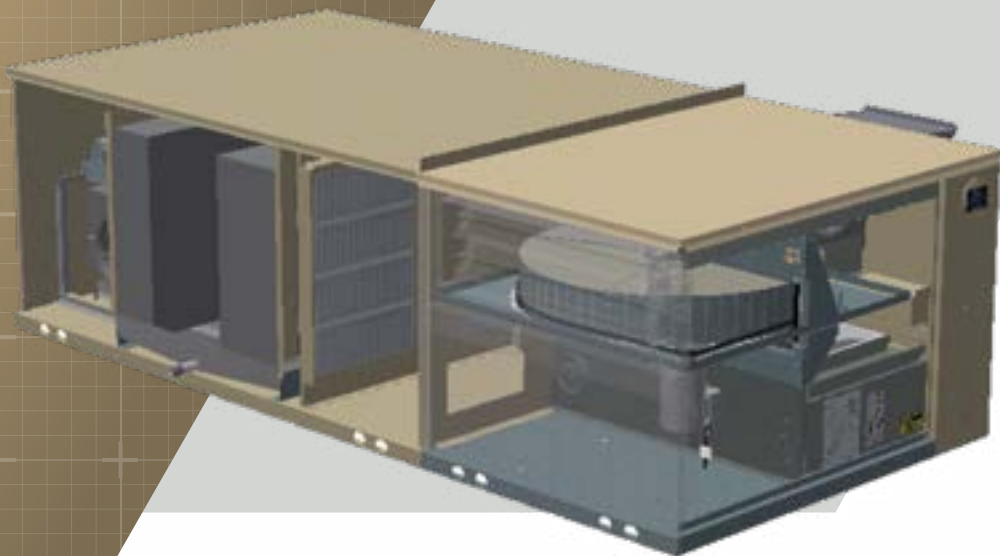


FV PRE-CONDITIONER WITH COIL MODULE

TECHNICAL GUIDE



FV-2000+CM
FV-3000+CM
FV-4000+CM
FV-5000+CM
FV-7500+CM

TABLE OF CONTENTS

FV+CM Outdoor Air Pre-conditioners	1
Indoor Air Quality	2
Applying the FV+CM Unit	2
Standard Features	3
Optional Features.....	4
Benefits Provided	6
Selection Procedure.....	7
Curb Mounting	11
Unit Dimensions: Plan View	12
Unit Arrangement H Series: Back & Side View.....	13
Indoor Filter Assembly	14
FV Electrical Preheat Layout	15
3Ø Circuit Diagram, FV-2000+CM through FV-7500+CM	16
1Ø Circuit Diagram, FV-2000+CM through FV-5000+CM.....	17
1Ø Circuit Diagram, FV-2000+CM through FV-5000+CM w/ VFD	18
3Ø Electric Preheat Frost Protection Circuit Diagram	19
1Ø Electric Preheat Frost Protection Circuit Diagram	19
Electrical Data.....	20
Electrical Preheat Data	22
Express Select Selection Tool.....	22
Order Summary Sheet.....	23
Sample Specifications	24

© SEMCO LLC 2007-2021. All rights reserved.

The information in this technical guide is furnished for informational use only, is subject to change without notice, and should not be construed as a commitment by SEMCO. SEMCO assumes no responsibility for any errors that may appear in this technical guide. Specifications are subject to change without further notice. Any FläktGroup SEMCO purchase is subject to FläktGroup SEMCO standard terms and conditions.

No part of this publication may be reproduced, stored in a retrieval system or transmitted, in any form or by any means, electronic, mechanical, recording, or otherwise, without the prior written permission of SEMCO.

SEMCO is a registered trademarks of SEMCO LLC. All other trademarks referenced herein are the properties of their respective owners.



THE FV+CM SERIES

The SEMCO FV+CM (Outdoor Air Preconditioner + Coil Module) Series has been specifically designed to complement and attach directly to the FV ‘H’ outdoor air pre-conditioner.

This powerful combination provides an effective solution to the ASHRAE Standard 62 dilemma, providing a significant increase in the outdoor air quantity (5 to 20 cfm/person) without increasing operating costs.

The FV+CM Series is available in five cabinet sizes ranging in airflow capacity from 800 scfm to 9,000 scfm. Each module can be configured for indoor or outdoor installations, and horizontal or vertical airflow.

The FV+CM Series offers several heating and cooling options. The cooling options include either chilled water or DX cooling coils, with options regarding the number of fins per inch and the number of rows. The heating options include hot water or electric coils.

HOW IT WORKS

The SEMCO FV+CM system is a packaged system, which includes supply and exhaust air fans, outdoor and return air filters and SEMCO’s Fusion 3Å total energy recovery wheel and options for chilled water cooling, DX cooling, hot water heating and electric heat. The Fusion 3Å wheel recovers both sensible (temperature) and latent (moisture) energy; it cools and dehumidifies the outdoor air during the cooling season,

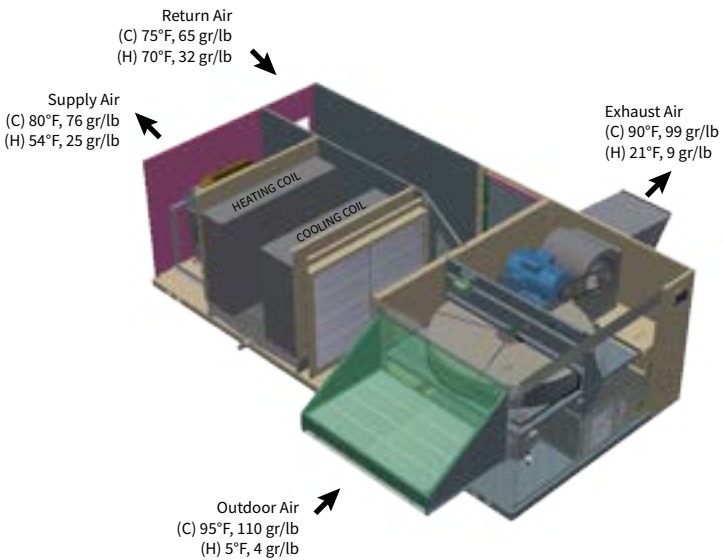
while heating and humidifying the outdoor air in the heating season.

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 air streams, the higher temperature air gives up its sensible energy to the aluminum. This energy is then given up to the cooler air stream 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 air stream without adsorbing the airborne pollutants contained within the air stream. 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’s total energy recovery wheels.

FIGURE 1. A view of the FV+CM Series Pre-conditioner & Coil Module with typical operating temperatures during the cooling (C) and heating (H) season, respectively.



INDOOR AIR QUALITY

PRECONDITIONING

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 SEMCO FV+CM unit provides an effective solution to the ASHRAE Standard 62 dilemma. When a FV+CM 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.

HUMIDITY CONTROL

APPLYING THE FV+CM UNIT

The SEMCO FV+CM Series units are offered in two basic configurations depending on the location of the supply air discharge opening. The H (horizontal) series has the supply and return air openings located on the back of

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.

the unit (See **FIGURE 2**). The V (vertical) series features the supply and return air openings in the floor of the unit (See **FIGURE 3**).

FIGURE 2. FV+CM Series with horizontal airflow application.

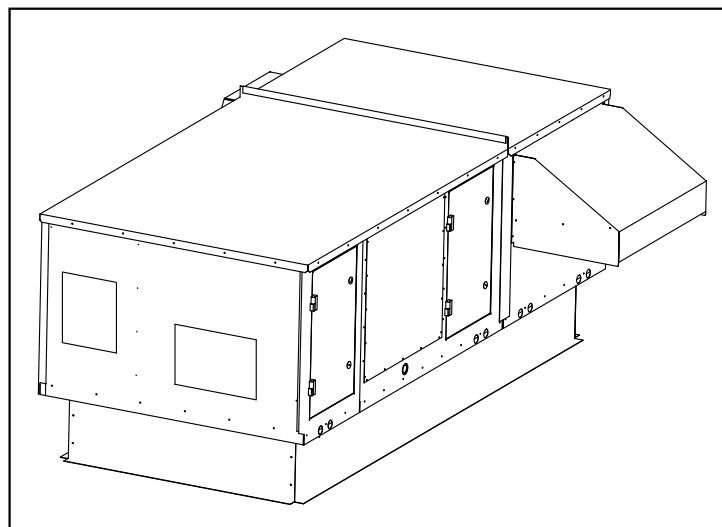
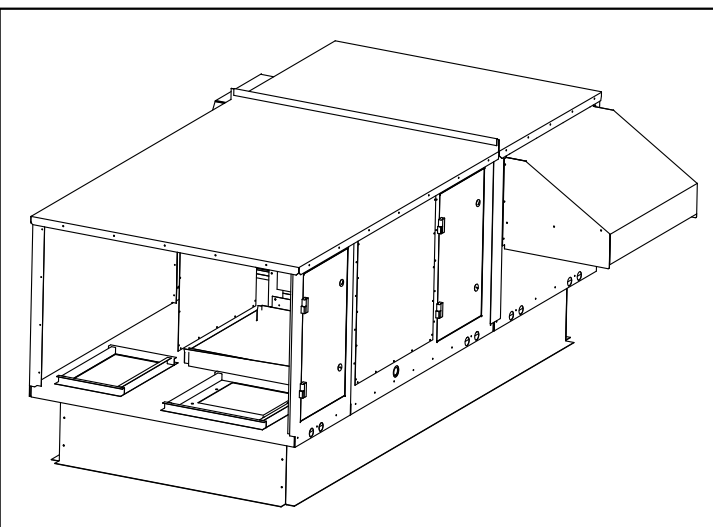


FIGURE 3. FV+CM Series with vertical airflow application.



STANDARD FEATURES

NOVEL SYSTEM DESIGN

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

- 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. Internal piping for coil applications - can be external unless using electric heat.

See **FIGURE 4** on the following page.

