READ AND SAVE THESE INSTRUCTIONS

PART #461248

GREENHECK
Building Value in Air.

HEAT RECOVERY UNIT WITH EVAPORATIVE COOLING

Models: HRE-20, 45, 55, & 90

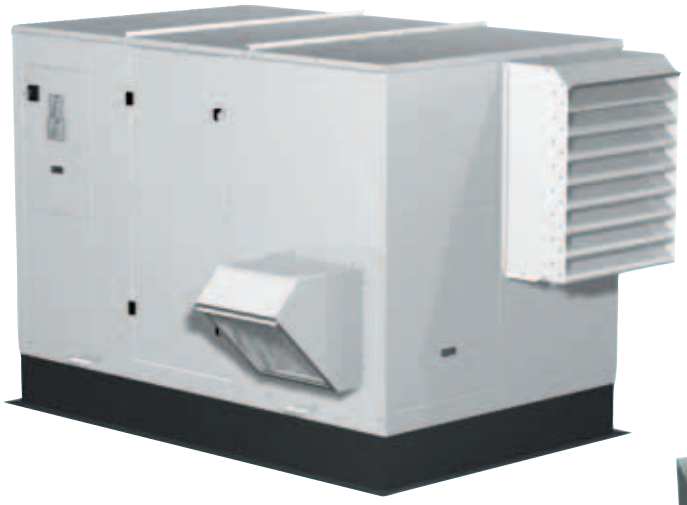
INSTALLATION, OPERATION AND MAINTENANCE MANUAL

RECEIVING AND HANDLING

The HRE is thoroughly inspected and test run at the factory. However, damage may occur during shipping and handling. Upon delivery, inspect the unit for both obvious and hidden damage. If damage is found, record all necessary information on the bill of lading and file a claim with the final carrier. In addition, ensure all accessory items are present. Some accessory items are stored inside the unit during shipping.

SAFETY WARNING

Improper installation, adjustment, alteration, service or maintenance can cause property damage, injury or death. Read this installation, operation, and maintenance manual thoroughly before installing or servicing this equipment. Installation and service must be performed by a qualified installer, service agency, or the gas supplier.



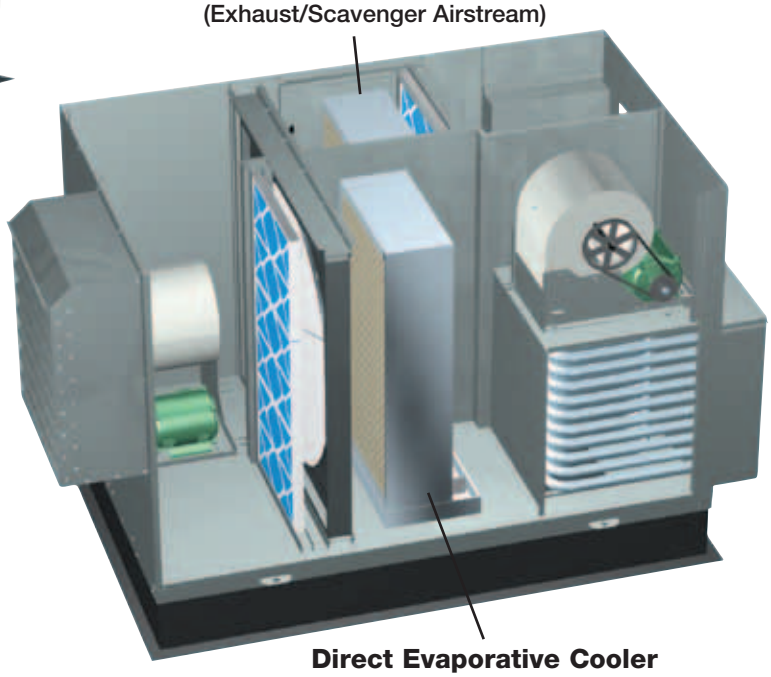
INSTALLATION SUPPLEMENT

Refer to the following installation supplement for HRE units when supplied with Indirect Gas (IG) heating:

Model PVF, Indirect Gas Fired Furnaces for Energy Recovery Units, Part #461006

SAVE THIS MANUAL

This manual is the property of the owner, and is required for future maintenance. This manual should remain with each HRE unit when the job is complete.



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STORAGE

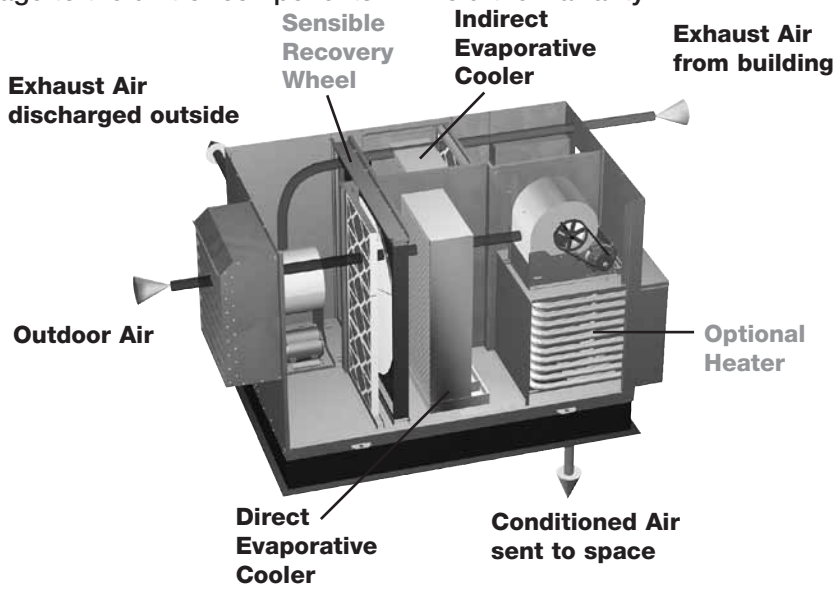
When a unit is not going to be in service for an extended amount of time, certain procedures should be followed to keep the fans in proper operating condition.

- Rotate fan wheel monthly and purge grease from bearings once every three months
- Cover unit with tarp to protect from dirt and moisture (Note: do not use a black tarp as this will promote condensation)
- Energize fan motor once every three months
- Store belts flat to keep them from warping and stretching
- Store unit in location which does not have vibration
- After storage period, purge grease from fan bearings before putting fan into service

If storage of unit is in a humid, dusty or corrosive atmosphere, rotate the fan and purge the bearings once a month. Improper storage which results in damage to the unit or components will void the warranty.

BASIC OPERATION

The HRE brings in fresh, outdoor air and removes stale, exhaust air. For summer operation, the exhaust air flows through an evaporative cooler (indirect) to lower the air temperature. A sensible recovery wheel transfers energy from the exhaust air to the outdoor air at an efficiency of 70-80% to reduce the temperature of the outdoor air. The outdoor air can then flow thru an optional evaporative cooler (direct) to further reduce the temperature of the outdoor air. The sensible wheel also recovers heat from the exhaust in the winter to precondition the outdoor air. Optional heaters are available after the wheel for final tempering.



INSTALLATION

The system design and installation should follow accepted industry practice, such as described in the ASHRAE Handbook.

Adequate space should be left around the unit for piping coils and drains, filter replacement, and maintenance. Sufficient space should be provided on the side of the unit for routine service and component removal should that become necessary.

See Service Clearances/Access Panel Locations section for more details.

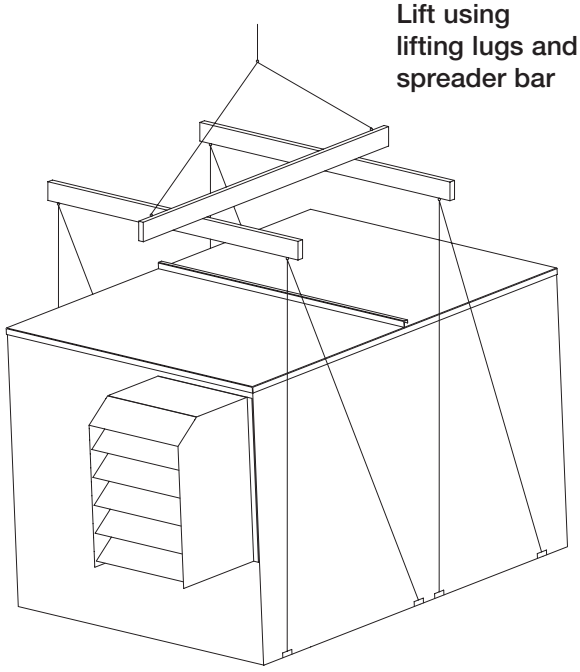
SAFETY WARNING

All factory provided lifting lugs must be used when lifting the units. Failure to comply with this safety precaution could result in property damage, serious injury, or death.

LIFTING

1) Before lifting, be sure that all shipping material has been removed from unit.
2) To assist in determining rigging requirements, weights are shown below.
3) Unit must be lifted by the eight lifting lugs provided on base structure.
4) Rigger to use suitable mating hardware to attach to unit lifting lugs.
5) Spreader bar(s) must span the unit to prevent damage to the cabinet by the lift cables.
6) Always test-lift the unit to check for proper balance and rigging before hoisting to desired location.
7) Never lift units by weatherhoods.
8) Never lift units in windy conditions.
9) Preparation of curb and roof openings should be completed prior to lifting unit to the roof.
10) Check to be sure that gasketing (supplied by others) has been applied to the curb prior to lifting the unit and setting on curb.
11) Do not use fork lifts for handling unit.

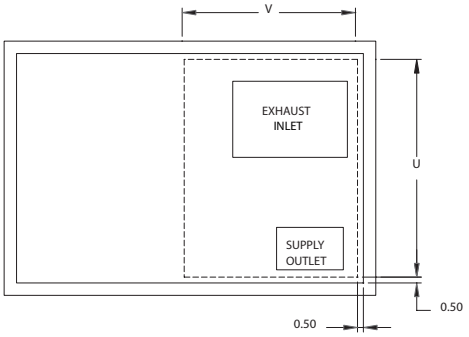
Lift using lifting lugs and spreader bar



UNIT WEIGHTS & RECOMMENDED ROOF OPENING

Unit Size	Approx. Dry Weight (lbs)	Approx. Wet Weight (lbs)	U	V
HRE-20	1660	1800	46	37
HRE-45	2580	2840	54	39
HRE-55	2950	3320	65	47
HRE-90	4750	5400	85	49

Unit weights assume indirect evap, direct evap, and IG furnace.
All dimensions shown are in inches.



Position the unit roof opening such that the supply discharge and exhaust inlet of the unit will line up with the corresponding ductwork. Be sure to allow for the recommended service clearances when positioning opening (see Service Clearances). Do not face the outdoor air inlet of the unit into prevailing wind and keep the supply inlet of the unit away from any other exhaust fans. Likewise, position the exhaust discharge opening away from fresh air intakes of any other equipment.

When cutting only duct openings, cut opening 1 inch (25mm) larger than duct size to allow clearance for installation. Area enclosed by roof curb must comply with clearance to combustible materials. If the roof is constructed of combustible materials, area within the roof curb must be ventilated, left open, or covered with non-combustible material which has an ÒRÓ value of at least 5. If area within curb is open, higher radiated sound levels may result.

Where the supply or warm air duct passes thru a combustible roof, a clearance of one inch must be maintained between the outside edges of the duct and combustible material in accordance with NFPA Standard 90A.

ROOF CURB MOUNTING

Rooftop units require curbs to be mounted first. The duct connections must be located so they will be clear of structural members of the building.

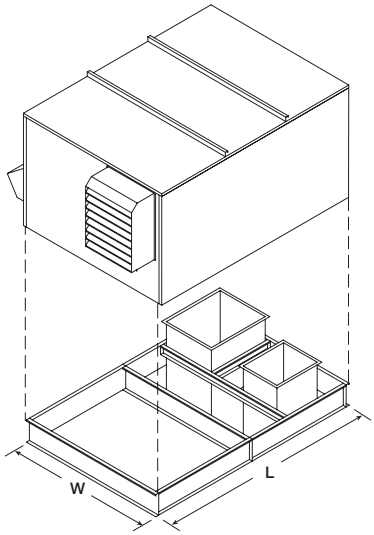
Roof curb details, including duct location dimensions, are available on HRE roof curb assembly instructions.

1. **Factory Supplied Roof Curbs**
   Roof curbs are Model GKD, which are shipped in a knockdown kit (includes duct adapter) and require field assembly (by others). Assembly instructions are included with the curb.

2. **Install Curb**
   Locate curb over roof opening and fasten in place. (Refer to Recommended Roof Openings). Check that the diagonal dimensions are within ±1/8 inch of each other and adjust as necessary. For proper coil drainage and unit operation, it is important that the installation be level. Shim as required to level.

3. **Install Ductwork**
   Installation of all ducts should be done in accordance with SMACNA and AMCA guidelines. Duct adapter provided to support ducts prior to setting the unit.

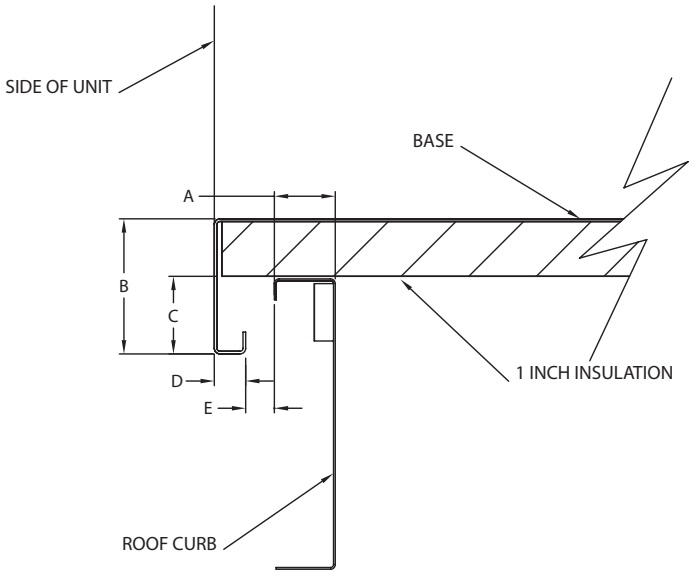
4. **Set the Unit**
   Lift unit to a point directly above the curb and duct openings. Guide unit while lowering to align with duct openings. Roof curbs fit inside the unit base. Make sure the unit is properly seated on the curb and is level.



Curb Outside Dimensions

Curb Outside Dimensions			Weight
Model	L	W	
HRE-20	93	51	280
HRE-45	100.5	60.63	355
HRE-55	112.75	71.5	450
HRE-90	125.75	90.75	625

All dimensions shown are in inches.



Curb CAP Details for Factory Supplied Roof Curbs

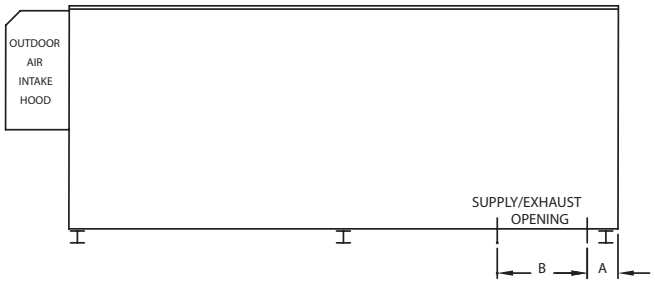
Model	Curb Cap Dimensions				
	A	B	C	D	E
HRE-20	2.00	2.00	1.00	0.88	0.75
HRE-45	2.00	4.25	2.00	1.31	0.50
HRE-55	2.00	4.25	2.00	1.31	0.50
HRE-90	2.00	4.25	2.00	1.31	0.50

All dimensions shown are in inches.

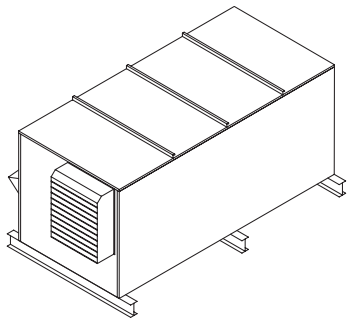
RAIL MOUNTING

Rail Layout

- Rails designed to handle the weight of the HRE should be positioned as shown on the diagram (rails by others).
- Make sure that rail positioning does not interfere with the supply air discharge opening or the exhaust air intake opening on the HRE unit. Avoid area dimensioned “B” below
- Rails should run the width of the unit and extend beyond the unit a minimum of 12 inches on each side.
- Set unit on rails.



Side view of HRE on rails



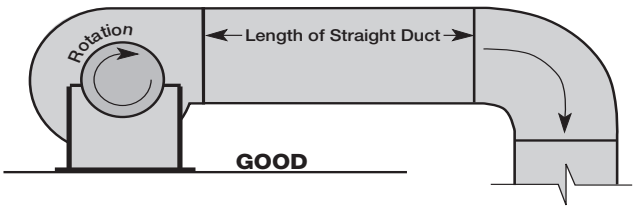
Isometric view of HRE on rails

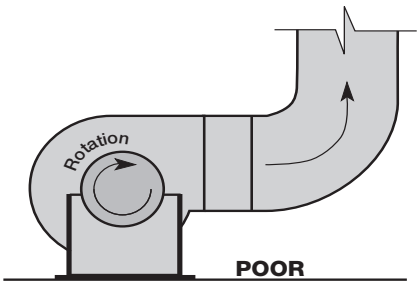
Model	Rail Mounting	
	A	B
HRE-20	5.1	25.0
HRE-45	7.1	25.1
HRE-55	5.7	35.0
HRE-90	6.6	36.1

All dimensions shown are in inches.

DUCTWORK CONNECTIONS

Examples of good and poor fan-to-duct connections are shown below. Airflow out of the fan should be directed straight or curve the same direction as the fan wheel rotates. Poor duct installation will result in low airflow and other system effects.





Recommended Discharge Duct Size and Length			
HRE Model	HRE Blower Size	Duct Size	Straight Duct Length
HRE-20	10	14 x 14	40
HRE-45	12	20 x 20	48
HRE-55	15	28 x 28	60
HRE-90	18	32 x 32	72

Dimensions shown are in inches.

SUPPLY WEATHERHOOD

Supply weatherhood will be factory mounted.

EXHAUST WEATHERHOOD

The exhaust weatherhood is shipped separately as a kit with its own instructions.

DAMPERS

Backdraft dampers are always included as an integral part of the exhaust hood assemblies. Motorized outdoor air and exhaust air dampers are optional and are factory mounted (and wired) at the inlet.

ELECTRICAL INFORMATION

The unit must be electrically grounded in accordance with the current National Electrical Code, ANSI/NFPA No. 70. In Canada, use current C.S.A. Standard C22.1, Canadian Electrical Code, Part 1. In addition, the installer should be aware of any local ordinances or electrical company requirements that might apply. System power wiring must be properly fused and conform to the local and national electrical codes. System power wiring is to the unit main disconnect (door interlocking disconnect switch standard on most units) or distribution block and must be compatible with the ratings on the nameplate: supply power voltage, phase, and amperage (Minimum Circuit Amps - MCA, Maximum Overcurrent Protection - MOP). All wiring beyond this point has been done by the manufacturer and cannot be modified without affecting the unit's agency / safety certification.

If field installing an additional disconnect switch, it is recommended that there is at least four feet of service room between the switch and system access panels. When providing or replacing fuses in a fusible disconnect, use dual element time delay fuses and size according to the rating plate.

