    - Dirty Return Air Filter
- Field wiring is only required from the remote panel to a low voltage terminal strip factory mounted on the FläktGroup SEMCO FV-T unit. Remote indicating panel includes a junction box and plaster ring for recessed or surface mounting.
- **NOTE:** Control Package Option must also be selected for Wheel Rotation Alarm function.

DUAL WALL CONSTRUCTION

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

FV-T CONTROLS

BASIC PACKAGE

The basic FläktGroup SEMCO FV-T unit ships with no controls. The standard wiring package provides connections for the starting/stopping of the complete unit, supply fan and the energy wheel. The connections are shipped with factory jumpers installed. Remote control of any of these options can be achieved by removing the correct factory jumper and installing a contact in its place. The contact should be capable of handling 24VAC power at 3.5 amps, except for the FläktGroup SEMCO FV-1000T which handles 24VAC at 2 amps. (See appropriate 1Ø or 3Ø circuit diagram on **PAGES 26** and **28**). 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 5** on **PAGE 12**).

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)

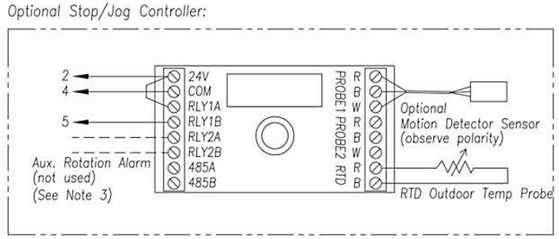
The stop/jog economizer option is used during moderate outdoor air temperatures to stop the recovery wheel. The jog function is included to allow the wheel to rotate periodically to self-clean.

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 3**). 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.

FIGURE 3 GPRD Controller settings.

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

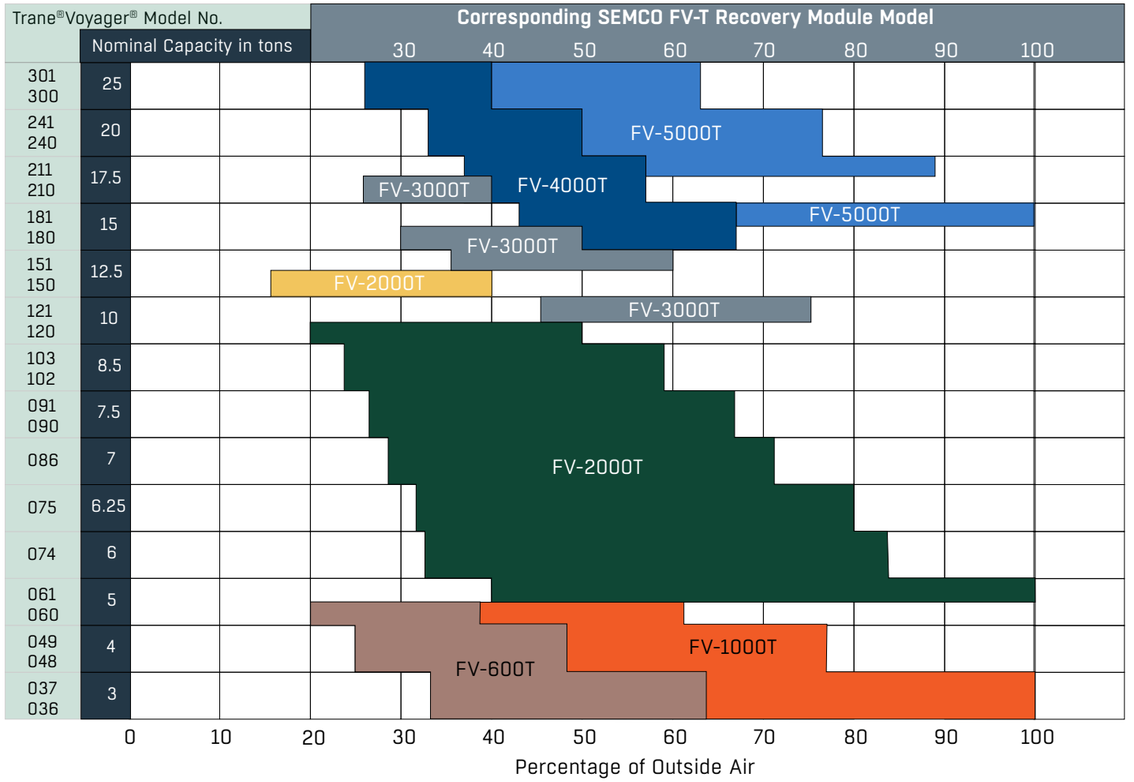


FIGURE 4 Overview of the valid combinations of the Trane® Voyager® roof top air conditioner unit model number and FläktGroup SEMCO FV-T recovery modules and the percentage of outside air the FläktGroup SEMCO FV-T module will provide.

SELECTION PROCEDURE

The selection of the FläktGroup SEMCO FV-T Energy Recovery Module is governed by two parameters: the amount of outside air needed to be pre-conditioned and the Trane® Voyager® unit to which the FläktGroup SEMCO FV-T module is to be mounted to.. Only a specific size FläktGroup SEMCO FV-T module will mount to a Trane® Voyager® unit. Nominally, the FläktGroup SEMCO FV-T module will provide between 30% and up to 100% of outside air. There is a limited product combination which will allow 100% outside air applications.

1. CHOOSE A UNIT SIZE

Use the unit capacity/wheel face area (See **FIGURE 6** on PAGE 10) 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. To ensure performance and functionality, the selected FläktGroup SEMCO FV-T unit must be compatible to the designated Trane® Voyager® (see **FIGURE 4**).

EXAMPLE. The application example is a restaurant requiring 1,800 cfm of supply air and 2,000 cfm of exhaust air. The exhaust air contains smoke, therefore no air is recirculated. This is a 100% outside air application. A combination of the FläktGroup SEMCO FV-2000T with a Trane® Voyager® model 061 is suitable in this particular case.

2. SELECT FAN MOTOR

Using the fan tables (PAGES 14-22) 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 CONTINUED. Assuming that the static pressure in the Trane® Voyager® supply side is -0.1 in. wg. and in the exhaust side 0.3 in. wg., we look up the required fan motors on PAGE 34 for the FläktGroup SEMCO FV-2000T.

For the supply fan at 1,800 cfm and -0.1 in. wg. external static the supplied fan will be 1.5 hp running at 1374 rpm. We also determine that the exhaust fan at 2,000 cfm and 0.3 in. wg. external static will be 2.0 hp running at 1990 rpm.

3. DETERMINE SUPPLY AIR RECOVERY EFFICIENCY

Enter **FIGURE 5** for the chosen unit to determine the recovery wheel face area per air-stream. Divide the smaller volume of the two air-streams by the wheel area obtained from **FIGURE 5** to determine face velocity. Enter **FIGURE 6** for the face velocity of the smaller air-stream to determine the unit base effectiveness at equal airflows.

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 6** and the calculated airflow ratio, enter **FIGURE 7** to obtain the corrected supply air efficiency for unequal airflow applications.

*EXAMPLE CONTINUED. From **FIGURE 5**, the FläktGroup SEMCO FV-2000T wheel area per side is 2.60 sq. ft. Dividing 1800 cfm (the smaller of the two air-streams) by 2.60, gives a (supply side) face velocity of 692 ft/min. From **FIGURE 6** the base effectiveness is interpolated at 70.5 percent. Using the base effectiveness and an airflow ratio of 0.9 (1800cfm/2000cfm) from **FIGURE 7** determines the supply side efficiency to be 75.6 percent.*

4. CALCULATE THE SUPPLY AIR CONDITIONS

Once the design conditions are known and the supply side efficiency is determined, the temperature and humidity content of the air supplied to the space can easily be calculated by using **EQUATION 1** on **PAGE 11**. Using dry bulb temperatures in **EQUATION 1** provides the supply air temperature. The supply air humidity level is also determined in **EQUATION 1** by using grains of

EXAMPLE CONTINUED. Summer outdoor air design conditions are 90°F, 110 gr/lb with a return condition of 75°F, 50% relative humidity (65 gr/lb.) Using Equation 1, the summer supply temperature and humidity is calculated as follows:

- T_{SA} = (90°F - .756 (90 - 75)°F) = 78.7°F
- W_{SA} = 110 gr/lb - .756 (110 - 65)gr/lb = 76 gr/lb

Winter outdoor air design conditions are 5°F, 4 gr/lb with a return air condition of 70°F, 32 gr/lb.

The winter supply air temperature and humidity level is calculated in the same fashion to give a condition of 54°F and 25 gr/lb.

FIGURE 5 Airflow Range and Energy Wheel Area.

FLÄKTGROUP SEMCO FV-T MODEL	AIRFLOW RANGE (SCFM)	WHEEL FACE AREA (FT²/SIDE)
FV-1000T	415-1245	1.42
FV-2000T	800-2000	2.60
FV-3000T	1800-3000	4.13
FV-4000T	2600-4000	5.00
FV-5000T	2600-6200	6.27

FIGURE 6 Unit Effectiveness vs. Wheel Face Velocity.

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 7 Unequal Airflow Efficiency Correction.

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

$$X_{SA} = \{X_{OA} - (\text{Efficiency}_{SA}) (X_{OA} - X_{RA})\}$$

EQUATION 1. Calculating supply temperatures and moisture content.

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

5. DETERMINE IF FROST PROTECTION IS REQUIRED

To achieve acceptable indoor air quality, ASHRAE Standard 62 recommends a three-to-four-fold increase in the amount of outdoor air provided to most facilities. In addition, the ASHRAE Standard 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 occupied spaces, the FläktGroup SEMCO FV-T pre-conditioner mounted to the Trane® Voyager® unit enables the Trane® Voyager® unit to effectively handle this increase in outdoor air load without the need for a larger sized package and without increasing energy consumption.