1. 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.

2. 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.
- Stainless steel condensate pans.

3. SUPPLY AND EXHAUST AIR FANS

- Sized for quiet and efficient operation.
- Mounted and balanced.
- Multiple motor/sheave selections for efficient adjustment of airflow.
- Optional backward inclined fans for higher static applications.

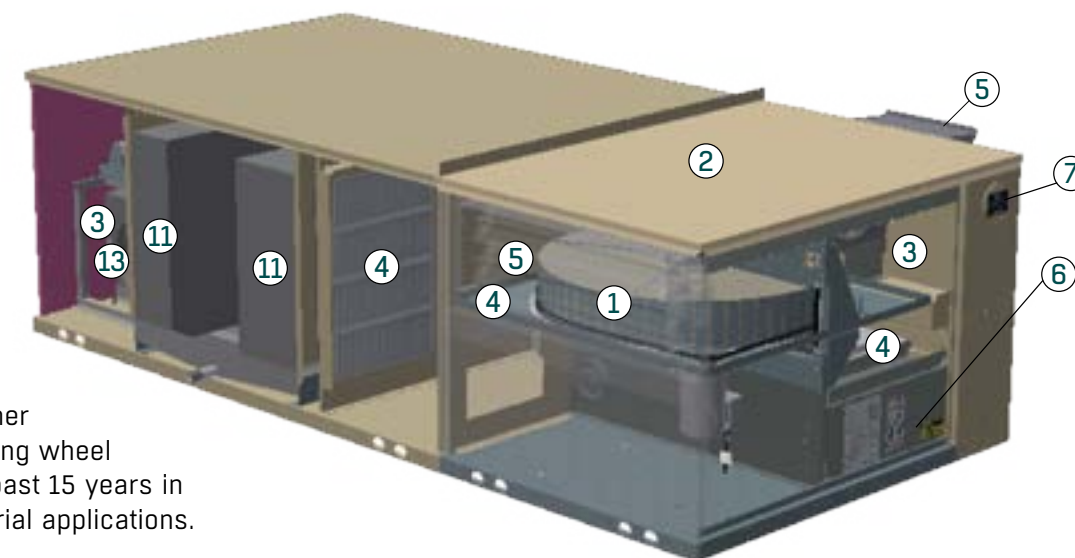


FIGURE 4. FV+CM Preconditioner uses the same high performing wheel technology proven over the past 15 years in large institutional and industrial applications.

4. FILTER SECTIONS

- Filtration provided for both the outdoor air and return air, and coil protection.

5. Hoods and Dampers

- Supply airflow balancing dampers.
- Unit provided with an intake hood with a cleanable filter to limit rain and snow introduction.
- Exhaust air back draft damper on outside units only.

6. Electrical Package with Single Point Connection

OPTIONAL FEATURES

7. AQFlow® Airflow Measuring System

Description

- AQFlow® is a flow measuring system calibrated to convert differential pressure across the total energy wheel into an airflow rate expressed in cubic feet per minute (CFM). Due to the laminar characteristics of the True 3A wheel, it has been found through laboratory testing that the relationship between static pressure across the wheel and the rate of airflow is nearly linear.

Operation

- The system consists of four pressure sensitive tips, located on each of the four wheel quadrants, connected to a 4" round, direct reading, flush mounted static pressure gauge.
- AQFlow effectively determines outdoor and return airflow rates needed for properly balancing an air handling system. You can monitor either outdoor or return air at any given time, depending on the routing of the connection hoses (See Figure 5).

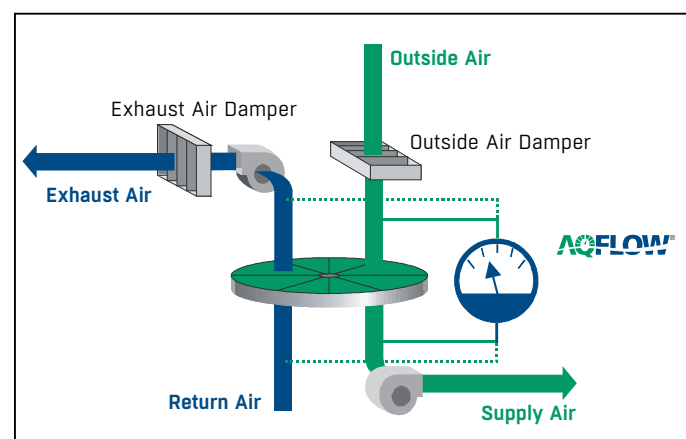
- Accepts contact inputs for supply fan start/stop, wheel start/stop and unit start/stop.
- Separate supply power required for the electric heat option in the coil section.
- Multiple options on input voltage to units:

FV-2000+CM:	208, 240V 1Ø
	208, 240, 480V 3Ø
FV-3000+CM:	208, 240V 1Ø
	208, 240, 480V 3Ø
FV-4000+CM:	208, 240V, 1Ø
	208, 240, 480V 3Ø
FV-5000+CM:	208, 240V, 1Ø
	208, 240, 480V 3Ø
FV-7500+CM:	208, 240, 480V 3Ø

AQFlow Features & Benefits

- Simpler, more accurate system balancing in just five minutes.
- Easy measuring and adjusting outdoor and exhaust air quantities.
- Accurate airflow for the stand alone FV unit or when mounted to a package rooftop unit where measuring outdoor air quantities is difficult.
- Reduced calls to engineers regarding air quantities.

FIGURE 5. Schematic of AQFlow airflow monitoring system.



- Peace of mind that proper ventilation is being provided to building occupants.
- Quick detection of problems such as dirty filters, motor failure, power outage, etc.
- Meets intent of current ASHRAE standards for monitoring delivered fresh air quantities.
- Airflow quantities are displayed on AQFlow.

With AQFlow, the energy recovery unit can be balanced in three easy steps:

- 1) With the connection hoses attached to the return air side and the unit operating, adjust the balancing damper on the exhaust fan outlet until the desired exhaust airflow rate has been attained as indicated by AQFlow.
- 2) Turn the energy recovery unit OFF and reroute the AQFlow connection hoses from the return air side to supply air side.
- 3) Turn the energy recovery unit OFF to adjust the outside air damper, accessed through the main door. Turn the unit ON to read the AQFlow. Repeat until the desired supply air flow rate is indicated by AQFlow.

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

8. Electrical Preheat (not shown)

An electric preheat coil can be provided to avoid frosting conditions for installations in cold climates, which have high indoor humidity design conditions. Electrical preheat is mounted on the FV rather than the Coil Module and is designed to protect the wheel. Dimensions shown on page 15.

9. Thermostat Frost Protection (not shown)

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

10. Control Package Option (not shown)

- 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.
- Wheel Frost Protection** allows the wheel only to be stopped by the stop/jog economizer at a predetermined outdoor temperature in applications where a preheat coil or thermostat shut-off of the CM unit is not desired.
- Rotation Detector Sensor** provides an alarm signal indicating failure of the wheel rotation.

11. Coil Options

- Chilled water (CW), DX and Hot water (HW) coils – a wide variety of coil construction options to satisfy a wide range of heating cooling demands (See chart on page 12 for configuration options).
- Electric heat only.
- Cooling coil with electric heat in preheat position.
- Water & DX coils in either position (limit 2 coils per cabinet).

12. Electric Heating Coils (see page 15)

- Enclosed and open element styles available. Electric heat comes standard with SCR control, staged control optional. The electric heat option requires a separate power feeder connection in addition to the power connection for the main unit electrical panel.

13. Backward Inclined Fan

- Double width, double inlet backward inclined fan available for higher static applications.

BENEFITS PROVIDED

Economical Compliance with ASHRAE Standard 62

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, 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+CM 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+CM preconditioner 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+CM 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 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+CM 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+CM 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 preconditioner ducted directly to a single unitary HVAC system (See **Figures 2 and 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+CM preconditioning solves this problem by providing moderated supply air conditions, even as the heating/cooling source is cycled on and off.

Heating and Cooling in One Cabinet

Simple integration with single source responsibility.

SELECTION PROCEDURE

SEE ALSO EXPRESS SELECT SELECTION TOOL ON PAGE 22

1. Choose a Unit Size

Use the unit capacity/wheel face area (See **Table 1**) 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. 2000 cfm of supply air and 1800 cfm of exhaust air is required. Select model FV-2000+CM based on the 2000 cfm flow volume.

2. Select Fan Motor

Select motors using the fan tables in the Express Select selection software. Contact FläktGroup SEMCO to gain access to the web-based software. 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+CM, 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 **Table 1** 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 **Table 1** to determine face velocity. Enter **Table 2** 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 **Table 2** and the calculated airflow ratio, enter **Table 3** on page 8 to obtain the corrected supply air efficiency for unequal airflow applications.

EXAMPLE. From **Table 1**, the FV-2000+CM 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 **Table 2** the base effectiveness is 70 percent. Using the base effectiveness and an airflow ratio of 1.11 (2000cfm/1800cfm) from **Table 3** determines the supply side efficiency to be 67.9%.

TABLE 1. Airflow Range and Energy Wheel Area.

Model	Airflow Range (scfm)	Wheel Face Area (ft²/side)
FV-2000+CM	800-2000	2.60
FV-3000+CM	1800-3000	4.13
FV-4000+CM	2600-4000	5.0
FV-5000+CM	2600-6200	6.27
FV-7500+CM	4500-9000	9.10

TABLE 2. 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

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

TABLE 3. 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 Equation 1. 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 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 Equation 1 to calculate the wet bulb temperature.

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

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

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 Equation 1, 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.

