



Energy Recovery Ventilator

Model: APEX-200

INSTALLATION, OPERATION, & MAINTENANCE MANUAL



Energy recovery wheels certified by the ARI Air-to-Air Energy Recovery Ventilation Equipment Certification Program in accordance with ARI Standard 1060. Actual performance in packaged equipment may vary. Certified Ratings are available in the Certified Product Directory at <http://www.ari.org/directories/erv>

RECEIVING AND HANDLING

The APEX 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.

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.

INSTALLATION SUPPLEMENT

Refer to the following installation supplement for APEX units supplied with a Temperature Control Package:
Temperature Control Package, Part #461468

Refer to the following installation supplement for APEX units supplied with a Greenheck roof curb, Model GKD:
APEX Roof Curb IOM, Part #462831

SAVE THIS MANUAL

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

Table of Contents

Storage	2	Fan information	15
General	3	Fan belt drives	16
Installation	3	Fan RPM	16
Lifting	3	Vibration	17
Unit weights	4	Energy recovery wheel	17
Recommended roof openings	4	Routine Maintenance	18
Roof curb mounting	4	Lubrication / Dampers / Belts	18
Rail mounting	5	Motors	19
Weatherhoods / Dampers	5	Wheel and fasteners	19
Electrical connections	6	Bearings	19
Service Clearances	7	Filters / Door Seals	20
Access Locations	7	Coil Maintenance	21
Dimensional Data	7	Maintenance	21
Access Door Descriptions	7	Winterizing	21
Coil Application Recommendations ...	8	Energy Recovery Wheel Maintenance ..	22
Water coils	8	Accessing energy recovery wheel ...	22
DX coils	8	Removing wheel segments	22
Drain pan trap piping	9	Cleaning wheel segments	23
Electric Heater Application/Operation .	9	Wheel belt / Wheel bearings	23
Variable Frequency Drive	9	Parts List	24
Frost Control Application/Operation ..	10	Sequence of Operation	25
Economizer Application/Operation ...	11	Airflow Troubleshooting	26
Optional Accessories	12-13	General Troubleshooting	27-28
Start-Up Checks	14		

Storage

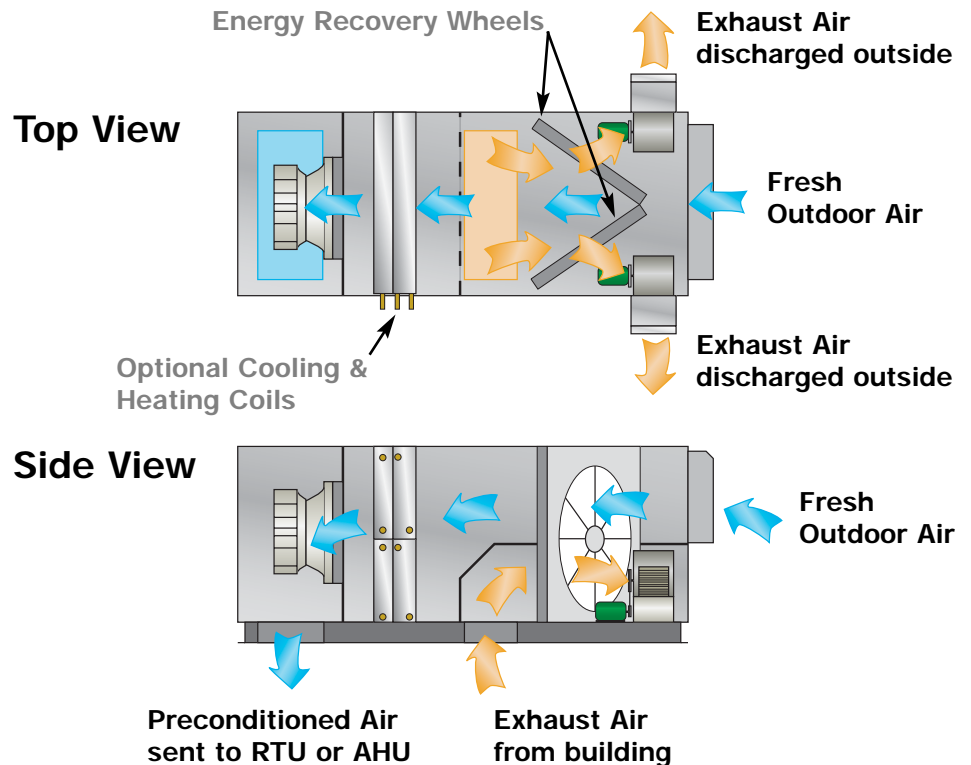
When a unit is not going to be in service for an extended amount of time, certain procedures should be followed to keep the fans in proper operating condition.

