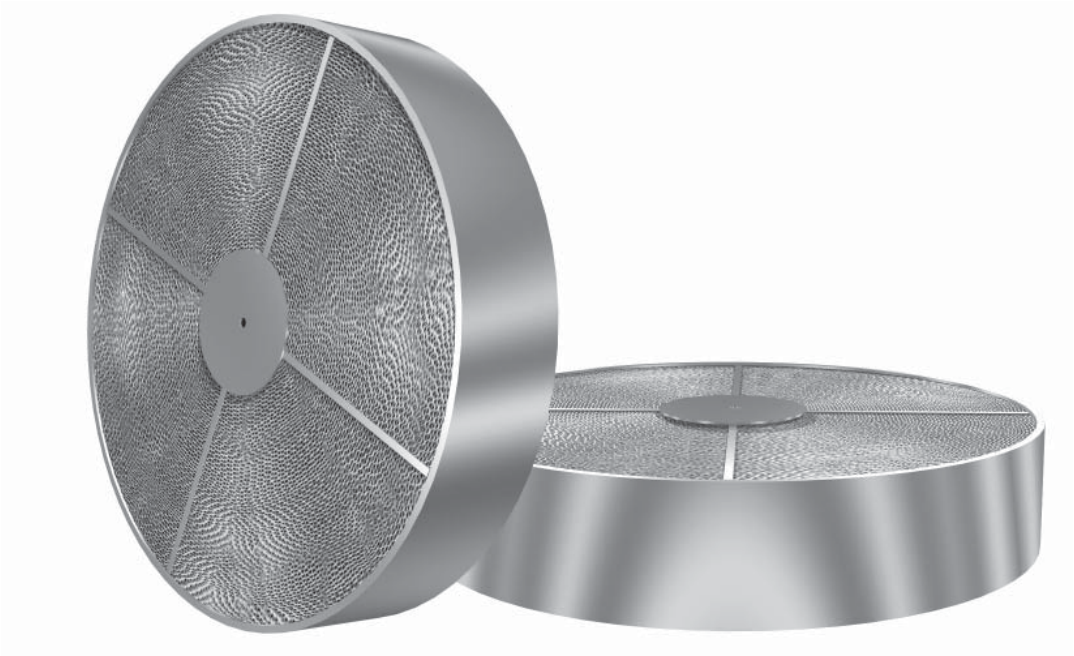
SEMCO®
A FLÄKT WOODS COMPANY

Desiccant Wheel Products

Energy Recovery Wheel



Owner's Manual

Table of Contents

Introduction and Definitions

This manual describes the installation and maintenance of the EXCLU-SIEVE® Energy Recovery Wheel. The descriptions include all optional equipment and devices for the unit currently available from SEMCO. If optional equipment is required after receiving the unit, please contact:

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Before proceeding with handling and installing the Energy Recovery Wheel Unit, review Figures 1 and 2 on page 4 showing the location of important features and devices on the unit. Some of the electronic devices are not shown, as they are located away from the wheel. Each item is described and explained in the following pages of this manual.

Please become familiar with the following definitions:

Adsorption — The process of bonding of water vapor on the surface of the solid desiccant coating of the Energy Recovery Wheel media.

Building side — The face of the Energy Recovery Wheel unit that always faces the inside air ducts (supply and return air.) The purge sector is always located on the building side of the wheel. (See Figure 1.)

Cassette — The stationary framework supporting the wheel. (See wheel.)

Desiccant — A naturally occurring or man-made material with a high affinity for water vapor. SEMCO uses a highly efficient 3Å desiccant material that minimizes cross contamination.

Enthalpy wheel — A common term used to describe all rotating, wheel-shaped devices that transfer sensible (temperature) and latent (water vapor) energy from one air stream to another. The word enthalpy means heat content or total heat. The term enthalpy exchanger may also be used.

Exhaust air — The indoor air that has passed through the Energy Recovery Wheel and is being ducted outdoors.

EXCLU-SIEVE Energy Recovery Wheel Unit — The complete, ready to install assembly consisting of motor, cassette seals, drive hub assembly controller(s) and sensors. Also referred to as a unit.

Heat wheel — This generally describes all rotation devices that transfer sensible-only energy.

Housing — The steel frame, sheet metal and flanges that surround and support the enthalpy wheel.

Inverter — See variable frequency drive.

Gear reducer — A device mounted on the motor to reduce the output rpm's.

Labyrinth seal — A four-pass, rubber seal that closely surrounds the rotor and effectively limits the amount of air that might bypass the media inside the rotor. To prevent binding, the specifically designed seal should not touch the rotor.

Media — The fluted material inside the wheel. The media used in the EXCLU-SIEVE Energy Recovery Wheel is unique and proprietary. The patented desiccant coating on the aluminum surface adsorbs only water vapor, which is transferred to the other air stream.

Outdoor air (OA) — The fresh outside air that passes through the Energy Recovery Wheel unit and is supplied to the inside space of the building.

Outdoor side — See weather side.

Purge — The narrow, triangular metal piece extending from the center of the wheel to its edge. It is located on the building side of the unit. The purge allows a small amount of outdoor air to pass through the media. This effectively removes all exhaust air trapped inside the wheel as a wheel segment moves from the exhaust airside to the supply air side. It prevents contamination of the fresh outdoor air with pollutants contained in the exhaust air stream.

Return air (RA) — Indoor air that is pulled through the Energy Recovery Wheel unit and then exhausted outdoors.

Rotation detector — A device located outside the unit that allows maintenance personnel to determine whether or not the wheel is turning without opening the access panels.

Rotation sensor — A probe located inside the unit that detects whether or not the wheel is turning and transmits that information by electrical pulse to the controller.

Rotor — The media-filled wheel that rotates and transfers heat energy and water vapor from one ducted air stream to the other. Also referred to as a wheel.

Sealing ring — The sheet metal located between the rotor and the mask panels. The ring's surface surrounds the rotor without touching it. Also referred to as a seal shelf.

Scrubber — See purge.

Seal — See labyrinth seal.

Sensor — See temperature sensor.

Spokes — Extruded aluminum supports radiant from the hub of the rotor. Spokes provide the rotor's structural integrity.

Supply air (SA) — Outside air that passes through the Energy Recovery Wheel unit and is provided to the indoor space.

Temperature controller — A pre-programmed electronic device that delivers a signal to the variable frequency controller. It receives and compares temperature information from temperature sensors located inside the air ducts.

Temperature sensor — A device that senses the air temperature in the duct, then transmits the information to the temperature controller. Depending on the configuration, an Energy Recovery Wheel unit has at least three or four temperature sensors in the ducting of the four air streams.

Unit — Used frequently throughout this manual referring to the EXCLU-SIEVE Energy Recovery Wheel and its accompanying components such as casing, motor, variable frequency controller, temperature controller and others that work together to make an effective energy recovery product. See EXCLU-SIEVE Energy Recovery Wheel.

Variable Frequency Drive (VFD) — A programmable electronic device that increases or decreases the electrical supply to the wheel's drive motor, thus speeding or slowing the motor and wheel's rotation. Also referred to as Variable Frequency Controller and Adjustable Speed Drive.

Weather side — The face of the Energy Recovery Wheel unit with the intake opening for outside air and the exhaust outlet. The words OUTDOOR AIR SIDE are stenciled on this side. The unit's purge section is never located on the outdoor side. (See Figure 2.)

Wheel — Refers to the rotating wheel containing the coated media. The wheel's cassette is the stationary framework supporting the wheel.

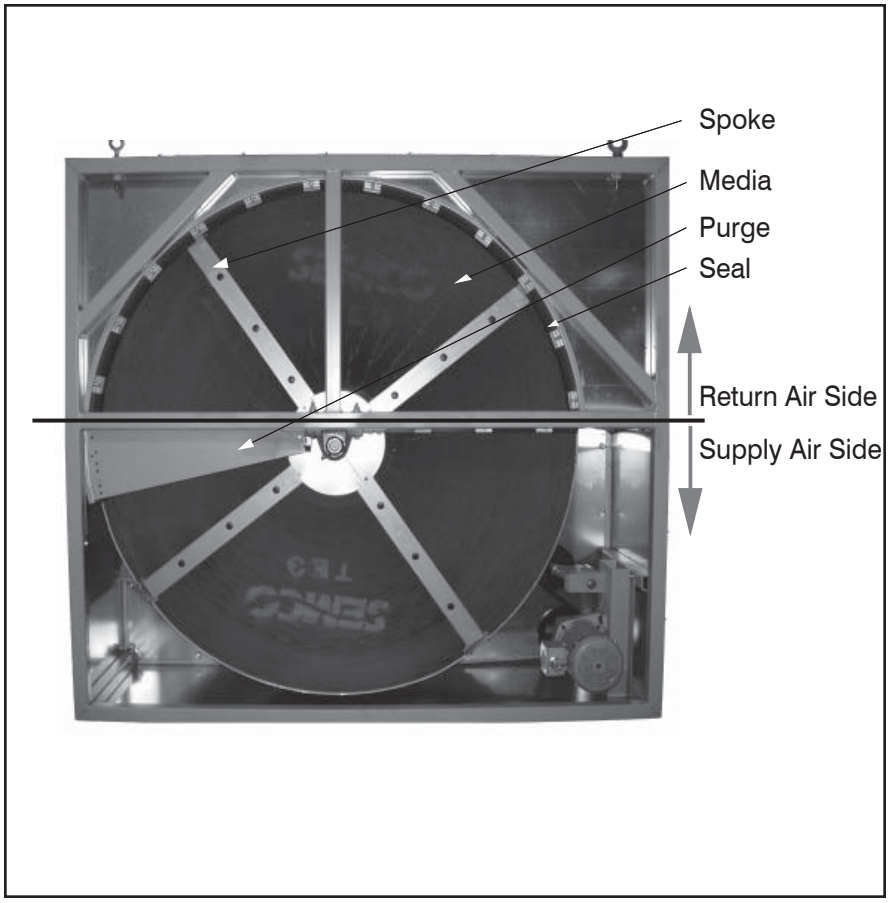


Figure 1. *Building side view of the wheel.*

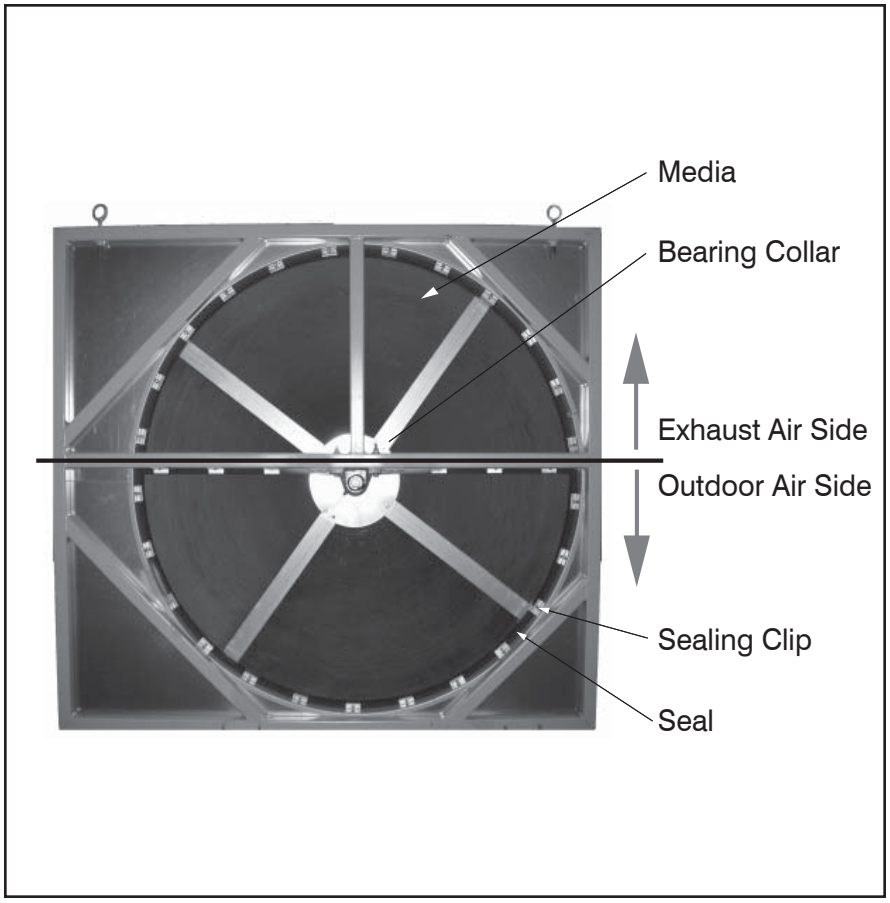


Figure 2. *Weather side view of the wheel.*

Principle of Operation

Recovering "Total" Energy

SEMCO EXCLU-SIEVE enthalpy exchanger recovers both sensible (temperature) and latent (moisture) energy, and does so far more effectively than other competitive offerings.

This performance edge is a result of EXCLU-SIEVE's unique transfer core. This "honeycomb-like" media utilizes an aluminum substrate coated with a fast acting, 3Å molecular sieve desiccant.

As the transfer core slowly rotates between the outdoor and return air stream, the higher temperature air stream gives up its sensible energy to the aluminum. This energy is then transferred to the cooler air stream during the second half of the revolution.

Just as the temperature is captured and released, so is the moisture (latent energy). This is accomplished by the wheel's desiccant coating, which has an enormous internal surface area and a strong attraction for water vapor. Since the opposing air streams have different temperatures and moisture contents, their vapor pressures differ. This vapor pressure differential is the driving force necessary for the transfer of water vapor. (See Figure 3.)

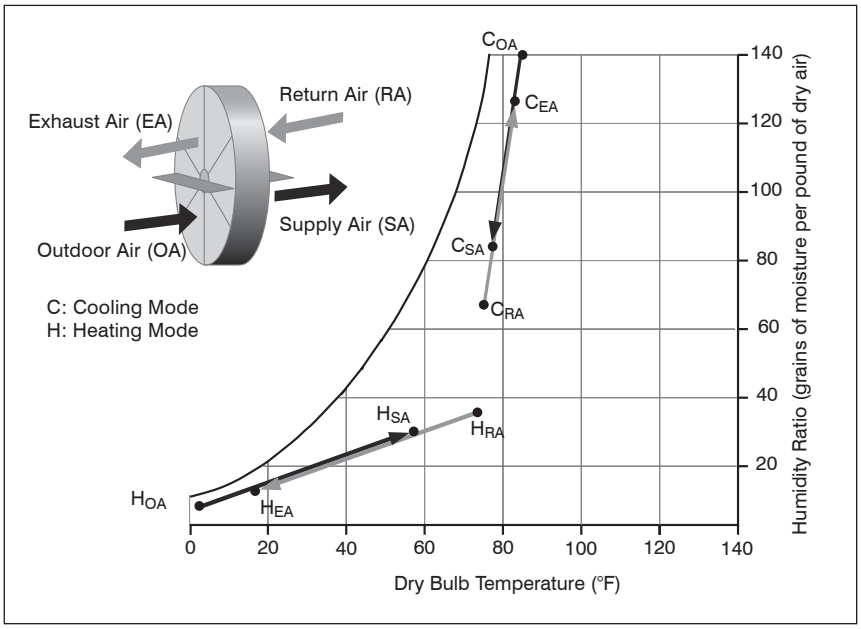


Figure 3. *Typical operating conditions encountered in the cooling and heating mode of a total energy recovery unit.*

The ability to recover latent energy provides important benefits in both the heating and the cooling season. During the cooling season, the outdoor air is dehumidified. (See Figure 3.) In the heating season, the costly humidification load is reduced through moisture recovery.