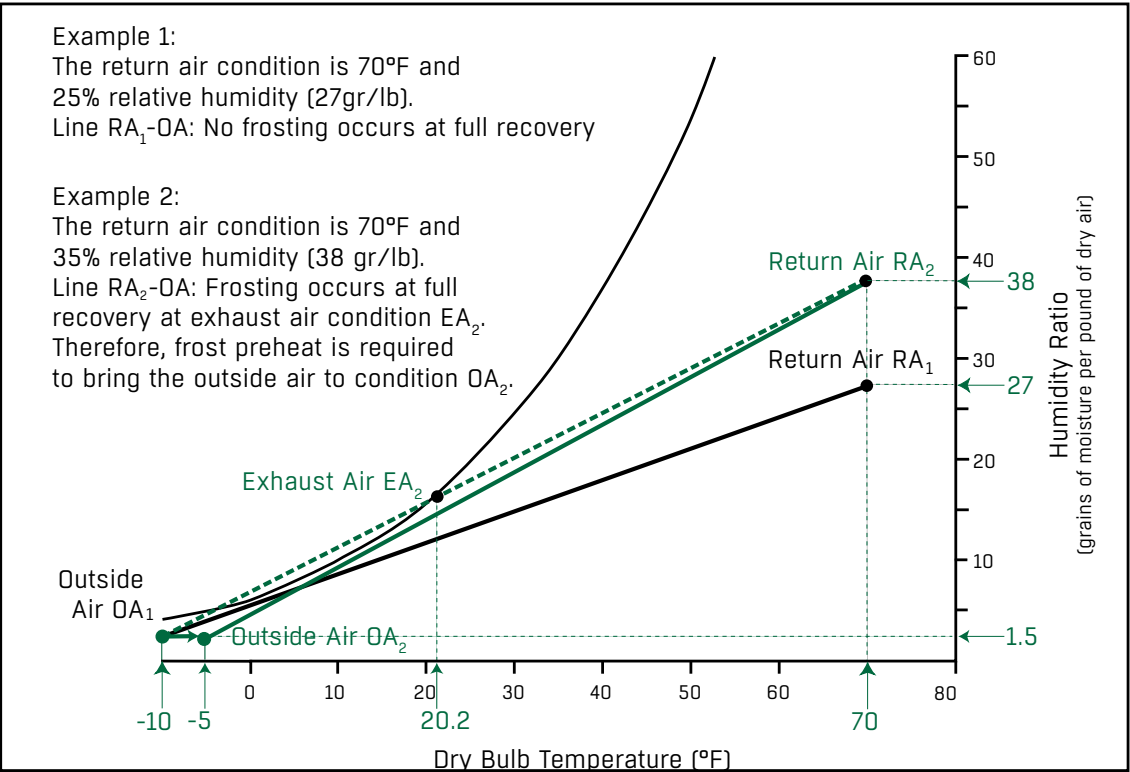
5. Determine if Frost Protection is Required

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 6). 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 6. Using the psychrometric chart to determine the need for preheat frost control.



6. Determine Dimensional and Electrical Data

The FV+CM unit can be installed in one of two possible configurations depending on the arrangement of the supply and return air openings.

The FV+CM-V (vertical) configuration is selected when the 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+CM-H (horizontal) configuration is selected when the 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 is provided on pages 11 through 13. When noting dimensional information, only the

supply and return outlet locations change between the FV+CM-H and FV+CM-V configurations. All other dimensions remain the same.

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

The electrical data is determined on page 20, equations 2 and 3. 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 Table 7, page 22.

EXAMPLE. If 240V/1Ø power is available then the required minimum circuit ampacity and maximum over-current protection are determined as follows. For the FV-2000+CM with the motors selected in step 2 and no electric preheat, the minimum circuit ampacity is calculated using Equation 2a on page 20.

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 Equation 3 on page 20.

2.25 * FLA largest fan motor = 27.0 (2.25*12)

+ FLA other fan motor = 12.0

+ FLA wheel drive/accessories = 1.25

MOP = 40.25

6. Determine Fan Data

See the Express Select web-based selection tool for fan data. It is available at www.semcohvac.com. Contact FläktGroup SEMCO for access to the program.

7. Summarize Selection Information

An order summary sheet is provided on page 23 which helps organize the performance data when ordering a FV+CM unit and simplifies the design schedule preparation process.

CURB MOUNTING

The FV+CM 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 unit are listed below.

The FV+CM-H and the FV+CM-V have the same curb dimensions. The curb can be provided by SEMCO or purchased from a curb manufacturer provided it is designed to support the weight of the unit specified in this manual and conforms to the dimensions listed in the table below.

FIGURE 7. Curb dimensions.

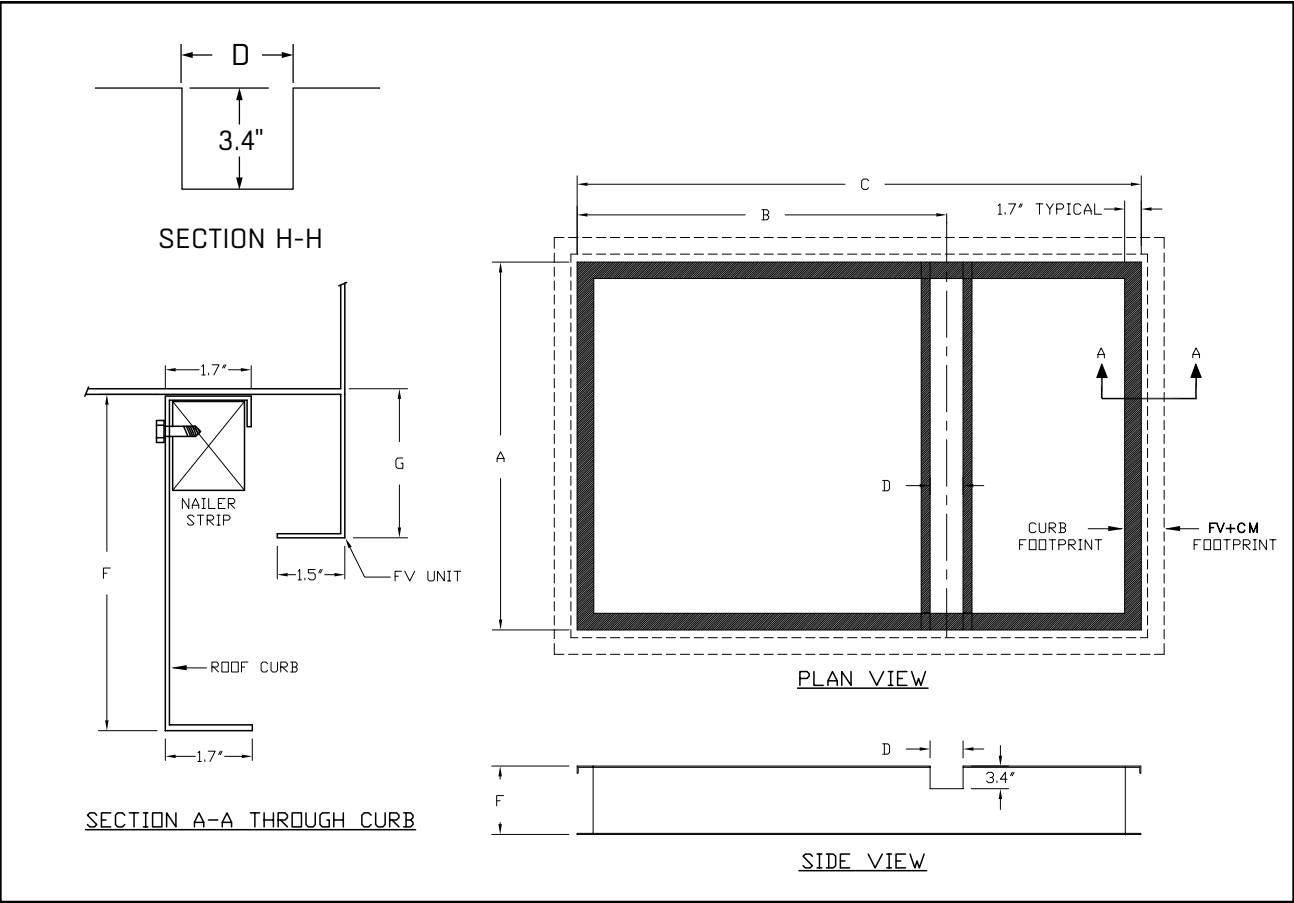
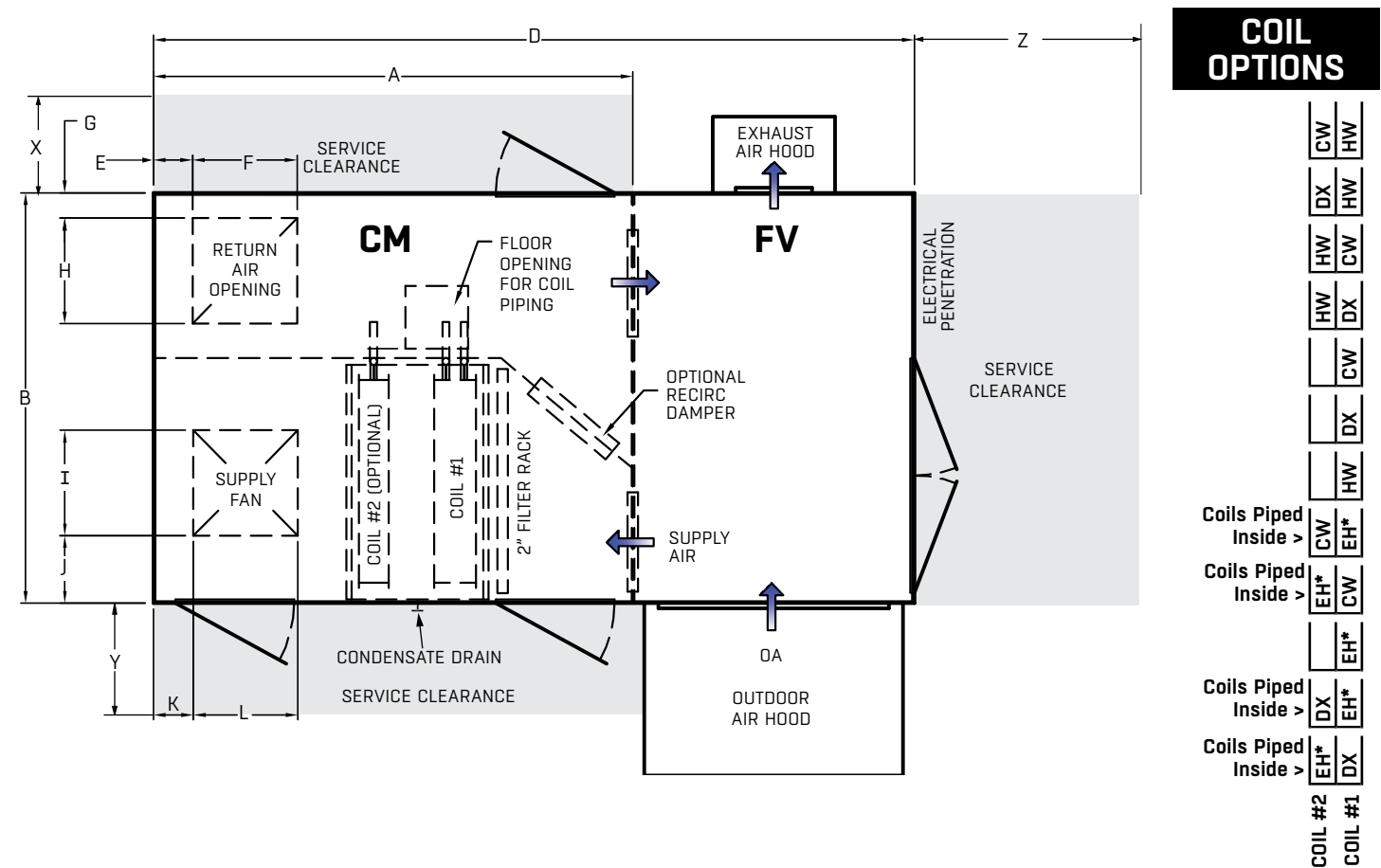