Without the addition of effective energy recovery, the capacity of HVAC systems must be increased greatly to handle the greater outdoor air loads. Increasing equipment size often requires the addition of reheat and sophisticated control sequences to control both humidity and temperature. The FläktGroup SEMCO FV-T pre-conditioner often reduces project first cost by allowing a smaller Trane® Voyager® unit and duct system to be used, without the need for reheat or complex controls.

Operation of conventional HVAC systems is governed by a thermostat, i.e., in response only to the conditioned space temperature. 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 FläktGroup SEMCO FV-T unit 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.

Enter **FIGURE 7** for the chosen unit to determine the recovery wheel face area per air-stream. Divide the smaller volume of the two air-streams by the wheel area obtained from **FIGURE 7** to determine face velocity. Enter **FIGURE 6** for the face velocity of the smaller air-stream to determine the unit base effectiveness at equal airflows.

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 6** and the calculated airflow ratio, enter **FIGURE 7**.

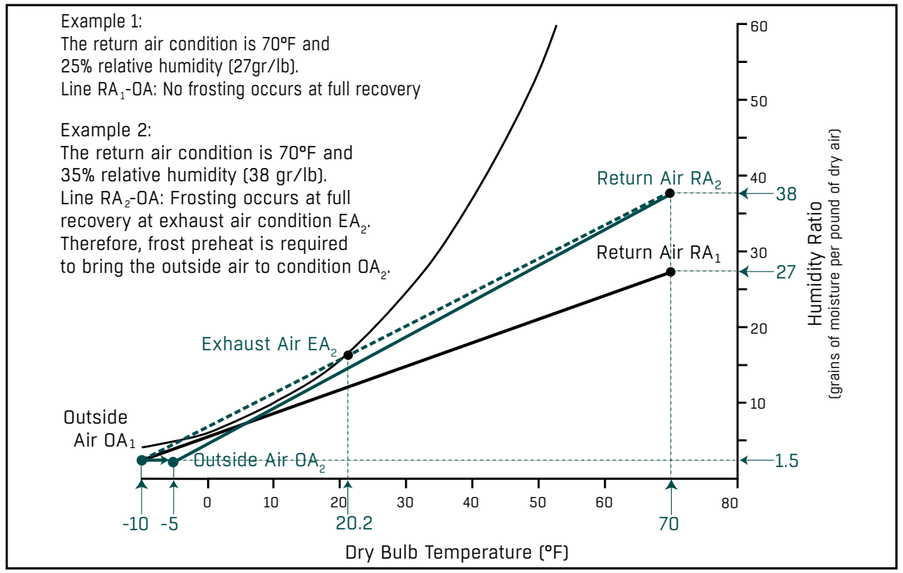


FIGURE 8 Using the psychometric chart to determine the need for preheat frost control.

to obtain the corrected supply air efficiency for unequal airflow applications.

Plotted on a psychometric chart, the performance of an enthalpy recovery wheel will form a straight line between the outdoor air and return air conditions (See **FIGURE 8**). If this line does not pass through the saturated line on the psychometric 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 percent 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 FläktGroup SEMCO FV-T modules.

- Preheat is used as the primary method of frost protection for the energy wheel in FläktGroup SEMCO FV-T 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 condition.

- 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 Trane® Voyager® unit.

- A frost protection thermostat which turns the FläktGroup SEMCO FV-T 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 CONTINUED. Since the outdoor air winter design temperature for this example is 5°F and the space humidity is 30 percent, frost protection is not required.

6. DETERMINE DIMENSIONAL AND ELECTRICAL DATA

The dimensional data for the FläktGroup SEMCO FV-T units is provided on **PAGES 24**. The FläktGroup SEMCO FV-T module is mounted to a Trane® Voyager® unit down blast unit.

The electrical data is determined on **PAGE 33**, **EQUATIONS 2 AND 4**. 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 pre-heater is required, the electrical data should be increased appropriately by the information given in **FIGURE 11** on **PAGE 34** and **35**. If a variable speed drive is required, contact SEMCO for electrical data.

*EXAMPLE CONTINUED. Assuming that 208V/3Ø power is available, the minimum circuit ampacity (MCA) for the motors selected in Step 2 is calculated using **EQUATION 2** on **PAGE 36**.*

1.25 * FLA largest fan motor	=	9.4 (1.25*7.5)
+ FLA other fan motor	=	6.6
+ FLA wheel drive	=	1.1
MCA	=	17.1

The maximum circuit over-current protection is calculated using **EQUATION 4** on **PAGE 36**.

2.25 * FLA largest fan motor	=	17.1 (2.25*7.5)
+ FLA other fan motor	=	6.6
+ FLA wheel drive	=	1.1
MOP	=	24.6

7. CREATE SELECTIONS

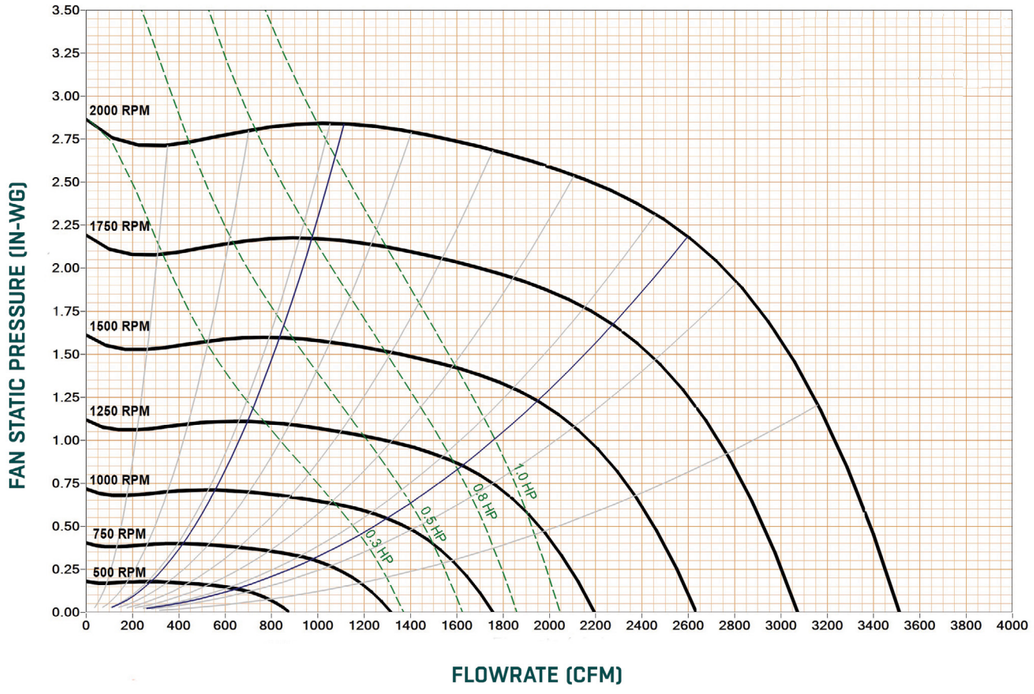
Utilize our web based Express Select software to create unit selections. This will allow you to review unit performance data prior to ordering FläktGroup SEMCO FV-T units. This also allows you to create a standard submittal and a quote in a very timely manner.

FAN TABLES AND CURVES

FLÄKTGROUP SEMCO FV-1,000T

FLÄKTGROUP SEMCO FV-1000T 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

FLÄKTGROUP SEMCO FV-1000T 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	-



NOTE: For power draw of motors, see **FIGURE 11** on PAGES 34-35. 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 FläktGroup SEMCO FV-T unit fan. Negative statics would work with the FläktGroup SEMCO FV -T unit fan. For example, a FläktGroup SEMCO FV-T recovery module mounted to a Trane® Voyager® unit with a -0.1" static pressure in the Trane® Voyager® unit's mixing section would have a FläktGroup SEMCO FV-T supply fan static of -0.1" and an exhaust fan static of +0.3". All statics internal to the FläktGroup SEMCO FV-T module are already included in the selection.