Latent recovery doubles the energy savings potential recognized with the use of sensible-only technology. It also allows for sizable cuts to be made in chiller and boiler capacity, which offsets the initial cost of the total energy recovery addition.

Since the exhaust air stream is dried as it is cooled, frost formation can be avoided with latent recovery.

Recovering "Sensible Only" Energy

The SEMCO TS series of sensible only energy wheels is specifically designed to recover temperature only. The transfer media is not desiccant coated but is polymer coated to avoid oxidation over time. Oxidation reduces the structural integrity of the media over time and can also cause some modest latent transfer, which is usually undesirable in sensible only applications.

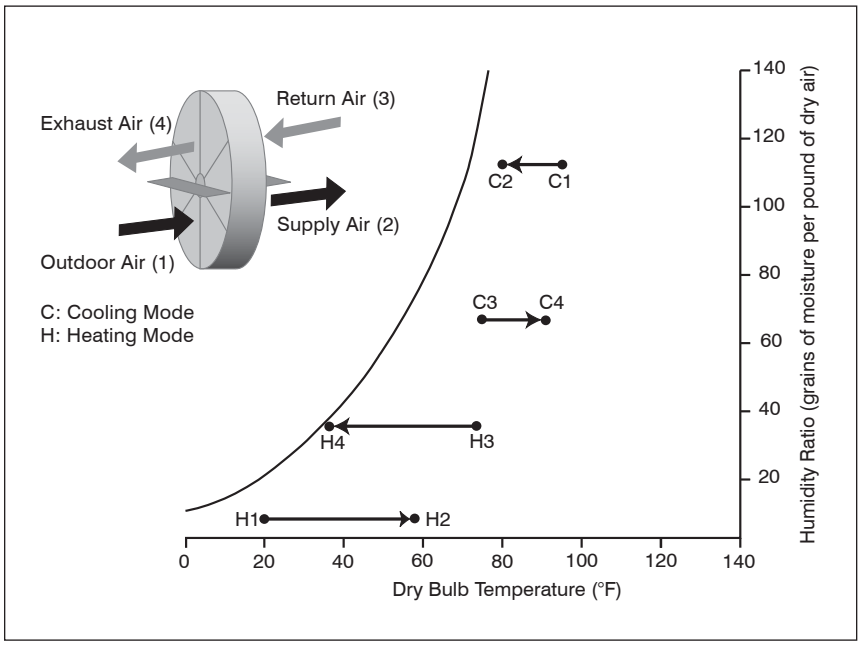


Figure 4. *Typical operating conditions encountered in the cooling and heating mode of a sensible only energy recovery unit.*

As shown in Figure 4, the air streams entering and leaving the sensible only wheel are heated or cooled. Since no latent recovery is accomplished, the moisture content of each air stream remains the same. A comparison of the processes in Figures 3 and 4 reveals two key advantages offered by total energy recovery. First, the total energy wheel recovers far more energy due to the latent component. Second, the sensible wheel will approach moisture saturation far more easily in the heating mode. This can cause frost formation.

For these reasons, sensible wheels should only be used in applications where moisture transfer is undesirable. Examples of such applications include indirect evaporative cooling systems, desiccant cooling systems and reheat wheels as used in the SEMCO Fresh Air Dehumidification systems.

In every other way, the SEMCO TS wheel is similar to the EXCLUSIEVE wheel and shares the benefits of superior performance, quality construction, and compact design.

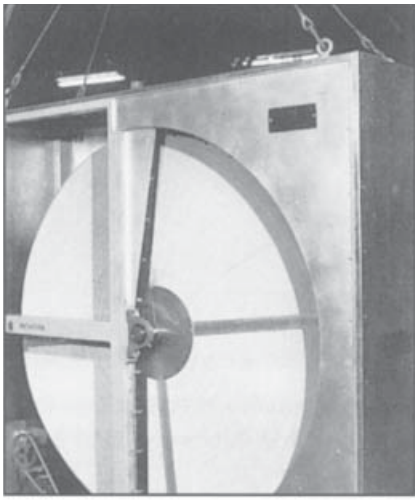


Figure 5. *Vertically oriented units are equipped with four permanently attached lift lugs.*

Figure 6. *EXCLU-SIEVE units should only be lifted with lugs located atop the unit.*

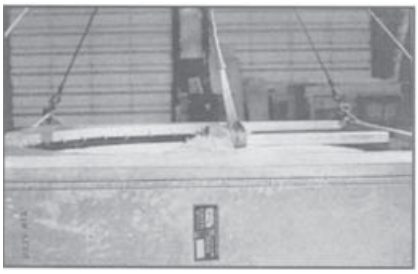


Figure 7. *Horizontally oriented units should be lifted with the four lugs plus a center strap.*

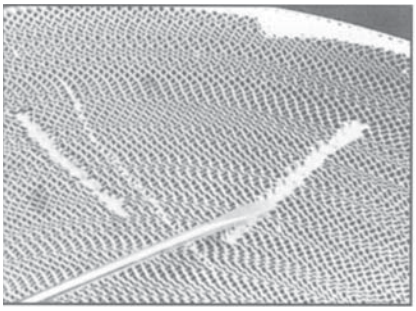


Figure 8. *The relatively thin aluminum in the media can be marred quite easily. Exercise caution when using tools, etc. near the media.*

Receiving & Inspecting

Lifting and Handling

EXCLU-SIEVE Wheel units, which are designed to be mounted vertically, are equipped with four lugs for lifting. (See Figures 5 and 6.) To off load the EXCLU-SIEVE Wheel unit, lift only with the lugs located on top of the unit. DO NOT lift the unit from the bottom with a forklift or any other device.

Units that mount horizontally should be lifted by the four lugs plus a strap attached to the unit's center beam. (See Figure 7.)

When lifting and handling the unit, be sure that lifting pressures are applied uniformly to all four or five lifting points. DO NOT twist or bend the unit.

Receiving

1. A packing list is supplied with each unit. The list should be compared with the arriving shipment to ensure that all parts have been delivered and are in good condition.

2. If the unit is to be stored for more than three days before it is uncrated, a visual inspection of all parts listed on the packing list is necessary. Freight claims are difficult–if not impossible– to justify long after delivery.
Exception: All crates for retrofit parts are labeled, "To be opened by SEMCO personnel only." If the outside of the crates has been visibly damaged, then and only then should the crates be opened on receipt.

Inspection

1. The wheel's face, the housing, and other larger parts of the assembled unit can be visually inspected for possible damage while still crated on the skid.

2. Check the media for damage. Some nicks and scratches are normal and will not affect the wheel's operation. However, the relatively thin aluminum in the media can be marred quite easily. (See Figure 8.) Workers should be warned to be careful when working around the face of the wheel.

   Even with cautious handling, some damage may occur. As long as the damage affects no more than 5 percent of the wheel's surface, no significant loss of effectiveness will occur. If damage is estimated to be greater than 5 percent, please contact SEMCO immediately.

3. Inspect the unit's casing and sheet metal for structural damage. Inspect the drive belt, gear reducer, temperature controller, and drive motor for visible damage.

Storage

If the unit is to be stored for more than 3 months, remove the shipping restraint located in the supply are side of the wheel near the drive motor (see figure 9 and 10,) grease the bearing and rotate the wheel at least three turns in the direction indicated by the rotation arrow in Figure 11.

To prevent the possibility of condensation and corrosion, air should be circulated through the unit. If this is not feasible, the unit should be stored in a dry place indoors. If the unit is to be stored outdoors, the unit must be protected from the elements.

If the unit is to be stored for more than 6 months, pump a high quality NLGI No.2 lithium based grease into both wheel bearing grease points. (See Figure 12.)

If you have any questions or concerns regarding long-term storage, please contact SEMCO.

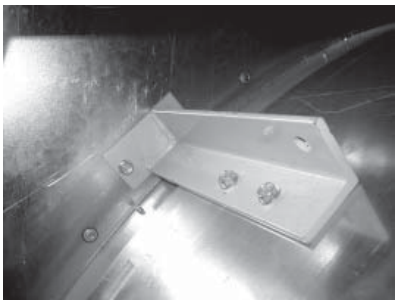


Figure 9. *Shipping restraint for flat rim wheel.*

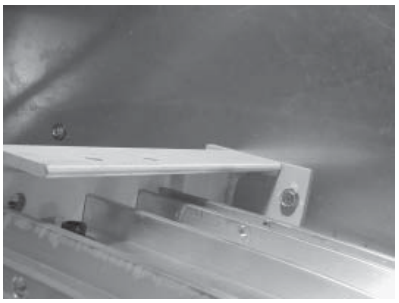


Figure 10. *Shipping restraint for ribbed rim wheel.*

Figure 11. *Rotate the rotor at least three turns in the direction indicated by the rotation arrow.*

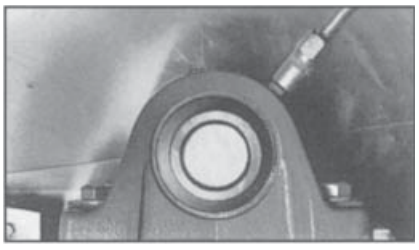


Figure 12. *Pump grease into two rotor bearing grease points, one on each side of the rotor. Do not over grease.*

Installation

Planning for Installation

Before proceeding with installation, carefully review the following guidelines. Consult Figures 13 through 21 as you plan the installation.

1. Units can be mounted in any of six different positions. Each unit is designed to operate in one of the arrangements. (See Figure 13)

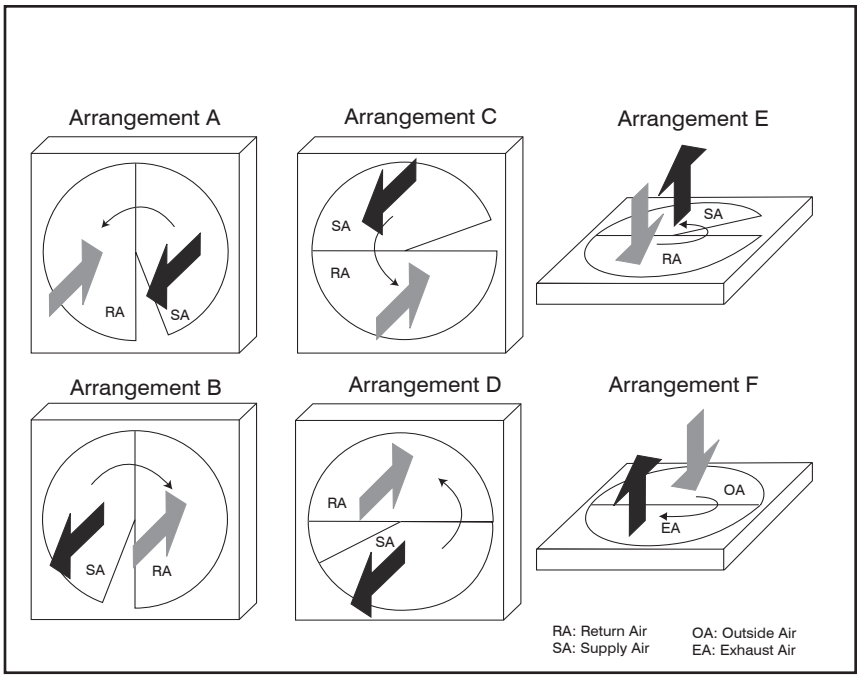


Figure 13. *EXCLU-SIEVE Wheels can be mounted in any of these six arrangements. Each unit is pre-engineered to perform in the required arrangement.*

2. Be sure to locate the unit's purge in the building side supply air stream.

3. The installation will require four ducts: two ducts on the outdoor side of the unit (OA and EA,) and two on the building side (RA and SA.)

4. Note the EA and OA locations and the RA and SA locations. Also note the location of the airflow arrows. Be sure that ductwork will correctly match direction and locations of airflow. (See Figures 15a through 15c for required duct sizes.)

5. Plan to include access doors immediately adjacent to the unit on all four ducts. Each opening should be large enough for body entry to access all seals and bearings. On smaller ducts, plan access doors that easily permit hand and arm movement and allow for visual inspection of the wheel. (See Figure 14.)

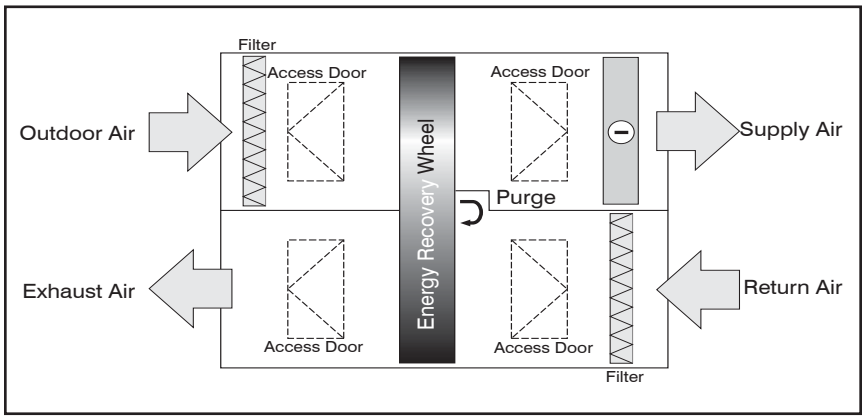


Figure 14. *Typically, access doors are located in each duct close to the rotor.*

6 Ensure that ductwork will not cover or hide airflow arrows and rotation arrows. (See arrow locations in Figures 19 and 20 on p. 12 and 13.)

7 Ductwork must be attached to the unit's frame only. DO NOT attach ducts to the unit's sheet metal. (See Figure 21 for correct duct attachment locations.)

8 All ducts must be self-supporting. DO NOT use the unit as structural support for the ductwork.

9 Air filters should be incorporated into the outside and return air streams. Filters aid in the efficient operation of the unit and help prevent dust and airborne contaminants from accumulating in the media. Filters must have restraints to keep them from blowing out should they become wet. A filter coming loose could destroy the entire wheel media. Filters should be changed regularly.