TABLE 4. Curb dimensions.

Model #	A	B	C	D	E	F	G
FV-2000+CM	47.4	70.0	104.9	4.1	1.7	14.0	2.0
FV-3000+CM	60.6	81.9	124.8	4.1	1.7	14.0	3.0
FV-4000+CM	74.6	89.9	141.8	4.1	1.7	14.0	3.0
FV-5000+CM	74.6	89.9	141.8	4.1	1.7	14.0	3.0
FV-7500+CM	91.1	89.9	152.4	4.1	1.7	14.0	3.0
High Static FV-7500+CM	91.1	99.7	162.2	4.1	1.7	14.0	3.0

All dimensions in inches.

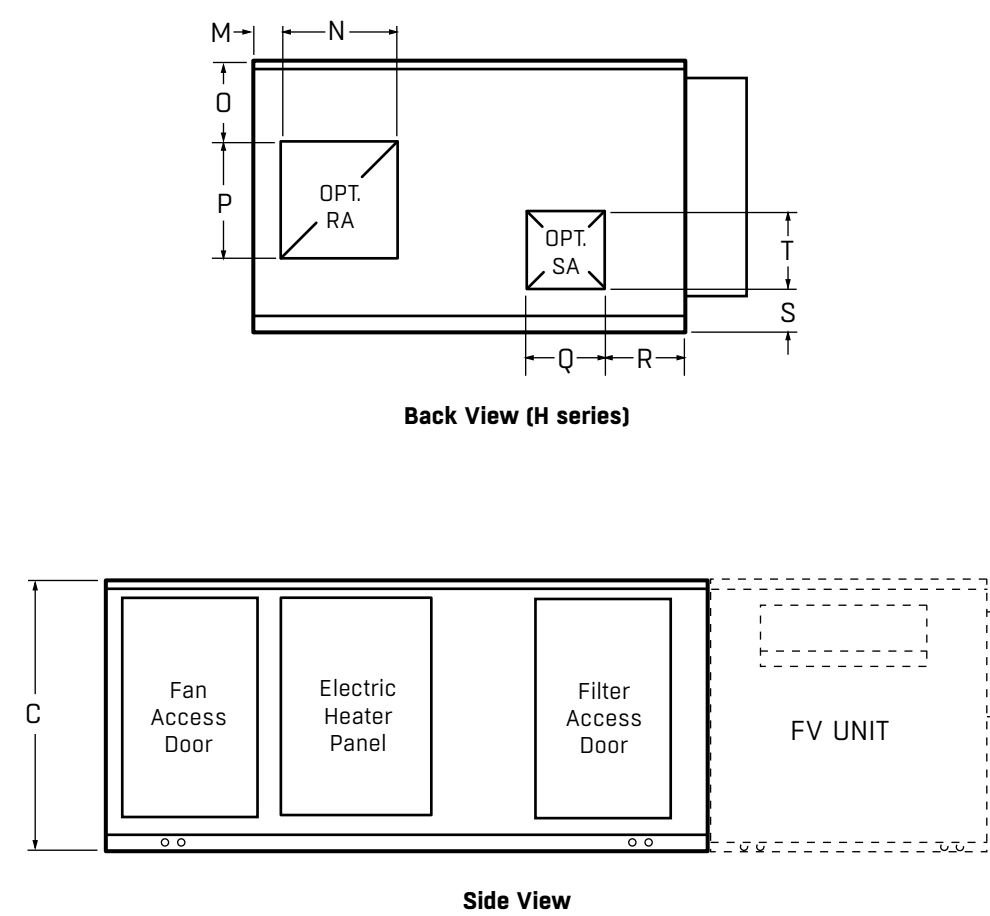
UNIT DIMENSIONS: PLAN VIEW



*See page 15 for electric heat depiction.

Model #	Net Wt. (lbs.)	Dimensions (inches)												
		A	B	C	D	E	F	G	H	I	J	K	L	M
FV-2000+CM	550*	72.0	51.5	32.4	109.0	4.5	18.0	4.5	10.0	12.0	11.4	3.5	10.4	2.7
FV-3000+CM	900*	84.0	64.8	47.7	129.0	10.0	17.0	7.0	17.0	13.1	12.6	4.9	11.4	7.0
FV-4000+CM	1300*	92.0	78.8	51.5	146.0	7.9	20.0	5.3	19.0	14.6	16.4	4.0	13.4	5.3
FV-5000+CM	1300*	92.0	78.8	51.5	146.0	7.9	20.0	5.3	19.0	18.6	16.4	4.0	15.9	5.3
FV-7500+CM	1850*	92.0	95.3	58.6	156.6	7.9	27.3	5.1	23.0	18.6	22.3	4.0	15.9	3.3
High Static FV-7500+CM	1850*	101.8	95.3	58.6	166.4	7.9	27.3	5.1	23.0	22.4	20.4	10.6	22.5	3.3

UNIT ARRANGEMENT H SERIES: BACK & SIDE VIEW



Model #	Dimensions (inches)									
	N	O	P	Q	R	S	T	X	Y	Z
FV-2000+CM	12.6	10.0	14.2	11.8	11.5	5.0	10.3	24.0	44.0	37.0
FV-3000+CM	17.0	6.8	17.0	13.1	12.6	9.6	11.4	24.0	44.0	45.0
FV-4000+CM	19.0	17.2	20.0	14.6	16.4	10.2	13.4	24.0	44.0	54.0
FV-5000+CM	19.0	17.2	20.0	18.6	16.4	12.2	15.9	24.0	44.0	54.0
FV-7500+CM	25.0	18.9	25.0	18.6	22.3	11.5	15.9	24.0	54.0	64.6
High Static FV-7500+CM	25.0	18.9	25.0	22.4	19.8	13.6	22.0	24.0	54.0	64.6

INDOOR FILTER ASSEMBLY

FIGURE 8. Schematic of the indoor filter assembly.

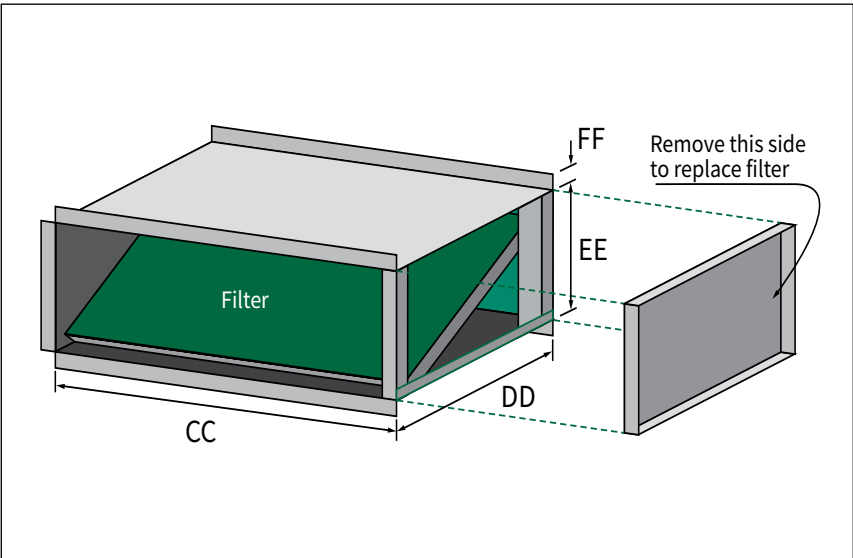


FIGURE 9. Front view of the FV Preconditioner with attached indoor filter assembly.