FLÄKTGROUP SEMCO FV-2000T 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	-	-

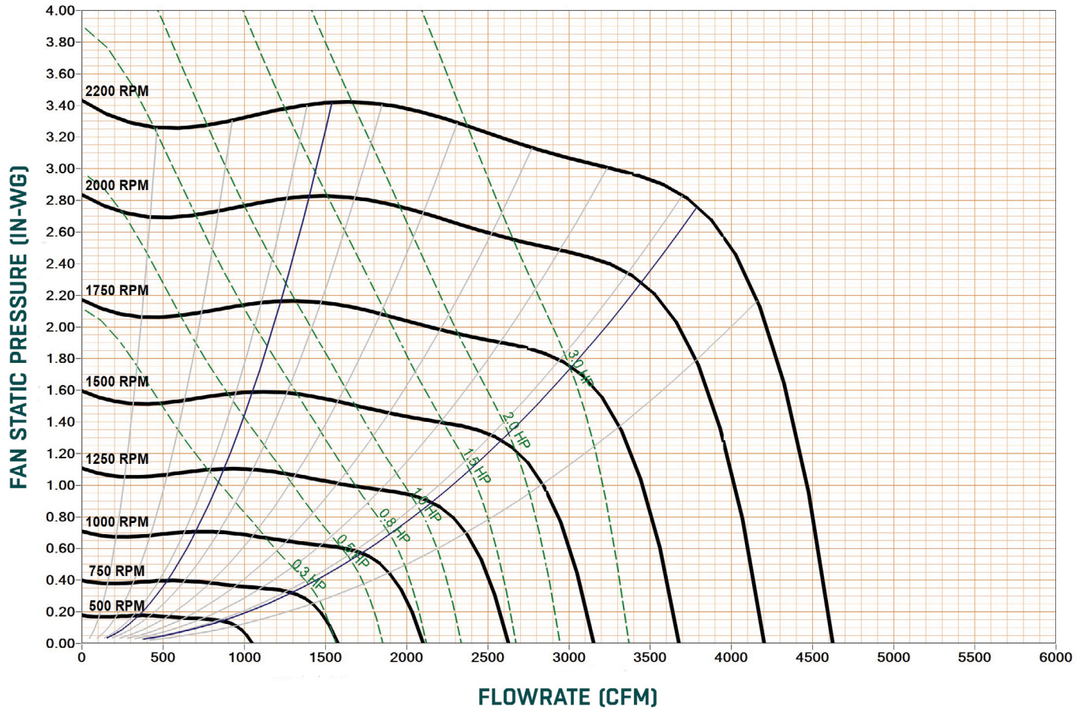
SUPPLIED MOTOR:

0.33 hp, 1725 rpm	0.75 hp, 1725 rpm	1.50 hp, 1725 rpm	2.00 hp, 1725 rpm

SEMCO FV-2000T 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	-	-	-	-

FLÄKTGROUP SEMCO FV-2000T FAN CURVE



FLÄKTGROUP SEMCO FV-3000T 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	-	-

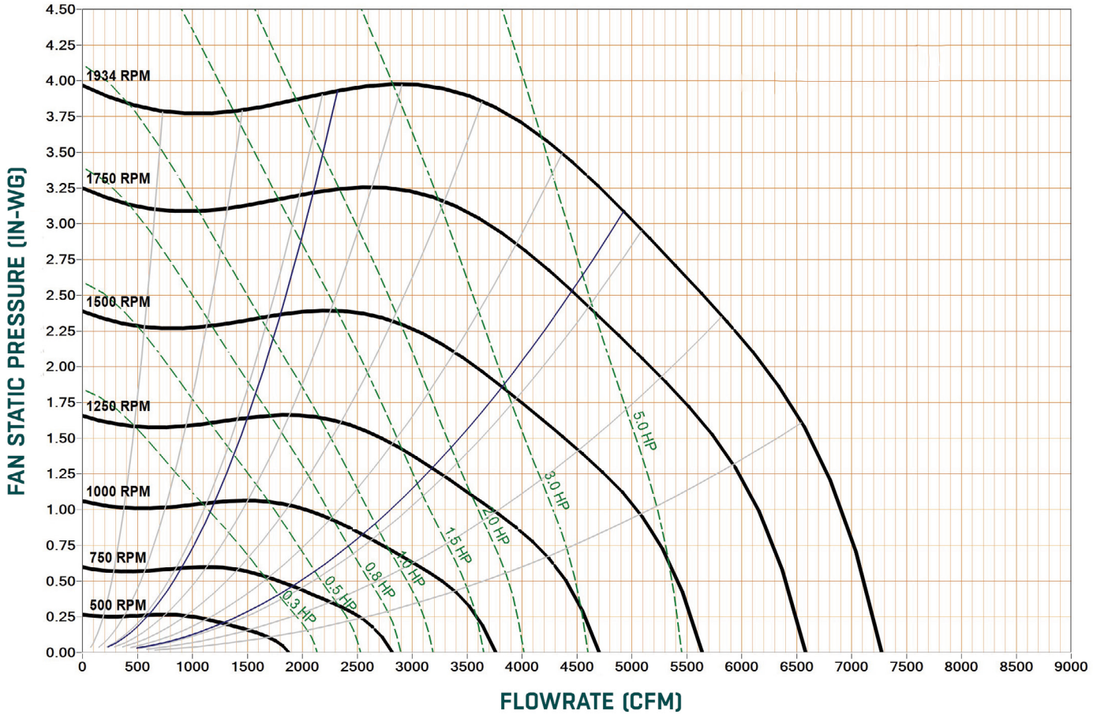
SUPPLIED MOTOR:

0.75 hp, 1725 rpm	1.50 hp, 1725 rpm	2.00 hp, 1725 rpm	3.00 hp, 1725 rpm (3 phase only)

FLÄKTGROUP SEMCO FV-3000T 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	-	-	-

FLÄKTGROUP SEMCO FV-3000T FAN CURVE



NOTE: For power draw of motors, see **FIGURE 11** on PAGES 34-35. When sizing fan motors, it is not required to add purge air or seal leakage as these corrections are reflected in the fan charts.

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FLÄKTGROUP SEMCO FV-4000T 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

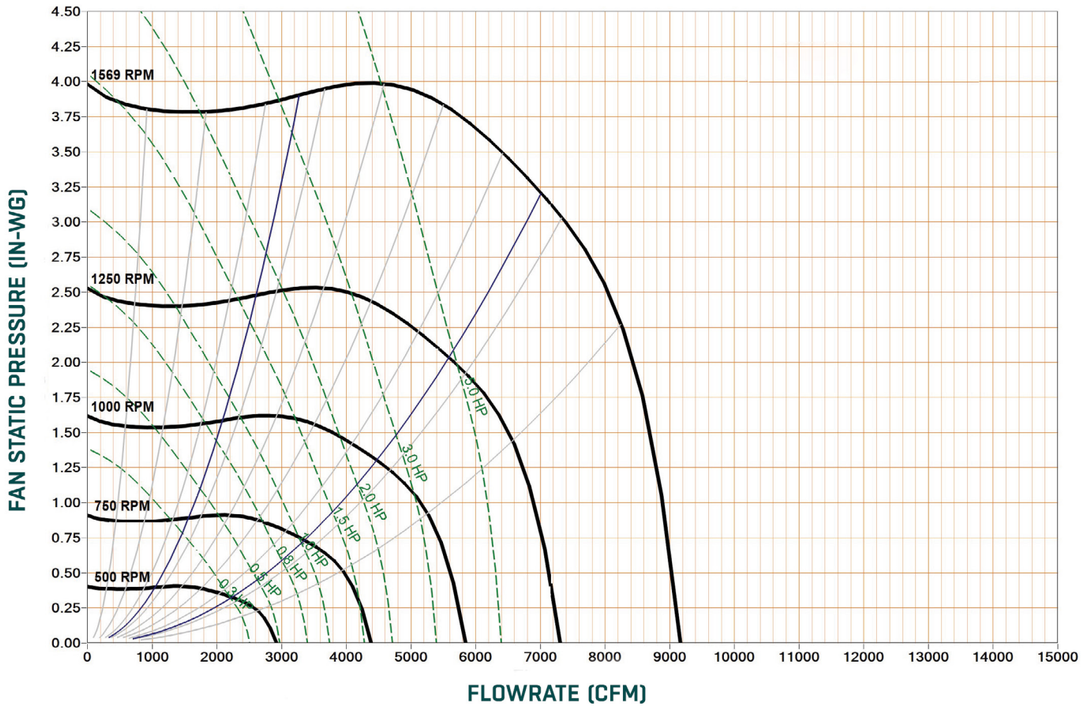
SUPPLIED MOTOR:

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)

FLÄKTGROUP SEMCO FV-4000T 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

FLÄKTGROUP SEMCO FV-4000T FAN CURVE



NOTE: For power draw of motors, see **FIGURE 11** on PAGES 34-35. 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 FläktGroup SEMCO FV-T unit fan. Negative statics would work with the FläktGroup SEMCO FV -T unit fan. For example, a FläktGroup SEMCO FV-T recovery module mounted to a Trane® Voyager® unit with a -0.1" static pressure in the Trane® Voyager® unit's mixing section would have a FläktGroup SEMCO FV-T supply fan static of -0.1" and an exhaust fan static of +0.3". All statics internal to the FläktGroup SEMCO FV-T module are already included in the selection.

FLÄKTGROUP SEMCO FV-5000T 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	.80/781	.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)

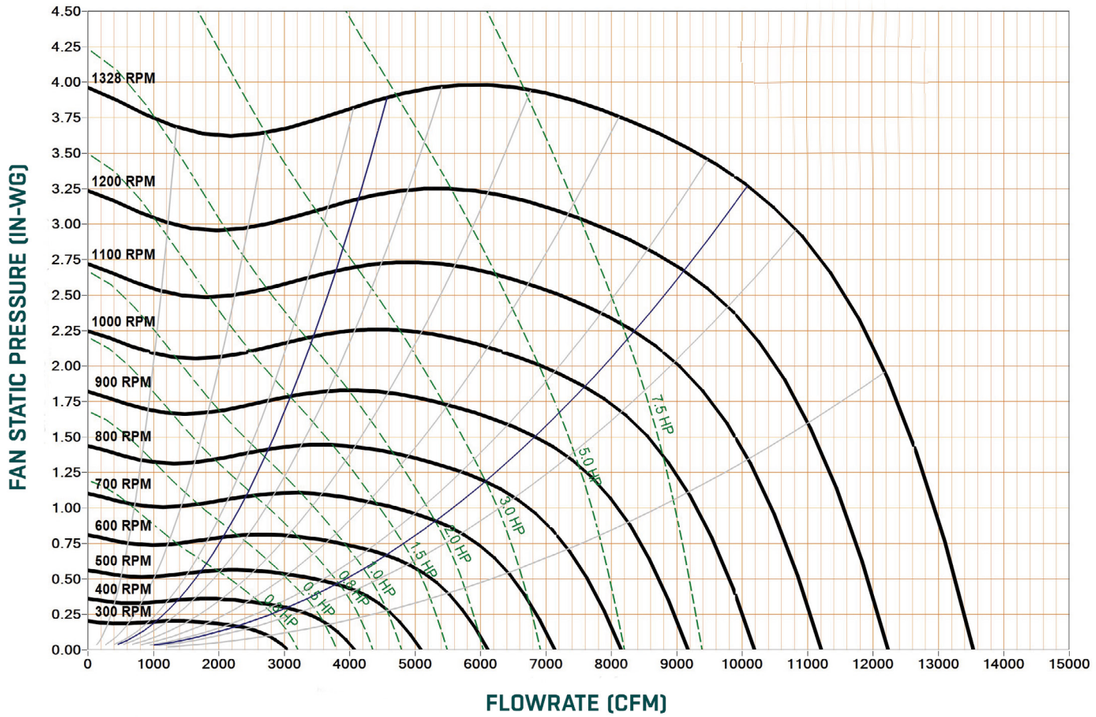
FLÄKTGROUP SEMCO FV-5000T EXHAUST FAN DATA