Wheel Dimensions

Wheel Sizes 3, 5, 9

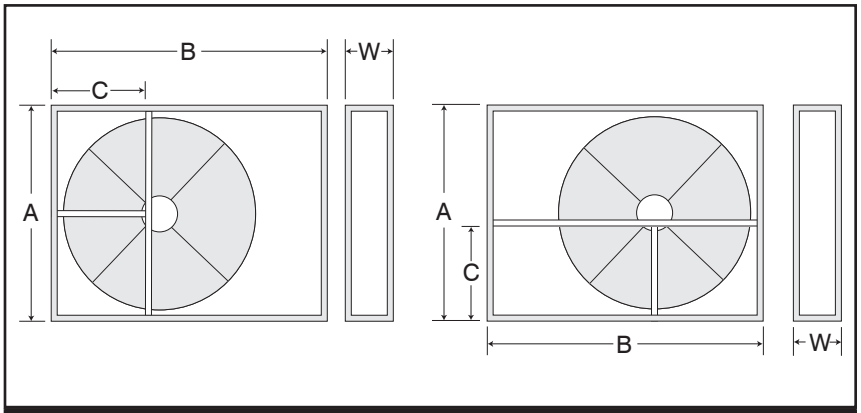


Figure 15a. *LEFT. Arrangements A and B, as referenced on page 9, Figure 13.*

Figure 15b. *RIGHT. Arrangements C, D, E, and F as referenced on page 9, Figure 13.*

WHEEL SIZE	A (in.)	B (in.)	C (in.)	W (in.)	Net Weight (lbs.)	Flow Area/Side (ft^2)	Nominal CFM
3	39.8	48.8	16.9	20.0	380	2.8	2000
5	51.8	58.2	22.9	20.0	520	5.3	4000
9	63.8	70.2	28.9	20.0	700	8.6	7000

Wheel Sizes 13 - 70

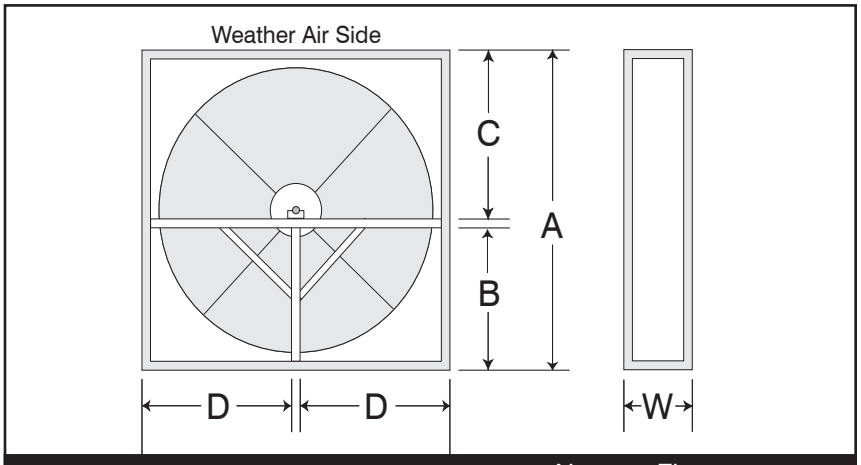


Figure 15c. *All arrangements for wheel sizes 13 through 70.*

WHEEL SIZE	A (in.)	B (in.)	C (in.)	D (in.)	W (in.)	Net Weight (lbs.)	Flow Area/Side (ft^2)	Nominal CFM
13	75.8	33.8	40.0	36.9	21.0	1070	13.1	10,500
18	87.8	39.8	46.0	42.9	21.0	1300	18.1	15,500
24	99.8	45.8	52.0	48.9	21.0	1640	23.8	19,500
28	111.8	49.8	59.0	54.4	23.0	2640	28.3	22,500
35	123.8	55.8	65.0	60.4	23.0	3000	35.2	28,000
43	135.8	61.8	71.0	66.4	23.0	3390	42.9	34,000
46	141.0	64.4	73.6	69.0	23.0	3570	46.2	37,000
56	154.0	70.9	80.1	75.5	23.0	4030	56.0	45,000
70	171.5	79.6	88.9	84.3	23.0	4680	70.4	56,000

Installing the Unit

1. After moving the unit to the installation site, check bearing bolts and set screws for tightness. If any bolts are loose, tighten them according to torque values shown on page 37. Tighten any loose setscrews.

2. Check the installation site. Vertical units should be provided with continuous bottom support. (See Figure 16.) Horizontal units should be provided with support under all four sides, plus support across the center. (See Figure 17.)

3. Units may be lifted into place easily with a crane or hoist. Attach lifting cables to the unit's lugs and to the center beam on horizontal units. After ensuring that lifting pressure is applied equally to all points, lift the unit into place. (See Figures 5 through 8 on page 7.)

4. Removing lugs is not recommended. However, if it is necessary to remove the large eyelet lugs, shown in Figure 18, then be sure to replace each removed lug with a bolt. The bolt holes must be closed.

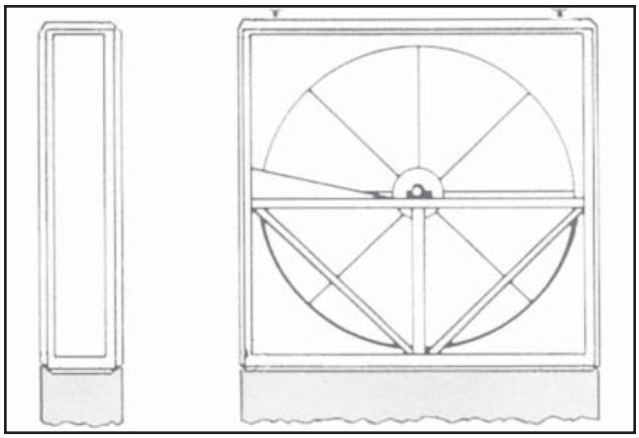


Figure 16. *Vertical units require continuous bottom support.*

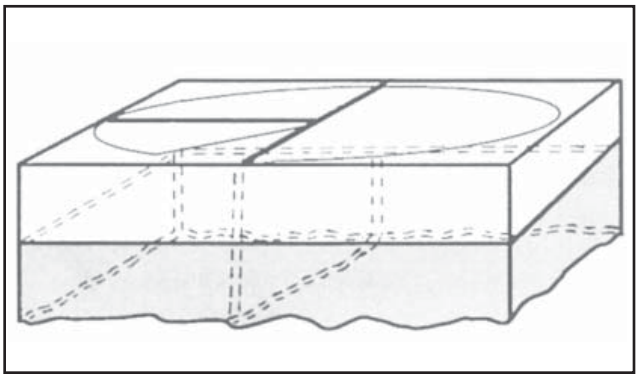


Figure 17. *LEFT. Horizontal units need support under all four sides, plus support across the center.*

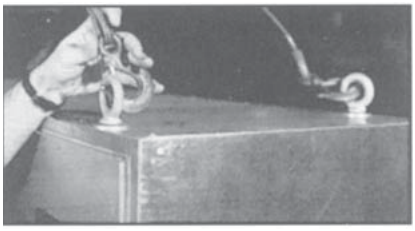


Figure 18. *Large eyelet lugs atop vertical units should remain attached permanently. However, if they must be removed, be sure to replace the lug with a bolt.*

Attaching Ductwork

5. Before securing ducts to the units, ensure that airflow arrows conform to duct airflow. (See Figure 19.) Also make sure that ductwork will not cover or hide airflow and rotation arrows. (See Figures 19 and 20.)

6. DO NOT force ductwork to fit to the unit housing. Units must stand-alone and should NOT be used to support ductwork or other members.

7. Attach ducts to tube frame only. (See Figure 21.) DO NOT attach ducts to sheet metal on the unit's sheet metal housing.

8. Verify that an access door close to the unit has been provided in each of the four ducts.

9. Inspect finished ductwork for air leakage and pay particular attention to the partition seal.

Figure 19. *Be sure that unit airflow arrows conform to duct airflow.*

Checking the Rotor

10 Pump grease into the two rotor bearing grease fittings using a high quality NLGI No. 2 grease.

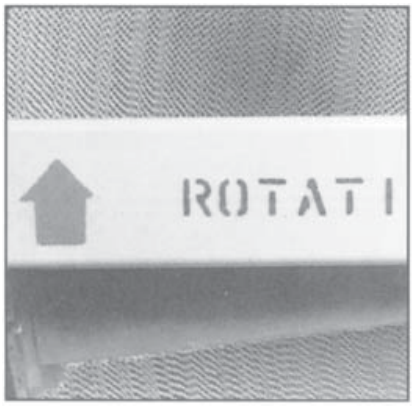


Figure 20. *Don't let ductwork hide rotation or airflow arrows.*

11 Remove shipping restraint located in the supply air side of the wheel near the drive motor. Remove all bolts and discard. The shipping restraint prevents the rotor from turning during shipment. (See Figures 22 and 23.)

12 Turn rotor by hand in the direction indicated by rotation arrows to verify that the rotor does not bind. (See Figure 24.) If binding occurs in a new unit, it is usually caused by the labyrinth seal or freight damage. Instructions for adjusting the seals are provided later in this section.

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

14 Inspect the bearing bolts, rim bolts and the Allen screws on the bearing collar to ensure that all are tight. Tighten any loose screws and bolts according to torque values described on page 37.

Figure 21. *Attach ducts to unit frame only.*

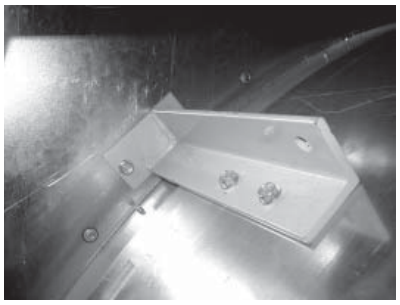


Figure 22. *Shipping restraint for flat rim wheel.*

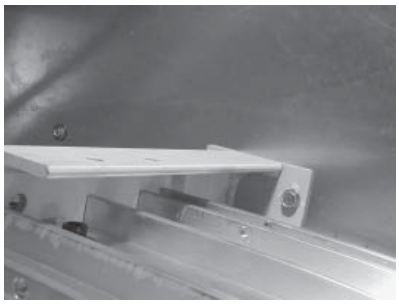


Figure 23. *Shipping restraint for ribbed rim wheel.*

Adjusting the Seals

The EXCLU-SIEVE unit uses a specially designed, four-pass labyrinth seal. Although the seal itself never touches the unit's rotor, it controls the air that attempts to pass between the seal and the rotor. The labyrinth seal causes air to expand repeatedly in the space between the seal and rotor, forming eddy currents. These currents create a pressure loss that forms an effective seal, therefore limiting air bypass and allowing the rotor to perform its heat transfer function. (See Figure 25, page 14.) Maintaining correct seal adjustment is vital to the effective operation of the unit.

Figure 24. *To make sure that the rotor does not bind, turn it by hand in the direction indicated by the rotation arrow.*

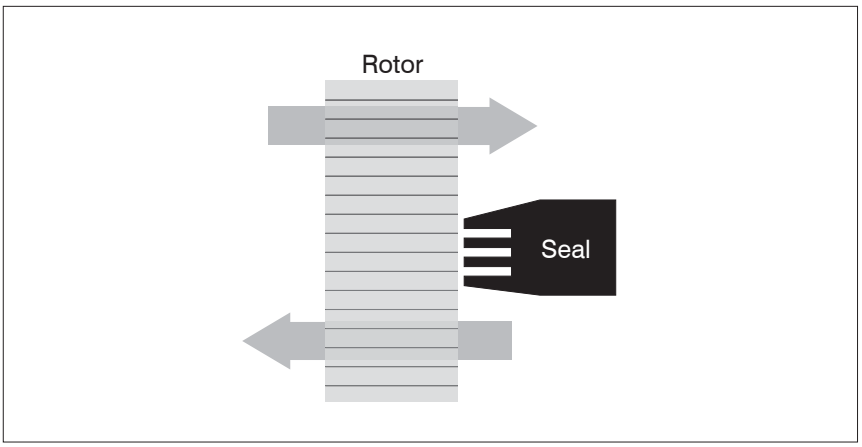


Figure 25. *LEFT. Air flowing between the rotor and labyrinth seal expands repeatedly, creating a pressure loss that forms an effective seal and prevents air from bypassing the rotor. The labyrinth seal never touches the rotor.*

15 Use the seal gauges provided with the unit or make a gauge from 16 and 22 gauge sheet metal. Use 22 gauge sheet metal for perimeter seals and 16 gauge sheet metal for seals across the wheel partition.

16 Every rotor has a high point on the face of the wheel. Locate the high point visually by rotating the rotor by hand and note the point at which it is closest to the seal.

17 Place the gauge at the rotor's high point and move the rotor slowly by hand. Adjust the seal at locations where the seal does not meet gauge depth by loosening the screw holding the nearest clip. After setting the seal to the correct gauge depth, tighten the screw. (See Figures 26 and 27.)

Figure 26. *Loosen clip and insert gauge. Adjust seal to correct gauge depth.*

18 Pay special attention to the seals across the wheel partition, which could possibly bind causing wheel damage.

19 Once the seals are set, caulk needs to be applied to the following areas as shown in Figures 28-30 to prevent leakage through any gaps. Apply caulk on the weather side of the wheel to the face seal at each end where it contacts the perimeter seal. On building side of the wheel apply caulk to the purge seal at the perimeter and where the seal ends near the center of the wheel. Caulk the face seal next to the purge where the seal meets the base of the purge and at the perimeter.

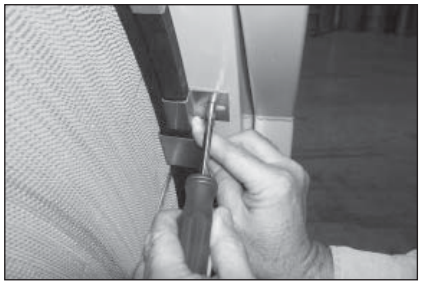


Figure 27. *Tighten the screw.*

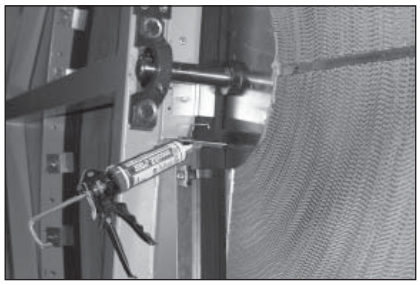


Figure 28. *Caulk gap where purge seal abuts sheet metal end wall at the base of the purge.*

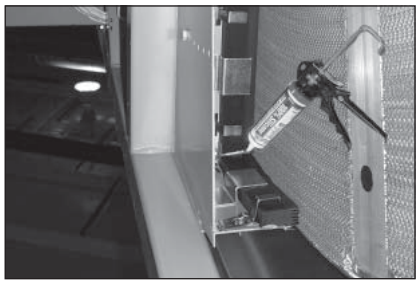


Figure 29. *Caulk purge seal where it meets perimeter seal.*

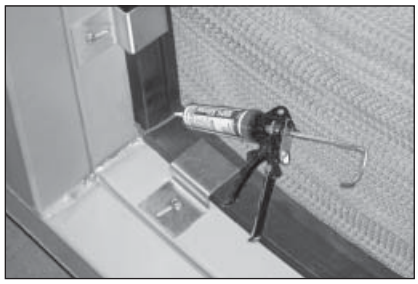


Figure 30. *On the weather side of the wheel caulk where face seal meets perimeter seal at both ends.*

Temperature Controller

Unit Description

The temperature controller is a programmable controller for HVAC applications. This controller will command the wheel speed by providing an analog signal to the variable frequency drive (VFD.)