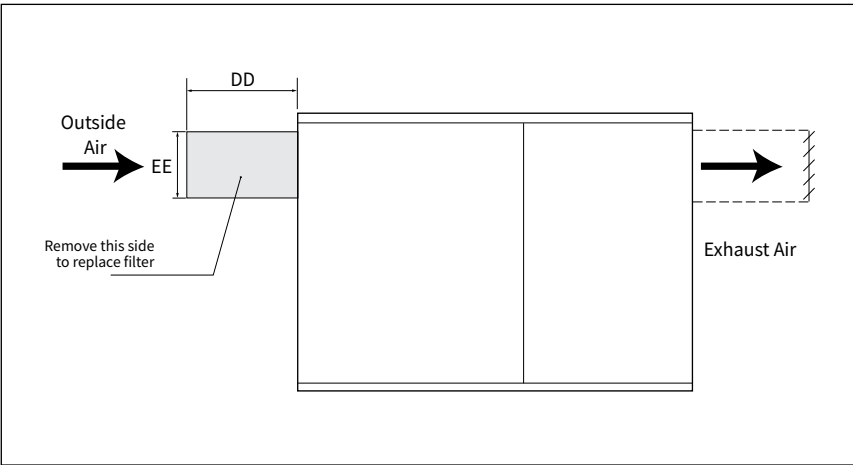


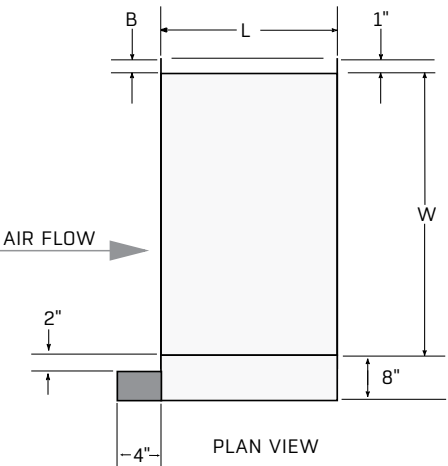
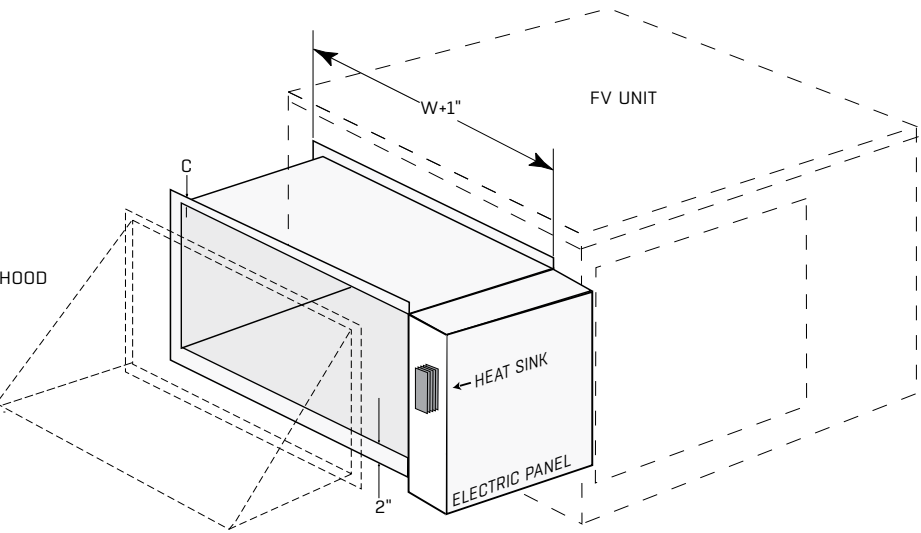
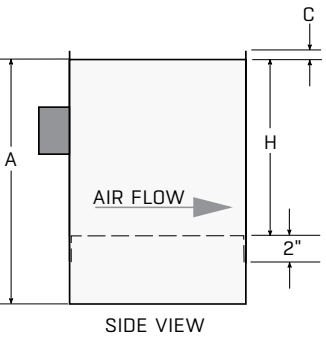
TABLE 5. Indoor filter assembly dimensions.

Model #	Dimensions (inches)			
	CC	DD	EE	FF
FV-2000+CM	32.1	24.0	12.3	0.8
FV-3000+CM	40.0	20.3	16.2	0.8
FV-4000+CM	50.0	20.8	18.1	0.8
FV-5000+CM	50.0	20.8	18.1	0.8
FV-7500+CM	59.0	18.8	23.0	0.8

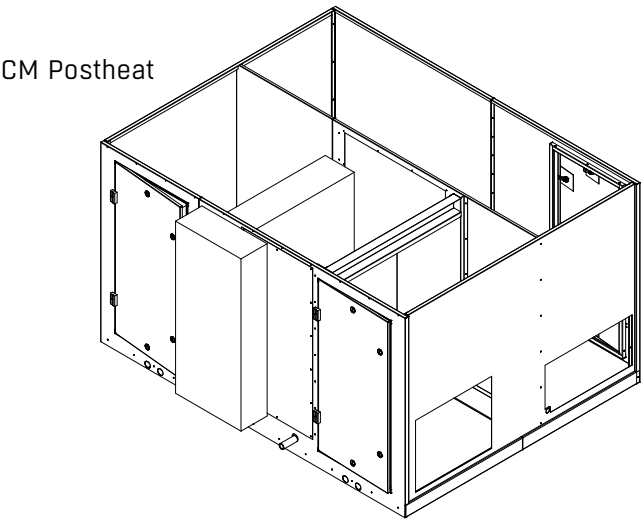
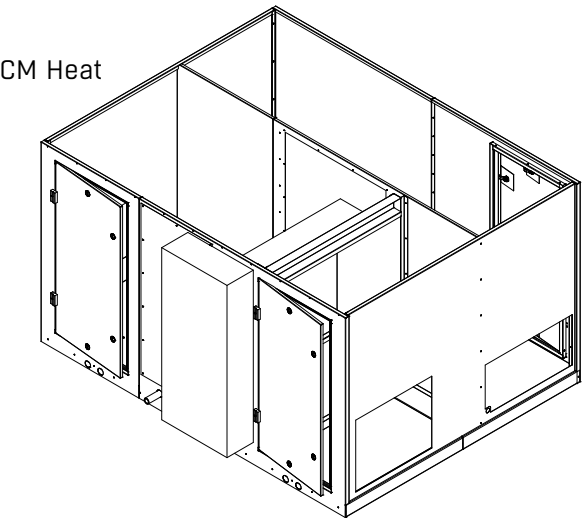
FV ELECTRIC PREHEAT LAYOUT

Model #	W	H	L	A	B	C
FV-2000+CM	31.1	11.0	14.0	20.0	1.0	2.0
FV-3000+CM	39.1	16.0	20.0	40.0	1.0	2.0
FV-4000+CM	49.1	17.0	20.0	40.0	1.0	2.0
FV-5000+CM	49.1	17.0	20.0	40.0	1.0	2.0
FV-7500+CM	56.0	24.0	20.0	40.0	3.0	2.0

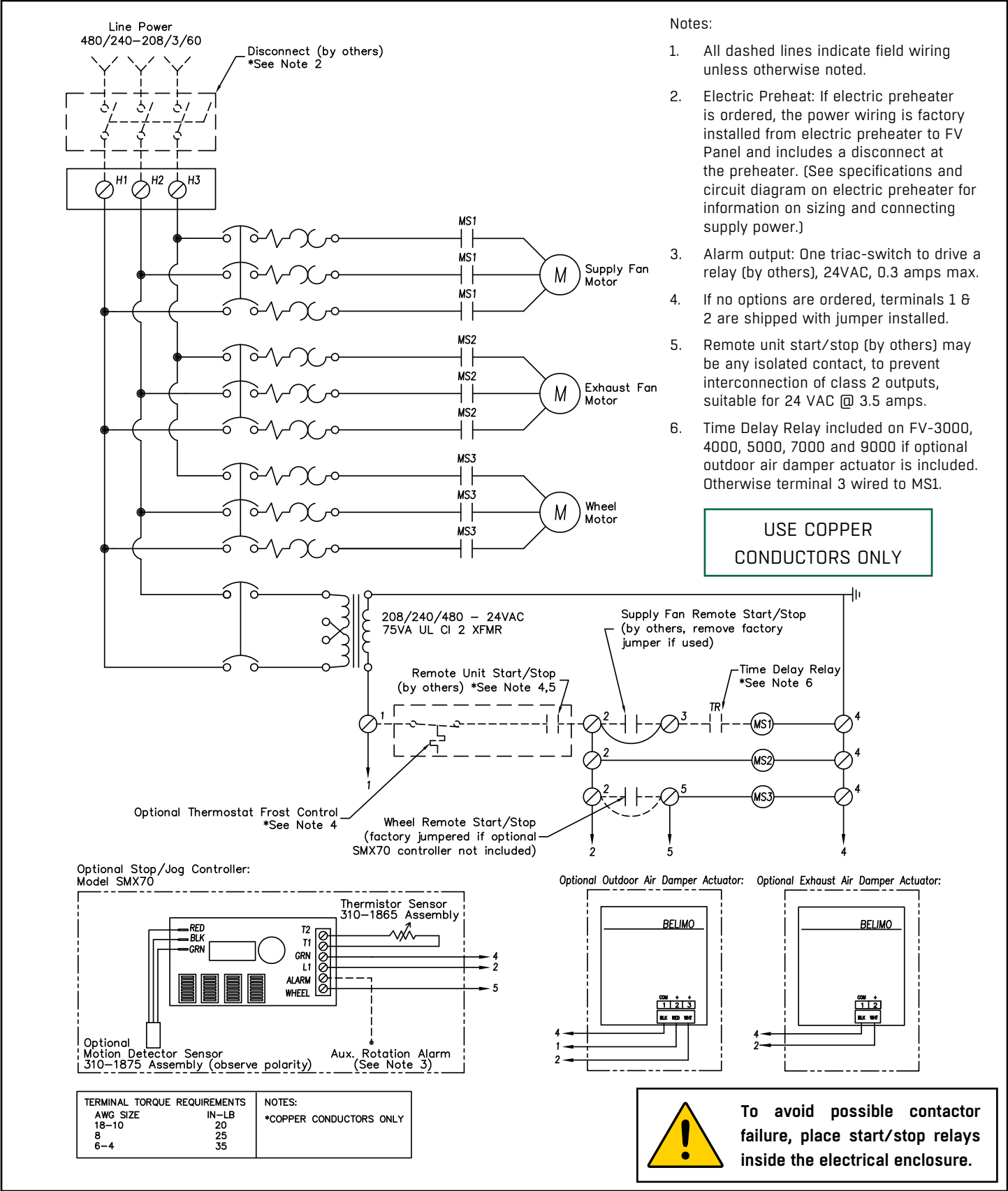
All dimensions in inches.