- 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 Unit Operation

The APEX brings in fresh, outdoor air and removes stale, exhaust air. Prior to discharging the exhaust air, the energy recovery wheel transfers energy from the exhaust air to the outdoor air at an efficiency of 70-80%. Simply put, this unit preconditions the outdoor air to save money on heating and cooling costs. This particular unit also has cooling and heating options available after the recovery wheel to further condition the fresh air temperature if desired.



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 for more details.

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 on next page.
- 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) Two spreader bars 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) Do not use fork lifts for handling unit.

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.

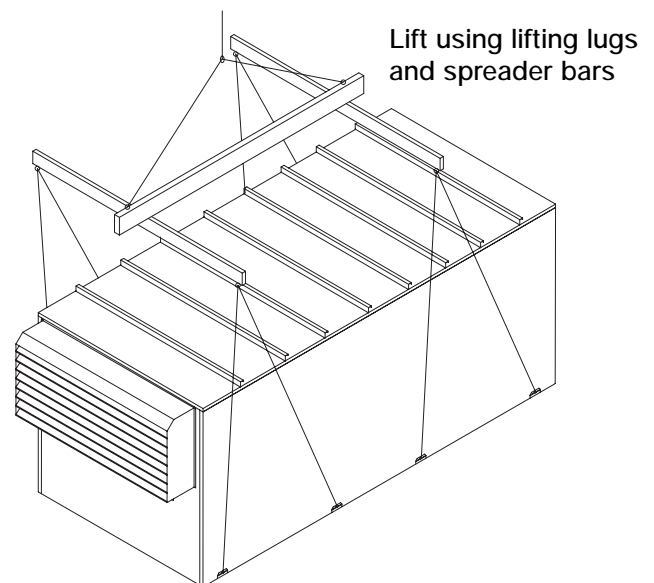


FIGURE 1: Example diagram of lifting the APEX

Installation

Unit Weights (dry weights)

Unit	Approx. Weight (lbs)
APEX-200 (without coils)	9,000
APEX-200 (with HW & CW coils)	12,000

Recommended Roof Openings

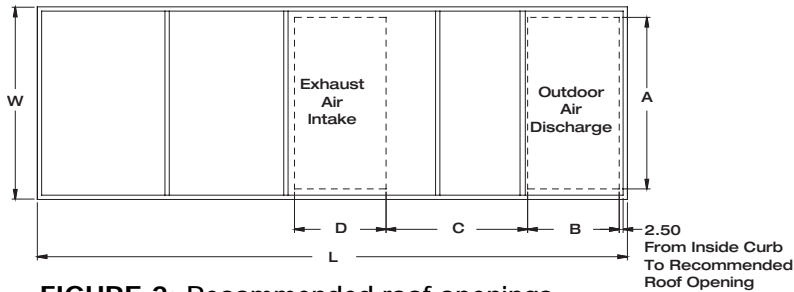


FIGURE 2: Recommended roof openings.

Model	A	B	C	D
APEX-200	86	44	68.75	44

All dimensions shown are in inches.

Curb Outside Dimensions		
Model	L	W
APEX-200	283.5	92.0

Dimensions shown are in inches.

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.