The standard single wheel program controls the supply air stream temperature based on feedback from four temperature sensors. The sensors are located in the outdoor, supply, return and exhaust air stream.

The supply air stream temperature is maintained by sending a 0-10 volt control signal from the temperature controller to the variable frequency drive (VFD.)

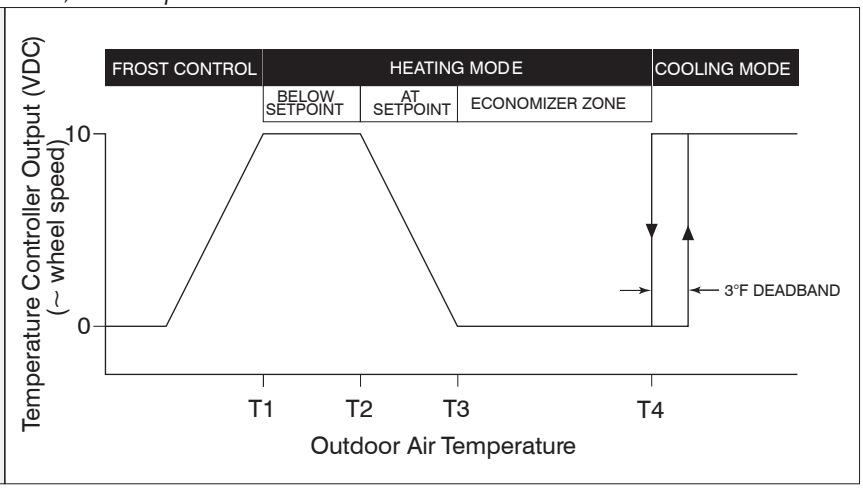
The VFD is used to control the speed of the enthalpy wheel, which determines the supply temperature. The speed of the wheel is proportional to the 0-10 volt signal generated by the temperature controller. When the temperature controller generates a 0 volt signal, the wheel spins at a minimum speed of 1/4 rpm. When the temperature controller is sending a 10 volt signal, the maximum speed is 20 rpm for an enthalpy wheel and 10 rpm for a sensible wheel.

The following diagram illustrates the control modes of the temperature controller and analog output signal associated with each mode.

Figure 31. *Schematic of the control modes of the temperature controller.*

Legend

T1: Outdoor air temperature which produces an exhaust temperature equal to the frost set point.
T2: Outdoor air temperature at which wheel supply air temperature equals heating set point with wheel at full speed.
T3: Outdoor air temperature equals heating set point; no recovery required.
T4: When the outdoor air exceeds the return (space) air temperature, the wheel runs at full speed (summer changeover.)



Sequence of Operation

Enthalpy Wheel Speed Control: The enthalpy wheel modulates to maintain the wheel supply temperature set point in heating mode, rotates at 1/4 RPM in economizer mode, and rotates at 20 RPM in summer cooling mode.

Cooling Mode: If the outdoor temperature is greater than return temperature, the mode is summer cooling and the wheel speed is 20 RPM.

Heating Mode: If the outdoor temperature is less than return temperature the wheel is in heating mode and the wheel modulates to maintain the supply temperature set point.

Economizer Mode: If the outdoor temperature is less than the return temperature, and the supply temperature is greater than the supply setpoint the wheel is in economizer mode. The VFD receives a 0% demand signal, and the wheel rotates at minimum speed (1/4th RPM.) Digital Output #4 (DO-4) is energized when the wheel is in economizer mode. This output can be used to power a pilot relay to control wheel bypass dampers, if desired. Wheel bypass dampers should be open during economizer mode, and otherwise closed.

Frost Control: The enthalpy wheel modulates to prevent the exhaust temperature from dropping below the wheel exhaust temperature set point. As the exhaust temperature nears the setpoint, the wheel speed is reduced. The exhaust temperature set point can be auto calculated or a fixed set point. If the auto calculated setpoint is used, either the BAS must write the return/space RH to the controller or the design return RH is used to calculate the setpoint.

Inputs:
IN-1 = Outdoor air temperature
IN-2 = Supply air temperature
IN-3 = Return air temperature
IN-4 = Exhaust air temperature
IN-5 = Wheel start/stop (optional, for field wiring)
IN-6 = Rotation detector alarm (optional, for field wiring)

Outputs:
DO-1 = Wheel VFD start/stop
DO-4 = Wheel economizer mode status
AO-1 = 0-10 VDC Wheel VFD signal

Setpoints:
Supply temperature setpoint
Frost control exhaust temperature setpoint
Auto/manual frost control temperature set point
Additional advanced setpoints are also accessible via the keypad. See Keypad Navigation guide on previous page for more info.

Display: Inputs, outputs, and set points may be viewed at the unit mounted two-row LCD display or remotely using communications software. Set points may be adjusted either at the unit or remotely through the BAS.

Control Hardware: The wheel controller is an Automated Logic Zone 583 Controller.

Communication Capabilities: Available 2-wire RS-485 communication protocols are: BACnet MS/TP, Modbus, or Johnson N2.

Physical installation: The temperature controller and rotation detector (where applicable) are factory installed in a NEMA 1 enclosure, which ships loose for field installation. Mount the control panel in a suitable indoor location free from excessive amounts of moisture or dust. The temperature controller is provided with probe style temperature sensors with plenum rated leads that are long enough to eliminate the need for splicing in many installations. Therefore it is recommended that the control panel be located a short distance from the wheel to reduce the need for splices.

Terminal blocks have been provided to aid in connection of control wiring between the temperature controller and the VFD. See the electrical schematic on Page 24 for details.

I/O Zone 583 Specifications	
Power	24VAC ± 10%, 50-60Hz, 20VA power consumption (single Class 2 source only, 100VA or less.)
Inputs	Eight inputs. 2 inputs, jumper configurable for 0-5VDC, 10K ohm thermistor, or dry contact; 2 inputs that support thermistor or dry contact only; 2 inputs that support thermistor, dry contact, or LogiStat; 2 inputs that support 1K to 10K ohm potentiometers only.
Input Resolution	10 bit A/D.
Digital Outputs	Five digital outputs, relay contacts rated at 1A resistive @ 24VAC. Configured as dry contact, normally open.
Analog Outputs	Three analog outputs rated as 0-10VDC, 5mA (max.)
Output Resolution	8 bit D/A.
Communication	One network port (Comm port) configurable for BACnet-over-ARC156 or EIA-485 BACnet MS/TP, (9600 bps, 19.2k bps, 38.4k bps, or 76.8k bps,) Modbus (9600 bps, 19.2k bps, or 38.4k bps,) or N2 (9600 bps;) one Access port (115.2k bps via Rnet passthrough;) one Rnet port (EIA-485, 115.2k bps.)
Operating Range	0° to 130°F (-17.8° to 54.4°C;) 10 to 90% relative humidity, non-condensing.
Status Indication	Visual (LED) status of network communication, running, errors, power, and all digital outputs.
Memory	1MB Flash memory and 512KB non-volatile battery-backed RAM (does not lose information that was stored before a power failure.)
Protection	Built-in surge and transient protection circuitry. The module is protected by internal solid state Polyswitches on the incoming power and network connections. These Polyswitches are not replaceable and will reset themselves if the condition that caused the fault returns to normal.
Battery	Lithium 3V coin cell battery, CR2032, provides a minimum of 10,000 hours of data retention during power outages.
Listed By	FCC Part 15 - Subpart B - Class A. Pending listings at the time of publishing this document: UL 916 (PAZX,) cUL C22.2 No. 205-M1983 (PAZX7,) CE (1997.)
Mounting	Screw the I/O Zone 583 into an enclosed panel using the mounting holes provided on the cover plate. Be sure to leave about 2 inches (5 centimeters) on each side for wiring.
Power Wiring	CAUTION The I/O Zone 583 is a Class 2 device (less than 30VAC, 100VA maximum.) Take appropriate isolation measures when mounting the I/O Zone 583 in a control panel where non-Class 2 devices (for example, 120VAC) or wiring are present.

Temperature Sensors

1 Four temperature sensors are shipped loose for field installation as shown in Figure 32.

2 The standard sensors are 1-1/4" stainless steel probes with plenum rated cable and are supplied with wire loops for field mounting. The metal head of the sensor should be inserted into the wire loop to old it securely in place. Alternatively, cut four pieces of conduit so each piece will fit across the inside of each air duct to be monitored and mount the temperature sensors to the conduit with wire ties.

Optional SA and EA Averaging Sensor - Averaging sensor is available for use in the supply and exhaust airstreams. Sensors should be arranged for uniform coverage of wheel face using the nylon loop clamps (provided.)

3 Mount each sensor no closer than six inches to the rotor in each duct to be monitored, no further than the next item of equipment in the duct, and oriented to the face of the rotor as shown on the inset in Figure 32.

4 Wire each sensor to the temperature controller. (See wiring diagram on page 24.)

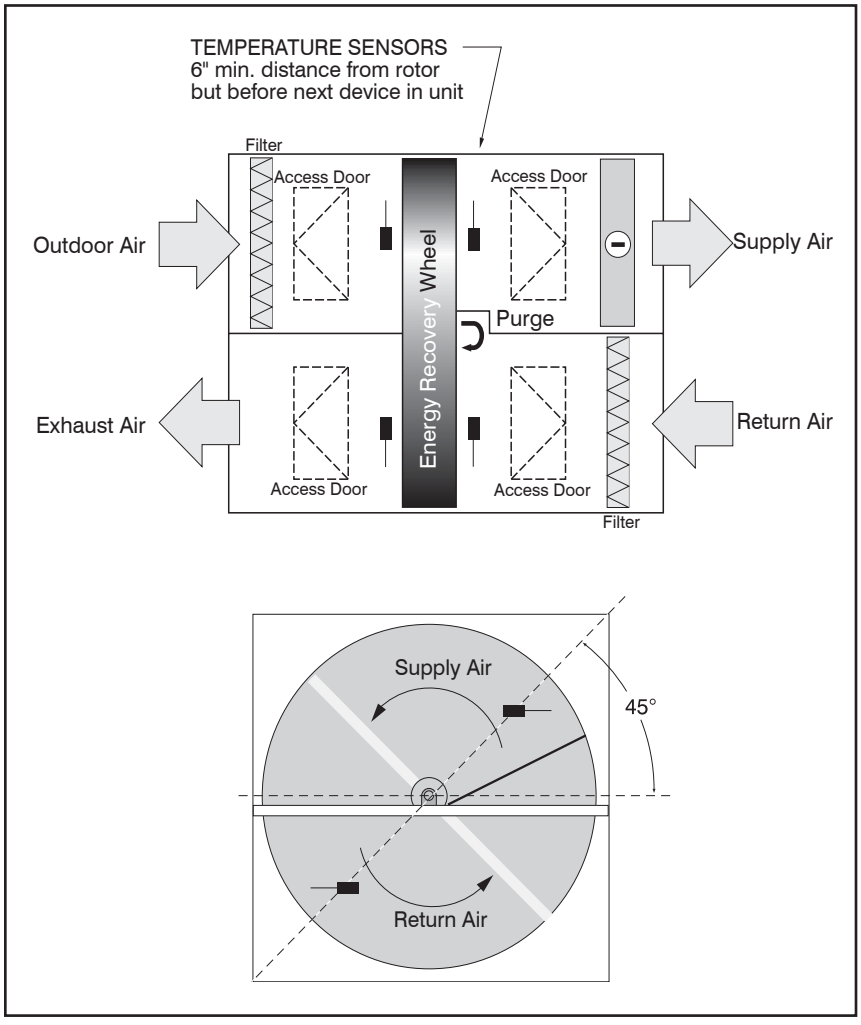
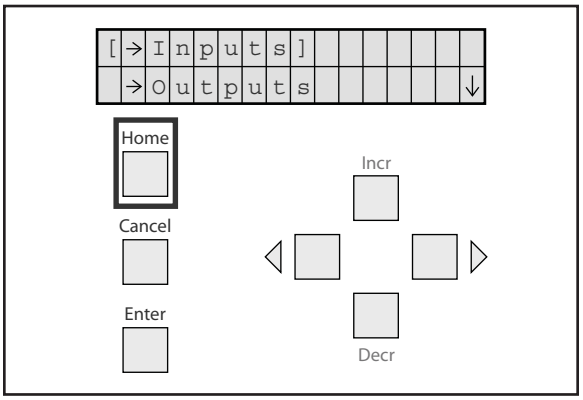
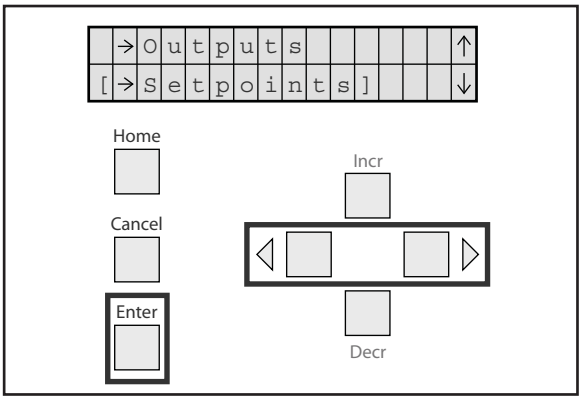


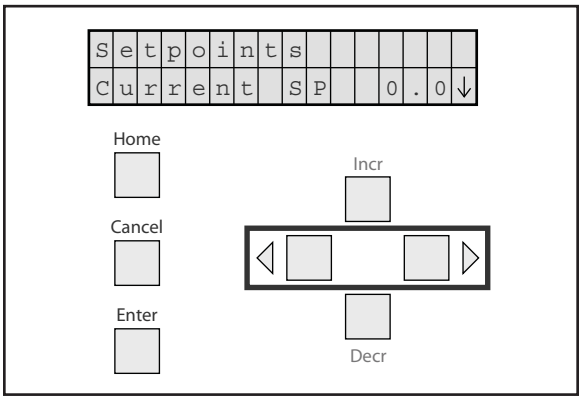
Figure 32. *Typical locations of sensors in ducts.*