If power supply is desired thru bottom of unit, run the wiring through the curb, cut a hole in the cabinet bottom, and wire to the disconnect switch.

The electric supply to the unit must meet stringent requirements for the system to operate properly. Voltage supply and voltage imbalance between phases should be within the following tolerances. If the power is not within these voltage tolerances, contact the power company prior to operating the system.

Voltage Supply - See voltage use range on the rating plate. Measure and record each supply leg voltage at all line disconnect switches. Readings must fall within the allowable range on the rating plate.

Voltage Imbalance - In a 3-phase system, excessive voltage imbalance between phases will cause motors to overheat and eventually fail. Maximum allowable imbalance is 2%. To determine voltage imbalance, use recorded voltage measurements in this formula.

Key: V1, V2, V3 = line voltages as measured

VA (average) = (V1 + V2 + V3) / 3

VD = Line voltage (V1, V2 or V3) that deviates farthest from average (VA)

Formula: % Voltage Imbalance = [100 x (VA-VD)] / VA

CAUTION

If any of the original wire as supplied with the appliance must be replaced, it must be replaced with wiring material having a temperature rating of at least 105ºC.

WARNING

To prevent injury or death due to electrocution or contact with moving parts, lock disconnect switch open.

WARNING

For units with a gas furnace, if you turn off the power supply, turn off the gas.

Most factory supplied electrical components are pre-wired. To determine what electrical accessories require additional field wiring, refer to the unit specific wiring diagram located on the inside of the unit control center access door. The low voltage control circuit is 24 Vac and control wiring should not exceed 0.75 ohms. Refer to Field Control Wiring Length/Gauge table for wire length maximums for a given wire gauge. Control wires should not be run inside the same conduit as that carrying the supply power. Make sure that field supplied conduit does not interfere with access panel operation.

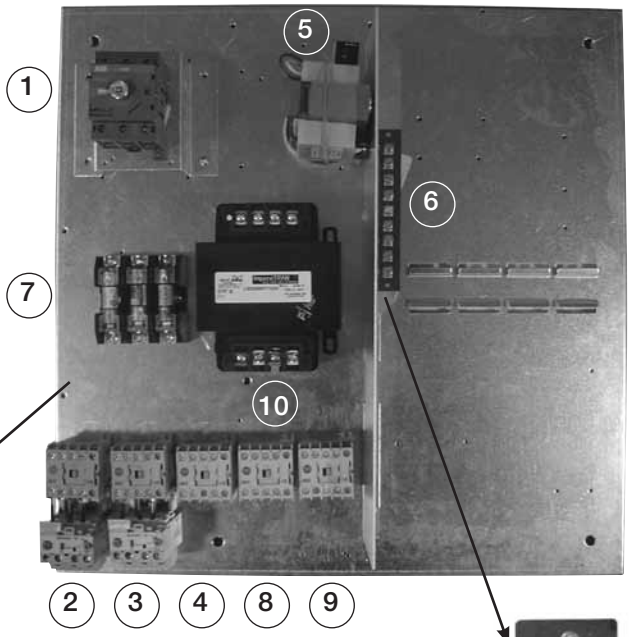
Field Control Wiring Length/Gauge	
Total Wire Length	Minimum Wire Gauge
125 ft.	18
200 ft.	16
300 ft.	14
450 ft.	12

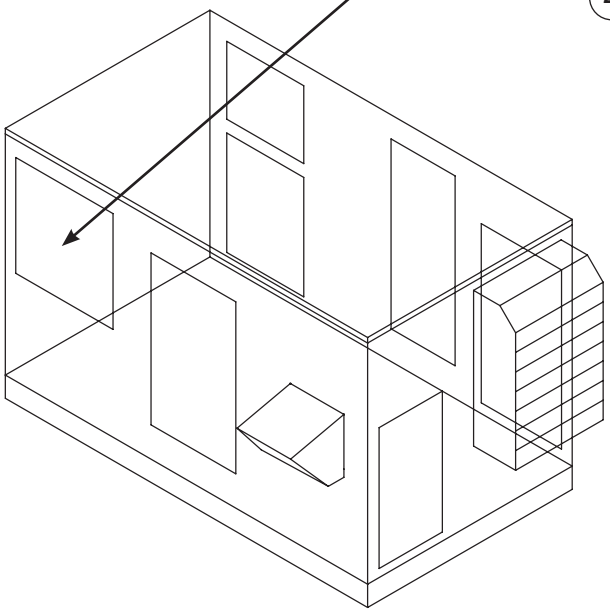
If wire resistance exceeds 0.75 ohms, an industrial-style, plug-in relay should be added to the unit control center and wired in place of the remote switch (typically between terminal blocks R and G on the terminal strip (refer to Typical Control Center Components). The relay must be rated for at least 5 amps and have a 24 Vac coil. Failure to comply with these guidelines may cause motor starters to "chatter" or not pull in which can cause contactor failures and/or motor failures.

Note: Standard factory installed electric post-heaters have their own disconnect separate from the unit disconnect. Thus, each electric post-heater requires its own separate power connection.

TYPICAL CONTROL CENTER COMPONENTS

1. Main Disconnect (non-fusible, lockable)
2. Motor Starter - Exhaust Air Fan
3. Motor Starter - Outdoor Air Fan
4. Motor Contactor - Energy Wheel
5. 24 VAC Control Transformer
6. 24 VAC Terminal strip
7. Fuses for blower motors
8. Motor Contactor - Indirect Evap Pump
9. Motor Contactor - Direct Evap Pump
10. Evap Pump Transformer
    (115 VAC Secondary)



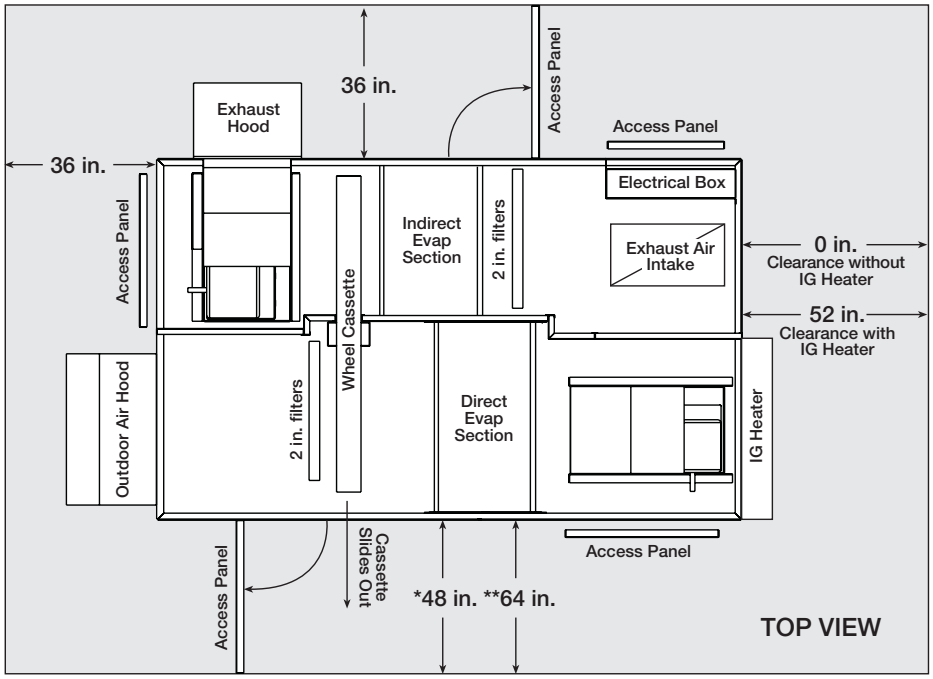


Exploded Detail of Terminal Strip

SERVICE CLEARANCES / ACCESS PANEL LOCATIONS

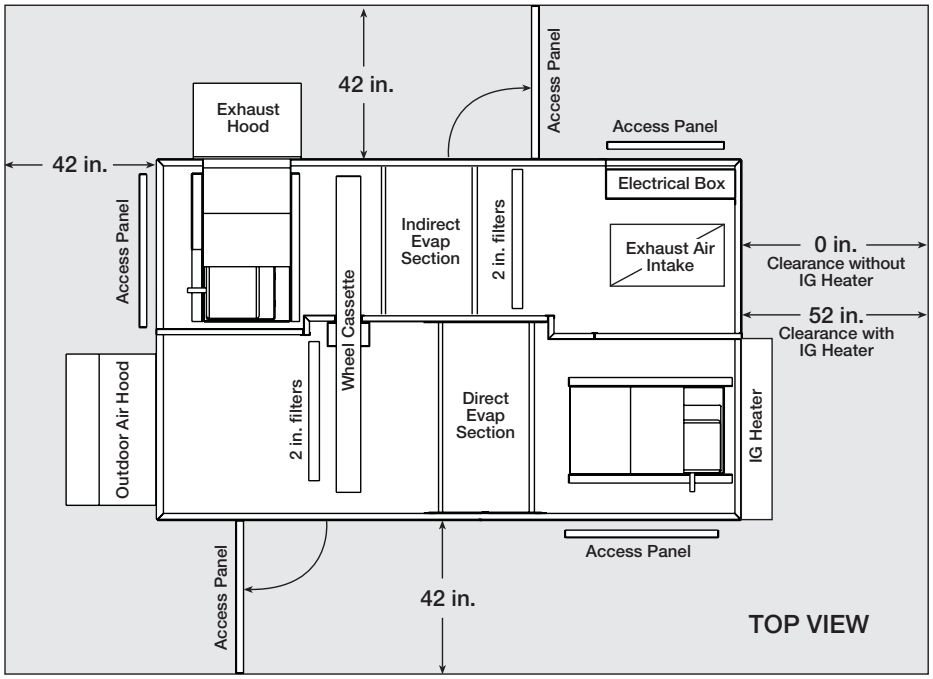
HRE-20, 45, 55, and 90 units require minimum clearances for access on all sides for routine maintenance. Filter replacement, drain pan inspection and cleaning, energy wheel cassette inspection, fan bearing lubrication and belt adjustment, are examples of routine maintenance that must be performed. Blower and motor assemblies, energy recovery wheel cassette, coil and filter sections are always provided with a service door or panel for proper component access. *Clearances for component removal may be greater than the service clearances, refer to drawings below for these dimensions.*

HRE-20
HRE-45



Clearances for service and component removal on HRE-20 and HRE-45
* Clearance for energy wheel removal on HRE-20
** Clearance for energy wheel removal on HRE-45

HRE-55
HRE-90



Clearances for service and component removal on HRE-55 and HRE-90

DIMENSIONAL DATA / ACCESS DOOR DESCRIPTIONS

Model	Exterior Dimensions								
	A	B	C	D	E	F	G	H	I
HRE-20	98	50	56	18	28.5	17	6	14.25	18
HRE-45	106	69	66	16	41	23.375	10.5	13.375	20
HRE-55	118	70	76	16	59.5	5.875	7.125	21.25	25
HRE-90	131	85	96	16	78	2.875	10	24.5	27

All dimensions shown are in inches.

Model	Overall Exterior Dimensions		
	Width (including Lifting Lugs)	Overall Width (with Exhaust Hood)	Overall Length (with Outdoor Air Hood)
HRE-20	59.5	75	116
HRE-45	69.5	86	122
HRE-55	79.5	101	134
HRE-90	99.5	123	147

All dimensions shown are in inches.

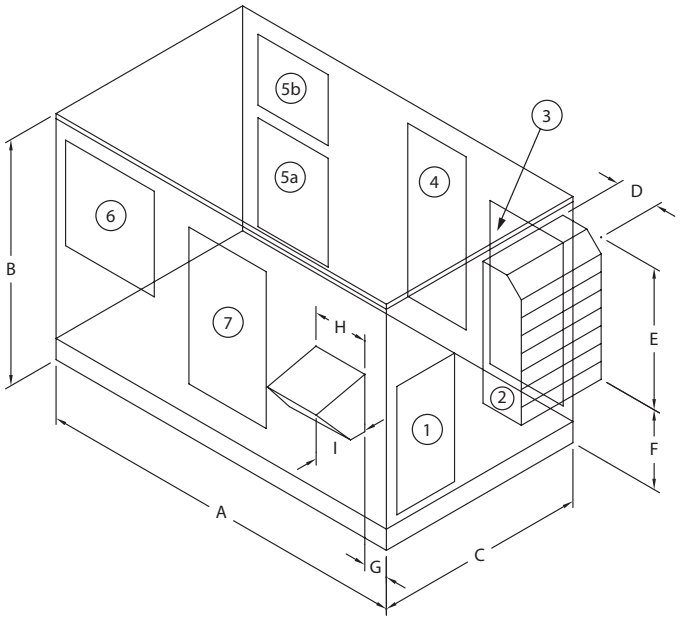
Following is a list of items accessible through the access doors shown on the diagram at the right. Some items are optional and may not have been provided.

1) Exhaust blower, motor, and drives
2) Aluminum mesh filters (intake hood)
3) Energy recovery wheel, motor, belt, and seals
   Outdoor air filters
   Outdoor air intake damper (optional)
   Electric preheater (optional)
   Frost control sensors (optional)
   Economizer sensors (optional)
4) Direct evaporative cooler, drain pan, and pump (optional)

5a) Outdoor air blower, motor, and drives (without indirect gas furnace)

5b) Outdoor air blower, motor, and drives (with indirect gas furnace)

6) Control center
   All electrical controls
   VFDs for blowers (optional)
   VFD for energy recovery wheel (optional)
7) Indirect evaporative cooler, drain pan, and pump
   Exhaust air filters
   Exhaust air intake damper (optional)

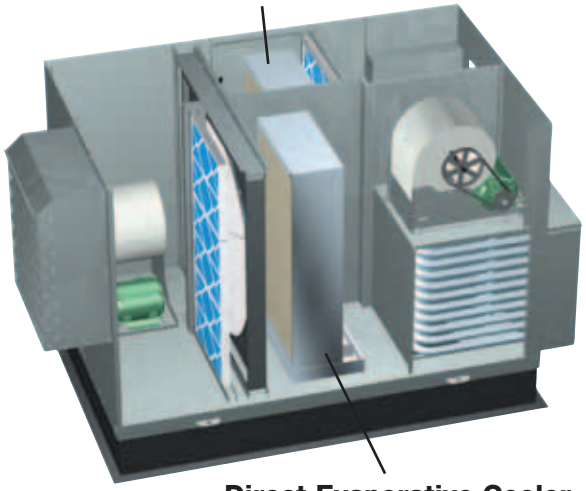


Dimensional data and access door locations

EVAPORATIVE COOLING MODULES

Mount the heat recovery unit level to ensure proper operation and water drainage. Piping should be of adequate size to provide sufficient supply of water to meet the maximum demand of the evaporative coolers.

Indirect Evaporative Cooler
(Exhaust/Scavenger Airstream)



Direct Evaporative Cooler
(Outdoor/Supply Airstream)

EVAP MODULE INSTALLATION

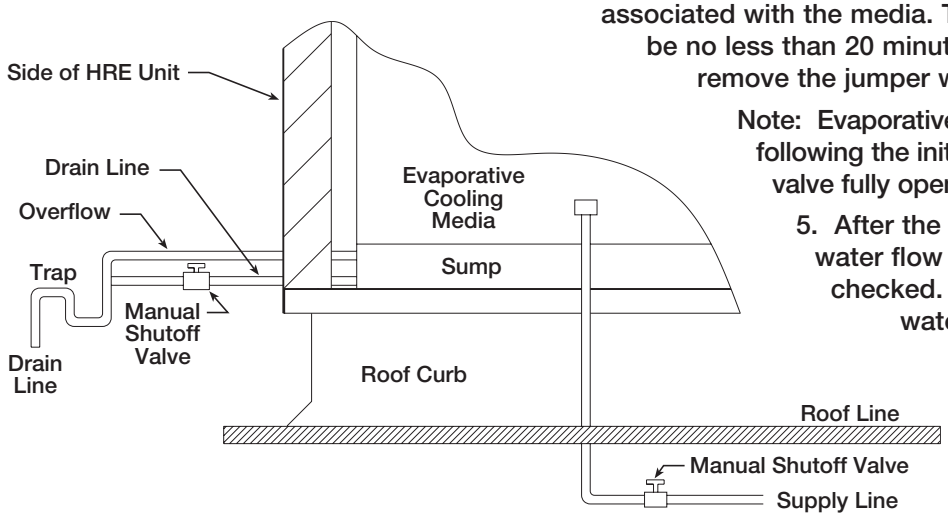
1. After the energy recovery unit is set in place, run the overflow and drain lines to the exterior fittings on the evaporative cooler (drain & overflow connections at unit are 1-inch male pipe thread). The supply line can be attached at the downstream side of the evaporative cooler. A manual shut off valve should be mounted in the supply line near the unit for servicing purposes. Also, a trap should be installed in the drain line to prevent air/sewer gas from being drawn into the unit (refer to Drain and Overflow Connection Locations and Drain Trap sections). Run bleed line into overflow.

EVAP MODULE START-UP

1. The cooler will be prewired by the factory. (pumps are 115VAC).
2. Check to make sure that the pump filter is around the pump inlet.
3. Turn the water on and allow the sump to fill. Adjust the float valve to shut-off the water supply when the sump is filled to a 1-inch height.
4. Open the bleed-off valve completely and saturate the media without any airflow through the unit. A jumper wire is required on the terminal strip to provide power to the evaporative cooler pump (see the wiring diagram for the proper location). This saturation process will break-in the media and minimize the odors associated with the media. The media's break-in period should be no less than 20 minutes. When the process is complete, remove the jumper wires in the control center.

   Note: Evaporative media may foam for a short period following the initial start-up. Leave the bleed-off valve fully open until the foaming stops.

5. After the media break-in period, the water flow rate over the media needs to be checked. The pumps should provide enough water to saturate the media in 1-3 minutes. If adequate flow rate is not achieved, adjust via water flow adjustment device found on water supply line running to evap header.



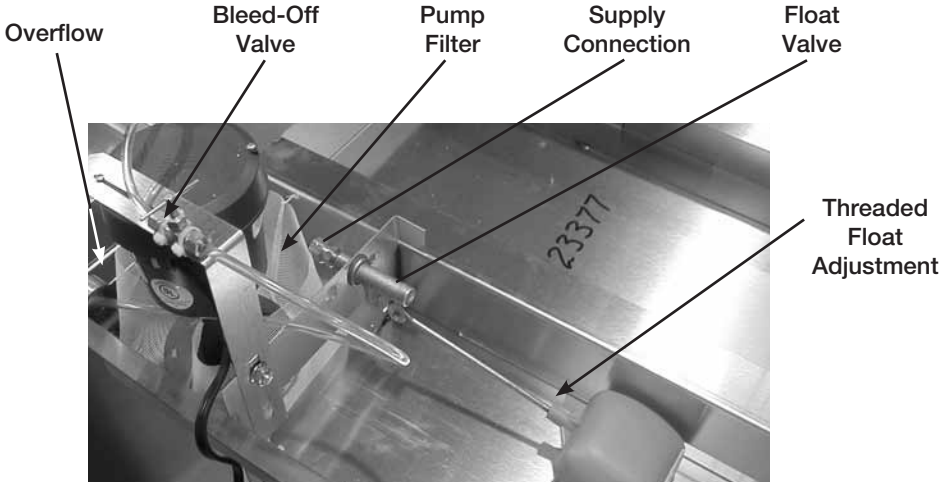
Standard Trap and Supply Line Configuration

6. The water bleed-off rate will now need to be adjusted. This measurement is 3 to 6 percent of the media flow rate. The recommended flow rate is 1½ to 2 GPM per square foot of media pad top area (see table at right). Actual water to the unit will be based on the evaporation rate. A water flow adjustment device is supplied and installed by Greenheck for ease of water flow adjustments. After the unit has been installed and running for two weeks the unit should be checked for mineral deposits. If there are deposits, the bleed-off rate needs to be increased. Some areas of the country have water with greater amounts of dissolved minerals requiring a higher bleed-off rate.