1. Factory Supplied Roof Curbs

Roof curbs are Model GKD, which are shipped in a knockdown kit and require field assembly (by others). Assembly instructions are included with the curb.

2. Cut Roof Opening and Locate Curb

Layout the unit roof openings such that the supply discharge & exhaust inlet of the unit will line up with the corresponding ductwork (refer to Recommended Roof Openings). Do not make openings larger than necessary. Be sure to allow for the recommended service clearances. 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.

3. Install Curb

Locate curb over roof opening and fasten in place. Check that the diagonal dimensions are within $\pm 1/8$ inch of each other and adjust as necessary. Shim as required to level.

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.

5. Duct Work

Installation of all ducts should be done in accordance with SMACNA and AMCA guidelines.

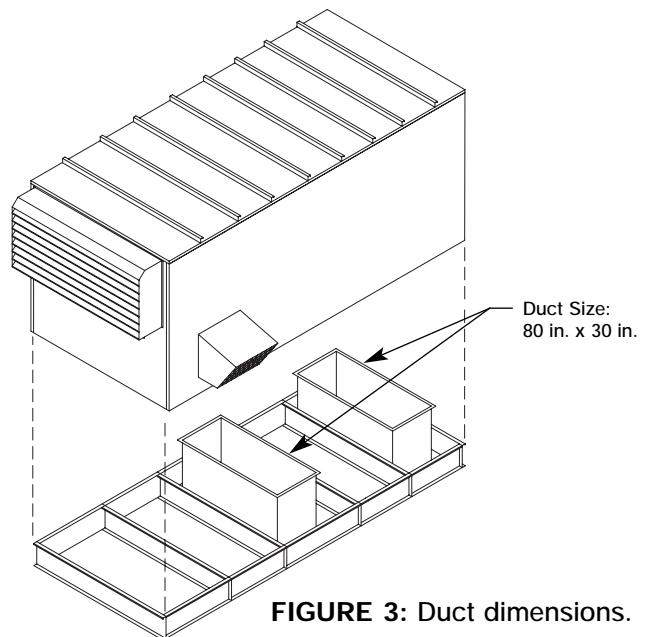


FIGURE 3: Duct dimensions.

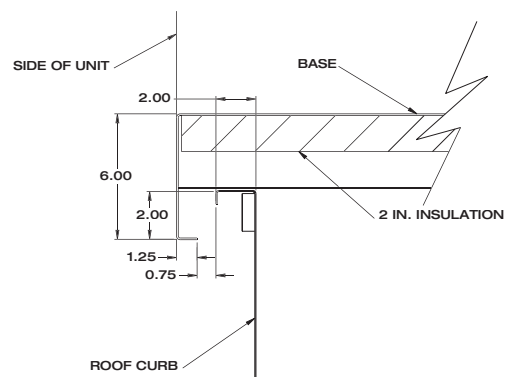


FIGURE 4: Roof curb details.

Dimensions based on Greenheck-supplied roof curb only!

Installation

Rail Mounting

Rail Layout

- Rails designed to handle the weight of the APEX should be positioned as shown on the diagrams below (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 APEX unit (see **FIGURE 6**).
- Rails should run the width of the unit and extend beyond the unit a minimum of 12 inches on each side (see **FIGURE 5**).
- Set unit on rails.

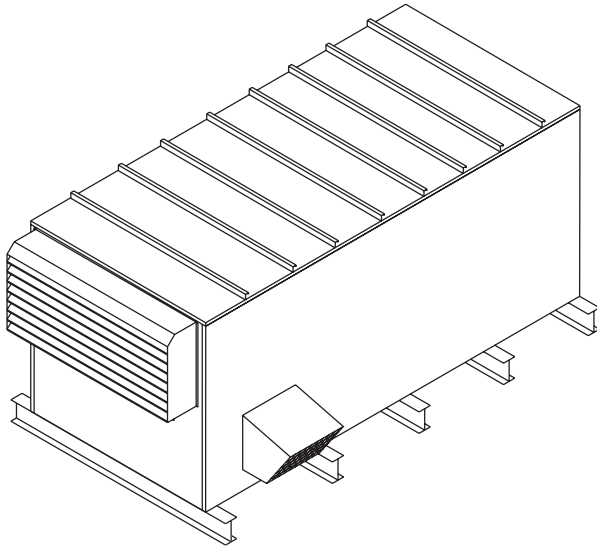


FIGURE 5: Isometric view of APEX on rails.