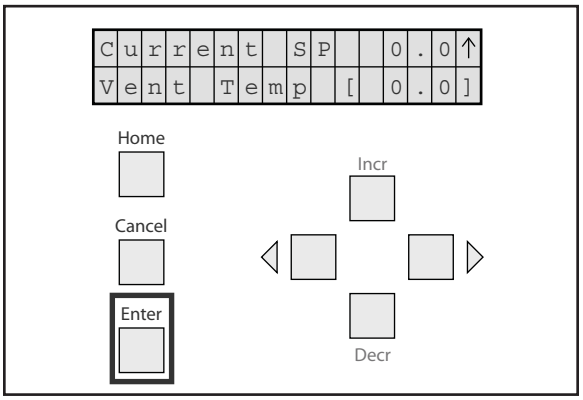
Step 1. *Pressing the* **HOME** *key will take you to the menu option screen.*



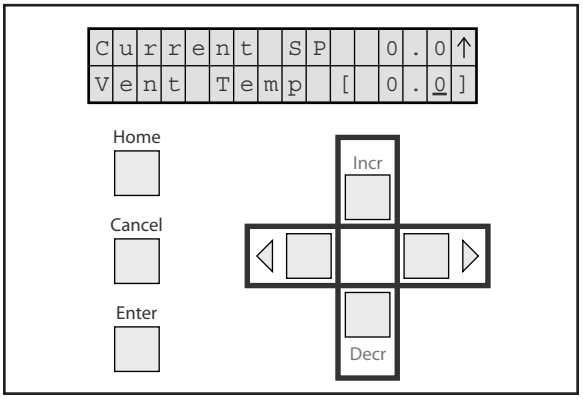
Step 2. *Use the* **LEFT** *and* **RIGHT** *arrow keys to scroll thru the menu. Pressing the* **ENTER** *key will take you to the selected option, indicated by the brackets [] around it.*



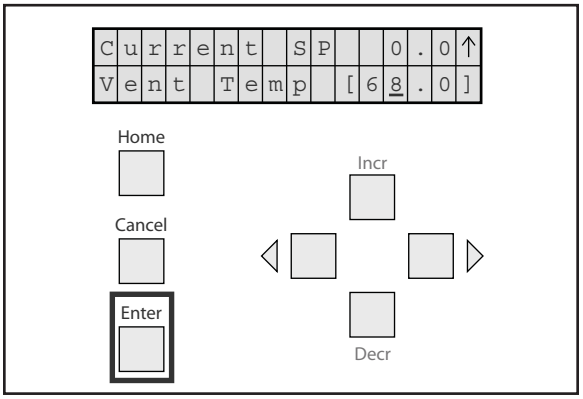
Step 3. *After entering a selected menu option, use the* **LEFT** *and* **RIGHT** *arrow keys to scroll through the available paramenters. Parameters with changable settings will have brackets [] around them when selected.*



Step 4. *To change a parameter setting use the* **LEFT** *and* **RIGHT** *arrow keys to scroll to the desired selection, then press the* **ENTER** *key.*



Step 5. *For numeric settings, use the* **LEFT** *and* **RIGHT** *arrow keys to move the cursor (_) to the desired digit. Use the* **INCR** *and* **DECR** *keys to change the number. For non-numeric settings, use the* **INCR** *and* **DECR** *keys to scroll through the available parameter settings.*



Step 6. *When the parameter setting has been changed to the desired value, press the* **ENTER** *key to lock in the new setting. If you do not wish to lock in the setting, press the* **CANCEL** *key.*

Keypad Menu Navigation Guide

Home		

Inputs		
StartSwitch	ON / OFF	Status of controller enable input(IN-5.)
BAS Start	ON / OFF	Status of controller enable via BAS communications.
EW RotDet	ALARM / OK	Status of wheel rotation detector alarm(when applicable.)
OutdoorT		Temperature (°F) of outdoor air entering enthalpy wheel (IN-1.)
Supply T		Temperature (°F) of supply air leaving enthalpy wheel (IN-2.)
Return T		Temperature (°F) of return air entering enthalpy wheel (IN-3.)
ExhaustT		Temperature (°F) of exhaust air leaving enthalpy wheel (IN-4.)

Outputs		
EWvfdEnable	ON / OFF	Start / Stop command to enthalpy wheel VFD (DO-1.)
EW Mode	Summer /Winter	Enthalpy wheel operation mode.
EWvfdSig%	0-100%	Enthalpy wheel VFD output signal % (AO-1.)
EWvfdSigV	0-10	Enthalpy wheel VFD output VDC (AO-1.)
Whl RPM	0-20	Enthalpy wheel speed (RPM)
WhlEffcy%	0-100%	Enthalpy wheel efficiency (%)
EconoMode	ON / OFF	Enthalpy wheel economizer mode status (DO-4)

Setpoints		
SP Source	BAS / KPD	Setpoint source determines whether the setpoints come from the BAS communications (BAS) or from the keypad (KPD.)
KPDTempSP		Keypad supply temperature setpoint (°F.) This setpoint is active if the SP Source is set to (KPD.)
BASTempSP		BAS supply temperature setpoint (°F.) This setpoint is active if the SP Source is set to (BAS.)

Advanced Setpoints		
SetptLoLimit		Temperature setpoint low limit (°F.) This sets the low limit for the supply temperature setpoint.
Condensation Control Settings		
CC Enable	ON / OFF	Enthalpy wheel condensation control. ON = control program monitors the exhaust temperature and will modulate the wheel to prevent frosting. OFF = wheel is not monitored for frost prevention.
CC Mode	AUTO / MANUAL	Use of manual condensation control setpoint (AUTO/MANUAL.) MANUAL - Condensation control loop uses the manual setpoint. AUTO - Condensation control loop uses a calculated setpoint.
ManCCSetpt		Manual condensation control setpoint (°F.) This setpoint is active when CC Mode is (MANUAL)
AutoCCSetpt		Auto condensation control setpoint (°F.) This setpoint is active when CC Mode is (AUTO)
CC SpaceRH		Design return relative humidity setpoint (%rh.) This setpoint is used to calculate the automatic condensation control set-point. A design return relative humidity can be set from the keypad or updated with the building return relative humidity from the BAS (requires BAS communications).
CCSatOffset		Saturation offset (°F.) Offset from the saturation line for the automatically calculated condensation control temperature setpoint.
Enthalpy Wheel Control Settings		
EW Cntrl	AUTO / MANUAL	Enthalpy wheel speed signal control setting. AUTO = automatic control of enthalpy wheel speed, enthalpy wheel speed analog signal output (AO-1) set by control program. MANUAL = manual control of enthalpy wheel speed, enthalpy wheel speed analog signal output (AO-1) set by EWMan RPM setpoint.
EW ManRPM		Manual enthalpy wheel speed setting (RPM). When EW Cntrl is set for MANUAL, this setting controls the enthalpy wheel speed analog signal output (AO-1.) 0-20 RPM = 0-10 VDC output.
EW LpSpd		Wheel PID control loop speed. Higher values increase responsiveness but can reduce stability; lower values decrease responsiveness but can increase stability. Default value = 1.0
EWFullSpdT		Wheel Full Speed. Low ambient temperature (°F) that forces the enthalpy to full speed.

Checking the Controller Operation

If it is cold outside and the controller is in winter mode (OAT<RAT):

1. **Check for frost protection —**
Using the keypad, raise the frost protection set point above the exhaust air temperature. The analog output of the controller should decrease in order to bring the exhaust air temperature above the new set point. After confirming this operation, reset the EAT set point back to the previous setting.

2. **Check for proper response to temperature inputs —**
Set the supply set point to 95° F, the controller should respond by modulating the control output (AO-1) to 10 VDC
Now lower the set point to 35° F. The output of (AO-1) should modulate down toward zero.

3. **Check for proper winter to summer changeover —**
Warm the outdoor air sensor with your hand until it is at least 10° F greater than the return temperature. The controller should change to summer-dehumidification mode as evident by the EW Mode shown on the display. The output of the controller should be 10 VDC.

If it is warm outside and the controller is in summer mode (OAT>RAT):

1. **Full recovery —**
The controller should have an output of 10 VDC.

2. **Check for proper summer to winter changeover —**
Warm the RA sensor with your hand and observe the changeover to winter mode as indicated by the EW Mode on the keypad display.

Troubleshooting the Temperature Controller

Are all connections tight?
The best way to check connection tightness is to pull on each wire. A wire might have come loose in shipment or due to vibration.

Is the controller powered up and turned on?
Verify that the controller has 24VAC power across the HOT and GND terminals in the upper right corner of the controller. There should be two LEDs on during normal operation, Power' and 'Run'. If the red 'Error' LED is on contact SEMCO for more information.

Are the controller jumpers in the correct position?
There are four jumpers located at the top center portion of the control board, just right of the battery. The legend for the jumpers is printed on the right side of the controller. The jumper locations below are for standard temperature based wheel control only. Jumper settings may change with more specialized programs. The default jumper positions are shown on the wiring schematic on Page 24.

- The top jumper location has three pins in line. The jumper should be across the two rightmost pins.
- The jumper immediately below has only two pins and the jumper should be in place across these two.
- The final two jumpers are set to the input type for IN-1 and IN-2. These locations have four pins each (2 x 2.) The jumpers should be positioned on the top two pins on each set.

Is the unit wired correctly?
This pertains to a new installation or an installation that has recently been modified. The 24VAC hot power lead goes to the top right terminal on the controller marked "HOT". The 24VAC common/neutral power lead goes to the terminal marked "Ground". IN-1 through IN-5 are input terminals. For the SEMCO standard wheel application, the outdoor air sensor wires to IN-1 and Gnd, the supply air wires to IN-2 and Gnd, the return air (exhaust intake) to IN-3 and Gnd, and the exhaust air (exhaust discharge) to IN-4 and Gnd. The temperature sensors are not polar. The wiring can be traced or the sensors can be individually warmed or cooled to make sure that the sensors are wired to the correct terminals. The sequence will definitely not work correctly if sensors are wired to the wrong terminals.

Are the sensors functioning properly?
One way to check is to measure resistance across the sensor and sensor wire. At 77°F, the resistance should be about 10K ohms. A very low value would suggest a bad sensor, bad connection or broken wire. Evaluate whether the displayed value is reasonable. If the displayed value is way high or low, considering swapping two sensors to determine if the sensor or the wiring is at fault.

Are the correct signal outputs being generated?
Use the left and right arrows on the keypad to cycle through the display. Find the wheel speed output value in VDC. Verify with an voltmeter than this voltage is correct across AO-1 and Gnd terminals on the controller. Check that the wiring from AO-1 and the VFD input A1 and AC has been completed as required and has not been damaged.

Is the wheel responding correctly to the controller output?
If the output is 10 volts, the wheel should rotate at full speed. This would be about 20 rpm for an enthalpy wheel and 10 rpm for a sensible wheel. If the output is 0 volts, the wheel should rotate at a minimum speed of 1/4 rpm. If the signal is correct but the wheel speed is wrong, the problem could either be in the variable frequency drive programming, or possible there is a drive failure and the rotor is freewheeling, being driven by airflow.

Installation Specifications for the Yaskawa V1000

Install the inverter in the vertical position on a metal or other nonflammable surface capable of holding the weight of the inverter. The temperature range of the inverter is 14°F to 122°F. The maximum relative humidity should be less than 95 percent. The inverter should be located away from the combustible or corrosive gases and condensing atmospheres. The inverter should have a clearance of 4 inches along the top and bottom edges and 1.25 inches along each side for proper cooling of the internal drive components.

Electrical Requirements for the Yaskawa V1000

Yaskawa Model	Line Power	Max. Input MCCB Rating	Rated Output Amps	Rated Input Amps	Hp
CIMR-VU-2A0006FAA	200-230/3/60	15A	6	7.3	1
CIMR-VU-4A0002FAA	460/3/60	15A	2.1	2.1	1

Electrical Connections for the Yaskawa V1000

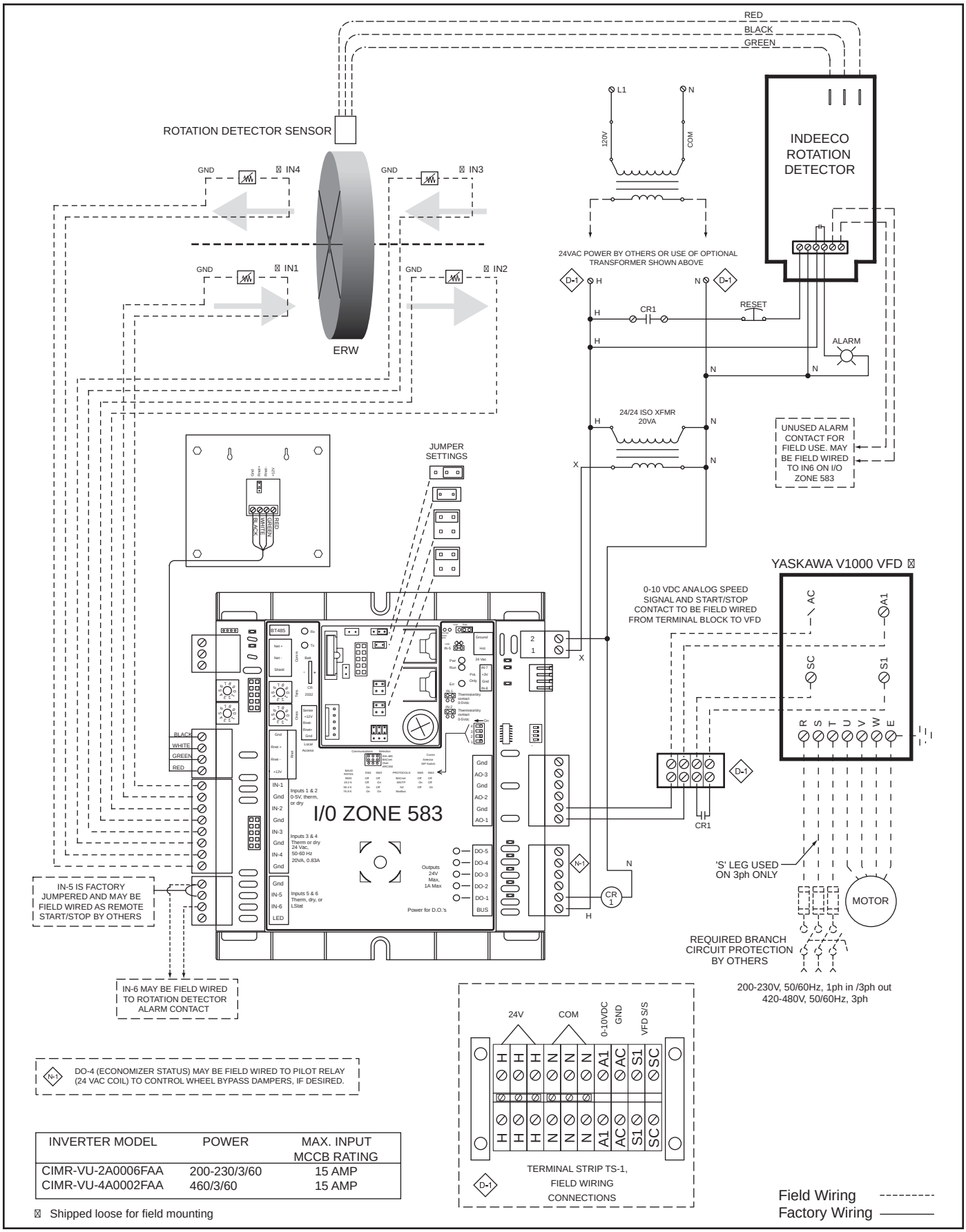
Connect three phase line power to terminals R, S, and T. Connect single phase line power to terminals R and S. Connect the motor leads to terminals U, V, W. If wheel rotation is backwards, disconnect power, and switch any two of the U, V, W leads. The drive is programmed by SEMCO to accept a 0-10 VDC control input signal and a dry contact start/stop signal. The 0-10 VDC signal positive lead is connected to terminal "A1" and the signal common to "AC". The start/stop signal is not polar and is connected to terminals "S1" and "SC". If this start/stop signal is not used, a jumper is required. See the Yaskawa V1000 drive technical manual for other control signal and start/stop options(e.g. 4-20mA or preset speeds.) A nearby service disconnecting means on the line side of the inverter is recommended.