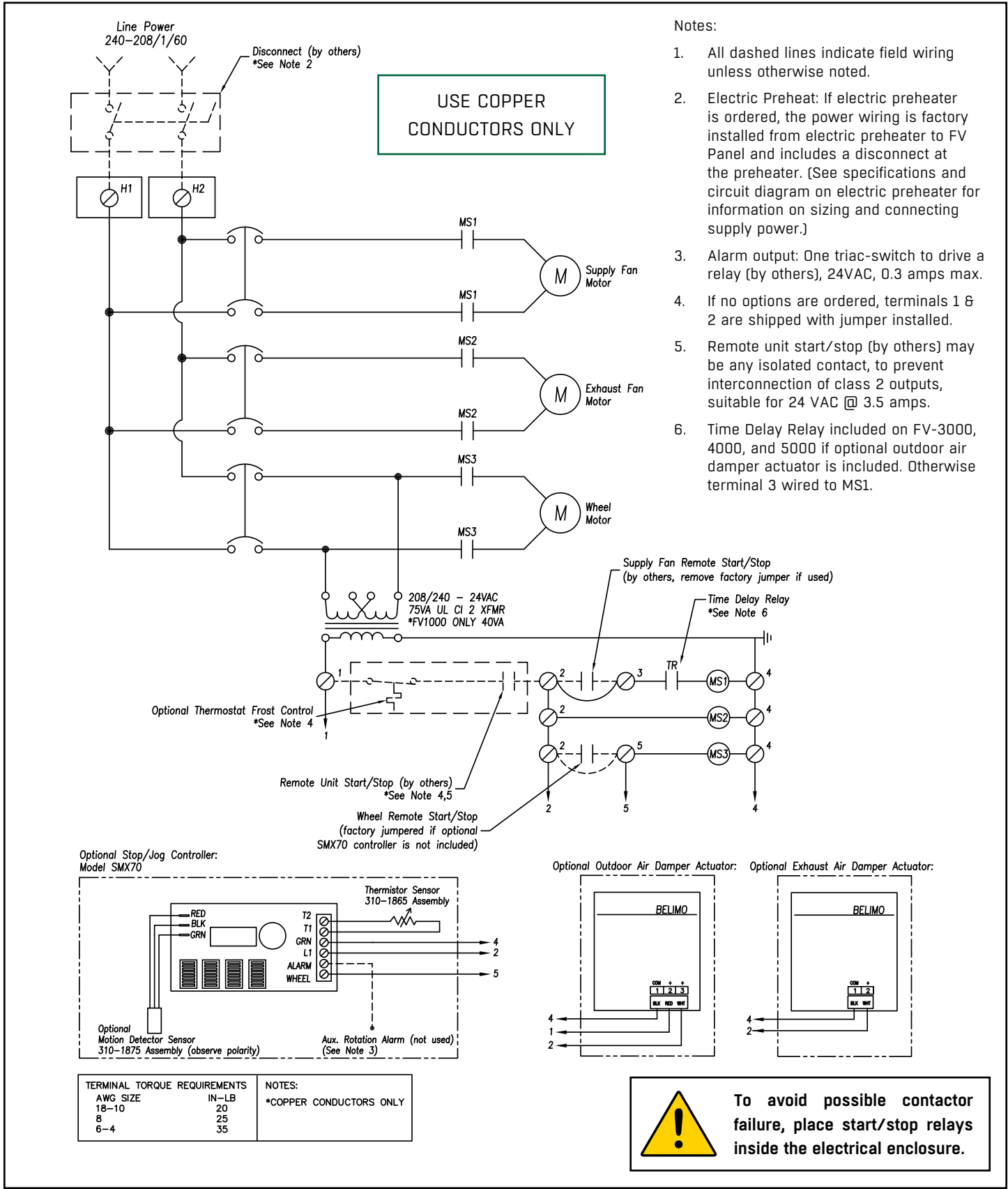
CM Electric Heating



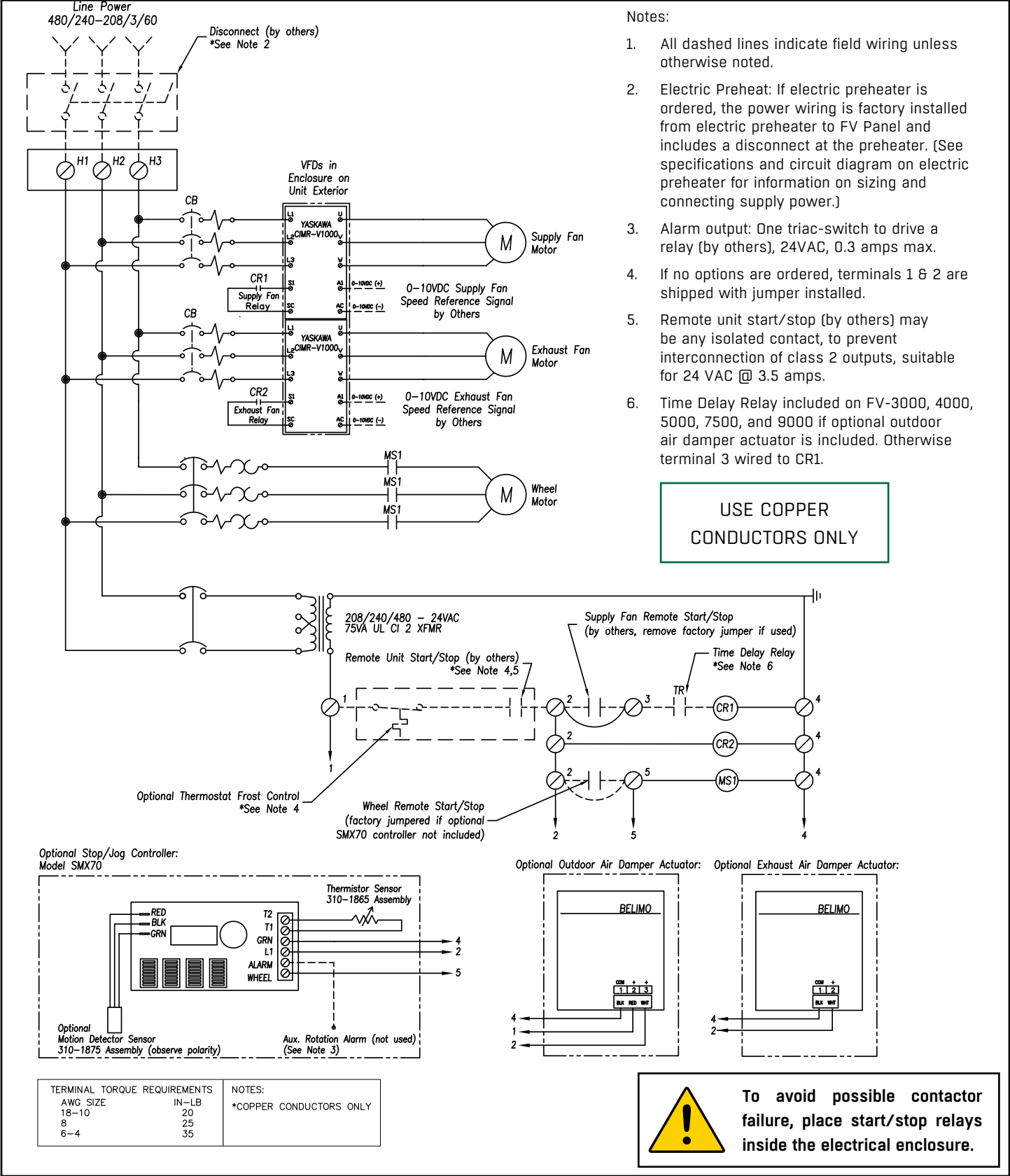
3Ø CIRCUIT DIAGRAM, FV-2000+CM THROUGH FV-7500+CM