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	-	-	-	-	-	-	-	-	-

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)

FLÄKTGROUP SEMCO FV-5000T FAN CURVE



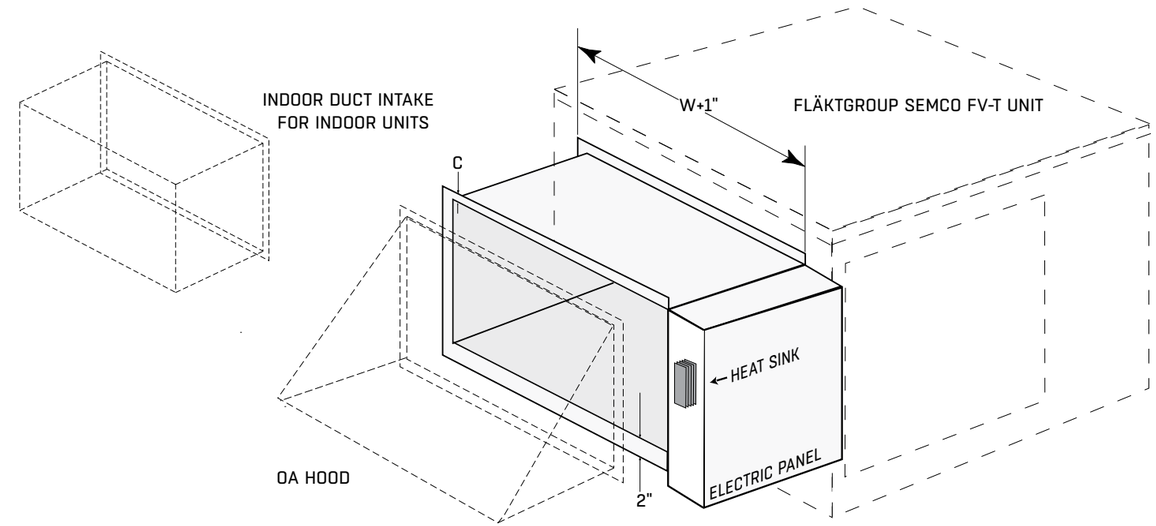
NOTE: For power draw of motors, see **FIGURE 11** on PAGES 34-35. When sizing fan motors, it is not required to add purge air or seal leakage as these corrections are reflected in the fan charts.

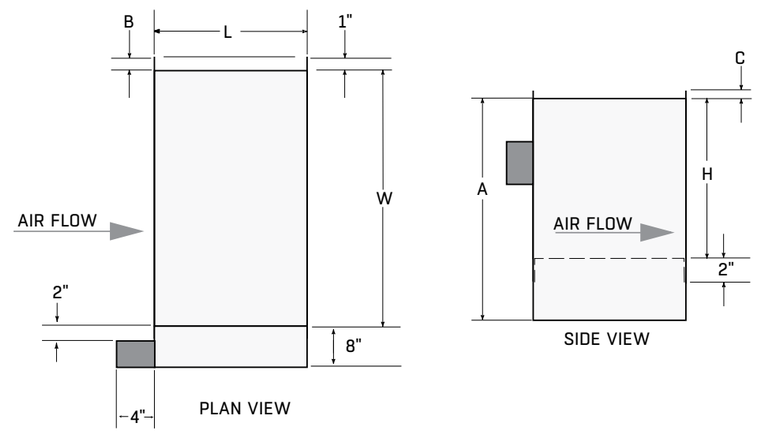
* Positive statics reference external static pressures that work against the FläktGroup SEMCO FV-T unit fan. Negative statics would work with the FläktGroup SEMCO FV -T unit fan. For example, a FläktGroup SEMCO FV-T recovery module mounted to a Trane® Voyager® unit with a -0.1" static pressure in the Trane® Voyager® unit's mixing section would have a FläktGroup SEMCO FV-T supply fan static of -0.1" and an exhaust fan static of +0.3". All statics internal to the FläktGroup SEMCO FV-T module are already included in the selection.

ELECTRIC PREHEAT LAYOUT

MODEL	W	H	L	A	B	C
FLÄKTGROUP SEMCO FV-1000T	24.4	9.0	14.0	20.0	1.0	1.0
FLÄKTGROUP SEMCO FV-2000T	31.1	11.0	14.0	20.0	1.0	2.0
FLÄKTGROUP SEMCO FV-3000T	39.1	16.0	20.0	40.0	1.0	2.0
FLÄKTGROUP SEMCO FV-4000T	49.1	17.0	20.0	40.0	1.0	2.0
FLÄKTGROUP SEMCO FV-5000T	49.1	17.0	20.0	40.0	1.0	2.0

NOTE: All dimensions are in inches.

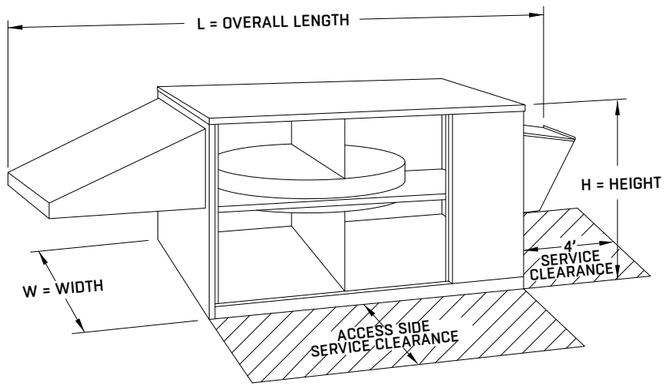




DIMENSIONS

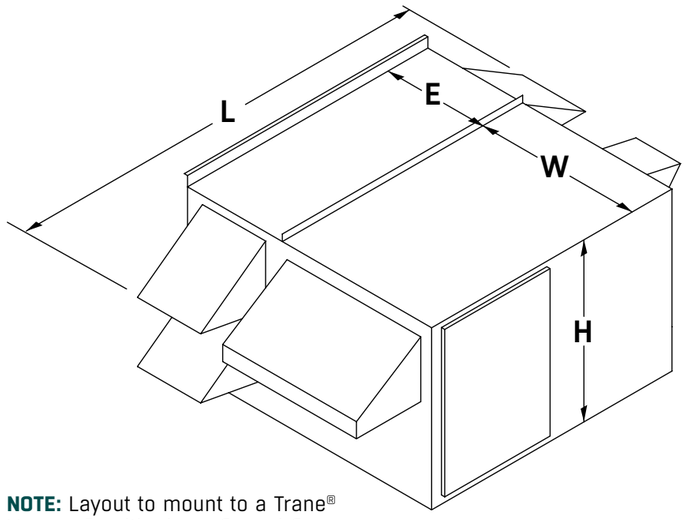
FIGURE 9: Overall unit dimensions

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.



UNIT	L	H	W
	(DIMENSIONS IN INCHES)		
FLÄKTGROUP SEMCO FV-1000T	77.5	31.1	29.1
FLÄKTGROUP SEMCO FV-2000T	88.5	32.6	37.0
FLÄKTGROUP SEMCO FV-3000T	102.7	47.8	45.0
FLÄKTGROUP SEMCO FV-4000T	133.8	51.9	54.0
FLÄKTGROUP SEMCO FV-5000T	133.8	51.9	54.0

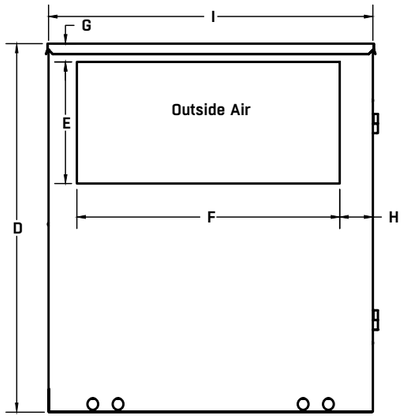
FIGURE 10: Unit dimensions including FläktGroup SEMCO Economizer option