Motor

The motor provided for the EXCLU-SIEVE Energy Recovery Unit is an inverter duty motor.

Note: In some special applications, a different motor may be supplied to power the unit. If so, separate instructions will be provided.
See the submittal data to verify the type of motor provided.

Wiring Schematic



INVERTER MODEL	POWER	MAX. INPUT MCCB RATING
CIMR-VU-2A0006FAA	200-230/3/60	15 AMP
CIMR-VU-4A0002FAA	460/3/60	15 AMP

Shipped loose for field mounting

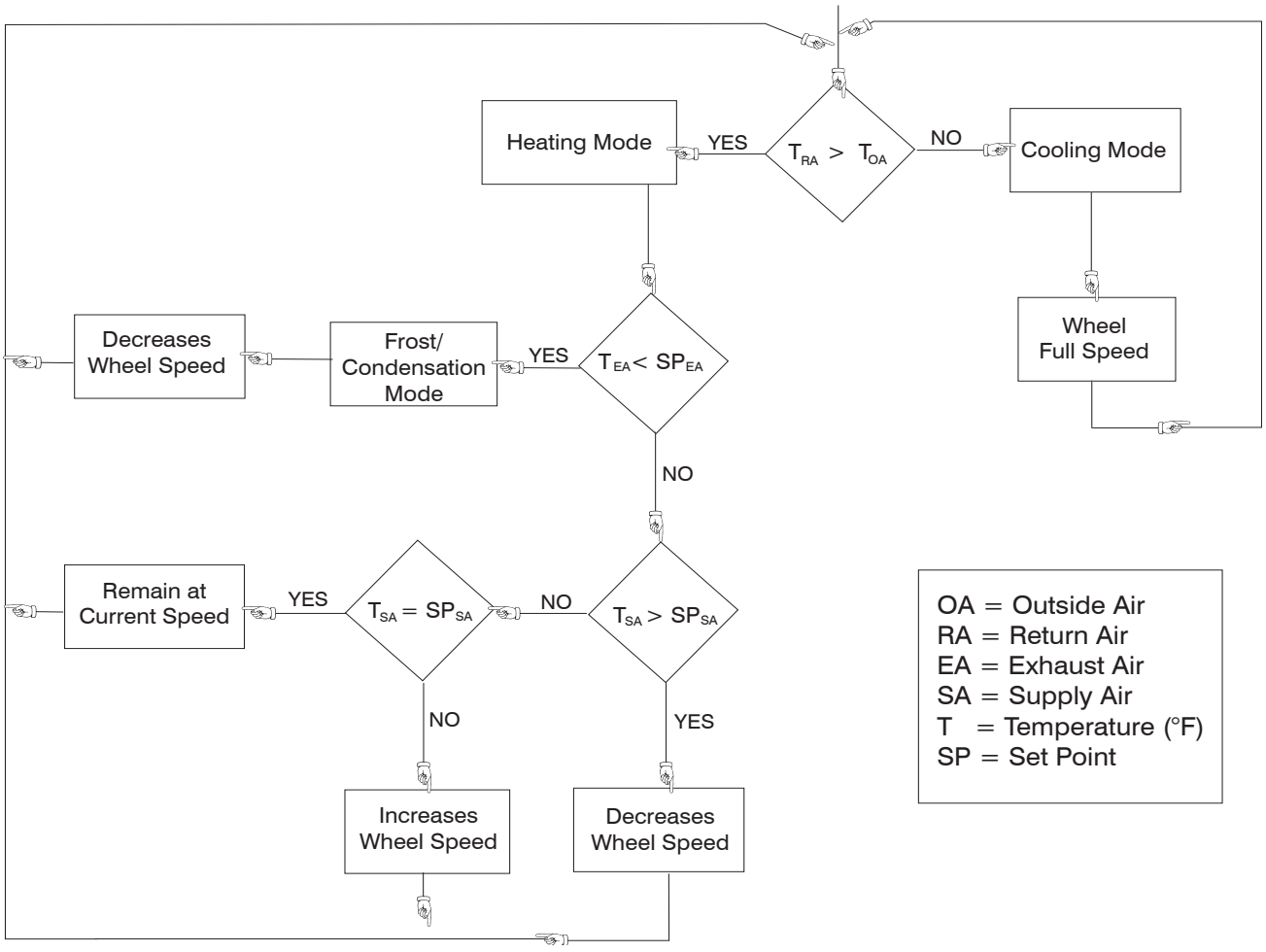
Brother Gear Motor

SEMCO uses the Brother model BG3LM and BGFM gear motors. Horsepower and drive ratio is shown on the gear motor nameplate and vary with wheel size. The gear motors use a maintenance free, lifetime lubricant synthetic grease.

Rotation Detector

The EXCLU-SIEVE wheel has a rotation sensor placed at the wheel rim. This sensor must be within 1/4" of magnet attached to wheel. The rotation detector consists of a printed circuit board mounted in a Nema 1 box with an alarm indicator light and push button reset switch on the face of the box. A set of normally open (N.O.) dry contacts is provided for field connection to a remote alarm (to be provided by others.) The Nema 1 box is shipped loose for customer mounting. The rotation detector requires 24V, 50/60Hz power.

Figure 33. *Operational flow chart for proper temperature and wheel speed operation.*



Start-up and Operation

1 Before starting the EXCLU-SIEVE Energy Recovery Wheel Unit, check the following:

• Are the shipping braces, brackets and restraints removed? If not, remove them.

• Does the rotor rotate freely by hand? If not, recheck the seal to determine whether or not it is binding and ensure that shipping brackets are removed. (See "Planning for Installation" on page 9.)

• Pull back the seal in several places. Does the rotor clear the sealing ring? If it's too close, adjust the seal. (See "Adjusting the Seals" on page 13.)

• Do the airflow arrows conform to the installed ducts? If not, ducting will have to be corrected. (See "Planning for Installation" and "Attaching Ductwork" on pages 9 and 12.)

• Does the power supply match the supply required by the electrical equipment? If not, the electrical equipment or the power supply must be changed. (See "Temperature Controller" on page 15.)

2 Determine drive sheave rotation to make sure that the motor will rotate the rotor in the correct direction. If the rotor is turning backward, reverse the rotation by switching any two motor leads on the motor side (terminals U, V, and W) of the variable frequency controller.

3 Attach the belt and check for adequate tension.

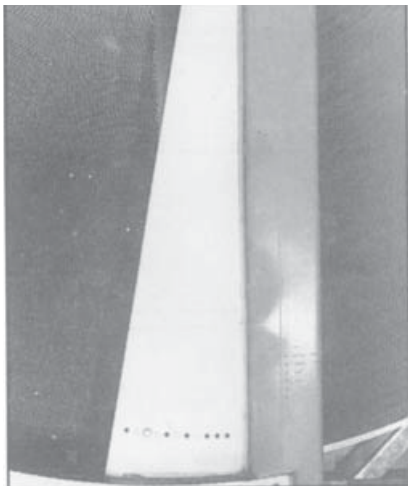


Figure 34. *The purge section on the wheel.*

Adjusting the Purge

As the wheel turns from the exhaust to the supply air stream, a small amount of the outdoor air is sent through the flutes for the media to clean it as it passes the purge. (See Figures 34 and 35.) If exhaust air were permitted to mix with clean supply air, cross-contamination would occur. The small amount of outdoor air directed through the purge prevents this from happening.

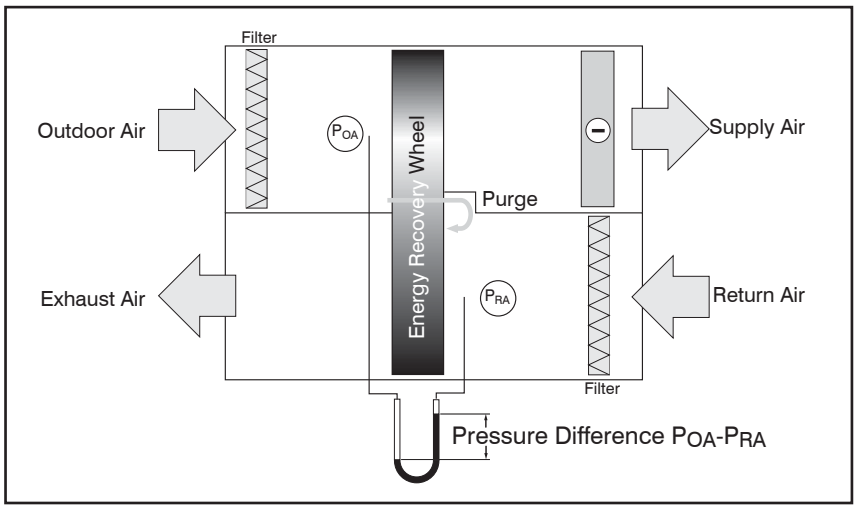


Figure 35. *The purge uses outdoor air to clean the media before the rotor turns into the outdoor air stream. Location of pressure taps to measure the pressure difference between the outdoor and the return air streams.*

The purge utilizes the pressure differential between the outdoor and return air streams to clean the media before the rotor turns into the outdoor air stream. (See Figure 35.)

Adjusting the purge to local conditions requires that the air pressure be measured in the two crucial air streams, the outdoor and return air streams. Install a pressure tap close to the rotor surface in the outdoor and return air stream as indicated in Figure 35. Connect the pressure taps to a differential pressure gauge and record the difference.

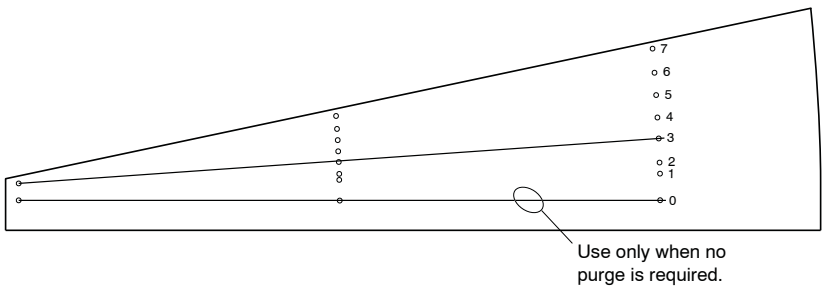
For proper operation, the pressure difference between the outdoor and the return air stream (POA - PRA) must be greater than 1 inch water gauge. If the pressure difference is less than 1 inch w.g. consult SEMCO.

Referring to Figure 36, determine the range where the measured pressure difference falls. For example, if you measure a pressure difference of 1.25 in. w.p., then the appropriate range would be 1.0 - 1.5.

Read the corresponding purge index setting in the same row. In our example, the corresponding purge index setting is 6.

Figure 36. *Purge index detail and setting*

After determining the difference between the return and outdoor pressures, use this table to determine the correct purge index.



Pressure Difference Range (in. w.g.)	Purge Index Setting
0.00 - 0.99	Consult SEMCO
1.00 - 1.5	6
1.6 - 2.0	5
2.1 - 3.0	4
3.1 - 6.0	3
6.1 - 10.0	2
> 10.0	1

Tube Frame Wheel Purge Adjustment

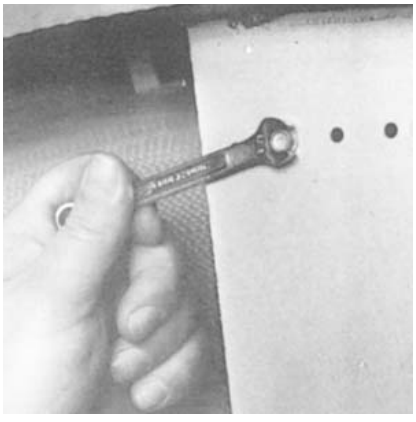


Figure 37. *To adjust the purge, remove the adjusting bolt.*

1. Remove the adjusting bolt(s) from the line of holes at the top (and middle if applicable) of the purge. (See Figure 37.)

2. Loosen the bottom pivot bolt. (See Figure 38.)

3. Close or open the wiper located between the wheel and the purge plate.

4. Locate the appropriate index hole and align purge wiper. The first hole from the rotor center line is “0”, the second hole is “1”, and so on.

5. Tighten both the adjusting bolt and the pivot bolt after setting the purge. Be sure to reseal the purge with silicone caulk after completing the adjustment. (See Figure 39.) A bead of caulk should be laid where the purge wiper joins the purge front plate.

6. Check the seal adjustment on the rim and the purge wiper. The seal should be adjusted as described on page 13, Adjusting the Seals.

Sheet Metal Frame Wheel Purge Adjustment

1. Remove the the screws that connect the purge plate assembly to the support beam as shown in Figure 40.

2. After screws are removed, slide assembly out from behind support beam as shown in Figure 41.

3. After removing the assembly. loosen the pivolt bolt (Figure 42) and remove the adjusting bolt. (Figure 43)

4. With adjusting bolt removed, adjust purge wiper to the appropriate index hole and re-install adjusting bolt using a thread locking compound. The hole closest to the bend is "0", the second is "1" and so on.