		Media Size (w x h x d) (in.)	Media Pad Top Area
HRE-20	**Supply**	18 x 36 x 12	1.5 ft²
	Exhaust	18 x 36 x 12	1.5 ft²
HRE-45	**Supply**	30 x 48 x 12	2.5 ft²
	Exhaust	24 x 48 x 12	2.0 ft²
HRE-55	**Supply**	36 x 56 x 12	3.0 ft²
	Exhaust	30 x 56 x 12	2.5 ft²
HRE-90	**Supply**	48 x 69.5 x 12	4.0 ft²
	Exhaust	40 x 69.5 x 12	3.3 ft²

7. Verify that both airflow and system static pressure are in agreement with the specifications. If these conditions are met, check for water carry over from the discharge side of the media. If carry over is observed, check the distribution header for holes or tears and the water standoff tube for blockage.
8. After all final adjustments are made, remove the jumper wires, connect “call for cooling” signal, and replace all access panels. The unit is now ready for operation.

Water Flow Adjustment Device



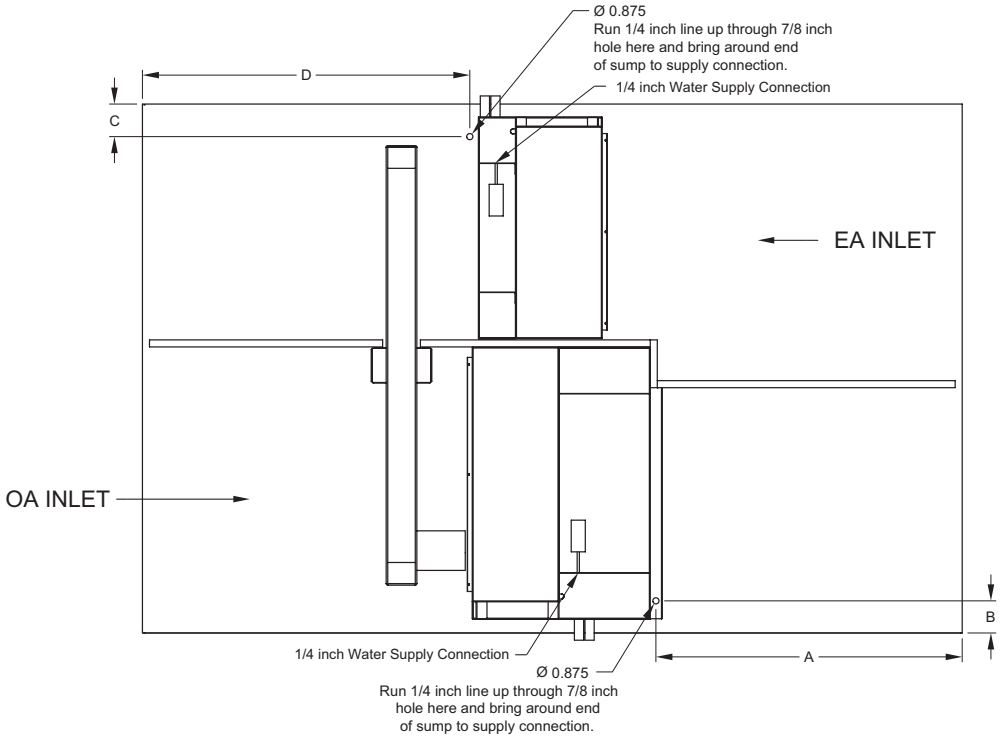
Pump and Float Components

HRE WATER SUPPLY CONNECTION LOCATION

Model	Water Supply Connection Locations			
	A	B	C	D
HRE-20	37.375	4.625	4.625	39.25
HRE-45	38.75	4.625	4.625	43.00
HRE-55	43.50	4.625	4.625	46.125
HRE-90	43.50	4.625	4.625	52.625

Dimensions from outside of unit (in inches)

Top View

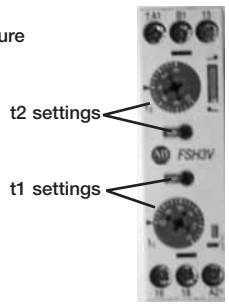


WATER CONTROL OPTIONS FOR EVAPORATIVE COOLING

AUTO DRAIN AND FILL WITH FREEZE PROTECTION

This system will automatically drain the sump tank and fill it with fresh water at the field adjustable intervals, typically once every 24 hours. This flushes mineral build-up and debris from the tank to promote low maintenance and increase media pad life. In addition, the system will protect the evaporative cooler from freezing by draining the sump tank and supply line when the outside temperatures fall below the set point of the outside air sensor. Typically, this is set at 45º to 50º F. The auto drain and fill outdoor air sensor should be installed in an area that is shaded from direct sunlight so the outside air sensor probe will detect an accurate air temperature. Set the timer. Timer settings are t1:1.0, 10 min and t2:0.4, 60h

Evaporative Freeze Protection



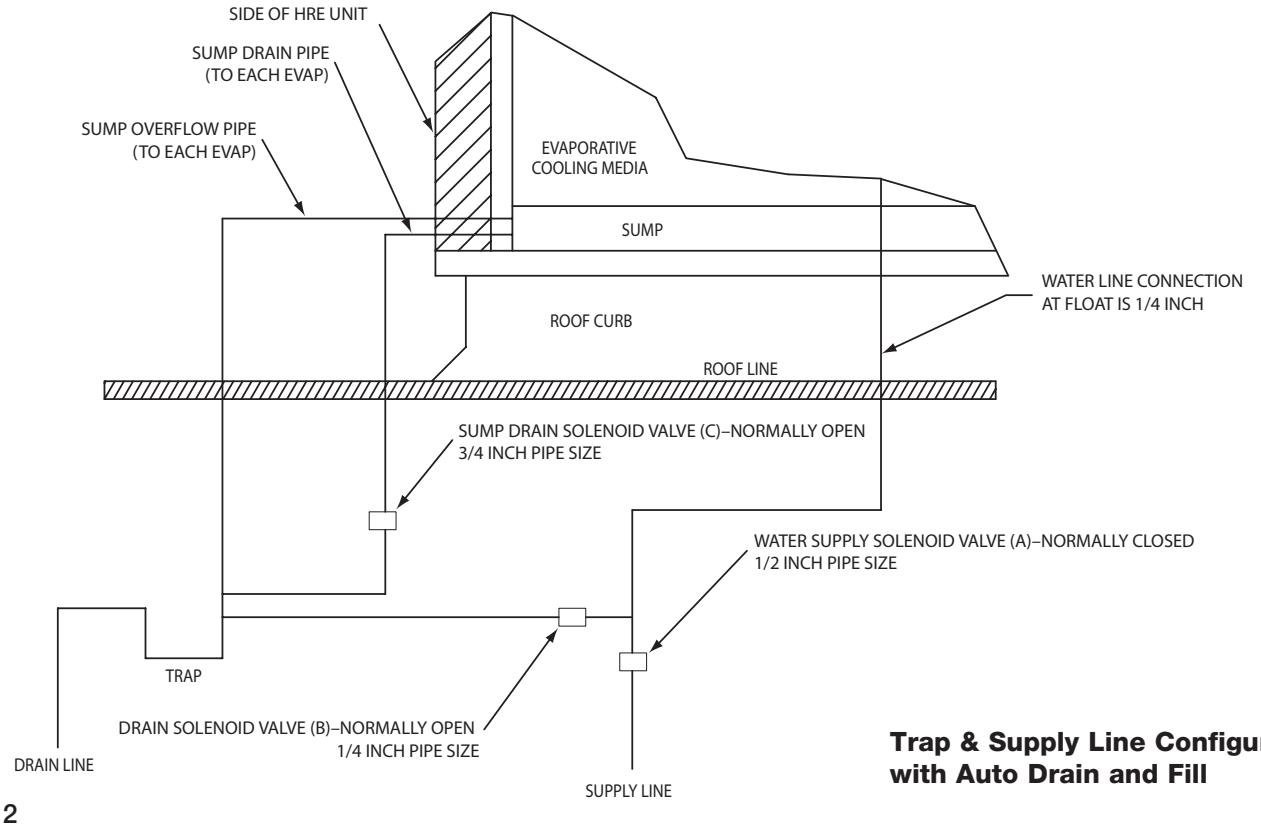
Evaporative Timer

PLUMBING FOR AUTO DRAIN AND FILL

1. Run water supply line to the unit and install **Water Supply Solenoid Valve (A)** in this line as close to the water source as possible.
2. Install **Drain Solenoid Valve (B)** in the supply line as indicated below. From the outlet on the drain valve, run line to a suitable drain location.
3. Run an unobstructed drain line from the sump overflow to the drain trap as shown below.
4. Install **Sump Drain Solenoid Valve (C)** in the drain line from the sump as indicated below. From the outlet on this drain valve, run a line to a suitable drain location.

Note: Water Supply Solenoid Valve (A) is not the same as the Drain Solenoid valves (B) and (C). Make sure to use the proper valve for each location. Check your local code requirements for proper installation of this type of system. Additional drain and supply plumbing may be needed to meet your local code.

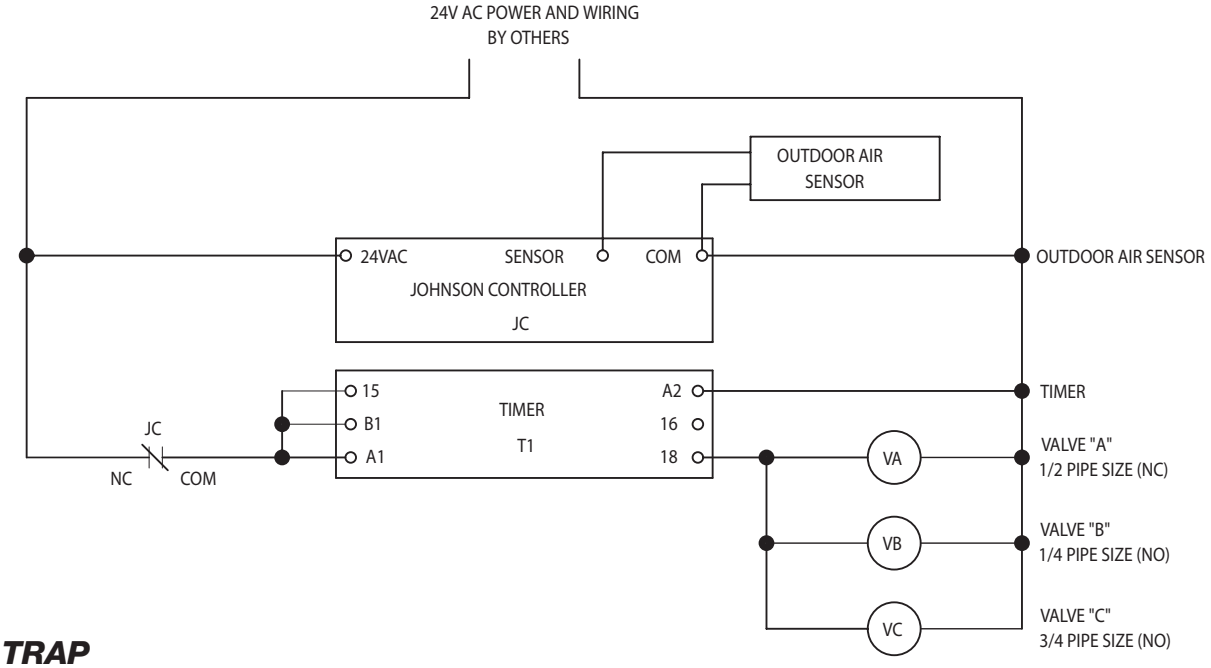
Caution: All solenoid valves A, B, and C must be installed below the roof to protect the supply water line from freezing. If these valves cannot be installed below the roof, an alternate method must be used to protect these lines from freezing.



Trap & Supply Line Configuration with Auto Drain and Fill

THE FOLLOWING COMPONENTS SHIP FROM GREENHECK WITH HRE (INSTALLATION, WIRING, AND POWER BY OTHERS)

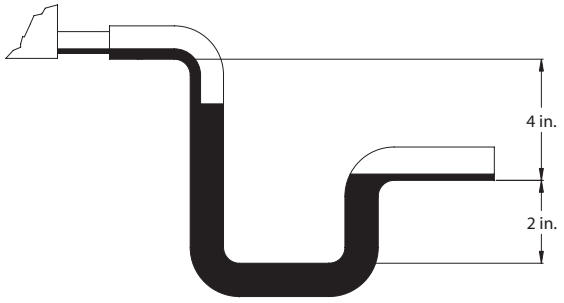
PART DESCRIPTIONS	GREENHECK P/N	QTY.	HOLDING VA	INRUSH VA
JOHNSON CONTROLLER	07458032	1	-	-
OUTDOOR AIR SENSOR	07458298	1	-	-
24 HOUR TIMER	07381940	1	-	-
VALVE, WATER SUPPLY (A)	05461262	1	25	70
VALVE, DRAIN (B)	05461263	1	25	50
VALVE, SUMP DRAIN (C)	05461264	1	25	70



DRAIN TRAP

Cooling coils are provided with a stainless steel drain pan with 3/4-in. female NPT drain connection. A drain trap must be connected to the drain connection to allow excess water to flow out of the drain pan. More importantly, though, due to the negative internal static of the cooling coil compartment, installing the drain trap prevents outdoor air from being pulled into the drain pan and consequently forcing water out of the pan and into the unit.

To ensure the drain trap works properly, the trap height must account for the difference in static pressure between ambient conditions outside the unit and the internal negative pressure of the cooling coil compartment. For energy recovery units, an assumption of 3.0 in. wg. differential will be sufficient. This would require a trap design as shown. If the internal static is believed to be higher, consult factory.



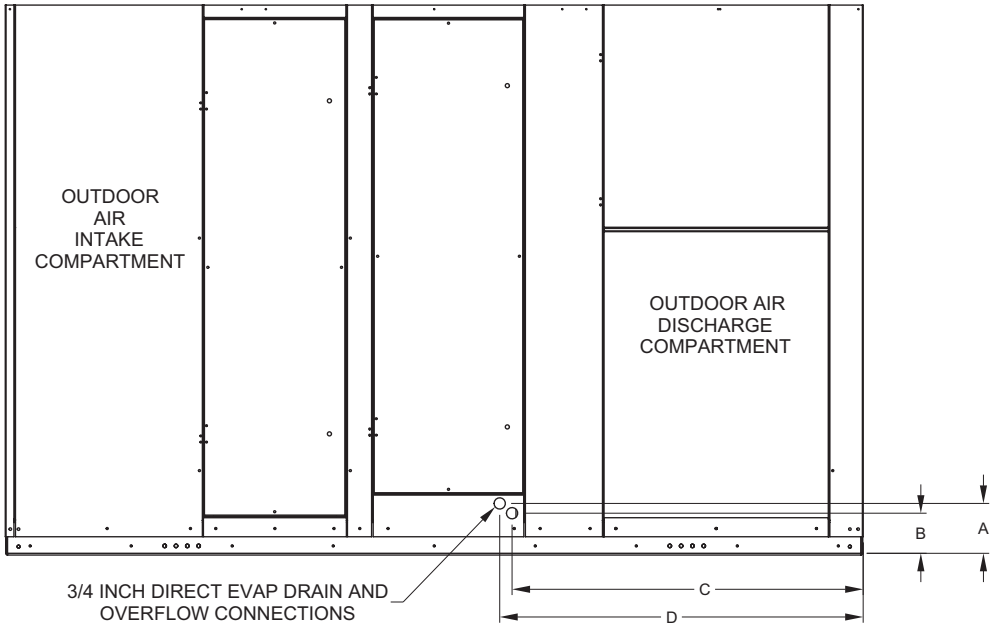
Refer to local codes to determine drainage requirements. If draining onto to roof, place a drip pad below drain to protect roof. If draining onto roof is not acceptable, a drain line must be attached to the trap. The drain line must be pitched away from the unit at least 1/8-in. per foot. On longer runs, an air break should be used to ensure proper drainage. Local codes may require drainage into a waste water system.

Drainage problems not only occur from improper drain trap design, but also from lack of maintenance of the cooling coil compartment. Algae can form in the drain pan and trap and cause reduced water flow, which can in turn result in backup into the system. Regular maintenance will prevent this from occurring. If the drains have a cleanout opening, be sure to close the opening after cleaning.