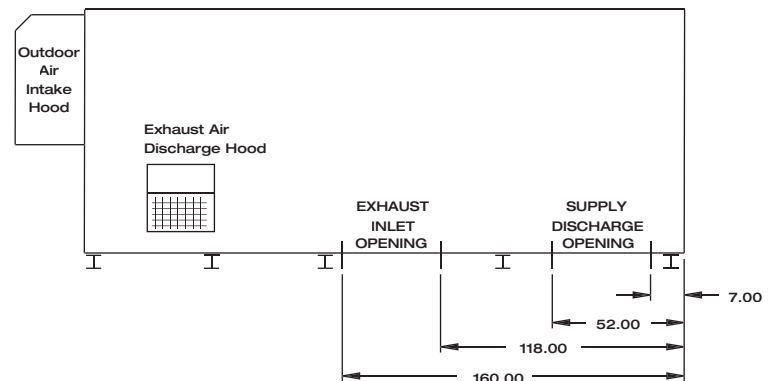


FIGURE 6: Side view of APEX on rails.

Weatherhoods

Supply weatherhood will be factory mounted. There are two exhaust weather hoods shipped separately as a kit with instructions on how to mount (refer to Page 7 for hood locations).



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.

An optional motorized damper is also available for recirculation mode. This damper allows 100% recirculation of exhaust air through the coils for continued tempering of the space during unoccupied mode (i.e. no outdoor air being brought in). This damper is mounted and wired at the factory.



Installation

Electrical Connections

The electrical supply must be compatible with that shown on the nameplate: voltage, phase, and amperage capacity. Connect power to the unit per the unit specific wiring diagram located on the inside of the control center access door. The wiring diagram indicates which electrical accessories were provided on the unit. The electrical supply line must be properly fused and conform to local and national electrical codes.

All internal electrical components are pre-wired at the factory. To determine what specific electrical accessories were provided with the unit, refer to the unit specific wiring diagram located in the unit control center. Field electrical connections required:

- 1) supply power to the main disconnect (See **FIGURE 7, Item #1**). A door interlocking safety disconnect is provided as a standard feature.
- 2) low voltage control power to the 24 VAC control circuit (See **FIGURE 7, Item #7**).

IMPORTANT: Use minimum 14 ga. wire for 24 volt control power. Control wire resistance should not exceed 0.75 ohms (approximately 285 feet total length for 14 ga. wire; 455 feet total length for 12 ga. wire). 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 control strip — See **FIGURE 7, Item #7**). 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.

Control wires should not be run inside the same conduit as that carrying the supply power. The unit must be electrically grounded in accordance with the current National Electrical Code, ANSI/NFPA-70.

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

Typical Control Center Components

1. Main Disconnect
2. Motor Starter — Exhaust Air Fan #1
3. Motor Starter — Exhaust Air Fan #2
4. Motor Starter — Outdoor Air Fan
5. Energy Wheels Motor Contactor
6. Control Power Transformer (24 VAC Secondary)
7. 24 VAC Terminal strip
8. Fuses for the control circuit, wheel drive transformer, and blower motors.
9. Energy Wheel Motor Transformer (230 VAC Secondary - for units with primary voltage greater than 230 VAC) (transformer not shown)