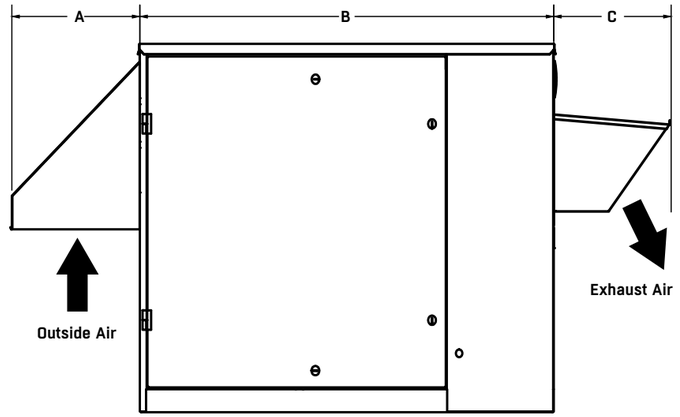


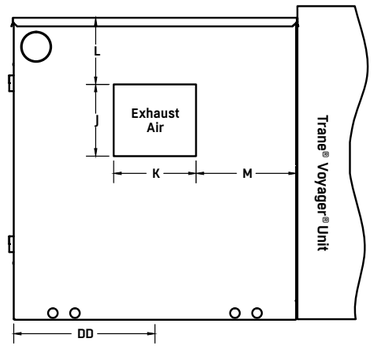
UNIT	W	E	L	H
FLÄKTGROUP SEMCO FV-3000T+E	45.0	26.0	108.7	47.7
FLÄKTGROUP SEMCO FV-5000T+E	54.0	26.0	132.9	51.5
FLÄKTGROUP SEMCO FV-5000T+E HC	54.0	26.0	142.3	51.5

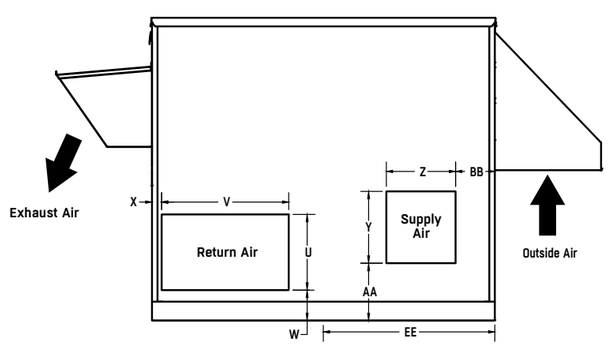
NOTE: Layout to mount to a Trane® Voyager® unit's down-flow airflow configuration only.

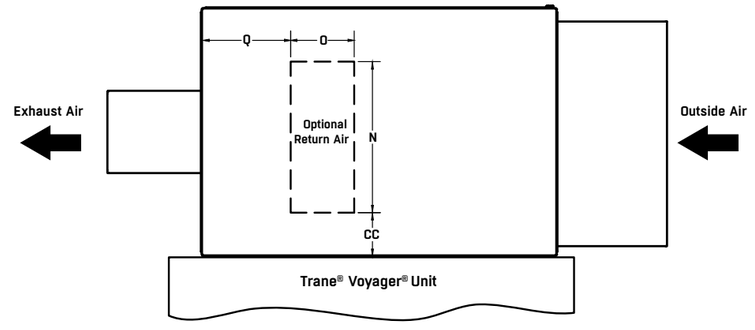
UNIT ARRANGEMENT









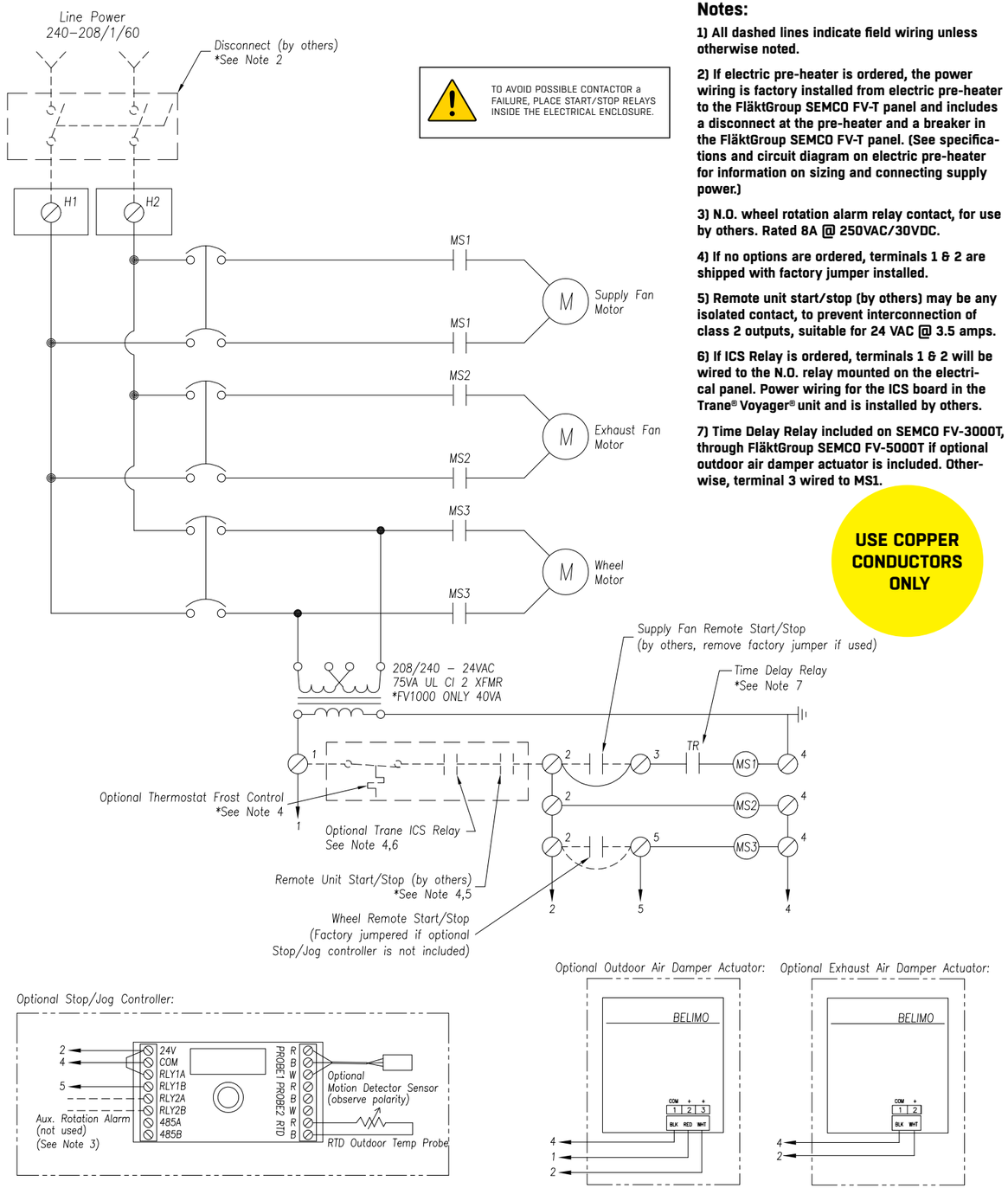


UNIT	NET WT. (LBS.)	DIMENSIONS (INCHES)								
		A	B	C	D	E	F	G	H	I
FLÄKTGROUP SEMCO FV-1000T	500	16.5	44.3	16.7	31.1	7.6	22.6	2.6	4.1	29.1
FLÄKTGROUP SEMCO FV-2000T	550	20.4	51.4	16.7	32.6	9.1	28.5	2.5	4.5	37.0
FLÄKTGROUP SEMCO FV-3000T	1000	20.4	64.8	17.5	47.8	15.8	36.4	2.3	5.0	45.0
FLÄKTGROUP SEMCO FV-4000T	1150	32.7	78.8	22.3	51.9	15.8	44.3	2.5	4.8	54.0
FLÄKTGROUP SEMCO FV-5000T	1150	32.7	78.8	22.3	51.9	15.8	44.3	2.5	4.8	54.0

NOTE: Service clearance, on front side, equal to depth of unit (dimension I).

UNIT	NET WT. (LBS.)	DIMENSIONS (INCHES)																
		J	K	L	M	N	O	Q	U	V	W	X	Y	Z	AA	BB	CC	DD	EE
FLÄKTGROUP SEMCO FV-1000T	500	10.2	9.2	4.2	9.9	11.2	10.0	12.6	7.0	16.0	3.8	8.0	10.2	9.3	5.8	5.0	9.0	13.6	21.3
FLÄKTGROUP SEMCO FV-2000T	550	10.2	11.7	4.3	7.3	19.7	9.3	17.9	7.8	23.0	3.2	2.8	10.1	11.7	4.9	4.2	7.9	17.4	24.7
FLÄKTGROUP SEMCO FV-3000T	1000	11.4	13.1	10.6	16.0	24.0	12.0	16.7	12.0	24.0	4.8	1.8	11.4	13.1	9.1	7.4	7.0	21.2	31.1
FLÄKTGROUP SEMCO FV-4000T	1150	13.4	14.6	11.8	19.6	20.0	19.0	20.7	20.0	19.0	4.3	2.4	13.4	14.6	10.2	7.1	12.0	25.4	37.8
FLÄKTGROUP SEMCO FV-5000T	1150	15.9	18.6	9.5	17.6	20.0	19.0	20.7	20.0	19.0	4.3	2.3	15.9	18.6	11.4	5.2	12.0	25.4	37.8

1Ø CIRCUIT DIAGRAM, SEMCO FV-1000T THROUGH SEMCO FV-5000T*



Notes:

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

2) If electric pre-heater is ordered, the power wiring is factory installed from electric pre-heater to the FläktGroup SEMCO FV-T panel and includes a disconnect at the pre-heater and a breaker in the FläktGroup SEMCO FV-T panel. (See specifications and circuit diagram on electric pre-heater 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 factory jumper installed.