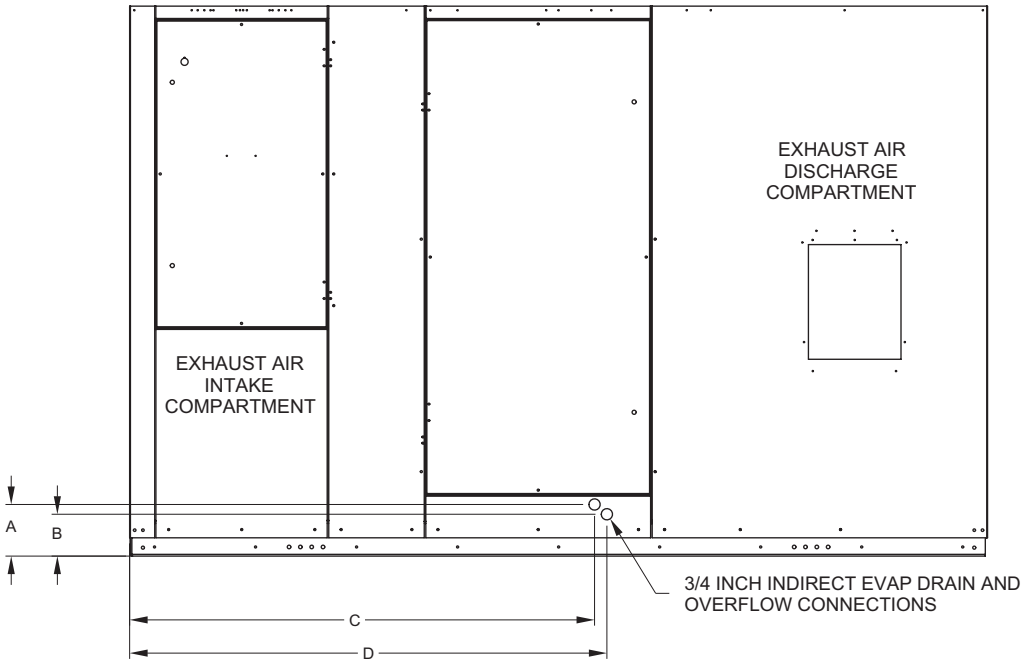
DRAIN AND OVERFLOW CONNECTION LOCATIONS

Model	Connection Locations - in inches							
	Outdoor Air Side				Exhaust Side			
	A	B	C	D	A	B	C	D
HRE-20	4.00	2.875	40.75	42.25	4.00	2.875	52.25	53.75
HRE-45	6.25	5.125	42.625	44.125	6.25	5.125	56.50	58.00
HRE-55	6.375	5.125	53.00	54.50	6.375	5.125	66.375	67.875
HRE-90	6.375	5.125	47.25	48.50	6.375	5.125	71.00	72.25

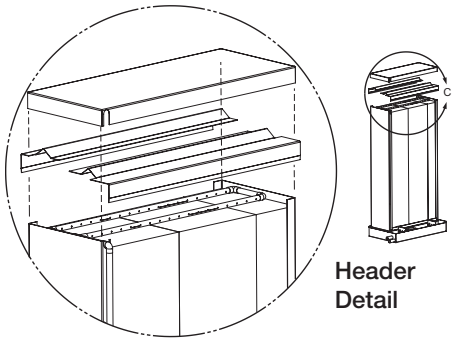
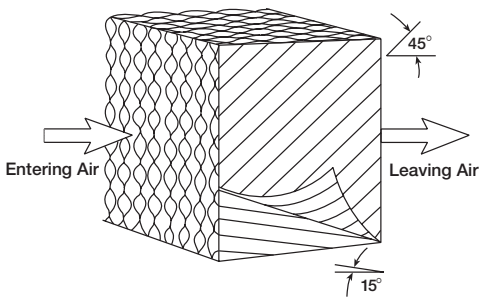
Outdoor Air



Exhaust



TROUBLESHOOTING FOR EVAPORATIVE MODULE

Symptom	Solution
Insufficient water volume or recirculation pump not operating	A. Check water level in base pan. The level should be at 1 inch. B. Check the pump filter at the inlet. Clean the filter if clogged or dirty. C. If pump is not operating, check wiring for loose connections and proper voltage. D. Clogged or worn out pump. E. Clogged header. F. Water flow adjustment device  Header Detail
Irregular water distribution on cooling media	Water distribution header, orifices or media partially blocked or plugged. Remove evaporative cooler from unit. Disassemble and clean distribution header, orifices and media.
Scale and mineral deposit formation on face of media	A. Increase bleed rate. B. Increase water flow rate. Media is self-cleaning with flow rate of 1 1/2 to 2 gpm per square foot of media top area. Generally this flow rate prevents dissolved solvents from collecting on the media. To prevent further trouble, flush and clean the system more frequently. C. Check water flow across the face of the media. Irregular water distribution must be corrected (see above) D. If this condition persists, chemicals may need to be added. Water pH should be maintained between 6 and 8.
Water Carry-Over	A. Irregular water distribution on face of media (see above). B. Average face velocity exceeds 550 fpm. Decrease fan rpm and airflow. C. Localized face velocities exceeding 550 fpm. Air filters or media face area is partially blocked. Clean or replace air filters and media. D. Check the overflow for blockage.
Inadequate cooling	A. Irregular water distribution over face of media (see above). B. Check for uniform airflow. C. Check outside wet-bulb temperature. High wet-bulb temperatures can decrease performance. D. Check water flow rate over media. Flow rate should be 1 1/2 to 2 gpm per square foot of media top area.
Excessive water discharge into drain	A. Check the water bleed off rate and make sure that it is not excessive. B. Check water level in base pan. The level should be at 1 inch.
Poor performance after cooling pad replacement	Pad installed backwards. To get the performance from the cooling pads, they must be installed properly. The pads are manufactured with 15/45 degree flute angles. The pads must always be installed with the steeper flute angle sloping down toward the entering air side. See figure on right. 

EVAPORATIVE COOLING MAINTENANCE

Regularly scheduled maintenance is the key to peak performance, minimized cost, and extended life of the evaporative cooler. The following is a checklist of items that need to be looked at on a regular basis.

1. The media should be checked for mineral and foreign material deposits that have built up. If these items are left on the media, the life and performance of the unit will be greatly reduced. Also, there are risks of water carryover when this type of condition exists. When signs of mineral build-up are noticed, you should increase the bleed off rate. If this does not solve the problem, chemicals may need to be added to the water. The evaporative pads tend to be self-cleaning. Depending on water quality and system maintenance, the useful life of the pads should be 3 to 5 years.

2. The media should be periodically brushed lightly with a soft bristle brush in an up and down motion (never brush side-to-side) while flushing with water. This will also aid in reducing the amount of foreign material build-up.

3. The water should be shut off and all the lines drained when the temperature drops below 50ºF.

4. When the evaporative cooler is going to be used for the first time each season, it is recommended that the media be flushed with clean water for a period of 2 minutes (see Evap Module Start-Up).

5. At the beginning of each cooling season, the upright recirculating pump should have the shaft oiled and spun to eliminate the potential of seizing and pump burn out.

6. If the cooling media was removed from the unit, check to make sure that is not installed backwards. If the media is installed backwards, there will be large amounts of water carry over downstream of the evaporative cooler. Continuous operation in this manner may cause serious damage and void the warranty.

7. At the end of each cooling season the evaporative cooler should be thoroughly cleaned. A dispersant and biocide (consult water treatment consultant for suitable materials and dosage levels) should be recirculated for 12 to 24 hours prior to performing the following steps:

   a) Disconnect power to unit.
   b) Shut off all water to the unit
   c) Open evaporative cooling section door
   d) Flush distribution headers and media for 20 minutes
   e) Turn off pumps and drain all water distribution piping, headers, etc.
   f) Dry media completely by running blowers.
   g) Brush media as described in Paragraph 2 and perform steps d and e again.
   h) Clean all remaining components (i.e. sump, pump, etc.) of any mineral deposits or foreign materials
   i) Replace all worn or non-functioning parts
   j) Reassemble the cooling unit.
   k) Close cooling section door.
   l) Turn the main disconnect 'ON', leaving the cooling switch in the 'OFF' position.

8. If the evaporative cooler will be turned off during the cooling season for an extended period of time, it is recommended that the media be dried out. This can be accomplished by allowing the blowers to continue to run for 1-2 hours. Doing so, will prevent organic build-up on the media and subsequent odors getting into the space.

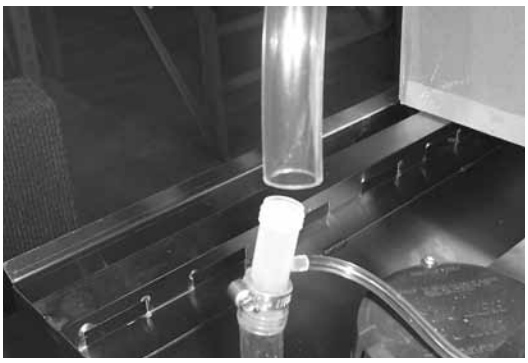
9. Media should be permitted to dry once per week by allowing the blowers to run for 1-2 hours.

10. A flush cycle should be performed weekly for one hour with the fans off.

IMPORTANT

Replacement media should be from the same manufacturer and be the same size as the original media provided with the unit.

To remove media, disconnect water line to evap header as shown below. Then slide media section out of unit. Sump will remain in unit. If media is wet, turn off water supply, then turn on unit and allow air to flow thru media for 10-20 minutes. This will dry the media out and make it lighter and easier to handle.



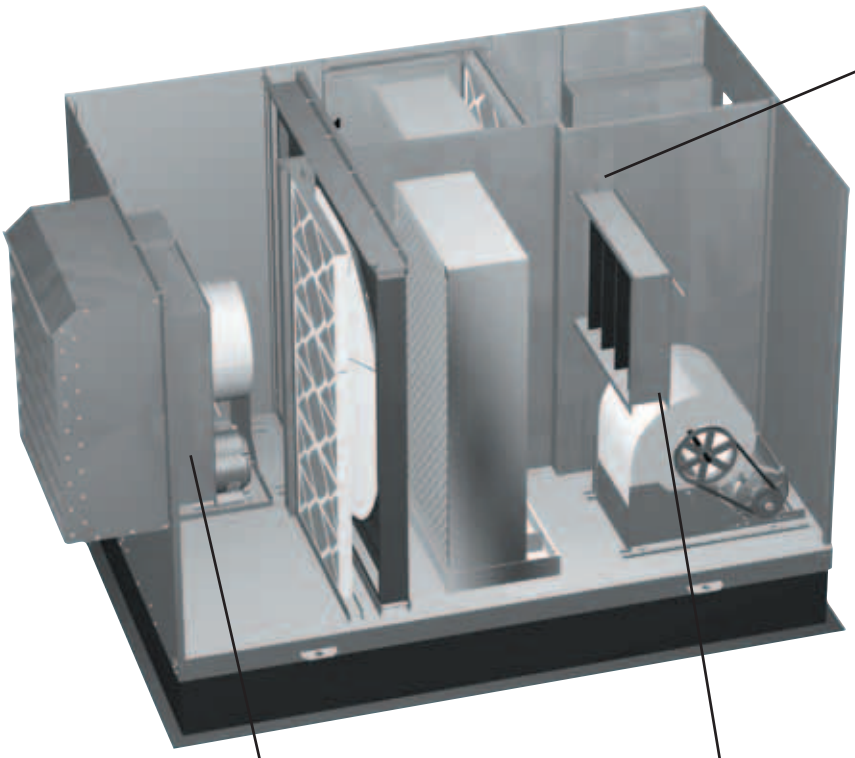
OPTIONAL ACCESSORIES

Electric Heater Application/Operation

Factory installed electric heaters can be provided for preheat and/or post-heat. An electric preheater warms the outdoor air prior to the energy recovery wheel to prevent frosting on the wheel. An electric post-heater warms the air leaving the energy recovery wheel to a user specified discharge temperature. Electric heaters are available in 208, 230, or 460 Vac (refer to heater nameplate for voltage).

Preheaters: Preheaters are standard as 2-stage, step control. Step control heaters are designed with multiple stages made up of equal increments of heating capability. For example, a 10 kW heater with two stages will be composed of two 5-kW stages. Preheaters are single point wired at the factory. A temperature sensor (with field adjustable set point) is mounted in the outdoor airstream after the preheater to turn the preheater on. See Frost Control Application /Operation for typical set points. If the temperature falls below the set point, the first stage of the preheater will turn on. If the first stage does not satisfy the set point, the second stage will also turn on.

Post-heaters: Post-heaters are standard as SCR control. Post-heaters are not single point wired (see Electrical Connections). A temperature sensor (with field adjustable set point) is mounted in the outdoor airstream after the post-heater to turn the post-heater on. A SCR heater provides an infinitely modulating control of the heat to provide an accurate discharge temperature. A call for heat is required.



Post-Heater Control Panel
The post-heater is not single point wired to the HRE control center. Separate power must be supplied to the post-heater disconnect (located in unit control center).

Access to the post-heater control panel is through the exhaust filter door. The indirect evaporative cooling media must be removed from the unit along with the exhaust filters to access.

Electric Preheater
The preheater is single point wired to the HRE control center. Access to the preheater control panel is through the supply filter door.

Electric Post-Heater

OPTIONAL ACCESSORIES

Frost Control Application/Operation

Extremely cold outdoor air temperatures can cause moisture condensation and frosting on the energy recovery wheel. Frost control is an optional feature that will prevent/control wheel frosting. Three options are available:

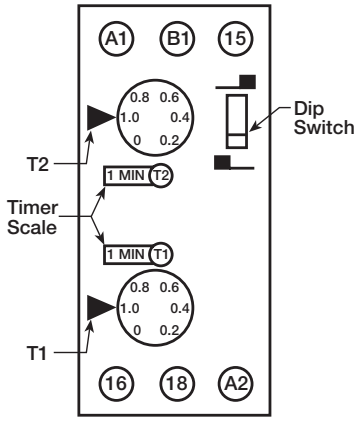
1) Timed Exhaust frost control
2) Electric preheat frost control
3) Modulating wheel frost control

Indoor RH @ 70° F	Frost Threshold Temp
20%	2° F
25%	7° F
30%	14° F

Frost Threshold Temperatures

All of these options are provided with a thermostat (with probe) mounted in the outdoor air inlet compartment and a pressure sensor to monitor pressure drop across the wheel. The typical temperature setting corresponds to the indoor air relative humidity as shown in the Frost Threshold Temperatures Table and represents when frost can occur. An increase in pressure drop would indicate that frost is occurring. Both the pressure sensor **AND** the outdoor air temperature sensor must trigger in order to initiate frost control. The two sensors together insure that frost control is only initiated during a real frost condition. Field wiring of a light (or other alarm) between 6 & C in the control center will notify personnel when unit is in frost control mode (refer to Remote Panel Wiring schematics section for wiring details). The following explains the three options in more detail.

Timed exhaust frost control includes a timer in addition to the thermostat and pressure sensor. When timed exhaust frost control is initiated, the timer will turn the supply blower on and off to allow the warm exhaust air to defrost the energy recovery wheel. Default factory settings are 5 minutes off and 30 minutes on. Use the following test procedure for troubleshooting.



Timer

Testing (refer to diagram at right)

- Jumper the pressure switch. Set the Timer Scale for T1 and T2 to 1 minute. Set the Timer Settings for T1 and T2 to 1.0. Set the dip switch to the down position.
- Turn the temperature sensor up as high as possible. The supply blower should cycle on for one minute, then turn off for one minute.
- After testing, set the ***Timer Scale*** as follows: T1 = 10 minutes, T2 = 1 hour
- Set the **Timer Settings** as follows: T1 = 0.5, T2 = 0.5. The timer is now set for 5 minutes off and 30 minutes on. *Remember to remove the jumper.*

Electric preheat frost control includes an electric heater (outdoor air inlet) and an air pressure switch (outdoor air outlet) in addition to the thermostat and pressure sensor on wheel. (Refer to Electric Heater Application/Operation for electric preheater location). When electric preheat frost control is initiated, the electric preheater will turn on and warm the air entering the energy wheel to avoid frosting. Use the following test procedure for troubleshooting.

Testing

- Turn the thermostat as high as it will go and jumper the wheel pressure sensor. The heater should turn on.
- If it doesn't, either put the supply side doors on or temporarily jumper the air pressure switch to avoid nuisance tripping of the pressure switch. *Remember to remove the jumpers.*

Modulating wheel frost control includes a variable frequency drive in addition to the thermostat and pressure sensor. When modulating wheel frost control is initiated, the variable frequency drive will reduce the speed of the wheel reducing the speed of the energy wheel reduces its effectiveness, which keeps the exhaust air condition from reaching saturation, thus, eliminating condensation and frosting. If the outdoor air temperature is greater than the frost threshold temperature OR the pressure differential is less than the setpoint, the wheel will run at full speed. If the outdoor air temperature is less than the frost threshold temperature AND the pressure differential is greater than the setpoint, the wheel will run at reduced speed until the pressure differential falls below the setpoint. The temperature and pressure differential set points are set at the factory, but are field-adjustable (refer to VFD section for more information). The variable frequency drive will be fully programmed at the factory.

OPTIONAL ACCESSORIES

Economizer Application/Operation

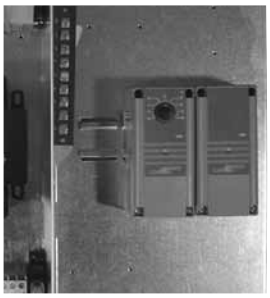
The energy recovery wheel operation can be altered to take advantage of economizer operation (free cooling). Two modes are available: 1) De-energizing the wheel or 2) Modulating the wheel. A field supplied call for cool (Y1) is required.

De-energizing the wheel is accomplished with a signal from a Temperature or Enthalpy sensor mounted in the supply air inlet compartment. This Primary sensor will de-energize the energy wheel when the outdoor air temperature (factory default is 65ºF) or enthalpy (factory default is the "D" setting) is below the field adjustable set point. An Override temperature sensor is also furnished in the supply air inlet compartment to deactivate economizer mode. The Override (with field adjustable set point) is set at some temperature lower than the Primary sensor (factory default is 50ºF). Effectively, the two sensors create a deadband where the energy recovery wheel will not operate and free cooling from outside can be brought into the building unconditioned.

Testing

Temperature Sensor with Override

- Turn both Temperature and Override thermostats down as low as they go. The wheel should be rotating.
- Turn the Temperature sensor up as high as it goes, and keep the Override sensor as low as it will go. The wheel should stop rotating.
- Turn both sensors as high as they will go. The wheel should start rotating.
- Set the Temperature sensor at desired point for economizer operation to begin. Set the Override sensor at desired point for economizer operation to end (factory default is 65ºF and 50ºF, respectively).

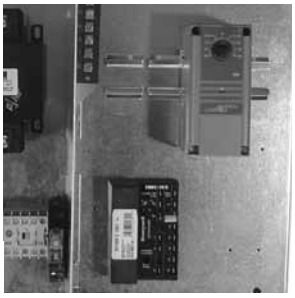


Temperature Sensor with Override

Enthalpy Sensor with Override

- Turn unit power off. Disconnect C7400 solid state enthalpy sensor from terminal So on the enthalpy controller. Also, disconnect the 620 ohm resistor from terminal Sr on the enthalpy controller. Turn unit power on. The LED on the enthalpy controller should light and the energy recovery wheel should not rotate.
- Turn unit power off. Reconnect 620 ohm resistor to terminal Sr on the enthalpy controller. Turn unit power on. The LED on the enthalpy controller should not light and the energy recovery wheel should energize and rotate.

  If the steps above provide the results described, the enthalpy economizer is working properly.
- Turn unit power off. Reconnect C7400 solid state enthalpy sensor to terminal So.



Enthalpy Sensor with Override

Enthalpy Controller

Modulating the Wheel

In applications in which an internal heat gain is present in the space, the rotational speed of the energy wheel may be modulated (via variable frequency drive) to avoid overheating the space during the winter. The speed of the energy wheel will be controlled in response to the discharge temperature setpoint.