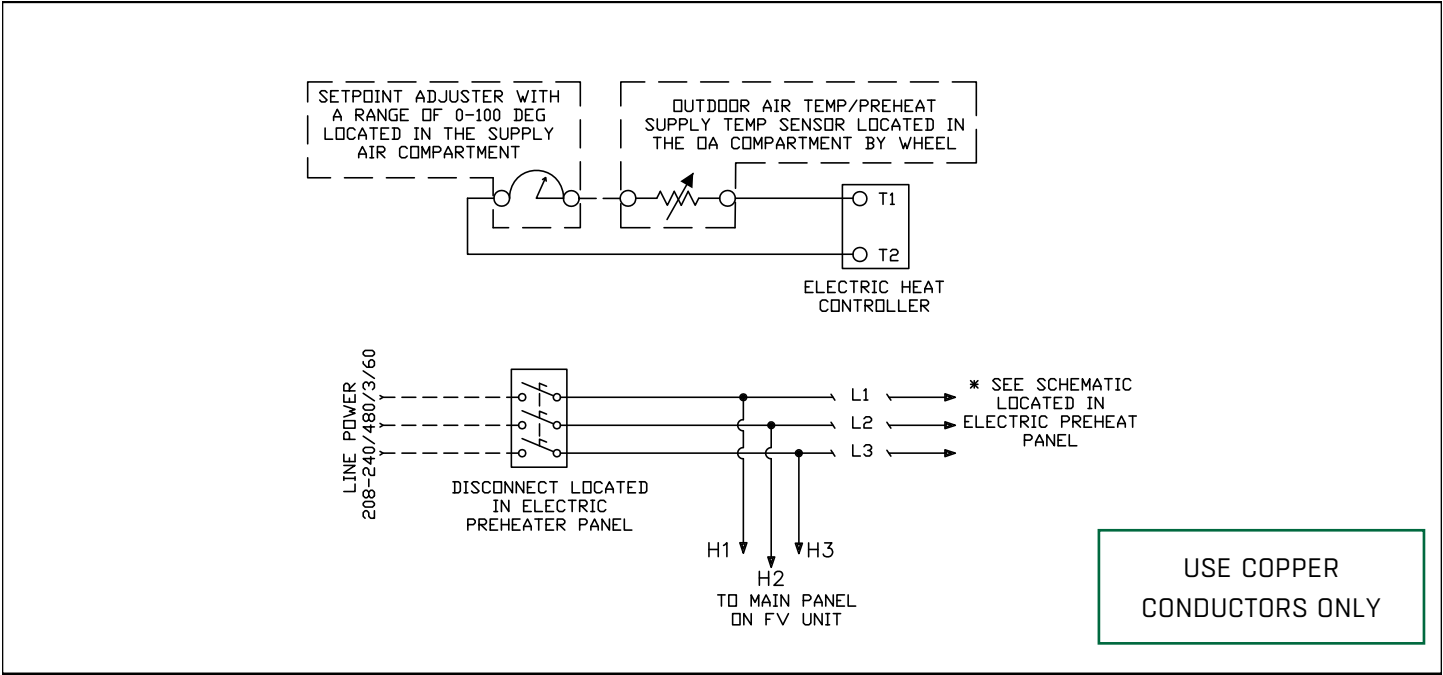
1Ø CIRCUIT DIAGRAM, FV-2000+CM THROUGH FV-5000+CM



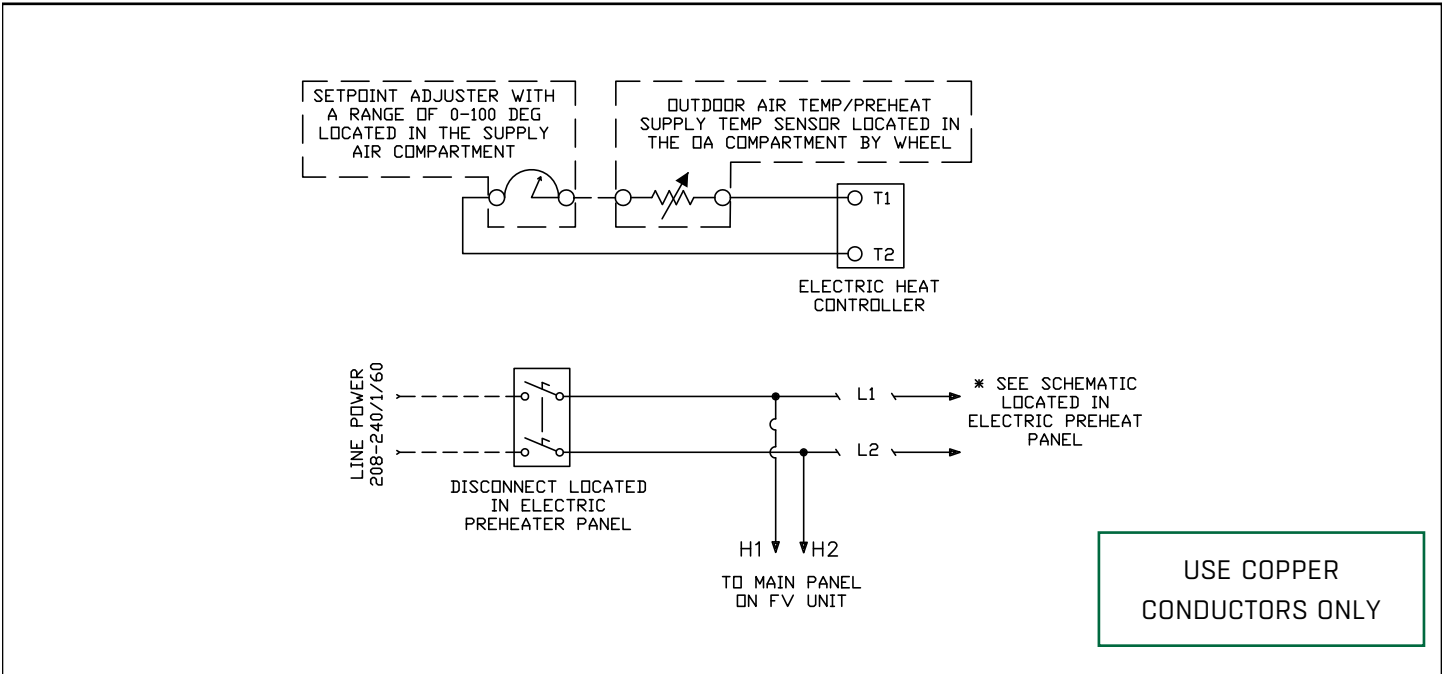
3Ø CIRCUIT DIAGRAM, FV-2000+CM THROUGH FV-7500+CM W/ VFD



3Ø ELECTRIC PREHEAT FROST CONTROL CIRCUIT DIAGRAM



1Ø ELECTRIC PREHEAT FROST CONTROL CIRCUIT DIAGRAM



NEUTRAL LEGEND		TERMINAL TORQUE REQUIREMENTS		NOTES:	*THIS STYLE OF DASHED LINE INDICATES ITEMS THAT ARE REMOTE TO SEMCO ELECTRICAL/CONTROL PANELS, ITEMS THAT REFERENCE DWG FOOTNOTES AND DETAIL DWGS.
115V - WHITE		AWG SIZE	IN-LB		
115V - GFI PROTECTED - GREY		18-10	20		
24V - YELLOW		8	25		
		6-4	35	*COPPER CONDUCTORS ONLY	*THIS STYLE OF DASHED LINE REPRESENTS FIELD WIRING BY OTHER THAN SEMCO.
				*CONTROL POWER MUST NOT LEAVE MAIN CONTROL PANEL.	

ELECTRICAL DATA

Select motors using the fan tables in the Express Select selection software. Contact your regional sales manager or FläktGroup SEMCO support team to gain access to the web-based software. For the unit and motors selected, **Table 6** will have the corresponding full load amps (FLA) for each motor.

To determine minimum circuit ampacity (MCA):

- 1.25 * FLA largest fan motor (Table 6)
- + FLA other fan motor (Table 6)
- + FLA wheel drive/ accessories (Table 6)

= MCA

EQUATION 2A. Formula to determine minimum circuit ampacity (MCA) without pre-heater.

To determine minimum circuit ampacity (MCA):

- FLA exhaust fan motor (Table 6)
- + FLA supply fan motor (Table 6)
- + FLA wheel drive/ accessories (Table 6)
- + FLA optional preheater (Table 7)
- * 1.25

= MCA

EQUATION 2B. Formula to determine minimum circuit ampacity (MCA) with preheater.

To determine maximum overcurrent protection (MOP):

- 2.25 * FLA largest fan motor (Table 6)
- + FLA other fan motor (Table 6)
- + FLA wheel drive/ accessories (Table 6)
- + FLA optional preheater (Table 7)

= MOP

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

EQUATION 3. Formula to determine maximum overcurrent protection (MOP).

TABLE 6. Electric Unit Data, Full Load Power Draw

	Full Load Power Draw (Amps)					
Unit	Motor Size (hp)	208V/1Ø	240V/1Ø	208V/3Ø	240V/3Ø	480V/3Ø
FV-2000+CM FV-3000+CM FV-4000+CM FV-5000+CM FV-7500+CM	1/3	4.0	3.6	1.7	1.6	0.8
	3/4	7.6	6.9	3.5	3.2	1.6
	1-1/2	11.0	10.0	6.6	6.0	3.0
	2	13.2	12.0	7.5	6.8	3.4
	3	-	-	10.6	9.6	4.8
	5	-	-	16.7	15.2	7.6
	7.5	-	-	24.2	22.0	11.0
	10	-	-	30.8	28.0	14.0
	15	-	-	46.2	42.0	21.0
	Wheel drive/ accessories	1.25	1.25	1.1	1.1	0.5

ELECTRICAL PREHEAT DATA

An electric preheat coil is an available option for all FV+CM 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 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.

Table 7 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 SEMCO representative to assure proper sizing.

TABLE 7. Electric preheat full load power draw data.

			Full Load Power Draw (Amps)				
Model	Optional Electric Preheater (kW)	Temperature Rise @ Full kW (°F)	208V/1Ø	230V/1Ø	208/V3Ø	230V/3Ø	460V/3Ø
FV-2000+CM	7.5	12-30	7.65 / 36.8	7.50 / 31.3	7.65 / 21.2	7.50 / 18.0	7.50 / 9.0
FV-3000+CM	13.5	14-24	13.60 / 65.4	13.50 / 56.3	13.50 / 37.5	13.50 / 32.5	13.50 / 16.2
FV-4000+CM	15.0	12-17	15.00 / 72.1	15.00 / 62.5	15.00 / 41.6	15.00 / 36.1	15.00 / 18.0
FV-5000+CM	15.0	9-16	15.00 / 72.1	15.00 / 62.5	15.00 / 41.6	15.00 / 36.1	15.00 / 18.0
FV-7500+CM	23.0	9-16	-	-	22.50 / 62.5	23.00 / 55.4	23.00 / 27.7

EXPRESS SELECT SELECTION TOOL

Visit www.semcohvac.com to utilize the web-based Express Select selection tool. Contact your regional sales manager or FläktGroup SEMCO support team to gain access to the software.