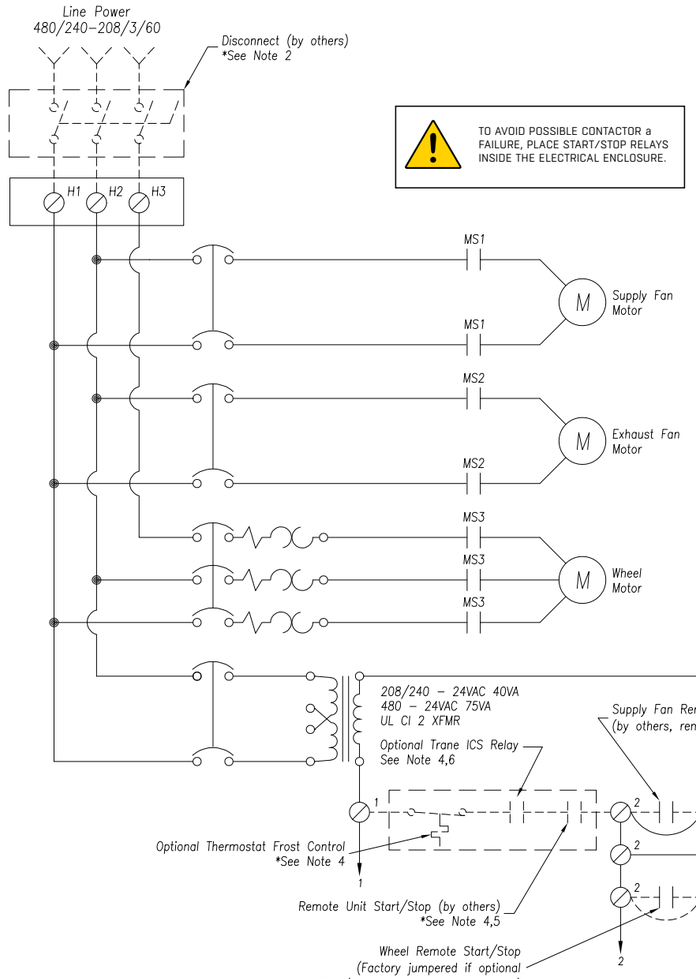
5) Remote unit start/stop (by others) may be any isolated contact, to prevent interconnection of class 2 outputs, suitable for 24 VAC @ 3.5 amps.

6) If ICS Relay is ordered, terminals 1 & 2 will be wired to the N.O. relay mounted on the electrical panel. Power wiring for the ICS board in the Trane® Voyager® unit and is installed by others.

7) Time Delay Relay included on SEMCO FV-3000T, through FläktGroup SEMCO FV-5000T if optional outdoor air damper actuator is included. Otherwise, terminal 3 wired to MS1.

USE COPPER CONDUCTORS ONLY

3Ø CIRCUIT DIAGRAM, SEMCO FV-1000T



Notes:

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

2) If electric pre-heater is ordered, the power wiring is factory installed from electric pre-heater to the FläktGroup SEMCO FV-T panel and includes a disconnect at the pre-heater and a breaker in the FläktGroup SEMCO FV-T panel. (See specifications and circuit diagram on electric pre-heater for information on sizing and connecting supply power.)

3) N.O. wheel rotation alarm relay contact, for use by others. Rated 8A @ 250VAC/30VDC.

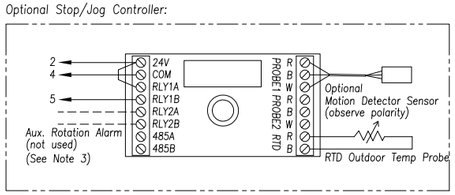
4) If no options are ordered, terminals 1 & 2 are shipped with factory jumper installed.

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.

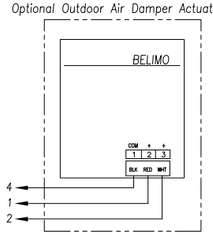
6) If ICS Relay is ordered, terminals 1 & 2 will be wired to the N.O. relay mounted on the electrical panel. Power wiring for the ICS board in the Trane® Voyager® unit and is installed by others.

USE COPPER CONDUCTORS ONLY

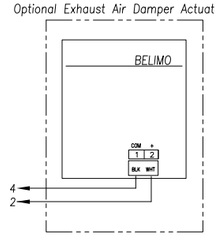
Optional Stop/Jog Controller:



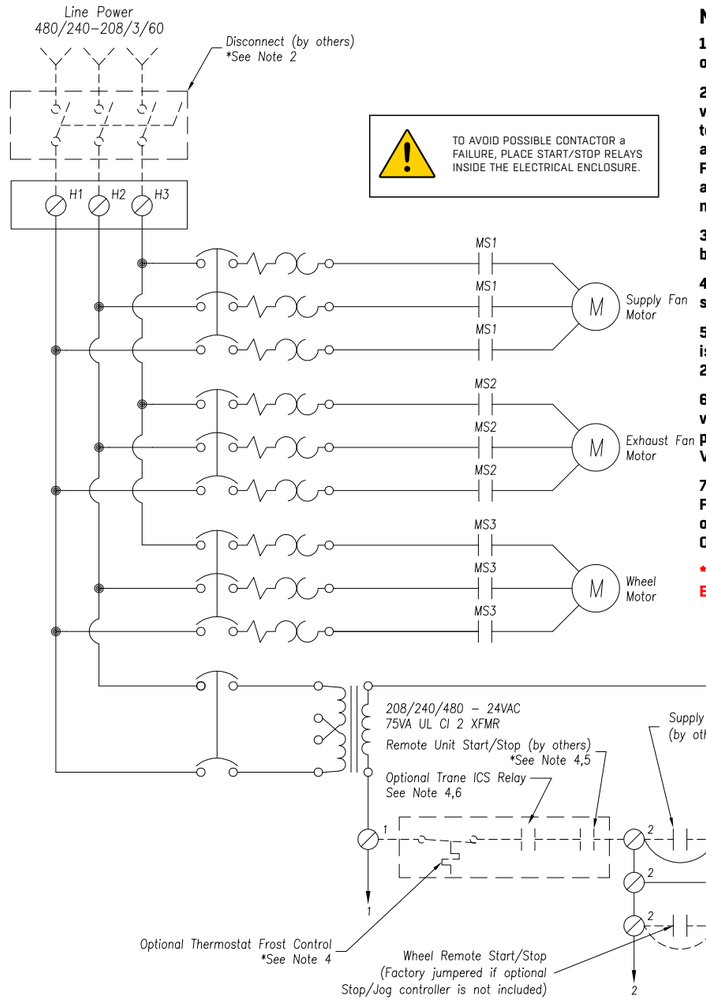
Optional Outdoor Air Damper Actuator:



Optional Exhaust Air Damper Actuator:



3Ø CIRCUIT DIAGRAM, SEMCO FV-2000T THROUGH SEMCO FV-5000T*



Notes:

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

2) If electric pre-heater is ordered, the power wiring is factory installed from electric pre-heater to the FläktGroup SEMCO FV-T panel and includes a disconnect at the pre-heater and a breaker in the FläktGroup SEMCO FV-T panel. (See specifications and circuit diagram on electric pre-heater 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 factory 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.

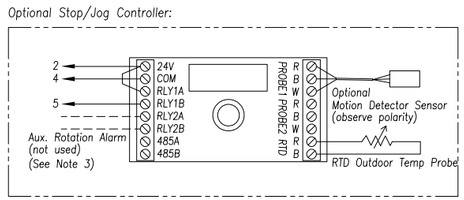
6) If ICS Relay is ordered, terminals 1 & 2 will be wired to the N.O. relay mounted on the electrical panel. Power wiring for the ICS board in the Trane® Voyager® unit and is installed by others.

7) Time delay relay included on the SEMCO FV-3000T through FläktGroup SEMCO FV-5000T if optional outdoor air damper actuator is included. Otherwise, terminal 3 wired to MS1.

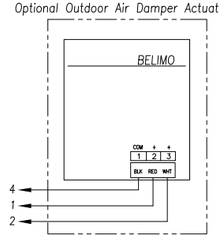
***Schematics for units with the FläktGroup SEMCO Economizer are provided with submittal and unit.**

USE COPPER CONDUCTORS ONLY

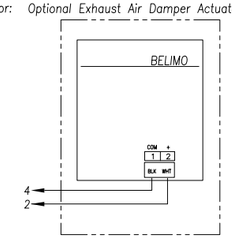
Optional Stop/Jog Controller:



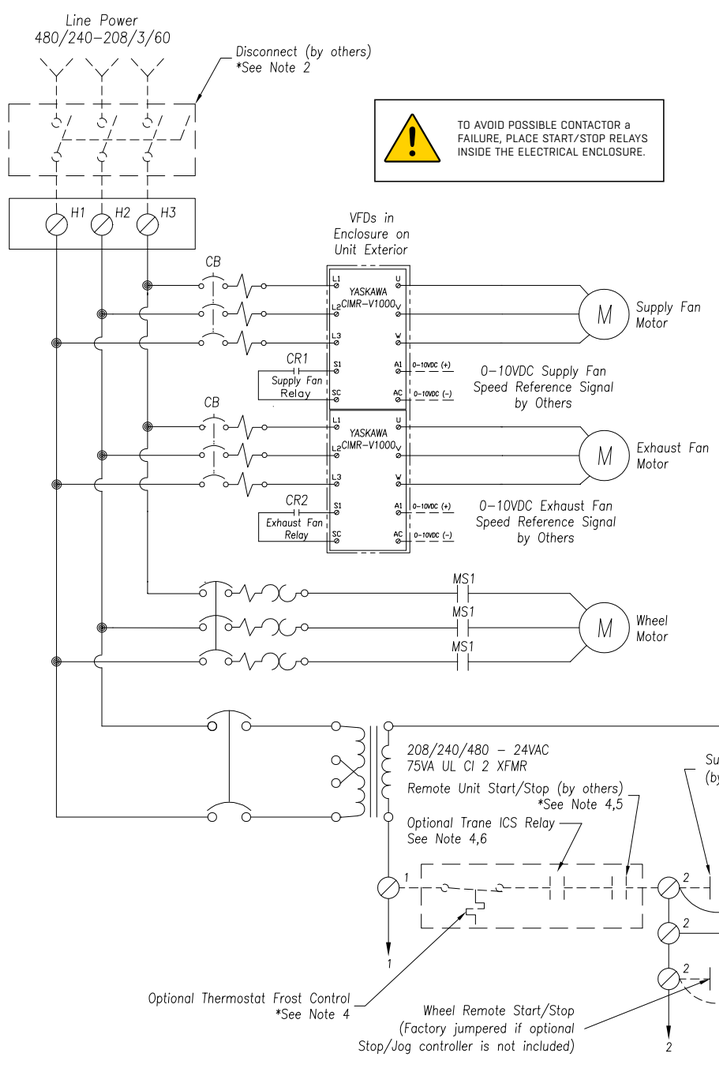
Optional Outdoor Air Damper Actuator:



Optional Exhaust Air Damper Actuator:



3Ø CIRCUIT DIAGRAM, SEMCO FV-2000T THROUGH SEMCO FV-5000T WITH VARIABLE SPEED FANS



Notes:

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

2) If electric pre-heater is ordered, the power wiring is factory installed from electric pre-heater to the FläktGroup SEMCO FV-T panel and includes a disconnect at the pre-heater and a breaker in the FläktGroup SEMCO FV-T panel. (See specifications and circuit diagram on electric pre-heater for information on sizing and connecting supply power.)

3) N.O. wheel rotation alarm contact, for use by others. Rated 8A @ 250VAC/30VDC.

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

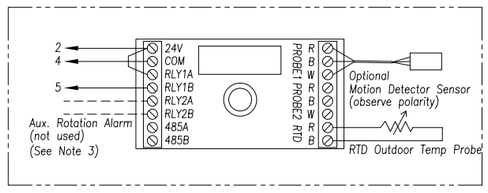
5) Remote unit start/stop (by others) may be any isolated contact, to prevent interconnection of class 2 outputs, suitable for 24 VAC @ 3.5 amps.

6) If ICS Relay is ordered, terminals 1 & 2 will be wired to the N.O. relay mounted on the electrical panel. Power wiring for the ICS board in the Trane® Voyager® unit and is installed by others.

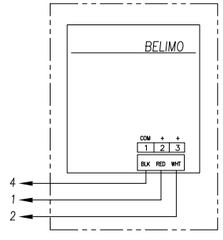
7) Time delay relay included on the FläktGroup SEMCO FV-3000T through FläktGroup SEMCO FV-5000T Otherwise, terminal 3 wired to CR1.

USE COPPER CONDUCTORS ONLY

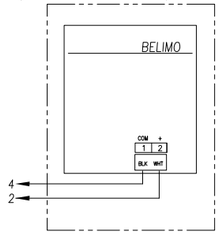
Optional Stop/Jog Controller:



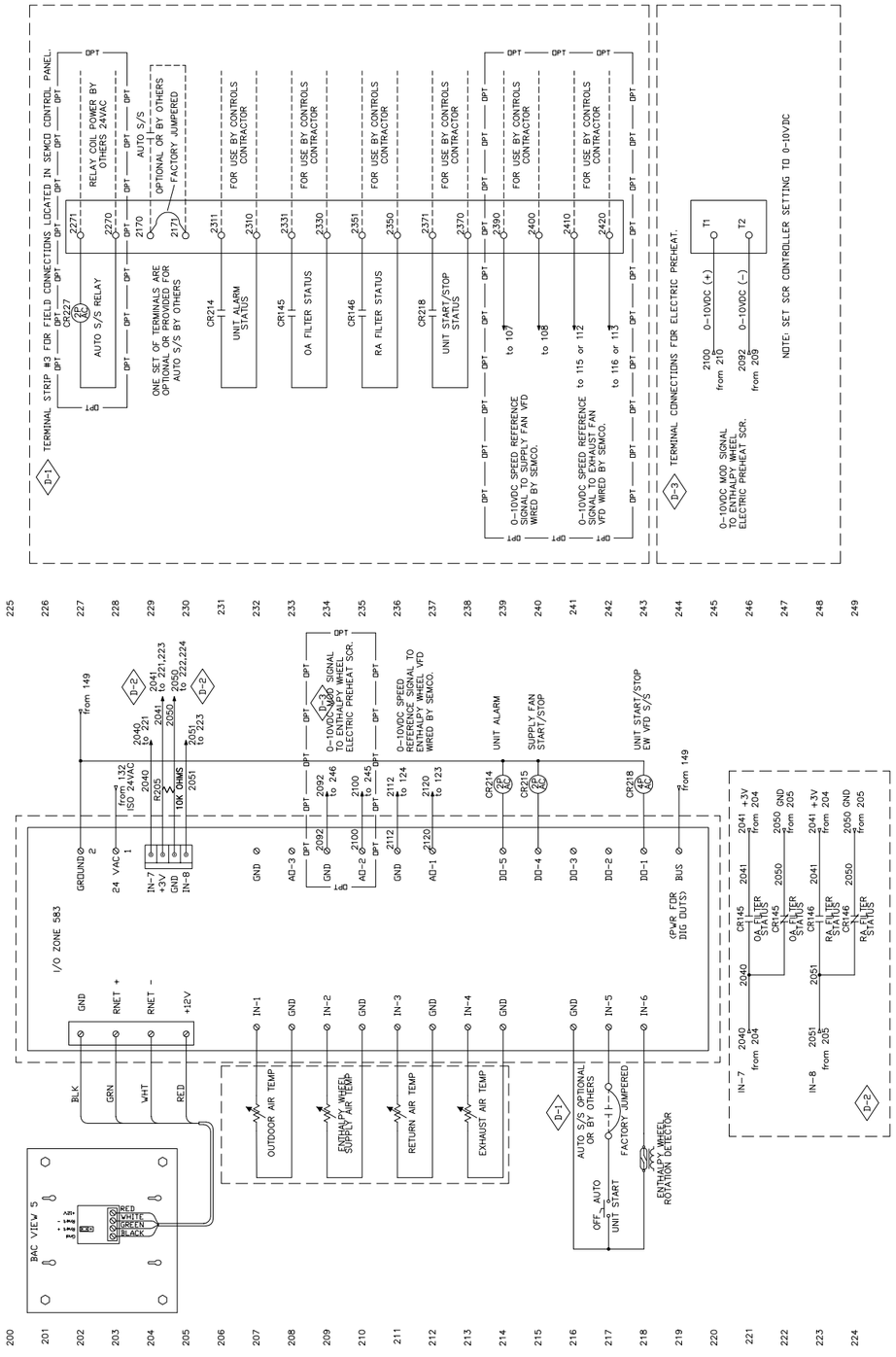
Optional Outdoor Air Damper Actuator:



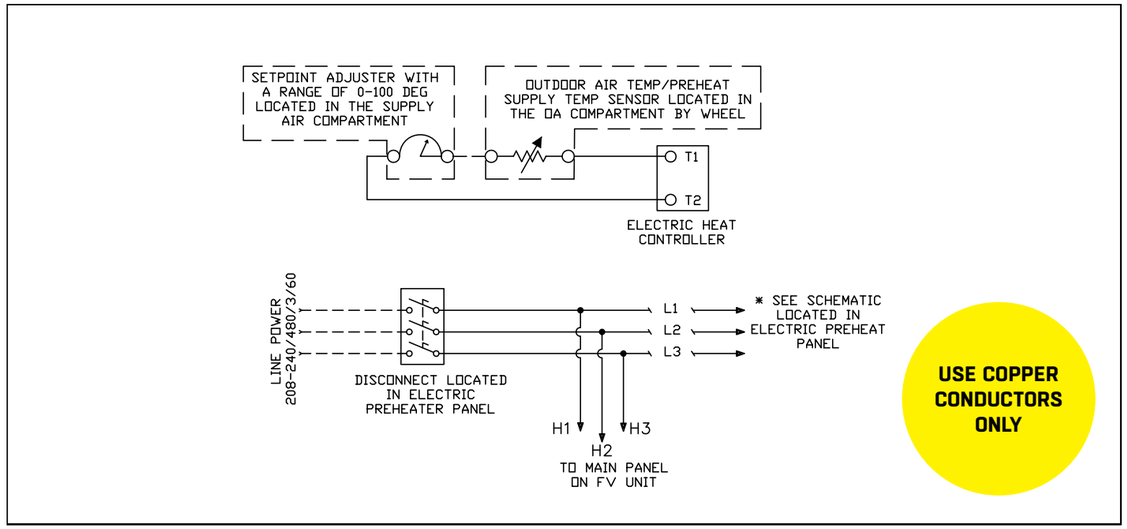
Optional Exhaust Air Damper Actuator:



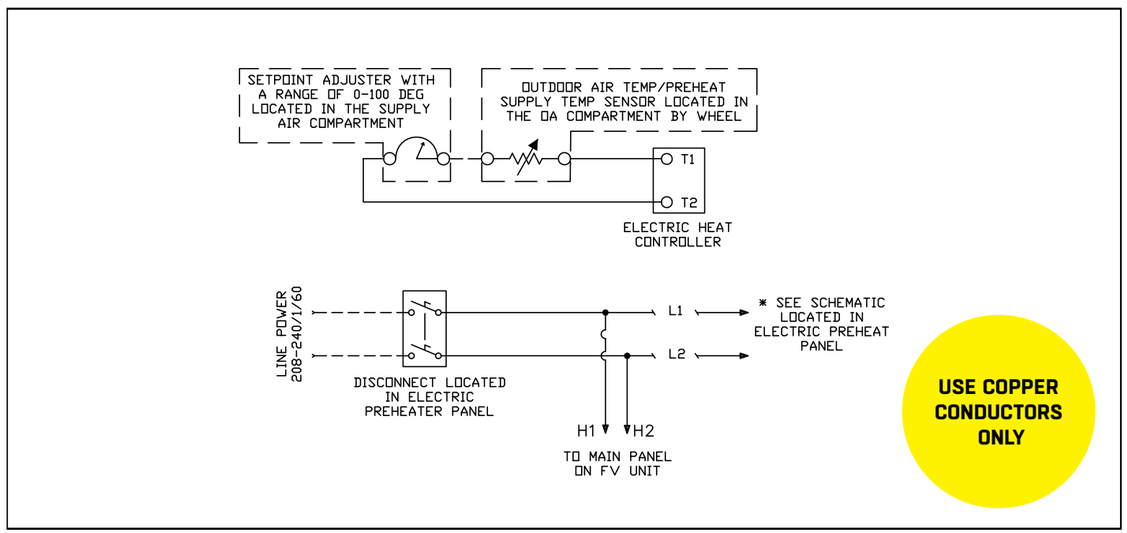
SEMCO FV-T WITH VARIABLE SPEED WHEEL CONTROL



3Ø ELECTRIC PREHEAT FROST CONTROL CIRCUIT DIAGRAM



1Ø ELECTRIC PREHEAT FROST CONTROL CIRCUIT DIAGRAM



NEUTRAL LEGEND
115V – WHITE
115V – GFI PROTECTED – GREY
24V – YELLOW

TERMINAL TORQUE REQUIREMENTS

AWG SIZE	IN-LB
18-10	20
8	25
6-4	35

NOTES:
*COPPER CONDUCTORS ONLY
*CONTROL POWER MUST NOT LEAVE MAIN CONTROL PANEL.

*THIS STYLE OF DASHED LINE INDICATES ITEMS THAT ARE REMOTE TO SEMCO ELECTRICAL/CONTROL PANELS, ITEMS THAT REFERENCE DWG FOOTNOTES AND DETAIL DWGS.
*THIS STYLE OF DASHED LINE REPRESENTS FIELD WIRING BY OTHER THAN SEMCO.

ELECTRICAL DATA

EQUATION 2 : Formula to determine minimum circuit ampacity (MCA) *without pre-heater and with transformer less than 1 amp.* See **FIGURE 11** on PAGE 37-38.

To determine minimum circuit ampacity (MCA):

1.25* FLA largest fan motor (find using **FIGURE 11** on PAGES 37-38)
\+ FLA other fan motor (find using **FIGURE 11** on PAGES 37-38)
\+ FLA wheel drive (find using **FIGURE 11** on PAGES 37-38)
= MCA

EQUATION 3 : Formula to determine minimum circuit ampacity (MCA) *with pre-heater or with transformer equal to 1 amp or greater.* See **FIGURE 11** on PAGES 39-40 and **FIGURE 12** on PAGE 41.

To determine minimum circuit ampacity (MCA):

FLA exhaust fan motor (find using **FIGURE 11** on PAGES 37-38)
\+ FLA supply fan motor (find using **FIGURE 11** on PAGE 37-38)
\+ FLA wheel drive (find using **FIGURE 11** on PAGE 37-38)
\+ FLA transformer if ≥ 1 amp
\+ FLA optional pre-heater (find using **FIGURE 12** on PAGE 39)
\+ 1.25
= MCA

EQUATION 4 : Formula to determine maximum over-current protection (MOP) See **FIGURE 11** on PAGE 37-38 and **FIGURE 12** on PAGE 39.

To determine maximum over-current protection (MOP):
For all FläktGroup SEMCO FV-T units:

2.25* FLA (find using **FIGURE 11** on PAGES 37-38)
\+ FLA other fan motor (find using **FIGURE 11** on PAGES 37-38)
\+ FLA wheel drive (find using **FIGURE 11** on PAGES 37-38)
\+ FLA transformer if ≥ 1 amp
\+ FLA optional pre-heater (find using **FIGURE 12** on PAGE 39)
= 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 do apply) If the fuses/breakers do not hold, consult the National Electric Code for suitability of larger fuses/breakers.

FIGURE 11: Electric Unit Data, Full load Power Draw

FLÄKTGROUP SEMCO FV-1000T				
MOTOR SIZE (HP)	**208/1/60**	**240/1/60**	**208/3/60**	**480/3/60**
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
FLÄKTGROUP SEMCO FV-2000T - FLÄKTGROUP SEMCO FV-9000T: FAN MOTOR NO VFD				
MOTOR SIZE (HP)	**208/1/60**	**240/1/60**	**208/3/60**	**480/3/60**
1/3	4.0	3.6	1.4	0.7
3/4	7.6	6.9	3.5	1.6
1 ½	11.0	10.0	6.6	3.0
2	13.2	12.0	7.5	3.4
3	—	—	10.6	4.8
5	—	—	16.7	7.6
7½	—	—	24.2	11.0
10	—	—	30.8	14.0
15	—	—	46.2	21.0
FLÄKTGROUP SEMCO FV-2000T - FLÄKTGROUP SEMCO: FAN MOTOR WITH VFD				
MOTOR SIZE (HP)	**208/1/60**	**240/1/60**	**208/3/60**	**480/3/60**
1/3	—	—	3.9	2.1
3/4	—	—	3.9	2.1
1½	—	—	7.3	4.3

FLÄKTGROUP SEMCO FV-2000T - FLÄKTGROUP SEMCO FV-9000T: FAN MOTOR WITH VFD				
MOTOR SIZE (HP)	**208/1/60**	**240/1/60**	**208/3/60**	**480/3/60**
2	—	—	10.8	4.3
3	—	—	10.8	4.3
5	—	—	24	9.4
7 ½	—	—	34.7	14.0
10	—	—	34.7	20.0
15	—	—	50.9	24.0
FLÄKTGROUP SEMCO FV-2000T - FLÄKTGROUP SEMCO FV-9000T: WHEEL MOTOR NO VFD (CONSTANT SPEED OR STOP/JOG)				
MOTOR SIZE (HP)	**208/1/60**	**240/1/60**	**208/3/60**	**480/3/60**
WHEEL (1/6)	2.4	2.2	0.6	0.3
TRANSFORMER	0.4	0.3	0.4	0.2
FLÄKTGROUP SEMCO FV-2000T - FLÄKTGROUP SEMCO FV-9000T: WHEEL MOTOR WITH VFD (VARIABLE SPEED WHEEL CONTROL PACKAGE)				
MOTOR SIZE (HP)	**208/1/60**	**240/1/60**	**208/3/60**	**480/3/60**
WHEEL (1/6)	—	—	1.2	0*
TRANSFORMER	—	—	0.7	1.0
* Wheel motor power included with transformer				

All FV-T units have SCCR 10k.

ELECTRICAL PREHEAT DATA

An electric preheat coil is an available option for all FläktGroup SEMCO 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 12: Electric preheat full load power draw data, 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.

			ACTUAL PER-HEATER SIZE (kW) / FULL LOAD POWER DRAW (AMPS)				
MODEL	OPTIONAL ELECTRIC PER-HEATER (kW)	TEMPERATURE RISE @ FULL kW (°F)	208V/1Ø	230V/1Ø	208V/3Ø	460V/3Ø	575V/3Ø
FLÄKTGROUP SEMCO FV-1000T	3.0	9-19	3.40/16.3	3.5/14.6	3.0/8.3	3.5/4.2	N/A
FLÄKTGROUP SEMCO FV-2000T	7.5	12-30	7.65/36.8	7.5/31.3	7.65/21.2	7.5/9.0	7.5/7.5
FLÄKTGROUP SEMCO FV-3000T	13.5	14-24	13.6/65.4	13.5/56.3	13.5/37.5	13.5/16.2	13.5/13.5
FLÄKTGROUP SEMCO FV-4000T	15.0	12-17	15.0/72.1	15.0/62.5	15.0/41.6	15.0/18.0	15.0/15.1
FLÄKTGROUP SEMCO FV-5000T	15.0	9-16	15.0/72.1	15.0/62.5	15.0/41.6	15.0/18.0	15.0/15.1

SAMPLE SPECIFICATIONS - SEMCO FV-T

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.

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 air-streams 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 (FläktGroup SEMCO FV-1000) or by motors using belts and sheaves (FläktGroup SEMCO 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.

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.

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 two-position actuator for control.

ROOF CURB

Units will be provided with a non-insulated roof pedestal curb sized to fit just inside of the unit's self-flashing base. Standard pedestal curb will be adjustable from 11 to 15.5 inches tall.

OPTIONS

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 back-lit LCD display to allow set-points 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.

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.

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.

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.

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.

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 FläktGroup SEMCO FV unit and the remote panel using Belden 5 conductor 8465 (20 gauge) or equivalent.

DUAL WALL CONSTRUCTION

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

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.

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.

MOTORIZED EXHAUST DAMPER

Unit 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.

ECONOMIZER

Unit shall be equipped with an economizer collar constructed in the same manner as the unit casing with proper separation of the intake and exhaust. Integrated intake dampers shall be low-leak and aluminum in construction; the frame being extruded for added strength; the blades being airfoil and opposed in action. Standard assembly shall include a two-position actuator for control.

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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