Sequence of Operation: The variable frequency drive is fully programmed at the factory (refer to VFD section for more information). A "call for cool" must be field wired to the unit (terminals provided in unit - refer to wiring diagram in unit control center) to allow for initiation of economizer mode. When the space calls for cooling, factory supplied controls will drive the following wheel operations:

$T_{OA} > T_{RA}$: Wheel runs at full speed (maximum energy recovery)

$T_{OA} < T_{RA}$ and $T_{OA} > T_{SA}$: Wheel is stopped (no energy recovery)

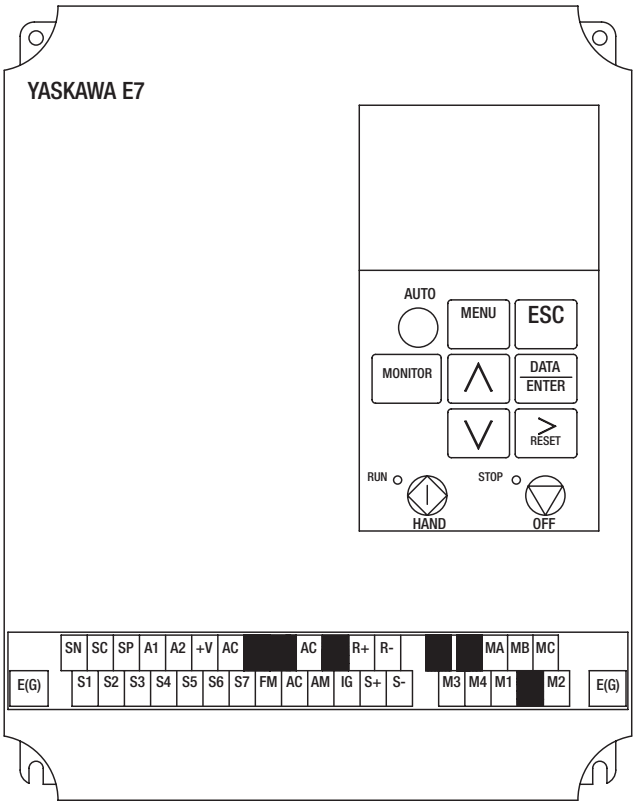
$T_{OA} < T_{RA}$ and $T_{OA} < T_{SA}$: Wheel will modulate to maintain discharge temperature

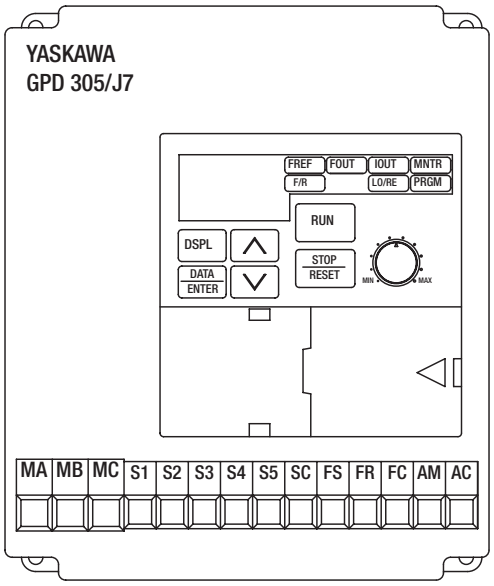
where (T_{OA}) is the outdoor air temperature set point, (T_{RA}) is the return air temperature set point, and (T_{SA}) is the supply air discharge thermostat setpoint (nominal 60¡F Ð not adjustable).

OPTIONAL ACCESSORIES

Variable Frequency Drives for Blowers

Optional factory installed, wired, and programmed variable frequency drives (VFD) may have been provided for modulating or multi-speed control of the blowers. One VFD is provided for each blower (outdoor air and exhaust). The VFDs provided are either Yaskawa model E7 or model GPD305. Refer to the tables on the next page for factory settings and field wiring requirements. Refer to the unit control center for unit specific wiring diagram (an example wiring diagram has been provided in this section for reference). When making adjustments outside of the factory setpoints, refer to Yaskawa VFD instruction manual, which can be found online at www.drives.com. For technical support, contact Yaskawa direct at 1-800-927-5292.





☐ OPTION 1 - 0-10 VDC CONTROL

USER TO PROVIDE ISOLATION AS REQUIRED

A1 | AC

0-10 VDC CONTROL SIGNAL (BY OTHERS)
WIRED TO A1 (+) AND AC (COMMON)
0 VDC=30 Hz
10 VDC=60 Hz

FOR ONE 0-10 SIGNAL, WIRE TO DRIVES IN PARALLEL

SEE VFD INSTALLATION MANUAL FOR MORE DETAIL

FOR CONTINUOUS 60Hz OPERATION JUMPER TERMINALS A1 AND +V.

☐ OPTION 2 - MULTI SPEED CONTROL

USER TO PROVIDE CONTACTS AND ISOLATION AS REQUIRED

S5 | S6 | SN

NEITHER S5 OR S6 CONTACT CLOSED
DRIVE SPEED = 60 Hz.

S5 TO SN CONTACT CLOSED (BY OTHERS)
DRIVE SPEED = 40 Hz.

S6 TO SN CONTACT CLOSED (BY OTHERS)
DRIVE SPEED = 30 Hz.

SEE VFD INSTALLATION MANUAL FOR MORE DETAIL

TO CHANGE THE FACTORY SET Hz CHANGE THE FOLLOWING PARAMETERS.

PARAMETER A1-01 CHANGE TO 2
PARAMETER D1-01 FOR NEW 60Hz SETTING
PARAMETER D1-02 FOR NEW 40Hz SETTING
PARAMETER D1-03 FOR NEW 30Hz SETTING
PARAMETER A1-01 CHANGE TO 0

☐ OPTION 1 - 0-10 VDC CONTROL

FR | FC

USER TO PROVIDE ISOLATION AS REQUIRED

0-10 VDC CONTROL SIGNAL (BY OTHERS)
WIRED TO FR (+) AND FC (COMMON)
0 VDC=30 Hz
10 VDC=60 Hz

FOR ONE 0-10 SIGNAL, WIRE TO DRIVES IN PARALLEL

SEE VFD INSTALLATION MANUAL FOR MORE DETAIL

FOR CONTINUOUS 60Hz OPERATION JUMPER TERMINALS FS AND FR.

☐ OPTION 2 - MULTI SPEED CONTROL

S4 | S5 | SC

USER TO PROVIDE CONTACTS
AND ISOLATION AS REQUIRED

NEITHER S4 OR S5 CONTACT CLOSED
DRIVE SPEED = 60 Hz.

S4 TO SC CONTACT CLOSED (BY OTHERS)
DRIVE SPEED = 40 Hz.

S5 TO SC CONTACT CLOSED (BY OTHERS)
DRIVE SPEED = 30 Hz.

SEE VFD INSTALLATION MANUAL FOR MORE DETAIL

TO CHANGE THE FACTORY SET Hz CHANGE THE FOLLOWING PARAMETERS.

PARAMETER n01 CHANGE TO 1
PARAMETER n21 FOR NEW 60Hz SETTING
PARAMETER n22 FOR NEW 40Hz SETTING
PARAMETER n23 FOR NEW 30Hz SETTING
PARAMETER n01 CHANGE TO 0

OPTIONAL ACCESSORIES

Factory Setpoints - *MODULATING CONTROL (0-10 VDC) FOR FAN SPEED*

Variable frequency drives (VFD) for the blowers are factory setup to receive a 0-10 VDC signal wired in the field (refer to previous page for terminal locations). Most of the setpoints in the VFDs are factory defaults. There are a few, though, that are changed at Greenheck and are shown in the tables below. To gain access to change setpoints on the E7 drive, parameter A1-01 needs to be set at "2". To gain access to change setpoints on the GPD-305 drive, parameter n01 needs to be set at "1". To prevent access on either drive, change the parameter to "0".

Yaskawa E7 Drive

S1 to SN contact for On/Off A1 (0-10VDC) referenced to AC (Can use +15 VDC from +V)		
Parameter		Setting
A1-01	Access Level	2
C6-02	Carrier frequency	2
d2-02	Ref Lower Limit	50%
E2-01	Motor Rated FLA	Motor FLA
H3-03	Terminal A1 Bias	50%
O2-03	User Defaults	1
A1-01	Access Level	0

Yaskawa GPD-305 Drive

S1 to SC contact for On/Off FR (0-10VDC) referenced to FC (Can use +12 VDC from FS)		
Parameter		Setting
n01	Access Level	1
n31	Ref Lower Limit	50%
n32	Motor Rated FLA	Motor FLA
n40	Multi-Function output (MA,MB,MC)	0
n42	Analog Freq. Reference Bias	50%
n46	Carrier Frequency	2
n01	Access Level	0

Factory Setpoints - *MULTI-SPEED CONTROL (1/3 OR 1/2 SPEED REDUCTION) FOR FAN SPEED*

Yaskawa E7 Drive

S1 to SN contact for On/Off		
Parameter		Setting
A1-01	Access Level	2
b1-01	(Frequency) Reference Source	0
C6-02	Carrier frequency	2
d1-01	Frequency Reference 1	60
d1-02	Frequency Reference 2	40
d1-03	Frequency Reference 3	30
d1-04	Frequency Reference 4	60
E2-01	Motor Rated FLA	Motor FLA
O2-03	User Defaults	1
A1-01	Access Level	0

Yaskawa GPD-305 Drive

S1 to SC contact for On/Off		
Parameter		Setting
n01	Access Level	1
n03	Reference Selection	1
n21	Frequency Reference 1	60Hz
n22	Frequency Reference 2	40Hz
n23	Frequency Reference 3	30Hz
n24	Frequency Reference 4	60Hz
n32	Motor Rated FLA	Motor FLA
n38*	Multi-function Input Sel 4 (Term S4)	6
n39*	Multi-function Input Sel 5 (Term S5)	7
n40	Multi-Function output (MA,MB,MC)	0
n46	Carrier Frequency	2
n01	Access Level	0

*Parameter n39 must be set to 7 before n38 can be set to 6 (the drive does not allow these parameters to be the same number, n39 default is 6)

Variable Frequency Drives for Energy Recovery Wheel

Factory installed VFD for the energy recovery wheel are programmed at the factory per the settings shown below. Refer to the instruction manual that ships with the unit when making adjustments. A copy of the manual can be found online at www.drives.com. For technical support, contact Yaskawa direct at 1-800-927-5292.

Yaskawa GPD-305 Drive

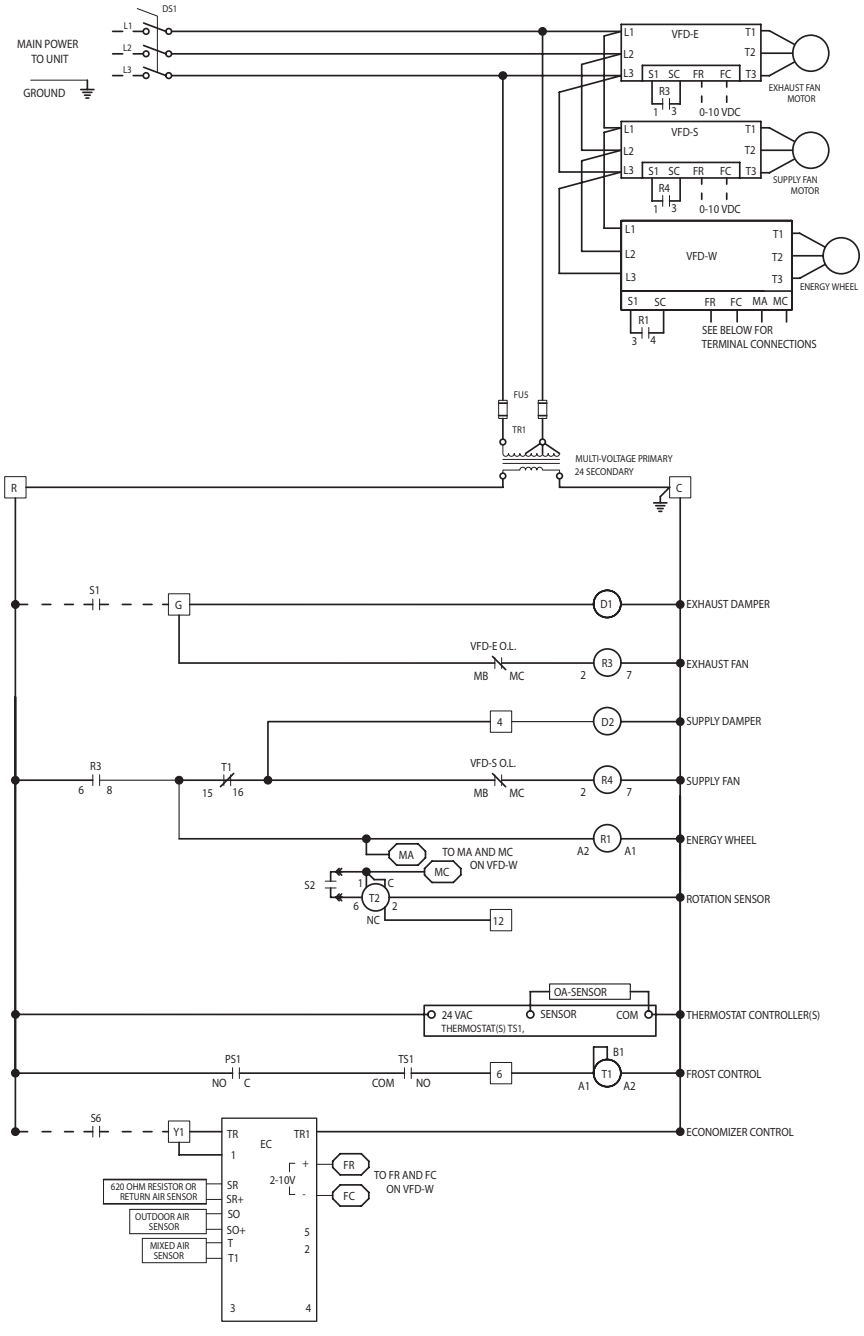
Parameter		Setting
n01	Access Level	1
n30	Ref Upper Limit	100% or 66%*
n32	Motor Rated FLA	Motor FLA
n33	Elect Thermal Overload	1
n36	Multi-Function input (terminal S2)	10
n40	Multi-Function output (MA,MB,MC)	4
n41	Analog Freq. Reference Gain	0
n42	Analog Freq. Reference Bias	99
n46	Carrier Frequency	2
n58	Frequency Detection Level	20
n01	Access Level	0

*36 inch wheel is 66% (40Hz). All other wheels are 100% (60Hz).

OPTIONAL ACCESSORIES

Wiring Diagram

Following is an example of a typical wiring diagram located in the unit control center. This wiring diagram includes a legend highlighting which accessories were provided with the unit. Factory wiring and field wiring are also indicated. This particular example includes 1) variable frequency drives on the blowers requiring a modulating input, 2) modulating energy recovery wheel with factory controls for economizer, 3) energy recovery wheel rotation sensor, 4) outdoor air and exhaust air dirty filter switches, 5) motorized outdoor air and exhaust air intake dampers, and 6) timed exhaust frost control. Many other factory installed and wired accessories are available.



LEGEND

CC COMPRESSOR CONTACTOR
CF CONDENSING FAN CONTACTOR
CH COMPRESSOR SUMP HEATER
*D DAMPER
DB POWER DISTRIBUTION BLOCK
DL DAMPER LIMIT SWITCH
*DS DISCONNECT SWITCH
*EC ECONOMIZER CONTROLLER
FCS CONDENSOR FAN CYCLE SWITCH
FU FUSES
*FU5 CONTROL TRANSFORMER FUSES (NOT ON CLASS II)
FZ1 FREEZE PROTECTION
HPS HIGH PRESSURE SWITCH (MANUAL RESET)
LPS LOW PRESSURE SWITCH
*PS1 WHEEL FROST PRESSURE SWITCH
*PS2 SUPPLY DIRTY FILTER PRESSURE SWITCH
*PS3 EXHAUST DIRTY FILTER PRESSURE SWITCH
*R1 ENERGY WHEEL RELAY/CONTACTOR
R2 OCCUPIED/UNOCCUPIED RELAY
*R3 EXHAUST BLOWER VFD RELAY
*R4 SUPPLY BLOWER VFD RELAY
R5 MODULATING WHEEL FROST CONTROL RELAY
R6 ECONOMIZER RELAY
R7 COMPRESSOR INTERLOCK RELAY
R8 EVAP RELAY (INDIRECT)
R9 EVAP RELAY (DIRECT)
R10 UNIT RELAY
oS1 FAN SWITCH
*S2 ROTATION SENSOR REED SWITCH
S3 ROTATION SENSOR REED SWITCH
S4 CALL FOR HEAT SWITCH
S5 BYPASS SWITCH
oS6 CALL FOR COOL SWITCH (FIRST STAGE)
S7 CALL FOR COOL SWITCH (SECOND STAGE)
*ST MOTOR STARTER
*T1 FROST CONTROL TIMER
TYPICAL SETTINGS t1(OFF) = 5 MIN., t2(ON) = 30 MIN.
*T2 ROTATION SENSOR TIMER
T3 ROTATION SENSOR TIMER
T4 ECONOMIZER WHEEL JOG TIMER
TYPICAL SETTINGS t1(OFF) = 3 HRS., t2(ON) = 10 SEC.
T5 EVAP DELAY OFF TIMER
T6 COMPRESSOR MINIMUM OFF TIMER (TYP. 3 MIN.)
T7 COMPRESSOR MINIMUM OFF TIMER (TYP. 3 MIN.)
*TR TRANSFORMER
*TS1 FROST CONTROL THERMOSTAT (JUMPER - HEAT)
CLOSES ON TEMP. DECREASE TYPICAL SETTING 5° F.
TS2 ECONOMIZER LOW LIMIT THERMOSTAT (JUMPER - HEAT)
OPENS ON TEMP. DECREASE TYP. SETTING 20° OFFSET OR 50°F.
TS3 ECONOMIZER UPPER LIMIT THERMOSTAT (JUMPER - HEAT)
CLOSES ON TEMP. DECREASE TYP. SETTING 65° F./2° DIFF.
TS4 ROOM OVERRIDE SENSOR
TS5 INLET AIR POST HEATER LOCKOUT THERMOSTAT (AFTER WHEEL)
CLOSES ON TEMP. DECREASE TYPICAL SETTING 65° F.
TS6 INLET AIR COMPRESSOR LOCKOUT THERMOSTAT (JUMPER-HEAT)
OPENS ON TEMP. DECREASE TYPICAL SETTING 60° F./2° DIFF.

* FACTORY SUPPLIED AND WIRED ————————

o FIELD WIRED – – – – – –

FIELD CONTROL WIRING RESISTANCE SHOULD NOT EXCEED 0.75 OHM. IF RESISTANCE EXCEEDS 0.75 OHM THEN CONSULT FACTORY. USE 14 GAUGE MINIMUM WIRE THICKNESS FOR CONTROL WIRING.

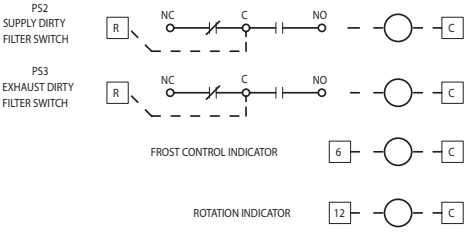
REPLACEMENT FUSES: MUST HAVE A MINIMUM I.R. RATING OF 5 KA

CAUTION:
UNIT SHALL BE GROUND IN ACCORDANCE WITH N.E.C.
POWER MUST BE OFF WHILE SERVICING.

USER INTERFACE CONNECTIONS:

USER TO VERIFY THAT TR1 CAN HANDLE THE VA LOAD OF INDICATOR DEVICES.

DIRTY FILTER INDICATOR SHOWN AS 24V POWER FROM UNIT.



OPTIONAL ACCESSORIES

Rotation Sensor

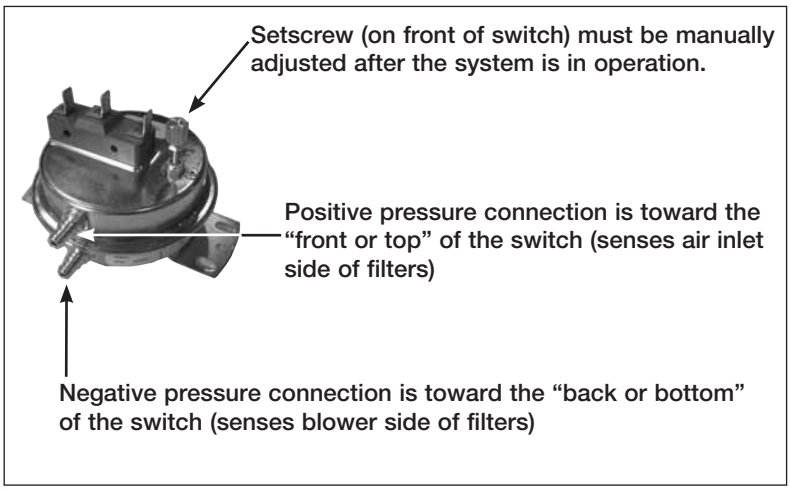
The rotation sensor monitors energy recovery wheel rotation. If the wheel should stop rotating, the sensor will close a set of contacts in the unit control center. Field wiring of a light (or other alarm) between terminals R & 12 in the unit control center will notify maintenance personnel when a failure has occurred (refer to Remote Panel Wiring Schematics section for wiring details).