ORDER SUMMARY SHEET for FV Preconditioner + Coil Module Series					
JOB NAME: _____			UNIT TAG: _____		
FV+CM MODEL/ARRANGEMENT:	FV-2000+CM ☐ HORIZONTAL (opt) ☐ VERTICAL (std)	FV-3000+CM ☐ HORIZONTAL (opt) ☐ VERTICAL (std)	FV-4000+CM ☐ HORIZONTAL (opt) ☐ VERTICAL (std)	FV-5000+CM ☐ HORIZONTAL (opt) ☐ VERTICAL (std)	FV-7500+CM ☐ HORIZONTAL (opt) ☐ VERTICAL (std)
UNIT VOLTAGE:	☐ 208V/1PH ☐ 240V/1PH ☐ 208V/3PH ☐ 240V/3PH ☐ 480V/3PH	☐ 208V/1PH ☐ 240V/1PH ☐ 208V/3PH ☐ 240V/3PH ☐ 480V/3PH	☐ 208V/1PH ☐ 240V/1PH ☐ 208V/3PH ☐ 240V/3PH ☐ 480V/3PH	☐ 208V/1PH ☐ 240V/1PH ☐ 208V/3PH ☐ 240V/3PH ☐ 480V/3PH	☐ 208V/3PH ☐ 240V/3PH ☐ 480V/3PH
SUPPLY STATIC: OUTSIDE AIR CFM:					
HIGH STATIC FAN: (Supply Fan Only)	☐ NO ☐ YES	☐ NO ☐ YES	☐ NO ☐ YES	☐ NO ☐ YES	☐ NO ☐ YES
RETURN STATIC: EXHAUST AIR CFM:					
LOCATION: (Indoor deletes hoods and adds OA duct adapter)	☐ INDOOR ☐ OUTDOOR	☐ INDOOR ☐ OUTDOOR	☐ INDOOR ☐ OUTDOOR	☐ INDOOR ☐ OUTDOOR	☐ INDOOR ☐ OUTDOOR
WHEEL FROST PROTECTION ELECTRIC PREHEAT (kW): (Includes unit disconnect)	☐ NONE ☐ 7.5	☐ NONE ☐ 13.5	☐ NONE ☐ 15	☐ NONE ☐ 15	☐ NONE ☐ 23
DISCONNECT: (Non-fused & ships loose)	☐ NO ☐ YES	☐ NO ☐ YES	☐ NO ☐ YES	☐ NO ☐ YES	☐ NO ☐ YES
CONTROL PACKAGE: w/ Stop/Jog Economizer & Low Temp Frost Protection (SMX-70)	☐ NO ☐ YES	☐ NO ☐ YES	☐ NO ☐ YES	☐ NO ☐ YES	☐ NO ☐ YES
WHEEL FREEZE PROTECTION: (On-Off Thermostat)	☐ NO ☐ YES	☐ NO ☐ YES	☐ NO ☐ YES	☐ NO ☐ YES	☐ NO ☐ YES
PAINT OPTION: (1,000-Hr Salt Spray Enamel)	☐ NO ☐ YES	☐ NO ☐ YES	☐ NO ☐ YES	☐ NO ☐ YES	☐ NO ☐ YES
AQFLOW GAUGE:	☐ NO ☐ YES	☐ NO ☐ YES	☐ NO ☐ YES	☐ NO ☐ YES	☐ NO ☐ YES
OA DAMPER ACTUATOR:	☐ NO ☐ YES	☐ NO ☐ YES	☐ NO ☐ YES	☐ NO ☐ YES	☐ NO ☐ YES
ROOF CURB: (Non-insulated)	☐ NO ☐ YES	☐ NO ☐ YES	☐ NO ☐ YES	☐ NO ☐ YES	☐ NO ☐ YES
COOLING COIL TYPE:	☐ WATER ☐ DX ☐ DX INTERLACED ☐ NONE	☐ WATER ☐ DX ☐ DX INTERLACED ☐ NONE	☐ WATER ☐ DX ☐ DX INTERLACED ☐ NONE	☐ WATER ☐ DX ☐ DX INTERLACED ☐ NONE	☐ WATER ☐ DX ☐ DX INTERLACED ☐ NONE
COOLING COIL MODEL #:					
HEATING COIL TYPE:	☐ WATER ☐ ELECTRIC ☐ NONE	☐ WATER ☐ ELECTRIC ☐ NONE	☐ WATER ☐ ELECTRIC ☐ NONE	☐ WATER ☐ ELECTRIC ☐ NONE	☐ WATER ☐ ELECTRIC ☐ NONE
HEATING COIL MODEL #: (water only)					
ELECTRIC HEATER SIZE (kW):					
HEATING COIL POSITION:	☐ PREHEAT ☐ REHEAT	☐ PREHEAT ☐ REHEAT	☐ PREHEAT ☐ REHEAT	☐ PREHEAT ☐ REHEAT	☐ PREHEAT ☐ REHEAT
RECIRCULATION DAMPER:	☐ NO ☐ YES	☐ NO ☐ YES	☐ NO ☐ YES	☐ NO ☐ YES	☐ NO ☐ YES
RECIRC DAMPER ACTUATOR:	☐ NO ☐ YES	☐ NO ☐ YES	☐ NO ☐ YES	☐ NO ☐ YES	☐ NO ☐ YES
RA FILTERS: (Choose 1)	☐ STD 1" ALUMINUM ☐ 2" MERV 8	☐ STD 1" ALUMINUM ☐ 2" MERV 8	☐ STD 1" ALUMINUM ☐ 2" MERV 8	☐ STD 1" ALUMINUM ☐ 2" MERV 8	☐ STD 1" ALUMINUM ☐ 2" MERV 8
OA Filters (standard 1" aluminium filter included):	☐ Add 2" MERV 8	☐ Add 2" MERV 8	☐ Add 2" MERV 8	☐ Add 2" MERV 8	☐ Add 2" MERV 8
To be completed in full before releasing into production - REQUIRED. ☐ RELEASE FOR PRODUCTION ☐ HOLD FOR APPROVAL					

SAMPLE SPECIFICATIONS

Casing - Standard panels shall be 20 gauge galvanized steel, lined with 1/2 inch thick neoprene insulation where required. 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. The outdoor air intake opening shall be protected by a galvanized steel sheet metal weather hood and include an automatic damper with electric operator. 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 and easily removable access panel. Access panels shall be constructed of the same materials as the unit casing and use 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 motors using belts and sheaves. Motors shall be standard NEMA frame with open drip-proof enclosures. V-belt drives shall be designed for a minimum 1.2 service factor. High static fans available.

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.

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.

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.

Filters - The filters shall be 1 inch thick permanent aluminum washable type mounted in the outside air hood and in the return air plenum. The filters shall be listed by Underwriters' Laboratories as Class 2. MERV 8 2" filter options available.

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 send a 24 volt AC signal suitable for operating a relay to be used as an alarm contact. 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.

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 NEMA 3R electrical panel shall be mounted on the unit exterior for ease of access. Unit shall be ETL listed and labeled.

Chilled Water, Dx And Hot Water Coils - Primary surface shall be round seamless .020-inch thick copper tube on 1.5-inch centers, staggered in the direction of airflow. All joints shall be brazed.

Secondary surface shall consist of .006 inch rippled aluminum plate fins for higher capacity and structural strength. Fins shall have full drawn collars to provide a continuous surface cover over the entire tube for maximum heat transfer. Bare copper tube shall not be visible between fins and the fins shall have no openings punched in them to accumulate lint and dirt. Tubes shall be mechanically expanded into the fins to provide a

continuous primary to secondary compression bond over the entire finned length for maximum heat transfer rates.

Casings shall be constructed of continuous galvanized steel. Coil side plates shall be of reinforced flange type.

Coils shall have equal pressure drop through all circuits. Coils shall be circuited for counter flow heat transfer to provide the maximum heat transfer rates.

Headers on coils shall be seamless copper tubing. The headers shall have intruded tube holes to provide a large brazing surface for maximum strength and inherent flexibility. Supply and return connections on water coils shall be steel with male pipe threads. DX coils shall have copper sweat connections.

The complete coil core shall be tested with 315 psig air pressure under warm water and be suitable for operation at 250 psig working pressures.

Individual tube tests and core tests before installation of headers shall not be considered satisfactory. Water cooling coils shall be circuited for drain ability. Use of internal restrictive devices to obtain turbulent flow shall not be acceptable. Vents and drains shall be furnished on all water coils. Coils shall be rated in accordance with ARI.

Coils shall be mounted in galvanized holding racks. Water coil drain and vent connections are accessible from the interior of the unit. Cooling coils shall be mounted in an insulated pitched 304 stainless steel condensate pan.

Electric Heating Coil - Where scheduled, electric coil shall be either the open element or enclosed element electric resistance type. Heater shall include main disconnect switch, fusing as required, magnetic contactors, control circuit transformer, pressure type air flow interlock switch and manual and auto reset thermal cutout over current protection. The electric coil shall require a separate power feeder connection in addition to the power connection to the main unit electrical panel.

Sole And Exclusive Warranty - Please see the terms and conditions for your order or contact service.semco@flaktgroup.com.

FläktGroup SEMCO delivers smart and energy efficient Indoor Air and Critical Air solutions to support every application area. We offer our customers innovative technologies, high quality and outstanding performance supported by more than fifty years of accumulated industry experience. The widest product range in the market, and strong market presence in 65 countries worldwide, guarantee that we are always by your side, ready to deliver Excellence in Solutions.

FläktGroup SEMCO
Corporate Headquarters
1800 East Pointe Drive
Columbia, Missouri 65201 USA
573.443.1481
sales.semco@flaktgroup.com

To learn more about FläktGroup SEMCO offerings and to contact your nearest representative please visit
www.semcohvac.com