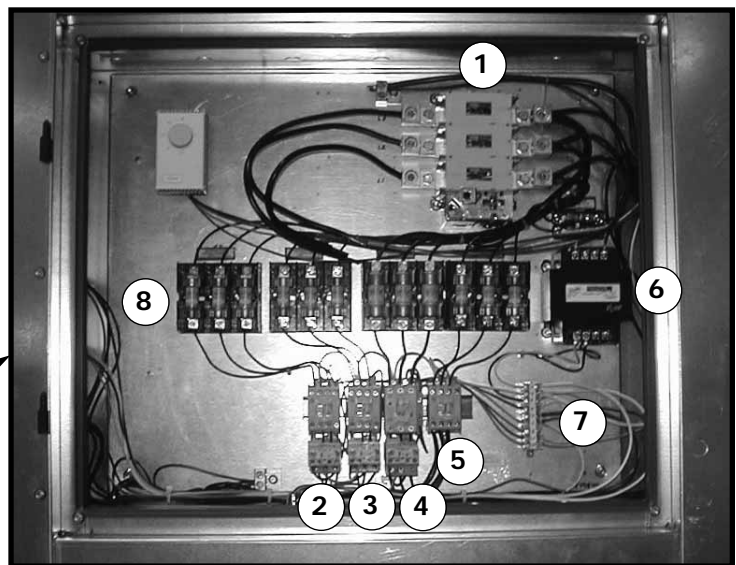
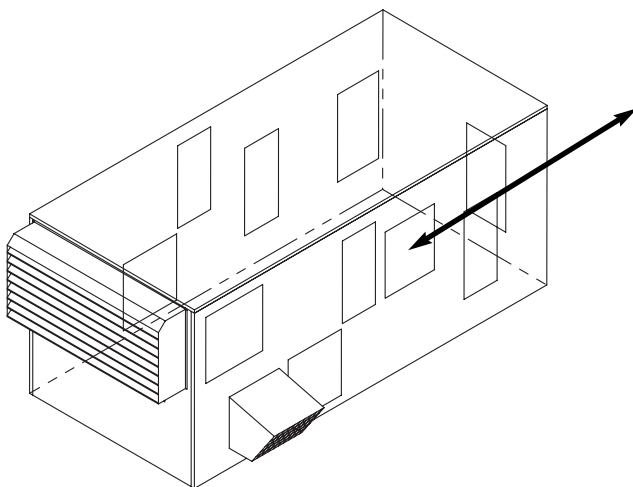


FIGURE 7: Typical control center components.

SAFETY DANGER!

Electric shock hazard. Can cause injury or death. All wiring should be performed by a qualified electrician. 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!

Verify power before wiring the supply and control voltage. Greenheck is not responsible for any damage to, or failure of the unit caused by incorrect field wiring.

Installation

Service Clearances / Access Locations

APEX-200 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 cassettes, 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. Contact Greenheck for component removal clearance.*