Dirty Filter Sensor

Dirty filter sensors monitor pressure drop across the outdoor air filters, exhaust air filters, or both. If the pressure drop across the filters exceeds the set point, the sensor will close a set of contacts in the unit control center. Field wiring of a light (or other alarm) to these contacts will notify maintenance personnel when filters need to be replaced.

The switch has not been set at the factory due to external system losses that will affect the switch. This switch will need **minor field adjustments** after the unit has been installed with all ductwork complete. The dirty filter switch is mounted in the exhaust inlet compartment next to the unit control center or in unit control center.

To adjust the switch, the unit must be running with all of the access doors in place, except for the compartment where the switch is located (exhaust inlet compartment). Model ERV units require the opening around the control center to be covered (with cardboard, plywood, etc.) to set up dirty filter switch. The adjusting screw is located on the top of the switch. Open the filter compartment and place a sheet of plastic or cardboard over 50% of the filter media. Replace the filter compartment door. Check to see if there is power at the alert signal leads (refer to electrical diagram). If there is no power, turn the adjustment screw on the dirty filter gauge clockwise until you have power. Open the filter compartment and remove the obstructing material. Replace the door and check to make sure that you do not have power at the alert signal leads. The unit is now ready for operation.



OPTIONAL ACCESSORIES

CO2 Sensor

This accessory is often used to provide a modulating control signal to a variable frequency drive to raise and lower airflow in relationship to the CO2 levels in the space. This strategy is often referred to as Demand Control Ventilation and provides further energy savings to the system. Follow instructions supplied with sensor for installation and wiring details.

Service Outlet

120 VAC GFCI service outlet ships loose for field installation. Requires separate power source so power is available when unit main disconnect is turned off for servicing.

Vapor Tight Lights

Vapor tight lights provide light to each of the compartments in the energy recovery unit. The lights are wired to a switch mounted on the outside of the unit. The switch requires a separate power source to allow for power to the lights when the unit main disconnect is off for servicing.

OPTIONAL ACCESSORIES

Remote Control Panel and Wiring Schematics

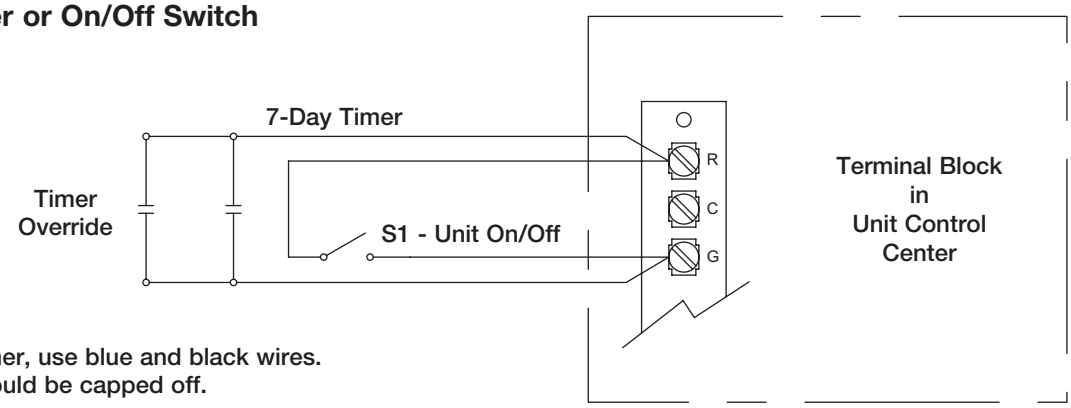
The remote panel is a series of junction boxes ganged together and includes a stainless steel face plate. The remote panel is available with a number of different alarm lights and switches to control the unit. The remote panel ships loose and requires mounting and wiring in the field.

The remote panel is available with the following options:

- Unit on/off switch
- Unit on/off light
- 7-day time clock
- Hand/off/auto switch
- Time delay override
- Exhaust air dirty filter light
- Outdoor air dirty filter light
- Economizer light
- Frost control light
- Wheel rotation sensor light

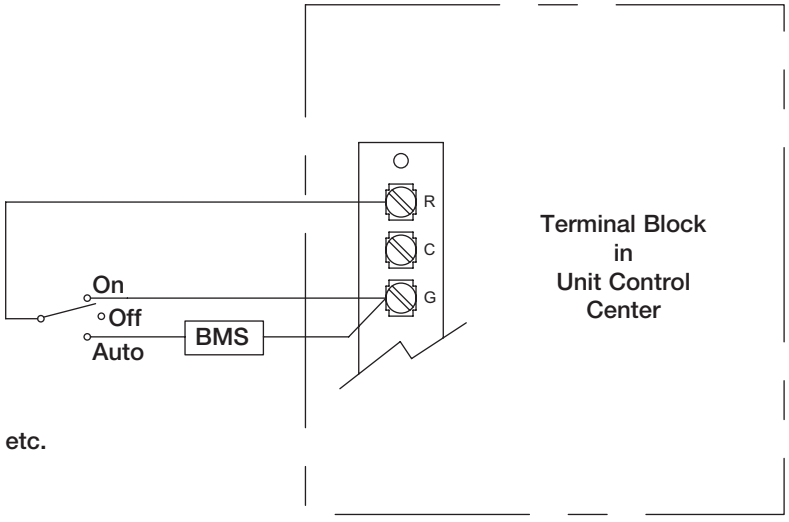
Refer to Electrical Connections section for Field Control Wiring recommendations.

7-Day Timer or On/Off Switch



For 7-Day Timer, use blue and black wires.
Red wires should be capped off.

Hand/Off/Auto Switch



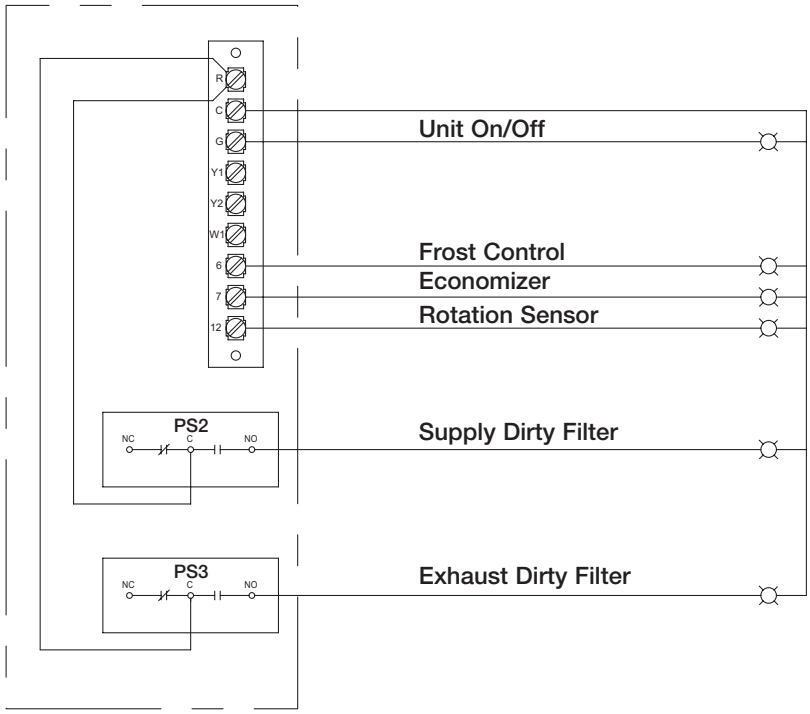
Hand/Off/Auto Switch allows the unit to
"Off" - off
"On" - Manual Operation
"Auto" - Unit is controlled by BMS, RTU, etc.

NOTE: RTU controllers are by others.

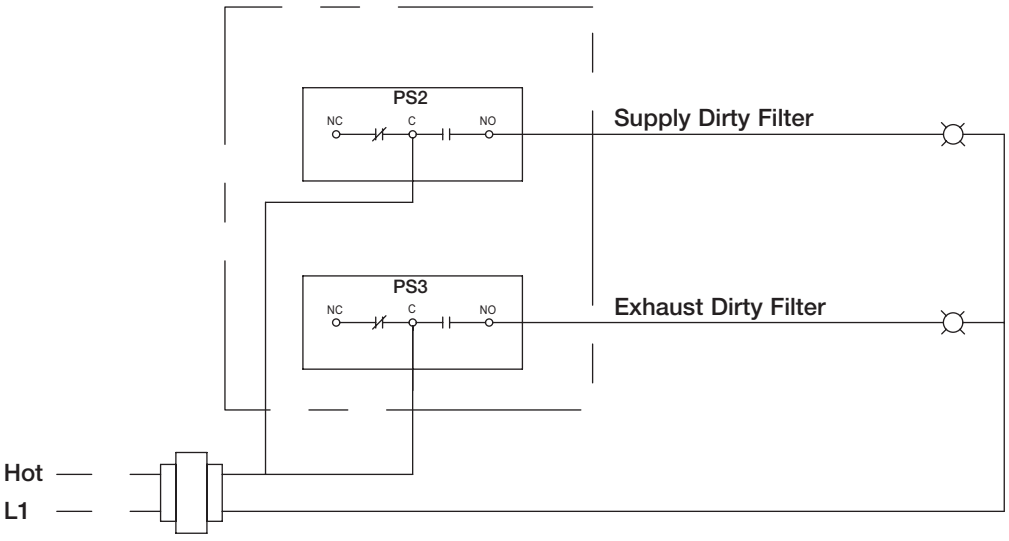
OPTIONAL ACCESSORIES

Remote Panel Wiring Schematics

Indicator Lights powered by the ER Unit



Dirty Filter Indicator (Power by Others)

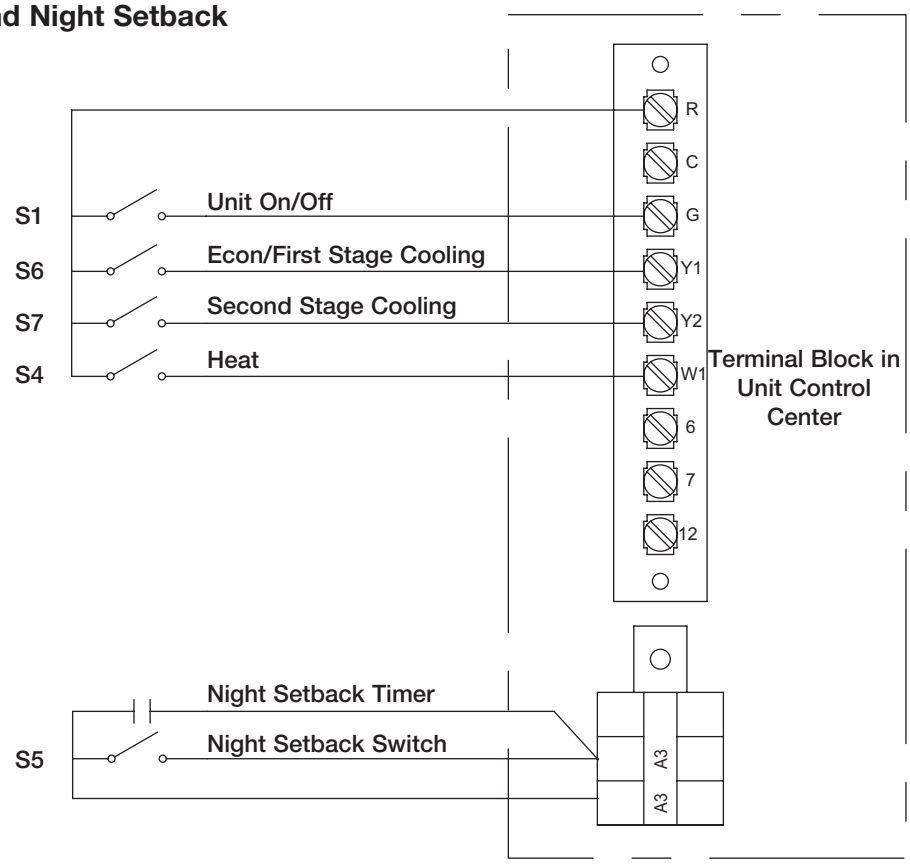


Refer to Pressure Switch for voltage and load ratings.

OPTIONAL ACCESSORIES

Remote Panel Wiring Schematics

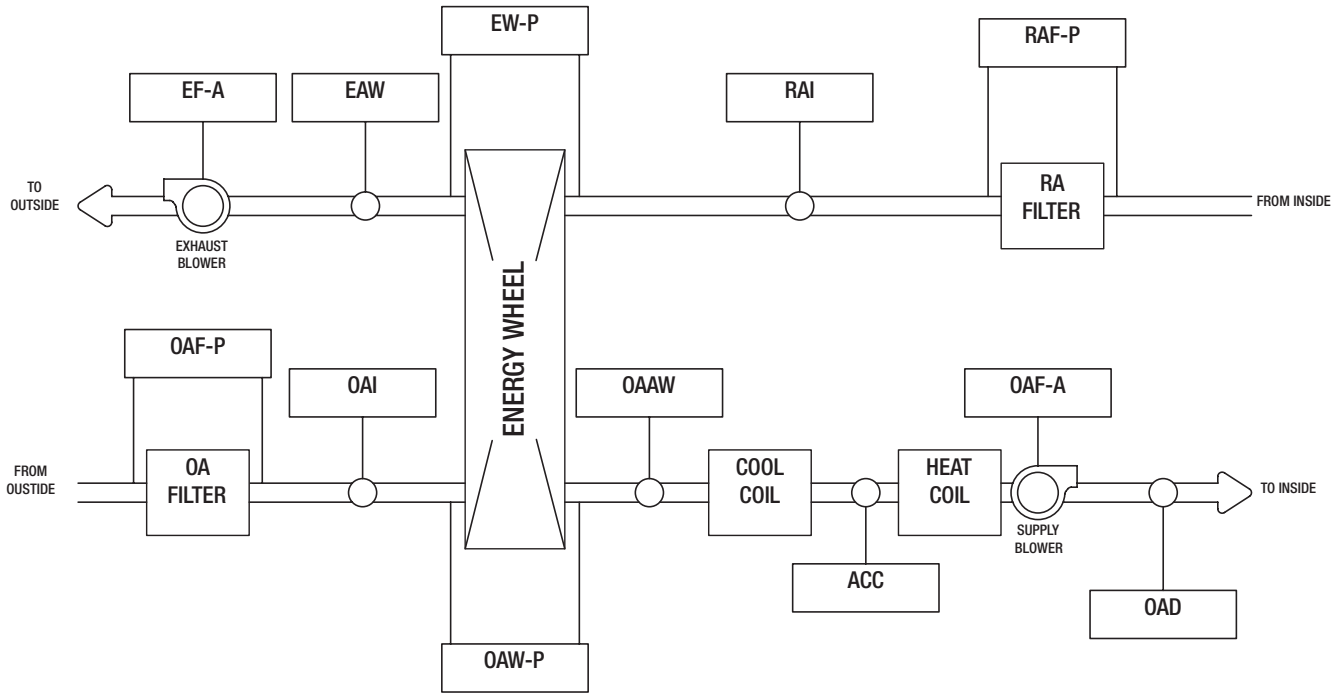
Heating/Cooling Switches and Night Setback Switch/Timer



OPTIONAL ACCESSORIES

Sensors Mounted by Factory

Factory mounted temperature, pressure, and current sensors are available in the locations indicated on the unit diagram below. A list of available sensors is shown below. The specific sensors provided on a given unit are labeled in the unit control center on the terminal strip. Sensors are wired to the terminal strip to make it easy for the controls contractor to connect the Building Management System for monitoring purposes.



Temperature Sensors - 1K Ohm RTD	
Drawing Labels	Terminal Strip Labels
OAI	OA/Supply Inlet Temp
OAAW	OA After
ACC	After Cooling Coil Temp
OAD	Supply Discharge Temp
EAW	Exhaust After Wheel Temp
RAI	RA/Exhaust Inlet Temp

Pressure Sensors (analog or digital)	
Drawing Labels	Terminal Strip Labels
OAF-P	OA/Supply Filter Pressure
OAW-P	Outdoor Air Wheel Pressure
RAF-P	RA/Exhaust Filter Pressure
EW-P	Exhaust Wheel Pressure

Amp - Current Sensors (analog or digital)	
Drawing Labels	Terminal Strip Labels
OAF-P	Supply Fan Amps
EF-A	Exhaust Fan Amps

START-UP CHECKLIST FOR UNIT

SAFETY DANGER!
Electric shock hazard. Can cause injury or death. Before attempting to perform any service or maintenance, turn the electrical power to unit to OFF at disconnect switch(es). Unit may have multiple power supplies.

SAFETY CAUTION!
Use caution when removing access panels or other unit components, especially while standing on a ladder or other potentially unsteady base. Access panels and unit components can be heavy and serious injury may occur.

SAFETY CAUTION!
Do not operate energy recovery ventilator without the filters and birdscreens installed. They prevent the entry of foreign objects such as leaves, birds, etc.

CAUTION!
Do not run unit during construction phase. Damage to internal components may result and void warranty.

Every installation requires a comprehensive start-up to ensure proper operation of the unit. As part of that process, the following checklist must be completed and information recorded. Starting up the unit in accordance with this checklist will not only ensure proper operation, but will also provide valuable information to personnel performing future maintenance. Should an issue arise which requires factory assistance, this completed document will allow unit experts to provide quicker resolve. Qualified personnel should perform start-up to ensure safe and proper practices are followed.

Unit Model Number	_____	(e.g. HRE-55)
Unit Serial Number	_____	(e.g. 04C99999)
Energy Wheel Date Code	_____	(e.g. 0450)
Start-up date	_____	(MM/DD/YYYY)
Start-up Personnel Name	_____	
Start-up Company	_____	
Phone Number	_____	

Pre-Start Up Checklist - check boxes as items are completed

- ☐ Disconnect and lock-out all power switches
- ☐ Remove any foreign objects that are located in the energy recovery unit.
- ☐ Check all fasteners, set-screws, and locking collars on the fans, bearings, drives, motor bases and accessories for tightness.
- ☐ Rotate the fan wheels and energy recovery wheels by hand and ensure no parts are rubbing. If rubbing occurs, refer to Start-Up section for more information.
- ☐ Check the fan belt drives for proper alignment and tension (refer to Start-Up section for more information).
- ☐ Filters can load up with dirt during building construction. Replace any dirty pleated filters and clean the aluminum mesh filters in the intake hood (refer to Routine Maintenance section).
- ☐ Verify that non-motorized dampers open and close properly.
- ☐ Check the tightness of all factory wiring connections.
- ☐ Verify control wire gauge (refer to the Electrical Connections section).
- ☐ Verify diameter seal settings on the energy recovery wheel (refer to Start-Up section for more information.
- ☐ Verify proper drain trap installation (refer to Drain Trap section).
- ☐ For plenum or BI fans, check the radial gap and overlap. Adjust if necessary.