5. Slide the assembly back under the support beam and re-attach assembly.

Figure 38. *After removing the adjusting bolt(s), loosen the bottom pivot bolt.*

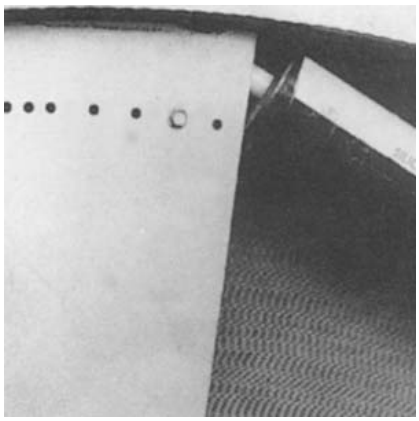


Figure 39. *After adjusting the purge and tightening the adjusting and bottom pivot bolts, apply silicone caulk where the purge wiper joins the purge front plate.*

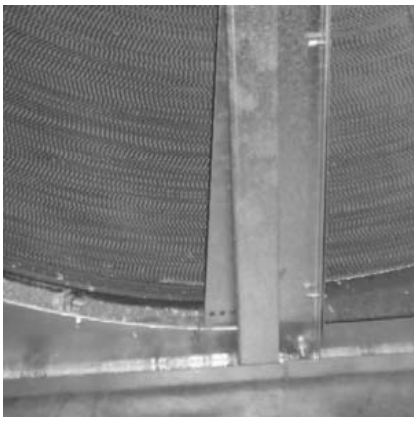


Figure 40. *Sheet Metal Frame purge section.*

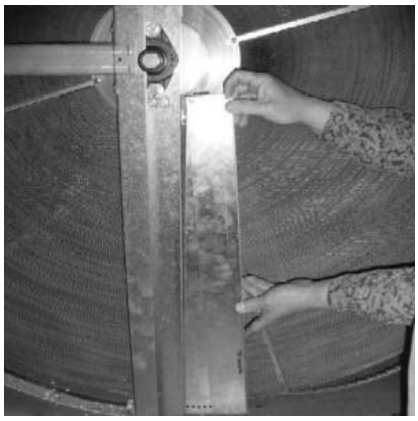


Figure 41. *Sheet Metal Frame purge section removal.*

Figure 42. *Purge wiper pivot bolt.*

Figure 43. *Purge wiper adjusting bolt.*

Programming the Wheel Motor VFD

LEDs for the Yaskawa V1000

LED	On	Flashing	Off
ALM	A fault has occurred	When an alarm occurs	Normal state (no fault or alarm)
REV	Motor is rotating in reverse	-	Motor is rotating forward
DRV	Drive Mode / Auto-tuning	When DriveWorksEZ is used	Programming mode
FOUT	Displays output frequency (Hz)	-	-
LO/RE	When run command is selected from LED operator (LOCAL)	-	Run command is selected from REMOTE device
RUN	During run	During deceleration to stop Run command is present but the frequency reference is zero	During stop

Functions for the Yaskawa V1000

The drive functions are accessible using the up and down arrows from the main menu:

Function	Display	Description
Frequency Reference Display	F 0.00	Allows user to monitor and set the frequency reference while the drive is running.
Forward/Reverse	For / rEv	Indicates if motor is rotating forward or in reverse.
Output Frequency Display	0.00	Monitors the frequency output by the drive.
Output Current Display	0.00A	Monitors the output current of the drive.
Output Voltage Reference	0.0v	Monitors the output voltage of the drive.
Monitor Display	Mon	Monitor parameters are displayed.
Verify Function	vrFY	Lists all parameters that have been edited or changed from default settings.
Setup Group Parameters	STUP	A select list of parameters necessary to get the drive operational quickly.
All Parameters	Par	Allows the user to access and edit all parameter settings.
Auto-Tuning	ARUn	Motor parameters are calculated and set automatically.

Start/Stop Control of the Yaskawa V1000

Toggle between REMOTE and LOCAL Control.
NOTE: Drive MUST be in a STOP condition before control can be switched.

1. Pressing "LO/RE" key will toggle between LOCAL/REMOTE Control. LOCAL Control is active when LO/RE key's LED is GREEN.

For REMOTE Control, choose REMOTE (RE) control.
"START/STOP" contact closure between S1-SC and 0-10V analog input at terminals A1-AC will control Drive.
1. Press "ESC" key until left-most part of Drive's display shows "F". "DRV" LED will also be lit. Frequency Reference is displayed.
2. Press "UP" arrow twice to view Drive's Output Frequency. "FOUT" LED will also be lit. This is not required to run Drive.
3. To RUN, close contact between S1-SC. Drive's Output Frequency is defined by 0-10Vdc input at terminals A1-AC.
4. To STOP, open contact between S1-SC.

For MANUAL Control, choose LOCAL (LO) control.
(LOCAL is active when LO/RE key's LED is GREEN.)
"RUN", "STOP" and keypad entered Frequency Reference setpoint will control Drive.
1. Press "ESC" key until left-most part of Drive's display shows "F". "DRV" LED will also be lit. Frequency Reference is displayed.
2. Using ARROWS, adjust Frequency. Change is automatic when Parameter (O2-05=1) otherwise ENTER key must be pressed
3. To RUN, simply press RUN key. To view actual Output Frequency, press "UP" arrow twice. "FOUT" LED will also be lit.
4. To STOP, simply press STOP key.

Programming Parameters

TO PROGRAM:
(NOTE: For most V1000 Parameters, the Drive must be in a STOP condition while programming.)
1. Press “ESC” key until left-most part of Drive’s display shows “F”. “DRV” LED will also be lit.
2. Press “DOWN” arrow twice to display “PAr” then Press “ENTER” key. (Parameters are now accessible)
3. Using “UP/DOWN/RIGHT” ARROWS, select parameters to be read and/or changed starting with A1-01.
4. If required, use “RIGHT” ARROW or “ENTER” key to scroll to right-most digits of parameter name. Digits will flash.
5. Press”ENTER” key to read value.
6. Using “UP/DOWN/RIGHT” ARROWS, set desired value then press “ENTER” key to store value.
   (Drive will accept value, if valid, then re-display parameter number (ie B1-01, C1-02, etc)).
7. Start with Parameter A1-01. Make sure A1-01=2 to allow access to ALL parameters.
8. Repeat steps 3 -- 6 to program remaining parameters per application requirements.
9. When complete, press “ESC” key until left-most part of Drive’s display shows “F”. “DRV” LED will also be lit.

V1000 Drive is now ready to run.

Param. title	Function	Options	Default setting	SEMCO setting	Comments
B1-01	Frequency Reference Selection 1	0: Operator - Digital preset speed d1-01 to d1-17. 1: Terminals - Analog input terminal A1 or A2. 2: MEMOBUS communications 3: Option PCB 4: Pulse Input (Terminal RP)	1	1	Selects the frequency reference input source.
B1-02	Run Command Selection 1	0: Operator - RUN and STOP keys on the digital operator. 1: Digital input terminals 2: MEMOBUS communications 3: Option PCB	1	1	Selects the run command input source.
B1-04	Reverse Operation Selection	0: Reverse enabled. 1: Reverse disabled.	0	1	Permits or prohibits reverse operation.
B1-07	Local / Remote Run	0: Run command must be cycled 1: Continue running	0	1	Drives runs if run command is active in new controller.
B1-17	Run Command at Power Up	0: Run command must be cycled 1: Run command issued	0	1	Drive runs if run command is active at power up.
C1-01	Acceleration Time	0.0 to 6000.0	10	60	Acceleration time
C1-02	Deceleration Time	0.0 to 6000.0	10	60	Deceleration time
C4-01	Torque Compensation Gain	0.00 to 2.50	1	0	Compensates for added load by increasing output voltage.
C6-01	Normal/Heavy Duty Selection	0: Heavy Duty (HD) for constant torque applications. 1: Normal Duty (ND) for variable torque applications.	1	1	Selects the load rating for the drive.
C6-02	Carrier Frequency Selection	1 : 2.0 kHz 2 : 5.0 kHz 3 : 8.0 kHz 4 : 10.0 kHz 5 : 12.5 kHz 6 : 15.0 kHz 7 : Swing PWM1 (Audible sound 1) 8 : Swing PWM2 (Audible sound 2) 9 : Swing PWM3 (Audible sound 3) A : Swing PWM4 (Audible sound 4) B to E: No setting possible F : User defined (determined by C6-03 through C6-05)	3	1	Lower carrier frequencies increase torque and audible noise.
D2-02	Frequency Reference Lower Limit	0.0 to 110.0	0	1.2	Sets the frequency reference lower limit as a percentage of maximum output frequency (E1-04). Output speed is limited to this value even if the frequency reference is lower. This limit applies to all frequency reference sources.
E1-03	V/f Pattern Selection	0 to FF	FF	FF	Allows custom voltage frequency curve.

Param. title	Function	Options	Default setting	SEMCO setting	Comments
E1-04	Max Output Frequency	40.0 to 400.0	60	120	Maximum frequency
E1-05	Max Output Voltage	0.0 to 255.0	230 460	230 460	Maximum output voltage.
E1-06	Base Frequency	0.0 to E1-04	60	60	Frequency at which maximum output voltage occurs
E1-07	Mid Output Frequency	0.0 to E1-04	3	3	Frequency for midpoint voltage
E1-08	Mid Output Voltage	0.0 to 255.0	18.4 36.8	See table	Output voltage at corresponding midpoint frequency
E1-09	Minimum Output Frequency	0.0 to E1-04	1.5	1.4	Minimum frequency
E1-10	Minimum Output Voltage	0.0 to 255.0	13.8 27.6	See table	Output voltage at minimum frequency.
E2-01	Motor Rated Current	10 to 200% of drive rated current	kVA dependent	See table	Motor nameplate FLA
E2-03	Motor No-Load Current	0 to [E2-01]	kVA dependent	See table	Motor No-Load Current
L1-01	Motor Overload Protection	0: Disabled 1: Std. Fan Cooled (speed range < 10:1) 2: Std. Blower Cooled (speed range ≥ 10:1) 3: Vector Motor (speed range 100:1)	1	3	Overload function based on motor type
L2-01	Momentary Power Loss Operation Selection	0: Disabled - Drive trips on (Uv1) fault when power is lost. 1: Power Loss Ride-Thru Time - Drive restarts if power returns within the time set in L2-02. 2: CPU Power Active - Drive will restart if power returns as long as the CPU is working.	0	1	Allows drive to restart after power loss without a fault
L3-01	Stall Prevention Level during Acceleration	0: Disabled 1: Enabled 2: Intelligent Stall Prevention	1	0	Disables stall prevention during acceleration
L3-04	Stall Prevention Level during Decceleration	0: Disabled 1: General Purpose Stall Prevention 2: Intelligent Stall Prevention 3: Stall Prevention with Braking Option 4: Overexcitation Braking	1	0	Disables stall prevention during decceleration
L3-05	Stall Prevention Level during Run	0: Disabled 1: Decelerate Using C1-02 2: Decelerate Using C1-04	1	0	Disables stall prevention during run
L5-01	Number of Auto Restart Attempts	0 to 10	0	5	Selects number of automatic restart attempts after fault.
L8-07	Output phase loss protection	0: Disabled 1: Enabled 2: Enabled	0,1	0	Selects the output Phase loss detection

Motor dependent parameters for Brother gearmotors*

	1/4 Hp		1/2 Hp		1 Hp	
Brother P/N	BG3LM**-***TK4A		BG3LM**-***TL4A		BG3LM**-***TM4A	
Motor Voltage	208-230/3/60	460/3/60	208-230/3/60	460/3/60	208-230/3/60	460/3/60
E1-08	15.3	31	15.3	28.5	16	35
E1-10	12.5	25	12.3	25	12.8	30
E2-01	1.0	0.5	1.8	0.9	3.1	1.6
E2-03	0.6	0.3	1.1	0.5	1.9	1.0

* SEMCO does not recommend use with motors other than those listed. Consult Yaskawa for assistance in programming for use with other motors.

Troubleshooting the Yaskawa V1000

A failure in the drive can fall into one of two categories, Alarm or Fault.

When the drive detects a fault:
- The digital operator displays text that indicates the specific fault and the ALM indicator LED remains lit until the fault is reset.
- The fault interrupts drive output and the motor coasts to a stop.
- It will remain inoperable until that fault has been reset.

When the drive detects an alarm or a minor fault:
- The digital operator displays text that indicates the specific alarm or minor fault and the ALM indicator LED flashes.
- The motor does not stop.
- The digital operator displays text that indicates the specific alarm or minor fault and the ALM indicator LED flashes.
- Remove the cause of an alarm or minor fault to automatically reset.

In the event of an alarm or fault consult the Yaskawa V1000 Technical Manual (page 241), also available at www.drives.com, or contact SEMCO DWP Technical Service for assistance.

Maintenance

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

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

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

All other maintenance activity should be conducted monthly, quarterly, semiannually or annually as described on the following pages. All essential maintenance services are summarized in a chart printed at the end of this section.

Rotor Bearing

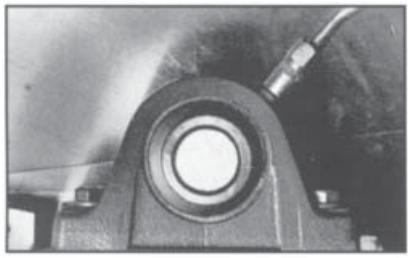


Figure 44. *Grease should be pumped into two rotor bearing grease points, one located on each side of the rotor. Lubrication frequency depends upon operating temperatures normally experienced around the rotor.*

The rotor bearing's anticipated average life is 20 years. The bearing was greased prior to shipment. However, lubrication just prior to start-up is recommended.

Recommended lubrication – The bearing's lubrication cycle depends upon the range of temperatures normally experienced by the unit 24 hours a day. For a typical temperature range of -20°F to 130°F, lubrication every 6 months is adequate. If higher temperatures are experienced, 130°F to 170°F, lubrication every 3 months is recommended. For environments with temperatures above 170°F, consult SEMCO.

Grease should be pumped into the 2 bearing grease points - one located on each side of the rotor. (See Figure 44.) A high grade NLGI No. 2 grease is recommended.

Note: If a rotor bearing requires replacement, contact SEMCO for detailed instructions.

The bearing bolts normally require checking at start-up only. For torque values, see table 2.