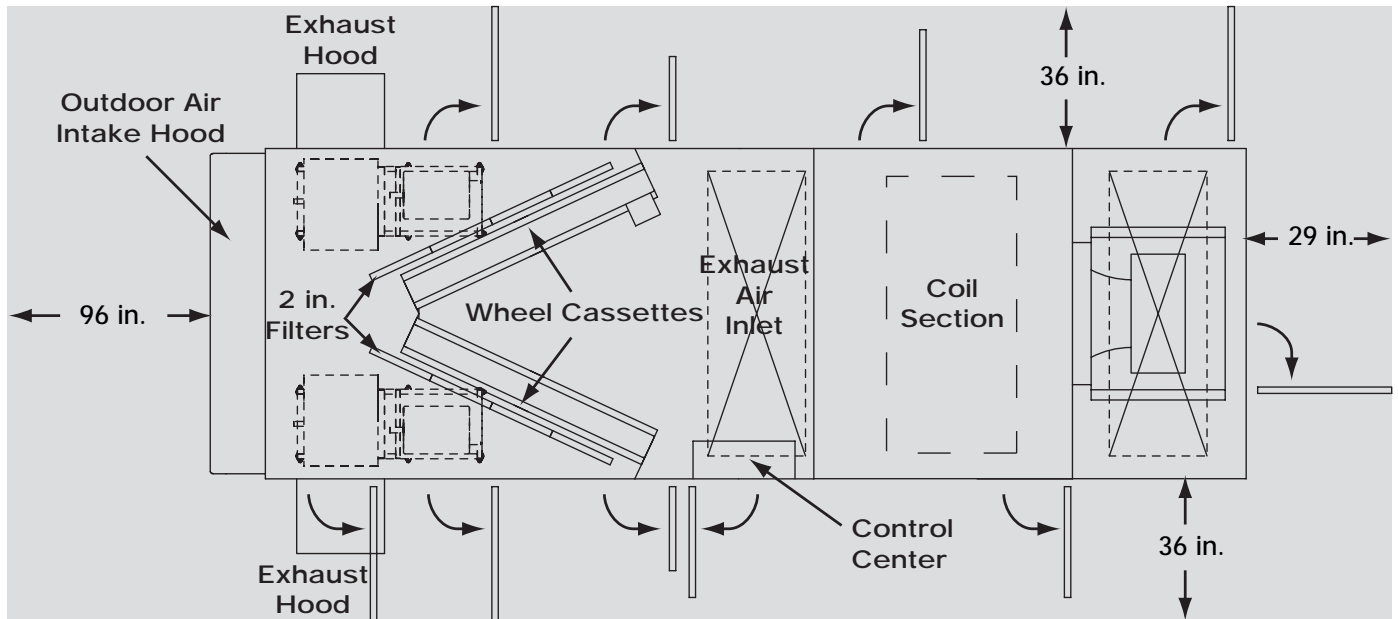


FIGURE 8: Clearances for service on APEX-200

Dimensional Data / Access Door Descriptions

Model	Exterior Dimensions								
	A	B	C	D	E	F	G	H*	I*
APEX-200	287.75	96.5	92.5	58.75	15.75	31	10.75	24.63	25.125

Width (just unit): 96.5
 Width (including lifting lugs): 99.875
 Overall Width (with exhaust hoods): 146.75
 Overall Length (with outdoor air hood): 303.5
 (All dimensions shown are in inches.)

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

- 1) Exhaust blower #1, energy recovery wheel #1 maintenance (segment removal for cleaning)
- 2) Half of supply filters
- 3) Exhaust filters (refer to Filter Maintenance). Energy recovery wheel motors, belts, and seals
- 4) Supply blower, motor, and drives
- 5) Supply blower and drives
- 6) Coil drain pan and electric heater
- 7) Control center, variable frequency drives, and temperature control package
- 8) Half of supply filters
- 9) Exhaust blower #2, energy recovery wheel #2 maintenance (segment removal for cleaning)
- 10) Outdoor air damper, electric preheater, frost control sensors, and economizer sensors
- 11) Aluminum mesh filters (both sides of hood)

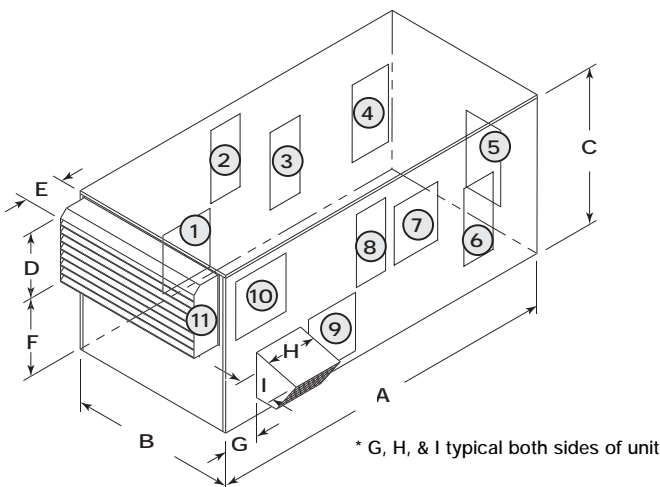


FIGURE 9: Dimensional data and access door locations.