START-UP CHECKLIST FOR UNIT

Special Tools Required

Voltage Meter (with wire probes)
Amperage Meter
Incline manometer or equivalent
Tachometer
Thermometer

Start-Up Checklist

The unit will be in operational mode during start-up. Use necessary precautions to avoid injury. All data must be collected while the unit is running. In order to measure volts & amps, the control center door must be open, and the unit energized using a crescent wrench to turn the disconnect handle.

Line Voltage - check at unit disconnect

L1-L2 _____ Volts L2-L3 _____ Volts L1-L3 _____ Volts

Motor Amp Draw:

Supply Motor Amps L1 _____ Amps L2 _____ Amps L3 _____ Amps

Exhaust Motor Amps L1 _____ Amps L2 _____ Amps L3 _____ Amps

Fan RPM: Supply Fan RPM _____

Exhaust Fan RPM _____

Correct fan rotation direction: Supply Fan Yes / No

Exhaust Fan Yes / No

START-UP CHECKLIST FOR EVAPORATIVE COOLER

Evaporative coolers are an integral part of the unit and must be set up properly. Doing so will ensure correct operation and avoid water or leakage problems. HRE units will have one or two evaporative coolers. The following checklist must be completed for each evaporative cooler. Qualified personnel should perform installation and be present for start-up to ensure safe and proper practices are followed. Please refer to the Evaporative Cooling Modules section for detailed information on start-up items below.

	Indirect Evap	Direct Evap
Connect overflow line (run bleed line into overflow)	☐	☐
Connect drain line	☐	☐
Install trap	☐	☐
Connect water supply line	☐	☐
For units with Auto Drain & Fill with Freeze Protection		
Install, wire, and provide power to components	☐	☐
Confirm temperature and timer settings	☐	☐
Pump filter clean and installed properly	☐	☐
Saturate media per IOM	☐	☐
Adjust bleed-off rate per IOM	☐	☐
Check for water carryover	☐	☐
Connect 'Call for Cooling' signal	☐	☐
Remove jumper wire	☐	☐

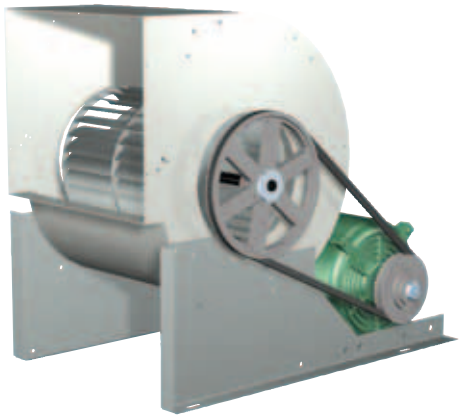
OPTIONAL ACCESSORIES CHECKLIST

Refer to the respective sections in this Installation, Operation and Maintenance Manual for detailed information. Refer to wiring diagram in unit control center to determine what electrical accessories were provided.

Provided with Unit?		Frost Control Application / Operation section:	Setting	Factory Default
Yes	No	Frost Control Setpoint		5ºF
		Differential		2ºF
		Timer		Refer to IOM
Yes	No	Frost Control Modulating		Refer to IOM
Economizer Application / Operation section:				
Yes	No	Economizer (temperature)		
		Setpoint		65ºF
		Offset		20ºF
		Differential		2ºF
Yes	No	Economizer (enthalpy)		
		Setpoint		B
Yes	No	Economizer (modulating)		Refer to IOM
Optional Accessories section:			**Operational**	
Yes	No	Wheel Rotation Sensor	Yes No N/A	
Yes	No	OA Dirty Filter Sensor	Yes No N/A	
Yes	No	EA Dirty Filter Sensor	Yes No N/A	
Yes	No	CO2 Sensor	Yes No N/A	
Yes	No	Service Outlet	Yes No N/A	
Yes	No	Vapor Tight Lights	Yes No N/A	
Yes	No	Remote Control Panel	Yes No N/A	
Variable Frequency Drives section:			**Operational**	
Yes	No	Blower VFDs	Yes No N/A	
Yes	No	Wheel VFD	Yes No N/A	
Damper section:			**Operational**	
Yes	No	Outdoor Air Damper	Yes No N/A	
Yes	No	Exhaust Air Damper	Yes No N/A	
Yes	No	Night Setback Damper	Yes No N/A	
Yes	No	**Indirect Gas Furnace** (refer to the PVF IOM, Part #461006 for start-up information)		
Standard		**Indirect Evaporative Cooler Section** (refer to Evap Start-Up checklist on following page)		
Yes	No	**Direct Evaporative Cooler Section** (refer to Evap Start-Up checklist on following page)		

UNIT START-UP

Refer to Parts List section for component locations.



Fans (Forward Curved Type)

The HRE Models contain a forward curved supply fan and a forward curved exhaust fan. These forward curved fans should be checked for free rotation. If any binding occurs, check for concealed damage and foreign objects in the fan housing. Be sure to check the belt drives per the start-up recommendations in the following section.

Fan Performance Modifications

Due to job specification revisions, it may be necessary to adjust or change the sheave or pulley to obtain the desired airflow at the time of installation. Start-up technician must check blower amperage to ensure that the amperage listed on the motor nameplate is not exceeded. Amperage to be tested with access doors closed and ductwork installed.

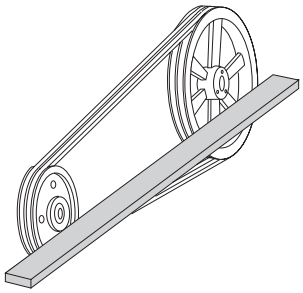
SAFETY CAUTION!

When operating conditions of the fan are to be changed (speed, pressure, temperature, etc.), consult Greenheck to determine if the unit can operate safely at the new conditions.

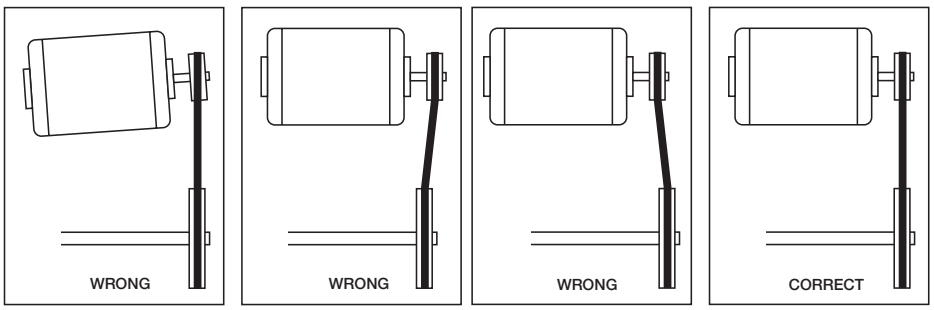
Fan Belt Drives

The fan belt drive components, when supplied by Greenheck, have been carefully selected for the unit's specific operating condition. Caution: utilizing different components than those supplied could result in unsafe operating conditions which may cause personal injury or failure of the following components: 1) Fan Shaft, 2) Fan Wheel, 3) Bearings, 4) Belt, 5) Motor. Tighten all fasteners and set screws securely and realign drive pulleys after adjustment. Check pulleys and belts for proper alignment to avoid unnecessary belt wear, noise, vibration and power loss. Motor and drive shafts must be parallel and pulleys in line (see below).

Belt Drive Installation



1. Remove the protective coating from the end of the fan shaft and assure that it is free of nicks and burrs.
2. Check fan and motor shafts for parallel and angular alignment.
3. Slide sheaves on shafts - do not drive sheaves on as this may result in bearing damage.
4. Align fan and motor sheaves with a straight-edge or string and tighten.
5. Place belts over sheaves. Do not pry or force belts, as this could result in damage to the cords in the belts.
6. With the fan off, adjust the belt tension by moving the motor base. (See belt tensioning procedures in the Routine Maintenance section of this manual). When in operation, the tight side of the belts should be in a straight line from sheave to sheave with a slight bow on the slack side.

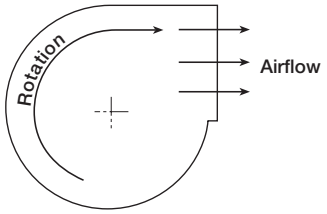


Proper alignment of motor and drive shaft.

UNIT START-UP

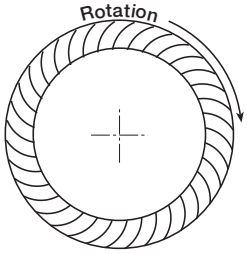
Direction of Fan Wheel Rotation

Blower access is labeled on unit. Check for proper wheel rotation by momentarily energizing the fan. Rotation is determined by viewing the wheel from the drive side and should match the rotation decal affixed to the fan housing (see Rotation Direction figures). If the wheel is rotating the wrong way, direction can be reversed by interchanging any two of the three electrical leads. Check for unusual noise, vibration, or overheating of bearings. Refer to the Troubleshooting section of this manual if a problem develops.



Fan RPM

Supply fan and exhaust fan will have an adjustable motor pulley (on 15 HP and below) preset at the factory to the customer specified RPM. Fan speed can be increased or decreased by adjusting the pitch diameter of the motor pulley. Multi-groove variable pitch pulleys must be adjusted an equal number of turns open or closed. Any increase in fan speed represents a substantial increase in load on the motor. Always check the motor amperage reading and compare it to the amperage rating shown on the motor nameplate when changing fan RPM. All access doors must be installed except the control center door. *Do not operate units with access doors open or without proper ductwork in place as the fan motors will overload.*



Rotation Direction

Vibration

Excessive vibration may be experienced during initial start-up. Left unchecked, excessive vibration can cause a multitude of problems, including structural and/or component failure. The most common sources of vibration are listed below.

1. Wheel Unbalance
2. Drive Pulley Misalignment
3. Incorrect Belt Tension
4. Bearing Misalignment
5. Mechanical Looseness
6. Faulty Belts
7. Drive Component Unbalance
8. Poor Inlet/Outlet Conditions
9. Foundation Stiffness

Many of these conditions can be discovered by careful observation. Refer to the Troubleshooting section of this manual for corrective actions. If observation cannot locate the source of vibration, a qualified technician using vibration analysis equipment should be consulted. If the problem is wheel unbalance, in-place balancing can be done.

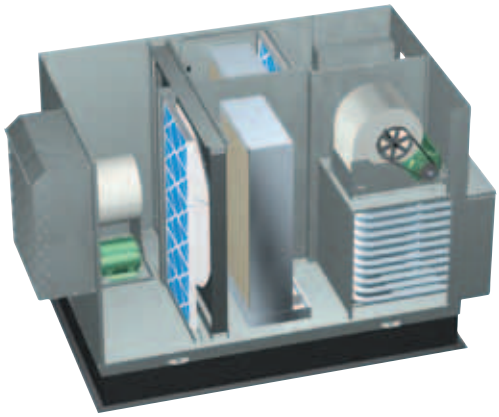
Generally, fan vibration and noise is transmitted to other parts of the building by the ductwork. To eliminate this undesirable effect, the use of heavy canvas connectors is recommended.

UNIT START-UP

Energy Recovery Wheel

The HRE models contain a sensible energy recovery wheel. The wheels are inspected for proper mechanical operation at the factory. However, during shipping and handling, shifting can occur that may affect wheel operation. The wheel is accessible through the access door marked “Energy Wheel Cassette Access”. For the HRE-20 AND HRE-45 models, the wheel cassette slides out. Due to the size and weight of the HRE-55 AND HRE-90 wheels, they remain stationary and all maintenance is performed in place. There is room inside the unit to perform energy recovery wheel servicing.

Turn the energy recovery wheels by hand to verify free operation. The wheel should rotate smoothly and should not wobble.



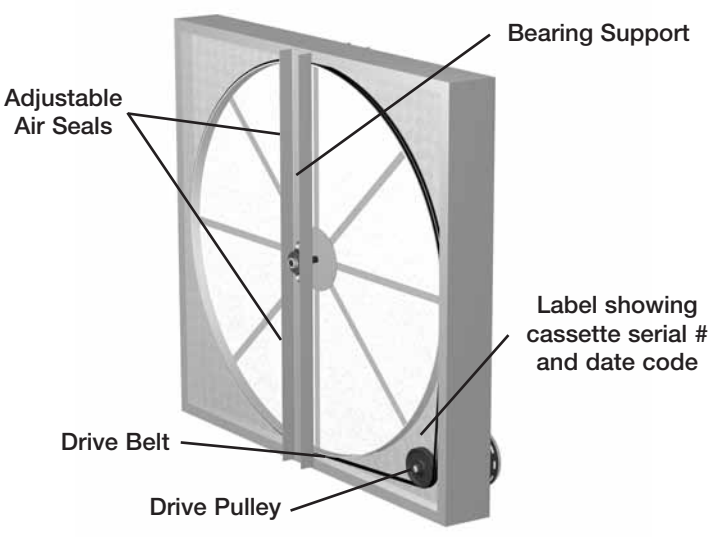
Inside layout of HRE unit

Drive Belt

Inspect the drive belt. Make sure the belt rides smoothly through the pulley and over the wheel rim.

Air Seals

Air seals are located around the perimeter of the wheel and across the face of the wheel (both sides of wheel). Check that these seals are secure and in good condition.



Check that the air seals located around the outside of the wheel and across the center (both sides of wheel) are secure and in good condition. Air seal clearance is determined by placing a sheet of paper, to act as a feeler gauge, against the wheel face. To access seals, enter unit for HRE-55 & HRE-90, or pull out the cassette for HRE-20 & HRE-45, following the instructions in Energy Recovery Wheel Maintenance section. To adjust the air seals, loosen all eight seal retaining screws. These screws are located on the bearing support that spans the length of the cassette through the wheel center. Tighten the screws so the air seals tug slightly on the sheet of paper.

Replace cassette into unit, plug in wheel drive, replace access door and apply power. Observe by opening door slightly (remove filters if necessary to view wheel) that the wheel rotates freely at about 35 RPM.

ROUTINE MAINTENANCE

SAFETY DANGER!
Electric shock hazard. Can cause injury or death. Before attempting to perform any service or maintenance, turn the electrical power to unit to OFF at disconnect switch(es). Unit may have multiple power supplies.

SAFETY CAUTION!
Use caution when removing access panels or other unit components, especially while standing on a ladder or other potentially unsteady base. Access panels and unit components can be heavy and serious injury may occur.

Once the unit has been put into operation, a routine maintenance program should be set up to preserve reliability and performance. Items to be included in this program are:

	DATE _____	DATE _____	DATE _____	DATE _____
Lubrication				
Apply lubrication where required	☐	☐	☐	☐
Dampers				
Check for unobstructed operation	☐	☐	☐	☐
Fan Belts				
Check for wear, tension, alignment	☐	☐	☐	☐
Motors				
Check for cleanliness	☐	☐	☐	☐
Blower Wheel & Fasteners				
Check for cleanliness	☐	☐	☐	☐
Check all fasteners for tightness	☐	☐	☐	☐
Check for fatigue, corrosion, wear	☐	☐	☐	☐
Bearings				
Check for cleanliness	☐	☐	☐	☐
Check set screws for tightness	☐	☐	☐	☐
Lubricate as required	☐	☐	☐	☐
External Filter				
Check for cleanliness - clean if required	☐	☐	☐	☐
Internal Filter				
Check for cleanliness - replace if required	☐	☐	☐	☐
Door Seal				
Check if intact and pliable	☐	☐	☐	☐
Coil Maintenance				
Check for cleanliness (coil and drain pan)	☐	☐	☐	☐
Winterizing Coils				
Drain - Fill with antifreeze - Drain	☐	☐	☐	☐
Energy Recovery Wheel				
Check for cleanliness - clean if required	☐	☐	☐	☐
Check belt for wear	☐	☐	☐	☐
Check pulley, bearings, and motor	☐	☐	☐	☐
Evap Cooler Section				
Refer to Evaporative Cooler Maintenance section	☐	☐	☐	☐

ROUTINE MAINTENANCE

Lubrication

Check all moving components for proper lubrication. Apply lubrication where required. Any components showing excessive wear should be replaced to maintain the integrity of the unit and ensure proper operation.

Dampers

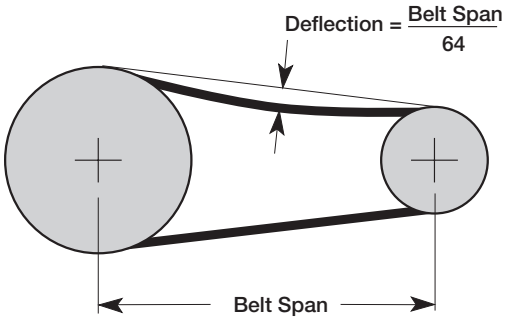
Check all dampers to ensure they open and close properly and without binding. Backdraft dampers can be checked by hand to determine if blades open and close freely. Apply power to motorized dampers to ensure the actuator opens and closes the damper as designed.

Fan Belts

Belts must be checked on a regular basis for wear, tension, alignment, and dirt accumulation. Premature or frequent belt failures can be caused by improper belt tension (either too loose or too tight) or misaligned sheaves. Abnormally high belt tension or drive misalignment will cause excessive bearing loads and may result in failure of the fan and/or motor bearings. Conversely, loose belts will cause squealing on start-up, excessive belt flutter, slippage, and overheated sheaves. Both loose and tight belts can cause fan vibration.

When replacing belts on multiple groove drives, all belts should be changed to provide uniform drive loading. Do not pry belts on or off the sheave. Loosen belt tension until belts can be removed by simply lifting the belts off the sheaves. After replacing belts, insure that slack in each belt is on the same side of the drive. Belt dressing should never be used.

Do not install new belts on worn sheaves. If the sheaves have grooves worn in them, they must be replaced before new belts are installed.



Proper fan belt settings

The proper belt setting is the lowest tension at which the belts will not slip under peak load operation. For initial tensioning, set the belt deflection at 1/64-inch for each inch of belt span (measured half-way between sheave centers). For example, if the belt span is 64 inches, the belt deflection should be 1 inch (using moderate thumb pressure at mid-point of the drive). Check belt tension two times during the first 24 hours of operation and periodically thereafter.

Fan Motors

Motor maintenance is generally limited to cleaning and lubrication. Cleaning should be limited to exterior surfaces only. Removing dust and grease buildup on the motor housing assists proper motor cooling. Never wash-down motor with high pressure spray. Greasing of motors is only intended when fittings are provided. Many fractional motors are permanently lubricated for life and require no further lubrication.

Fan Wheel & Fasteners

Wheels require very little attention when moving clean air. Occasionally oil and dust may accumulate on the wheel causing imbalance. When this occurs the wheel and housing should be cleaned to assure smooth and safe operation. Inspect fan impeller and housing for fatigue, corrosion or wear.

Routinely check all fasteners, set screws and locking collars on the fan, bearings, drive, motor base and accessories for tightness. A proper maintenance program will help preserve the performance and reliability designed into the fan.