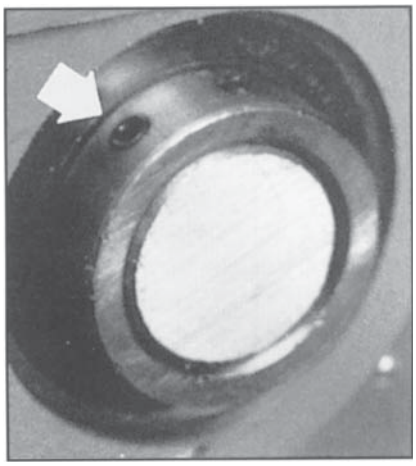


Figure 45. *The bearing set screws, one on each side of the rotor, should be checked for tightness every six months.*

Bearing Set Screws

1. The bearing set screws should be checked periodically for tightness. A bearing set screw is located on each side of the rotor. (See Figure 45.)

   Recommended checking frequency – Bearing set screws should be checked at start-up, one month after start-up, then every 6 months thereafter.

2. The bearing set screws should be torqued to 15 ft-lbs.

Motor

The motor has deep grooved, double-shielded bearings with sufficient lubricant packed into the bearings by the manufacturer for "life lubrication." The initial lubricant is supplemented by a supply packed into larger reservoirs in the end shield at the time of assembly. No grease fittings are provided as the initial lubrication is adequate for up to 10 years of operation under normal conditions. No lubrication is required.

Fastener Type		Torque ft-lb.
Bearing bolts	1/2" 5/8" 3/4"	50 80 120
Bearing set screws Rim bolts Taper locks(busing bolts)		15 35 15

Table 2. Torque values for various bolts

Variable Frequency Controller

1. The variable frequency controller is cooled by air flowing through the heat sink slots. The slots must never be allowed to become obstructed with dirt or foreign material. Periodically check and clean the heat sink slots with compressed air or a vacuum. Airflow must never be restricted in any way.

2. Check and clean the variable frequency controller annually.

Seals

Properly adjusted seals are an important element for effective, efficient unit operation.

The seals must be adjusted to gauge depth prior to the start-up. Subsequently, seals should be checked in several places with the seal gauge after the first month of operation, and every 3 months thereafter.

Note: If seals give any sign of binding the rotor, they should be adjusted immediately.

To adjust the seals, see complete instructions on page 13 under "Adjusting the Seals."

The rotor should be checked periodically to ensure the continued integrity of the bushings, shaft, spokes, media and rim.

The Rotor and Media

1 Checking for rotor run out – Shut off the unit. Has any media loosened from the spokes? Are the rims securely bolted to the spokes? Are the spokes tight? Is the rotor well centered? Examine the shaft closely for any indication that the bushings have moved. Note whether or not the rotor has moved closer to the seals on one side of the unit or the other. Has the rotor moved closer to the seals at the right or the left of the rotor or has it moved closer to seals at the top or bottom? If so, call SEMCO.

Check the rotor for flatness. Using a machinist's scale or a dial indicator, measure the distance between the media and a main support. Rotating the rotor by hand, measure distances at three positions on each media wedge and in the center of each spoke. (See Figure 46.) All measurements should be within 1/16 inch. If not, call SEMCO.

Rotor run out checks should be conducted at start-up, after 3, 6 and 12 months of operation, and at least once a year thereafter.

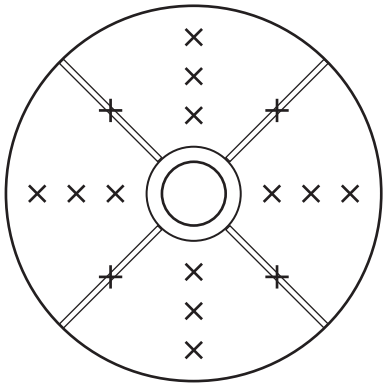


Figure 46. *To check the rotor for flatness, measure the distance from main frame support to media and spokes at location marked by an "X" in this illustration. If the rotor contains more than four wedges, the same measurement locations should be used for the additional wedges and spokes.*

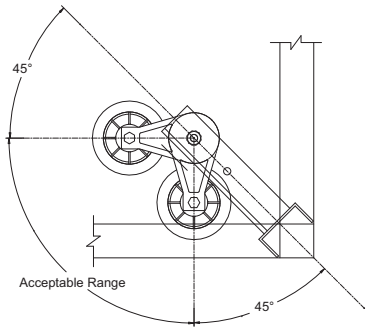
2 Checking for media tightness – Shut off the unit. Select an area of media near the hub and place your hands flat against the media. Attempt to move the media to either side and up and down. Perform this test on each wedge of media. If any movement is detected, call SEMCO immediately. Check for media tightness at start-up, after the first month of operation, and every 3 months thereafter.

3 Media cleaning – The SEMCO EXCLU-SIEVE energy recovery wheel has been designed so that a laminar flow is maintained within the transfer media at all operating conditions. This means that the air and all other particles in the air stream pass straight through the wheel.

Due to the laminar flow profile through the EXCLU-SIEVE energy wheel, any collection of dust or particulate matter will occur at the entering and leaving edges of the transfer media. Such buildup can usually be vacuumed, purged with compressed air or wiped from the rotor surface. In rare cases where a more thorough cleaning is required, low temperature steam or hot water and detergent may be used. Consult SEMCO for instructions when using cleaning methods other than compressed air or vacuuming.

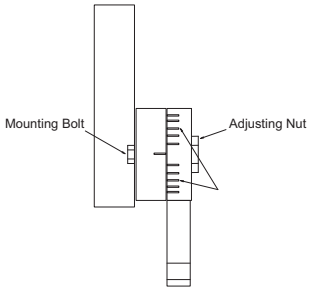
Drive Belts

The belts should be checked periodically for wear and correct belt tension after start-up and semi-annually thereafter.



Belt Tension Detail

The tensioner must be positioned so that after final tensioning it is at no less than a 45 degree angle with the centerline of the mounting bracket. Anything less will limit the effectiveness of the tensioner and may cause premature belt failure. If, due to belt wear, the standard mounting position and belt length cannot meet this requirement the belt tensioner may need to be moved on the mounting bracket.



Tensioner Adjustment

1) Loosen the tensioner by accessing the mounting bolt from the back side of the mounting bracket.
2) Adjust the tensioner base by using a wrench on the adjusting nut to load the tension spring.
3) Tighten until belt is snug and preload tensioner spring to approximately 50%-75%. Utilize tick marks on the tensioning arm and base as a guide. After final tensioning the tensioner should be able to move one full tick mark when pulled to compress the spring (removing belt tension).

Maintenance Schedule

Service	Startup	Month											
		1	2	3	4	5	6	7	8	9	10	11	12
Rotor bearing lubrication	X						X						X
Bearing bolts tightness	X												
Bearing set screw tightness	X	X					X						X
Sheave set screw tightness	X	X					X						X
Motor and gear reducer bolt tightness	X	X					X						X
Belt wear	X						X						X
Adjust seals	X	X		X			X			X			X
Rotor runout & flatness	X			X			X			X			X
Media tightness	X	X		X			X			X			X
Check/ recalibrate temperature controller													X
Check/clean variable frequency controller													X

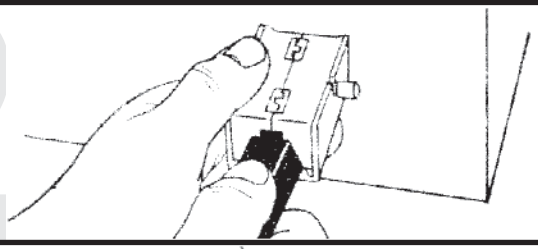
Note: Rotor runout and flatness checks should be accomplished annually after the first year of operation.

Applying the V-Belt Fastener

1

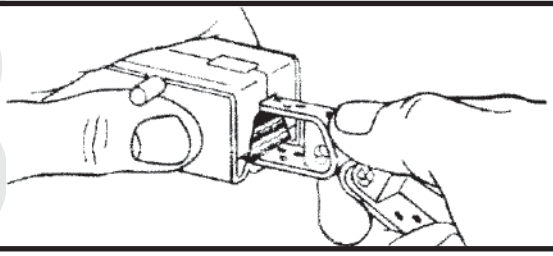
STRAIGHTEN BELT END. Reverse-bend end of belt as shown to remove curl.

2



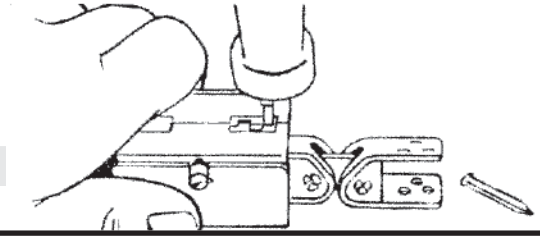
INSERT BELT IN HOLDER. Press against flat surface to square belt end with end of holder. Tighten holder screw.

3



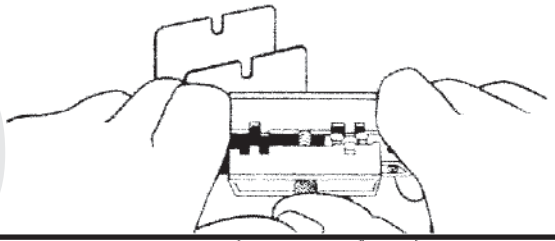
INSERT FASTENER IN HOLDER, tight against end of belt. Be sure belt stays flush with end of holder.

4



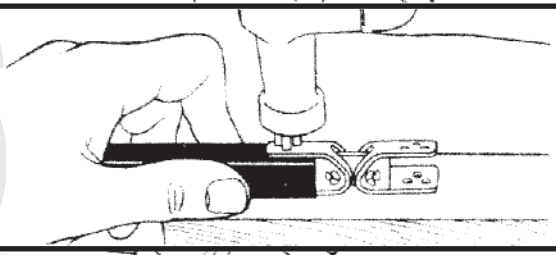
DRIVE NAILS, one at a time, with light hammer blows. Work on a solid surface.

5



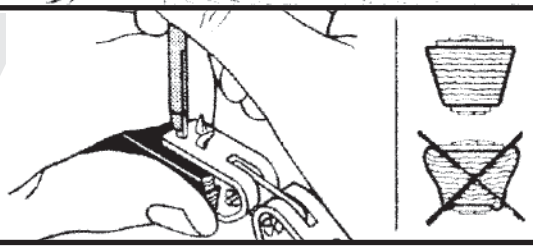
REMOVE BELT from holder.

6



DRIVE NAILS all the way through fastener into soft wood. (do not crush fastener)

7



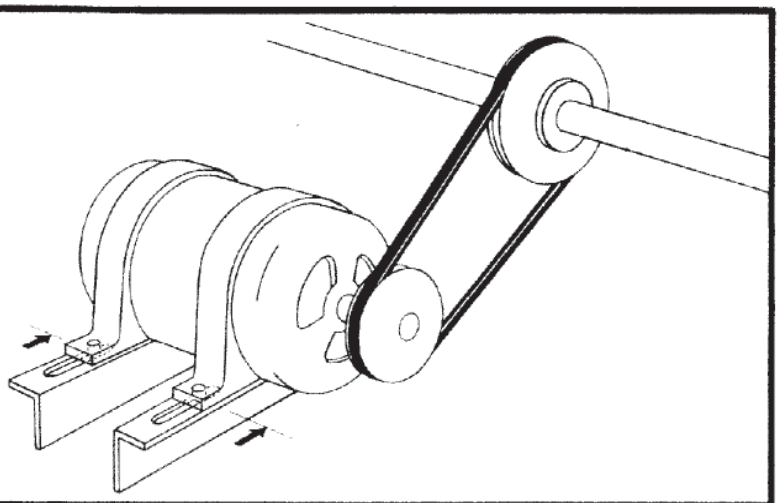
BEND NAILS AND CLINCH. (do not crush fastener)

Note: For line shafts or outboard bearings, wrap belt around shaft before applying second half of fastener.

Adjusting Belt Length

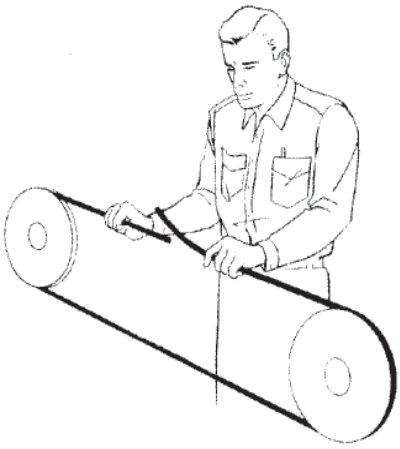
1

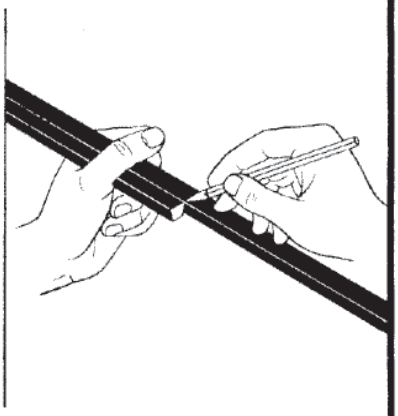
Set motor using 1/3 of its take-up



2

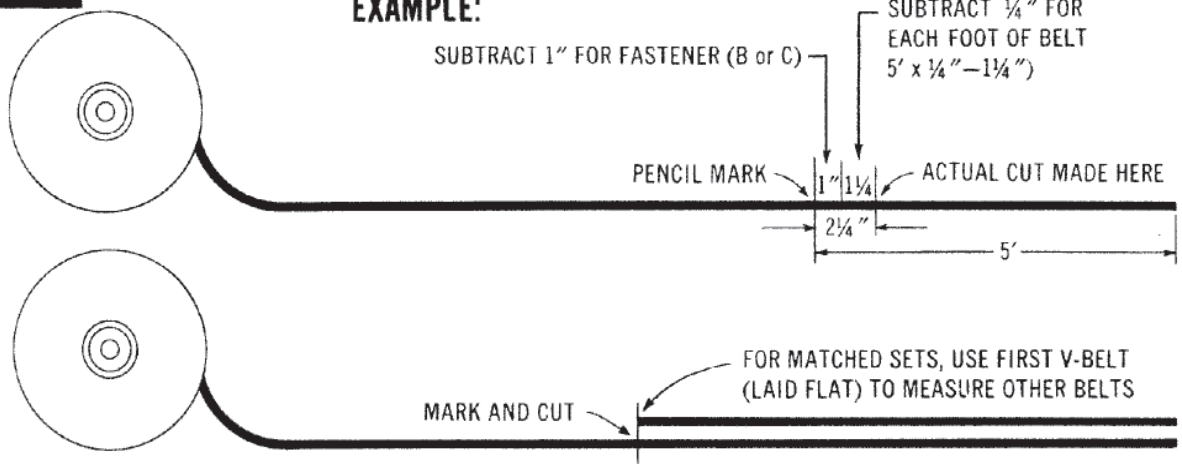
Wrap belt around sheaves, pull tight, and mark





3 *Correct the length*

EXAMPLE:



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