ROUTINE MAINTENANCE

Bearings

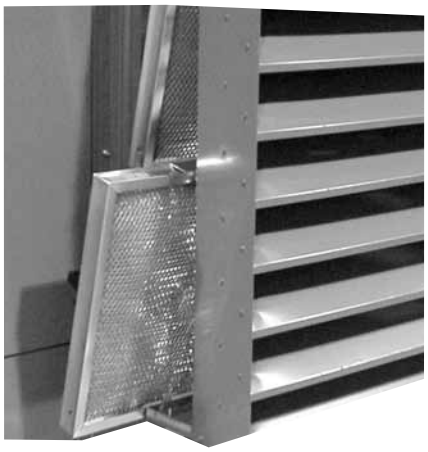
Most bearings are permanently lubricated and require not further lubrication under normal use. Normal use being considered -20ºF to 120ºF and in a relatively clean environment. Some bearings are re-lubricatable and will need to be regreased depending on fan use. Check your bearings for grease zert to find out what type of bearing you have. If your fan is not being operated under normal use, bearings should be checked monthly for lubrication.

External Filter Maintenance

Aluminum mesh, 2-inch deep filters are located in the supply weatherhood (if the weatherhood option was purchased). Filters should be checked and cleaned on a regular basis for best efficiency. The frequency of cleaning depends upon the cleanliness of the incoming air. These filters should be cleaned prior to start-up.

To access these filters, remove bottom bolt in the access door on the side of the weatherhood. Slide the access door up and then pull bottom out to remove door. Then, slide the filters out (see figure at right).

Clean filters by rinsing with a mild detergent in warm water.



Outdoor air intake hood mesh filter access

Internal Filter Maintenance

The HRE units will typically be provided with 2-inch, pleated filters in the outdoor air and exhaust airstreams. These filters should be checked per a routine maintenance schedule and replaced as necessary to ensure proper airflow through the unit. See table at right for pleated filter size and quantity for each unit. Replacement filters shall be of same performance and quality as factory installed filters. Filter type must be pleated design with integral metal grid. Two acceptable filter replacements are Aerostar Series 400 or Farr 30/30®.

Outdoor Air Filters: Access to the outdoor air filters is through the door labeled as “Filter Access” on the outdoor air side of the unit.

Exhaust Air Filters: Access to the exhaust air filters is through the door labeled as “Filter Access” on the exhaust air side of the unit.

Refer to Access Door Descriptions section for additional information on filter locations.

Filter Size and Quantities

Model	Internal Filter Size	Quantity Supply	Quantity Exhaust
HRE-20	20 in. x 20 in.	2	2
HRE-45	20 in. x 25 in.	3	3
HRE-55	16 in. x 25 in.	6	6
HRE-90	20 in. x 20 in.	8	8

Door Seal Maintenance

Slip-on type vinyl seal is installed on the perimeter of the door openings. Inspect at least annually to ensure that seal is still pliable and intact.

ROUTINE MAINTENANCE

Energy Recovery Wheel Maintenance

Annual inspection of the energy recovery wheel is recommended. Units ventilating smoking lounges and other non-clean air spaces should have energy recovery wheel inspections more often based upon need. Inspections for smoke ventilation applications are recommended bimonthly to quarterly until a regular schedule can be established.

Access to wheel through outdoor air filter door

ACCESSING ENERGY RECOVERY WHEEL

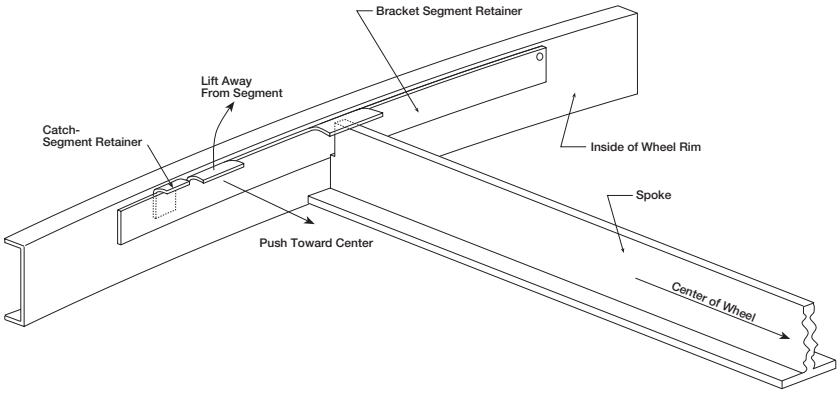
The HRE units have one energy recovery wheel. Open the outdoor air filter door to access the wheel. For the HRE-20 and HRE-45 models, the wheel cassette slides out. Due to the size and weight of the HRE-55 and HRE-90 wheels, they remain stationary and all maintenance is performed in place. There is room inside the unit to perform energy recovery wheel servicing. Filters must be removed to access stationary wheels.

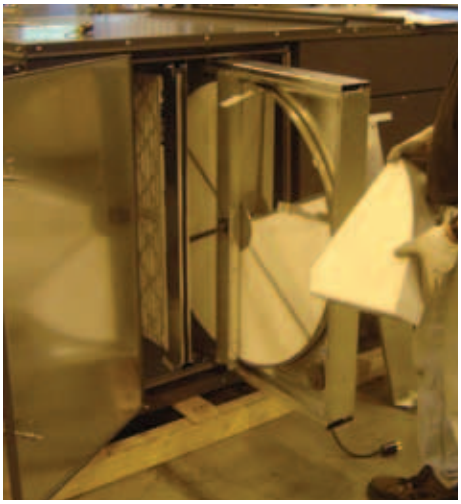
****WARNING: Disconnect power to the unit before performing any type of service.**

REMOVING THE ENERGY RECOVERY WHEEL SEGMENTS

Models HRE-20, 45, 55, & 90

Steel retainers are located on the inside of the wheel rim (see diagram at right). Push the retainer toward center of wheel, then lift up and away to release segments (see below).





Wheel segment removed

IMPORTANT! *PLACE RETAINERS BACK IN THE ORIGINAL POSITION BEFORE ROTATING THE ENERGY RECOVERY WHEEL. OTHERWISE DAMAGE TO RETAINER WILL OCCUR.*

ROUTINE MAINTENANCE

CLEANING THE ENERGY RECOVERY WHEEL

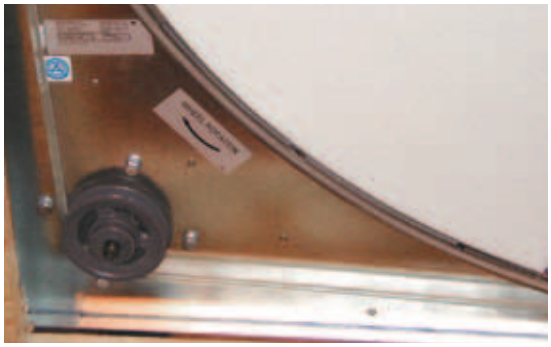
If the wheel appears excessively dirty, it should be cleaned to ensure maximum operating efficiency. Only excessive buildup of foreign material needs to be removed. *DISCOLORATION AND STAINING OF ENERGY RECOVERY WHEEL DOES NOT AFFECT ITS PERFORMANCE.*

Thoroughly spray wheel matrix with household cleaner such as Fantastic® or equivalent. Gently rinse with warm water and using a soft brush remove any heavier accumulation. A detergent/water solution can also be used. Avoid aggressive organic solvents, such as acetone. The energy recovery wheel segments can be soaked in the above solution overnight for stubborn dirt or accumulation.

After cleaning is complete, shake the excess water from the wheel or segments. Dry wheel or segments before placing them back into the cassette. Place wheel or segments back into cassette by reversing removal procedures.

***** DO NOT CLEAN ENERGY RECOVERY WHEEL SEGMENTS WITH WATER IN EXCESS OF 140ºF***
***** DO NOT DRY ENERGY RECOVERY WHEEL SEGMENTS IN AIR IN EXCESS OF 140ºF.***
***** THE USE OF A PRESSURE WASHER TO CLEAN SEGMENTS IS NOT RECOMMENDED. DAMAGE COULD RESULT.***

Energy Recovery Wheel Belt
Inspect belts each time filters are replaced. Belts that look chewed up or are leaving belt dust near the motor pulley may indicate a problem with the wheel. Be sure to inspect wheel for smooth and unrestricted rotation. If a belt requires replacement, contact the local Greenheck representative. Instructions for replacement will ship with the new belt.

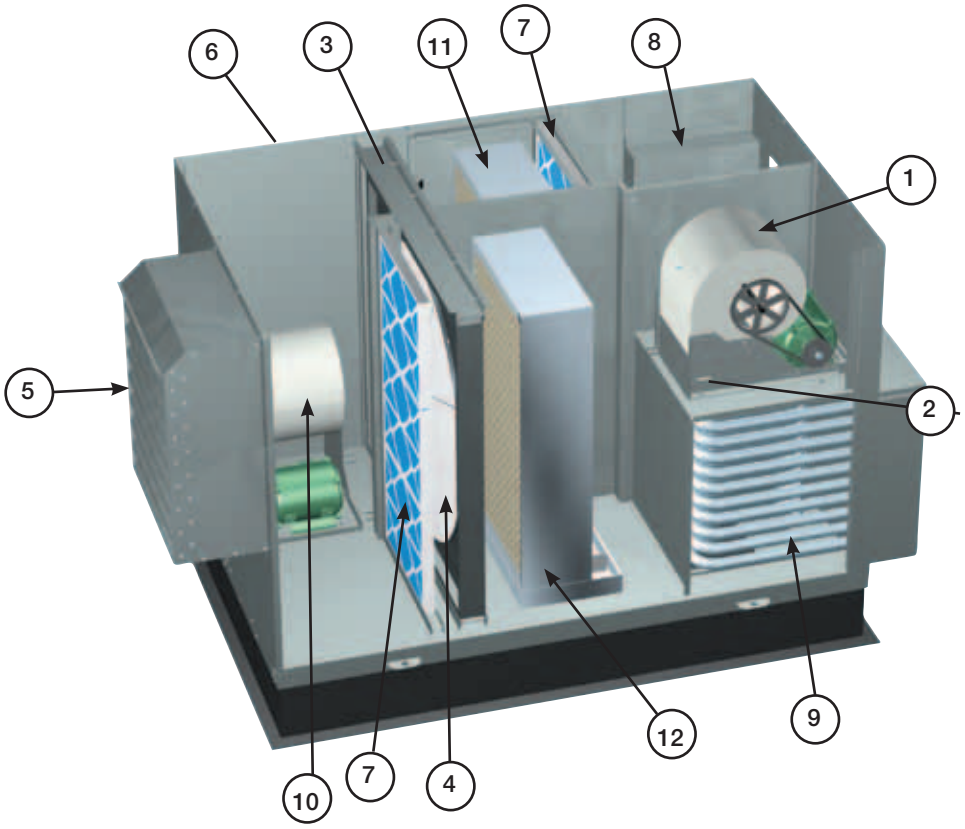


Wheel Belt & Pulley

Energy Recovery Wheel Bearings
In the unlikely event that a wheel bearing fails, access is available through the outdoor air filter door and through a removable plate in the divider in the unit (accessed through the exhaust air filter door). Contact the local Greenheck representative for detailed instructions on how to replace the bearing.

Wheel Bearing

PARTS LIST



Model HRE

(shown with indirect evaporative cooler, optional direct evaporative cooler, and indirect gas heater)

1. Supply blower
   - Forward curved fan
   - Adjustable motor mount for belt tensioning
   - Adjustable sheaves for speed control

2. Vibrations isolators (quantity 4 per blower)
   - Neoprene

3. Energy recovery wheel cassette

4. Removable energy recovery wheel segments

5. Optional supply weatherhood with 2 in. aluminum mesh filter

6. Optional exhaust weatherhood with birdscreen

7. Optional supply and exhaust air filter racks for 2 in. pleated, 30% efficient filters

8. Electrical control box (standard features)
   - Single point power
   - Disconnect interlocked with access door
   - Motor starters for the supply blower, exhaust blower and energy wheel motors
   - 24 Vac, control circuit with terminal strip

9. Supply air tempering options
   - Electric heat (requires separate power)
   - Hot water heat
   - Indirect gas heat

10. Exhaust blower
    - Forward curved fan
    - Adjustable motor mount for belt tensioning
    - Adjustable sheaves for speed control

11. Indirect evaporative cooler

12. Direct evaporative cooler

SEQUENCE OF OPERATION

Basic Unit

The HRE units are pre-wired such that when a call for outside air is made (via field supplied 24 VAC control signal wired to unit control center), the supply fan, exhaust fan and energy wheel are energized and the motorized dampers open. The HRE units can be supplied with or without heating and cooling coils. For units with coils, controls can be supplied by Greenheck or by the controls contractor. If supplied by the controls contractor, they would provide, mount, and wire any temperature controllers and temperature or relative humidity sensors required for the unit to discharge air at the desired conditions.

Summer Operation

A sensible wheel preconditions the outdoor air (temperature is decreased) by the transfer of energy from the cool exhaust air coming out of the indirect evaporative cooler.

Units supplied with a direct evaporative cooling coil can further cool the air coming off the wheel to levels near 55ºF.

Economizer Operation: See Economizer Application/Operation section

Winter Operation

Outdoor air is preconditioned (temperature is increased) by the transfer of energy from the warmer exhaust air via the sensible recovery wheel.

Units supplied with heating coils can further heat the air coming off the wheel to levels at or above room design.

Frost Control Operation: See Frost Control Application/Operation section

Troubleshooting Airflow

Test and Balance Report

The test and balance report (TAB) is utilized to determine whether the appropriate amount of outdoor air and exhaust air is being supplied and removed from a building, respectively. There are no set rules on what information must be included in a TAB report. As such, if a TAB report indicates that the airflow on a unit is low, prior to contacting the factory, please determine the following information:

	Unit #1	Unit #2	Unit #3	Unit #4
Model Number				
Serial Number				
Name Plate Information				
Voltage				
Hertz				
Phase				
Outdoor Air Fan Amps				
Exhaust Fan Amps				
Outdoor Air Fan Horsepower				
Exhaust Fan Horsepower				
Design Airflow				
Outdoor Air				
Exhaust				
Measured Airflow				
Outdoor Air				
Exhaust				
Measured Data				
Blower Rotation				
Outdoor Air Fan RPM				
Exhaust Fan RPM				
Outdoor Air Fan Amp Draw				
Exhaust Fan Amp Draw				
Pressure Drop Across Energy Recovery Wheel				
Outdoor Air Side				
Exhaust Side				

Airflow problems can often be tied back to improper ductwork installation. Be sure to install ductwork in accordance with SMACNA and AMCA guidelines.

Troubleshooting

Symptom	Possible Cause	Corrective Action
Blower Fails to Operate	Blown fuse or open circuit breaker.	Replace fuse or reset circuit breaker and check amps.
	Defective motor or capacitor.	Replace.
	Motor starter overloaded.	Reset starter and check amps.
	Electrical.	Check for On/Off switches. Check for correct supply voltage.
	Drive.	Check for broken or loose belts. Tighten loose pulleys.
Motor Starters 'Chatter' or Do Not Pull In	Control power (24 Vac) wiring run is too long (resistance should not exceed 0.75 ohms).	Shorten wiring run to mechanical room or install a relay which will turn unit on/off (C/F for relay information).
	Incoming supply power is less than anticipated. Voltage supplied to starter coil must be within +10% / -15% of nominal voltage stated on the coil.	Need to increase supply power or use a special control transformer which is sized for the actual supply power.
Motor Over Amps	Cfm too high.	Check cfm and adjust drives if needed.
	Static pressures are higher or lower than design.	If higher, ductwork should be improved. If lower, fan rpm should be lower.
	Blower rotation is incorrect.	Check rotation and reverse if necessary.
	Motor voltage incorrect.	Check motor nameplate versus supplied voltage.
	Motor horsepower too low.	See specifications and catalog for fan curves to determine if horsepower is sufficient.
	Shorted windings in motor.	Replace motor.
Low Airflow (cfm)	Unit damper not fully open.	Adjust damper linkage or replace damper motor.
	System static pressure too high	Improve ductwork to eliminate losses using good duct practices.
	Blower speed too low.	Check for correct drives and rpm with catalog data.
	Fan wheels are operating backwards.	For 3-phase, see Direction of Fan Wheel Rotation under Unit Start-Up section.
	Dirty filter or energy wheel.	Follow cleaning procedures in Routine Maintenance section.
	Leaks in ductwork.	Repair.
	Elbows or other obstructions may be obstructing fan outlet.	Correct or improve ductwork.
	Belt slippage.	Adjust belt tension.
High Airflow (cfm)	Blower fan speed too high.	Check for correct fan rpm. Decrease fan speed if necessary.
	Filter(s) not in place.	Install filters.
	Insufficient static pressure (Ps) (airflow resistance).	Induce Ps into system ductwork. Make sure grilles and access doors are installed. Decrease fan speed if necessary.

** Always provide the unit model and serial number when requesting parts or service information. * Always check motor amps and compare to nameplate rating.*

Troubleshooting

Symptom	Possible Cause	Corrective Action
One or Both Blowers Turn Off Intermittently and Back on After About 2 Minutes	Blower fan motor overloads are tripping and auto-resetting.	Decrease fan speed.
	Exhaust Only frost control sensors are tripping.	Adjust frost temperature sensor set point as needed.
Energy Wheel Does NOT Turn	Air seals are too tight.	See Energy Recovery Wheel under Unit Start-Up section.
	'Economizer' sensors are operating.	Adjust temperature or enthalpy set points as needed.
	No power to wheel motor.	Make sure wheel drive is plugged in. Verify power is available.
	Wheel drive belt	Check for loose or broken belts. Replace belts (consult factory).
Energy Wheel Runs Intermittently	Wheel motor overloads are tripping, due to rubbing between wheel and air seals.	Recheck air seals, make sure they are not too tight. See Energy Recovery Wheel under Unit Start-Up Section.
Excessive Noise or Vibration	Fan wheel rubbing on inlet	Adjust wheel and/or inlet cone. Tighten wheel hub or bearing collars on shaft.
	Bearings.	Replace defective bearings (s). Lubricate bearings. Tighten collars and fasteners.
	Wheel out of balance.	Replace or rebalance.
	Loose wheel on shaft.	Tighten wheel setscrew.
	Loose motor or blower sheave.	Tighten sheave setscrew.
	Belts too loose.	Adjust belt tension after 24 hours of operation.
	Belts too tight.	Loosen to maintain a 3/8 inch deflection per foot of span between sheaves.
	Worn belt.	Replace.
	Motor base or blower loose.	Tighten mounting bolts.
	Build-up of material on wheel.	Clean wheel and housing.
	Bearing and drive misaligned.	Realign.
	Noise being transmitted by duct.	Make sure duct work is supported properly. Make sure duct work metal thickness is sized for proper stiffness. Check duct size at discharge to ensure that air velocities are not too high.

**Always provide the unit model and serial number when requesting parts or service information. *Always check motor amps and compare to nameplate rating.*

Warranty

Greenheck warrants this equipment to be free from defects in material and workmanship for a period of one year from the purchase date. The energy recovery wheel is warranted to be free from defects in material and workmanship for a period of five years from the purchase date. Any units or parts which prove defective during the warranty period will be replaced at our option when returned to our factory, transportation prepaid.

Motors are warranted by the motor manufacturer for a period of one year. Should motors furnished by Greenheck prove defective during this period, they should be returned to the nearest authorized motor service station. Greenheck will not be responsible for any removal or installation costs.

As a result of our commitment to continuous improvement, Greenheck reserves the right to change specifications without notice.

GREENHECK

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