Installation

Coil Application Recommendations

Factory installed cooling and heating components are mounted in the coil section of the unit. The coil section is downstream of the energy wheel on the supply air side of the unit.

See **FIGURE 10** for coil connection location. Coil connections are located external to the unit as shown. Coil connections that are not external have been ordered from the factory with interior or exhaust airstream coil connections.

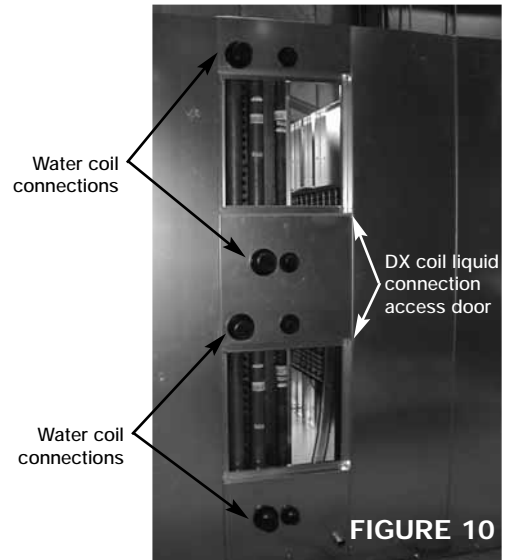
Note: DX coil liquid connections are accessible through access doors shown in **FIGURE 10**.

Water Coils

1. Piping should be in accordance with accepted industry standards. Pipework should be supported independently of the coils. Water connections are male N.P.T iron pipe. When installing couplings, do not apply undue stress to the connection extending through the unit. Use a backup pipe wrench to avoid breaking the weld between coil connection and header.
2. Connect the WATER SUPPLY TO THE BOTTOM CONNECTION on the air leaving side and the WATER RETURN TO THE TOP CONNECTION on the air entering side. To ensure proper venting, an external air vent in the piping is recommended. Connecting the supply and/or return in any other manner will result in very poor performance. Be sure to replace factory installed grommets around coil connections if removed for piping. Failure to replace grommets will result in water leakage into the unit and altered performance.
3. The air vent at the uppermost point should be temporarily opened during system start-up to release all of the air from the coil. To maintain heat transfer capacity, periodically vent any air in coil.
4. Water coils are not normally recommended for use with entering air temperatures below 40°F; however, the energy recovery wheel maintains a pre-coil temperature higher than 40°F. No control system can be depended on to be 100% safe against freeze-up with water coils. Glycol solutions or brines are the only safe media for operation of water coils with low entering air temperatures.
CONTINUOUS WATER CIRCULATION THROUGH THE COIL AT ALL TIMES IS HIGHLY RECOMMENDED.
5. Pipe sizes for the system must be selected on the basis of the head (pressure) available from the circulation pump. The velocity should not exceed 6 feet per second and the friction loss should be approximately 3 feet of water column per 100 feet of pipe.
6. For chilled water coils, the condensate drain pipe should be sized adequately to ensure the condensate drains properly. See **Drain Pan Traps** and **FIGURE 11**.

Direct Expansion (DX) Coils

1. Piping should be in accordance with accepted industry standards. Pipework should be supported independently of the coils. Undue stress should not be applied at the connection to coil headers.
2. The condensate drain pipe should be sized adequately to ensure the condensate drains properly. See **Drain Pan Traps** and **FIGURE 11**.
3. When connecting suction and liquid connections make sure the coil is free from all foreign material. Make sure all joints are tight and free of leakage. Be sure to replace factory installed grommets around coil connections if removed for piping.
4. Greenheck does not supply condensing units; for further instruction on DX coil installation and operation contact your condensing unit manufacturer.



Installation

Drain Pan Traps

Drain lines and traps should be run full size or larger from the drain pan connection (drain pan connection is 1.25-inch diameter female thread). Drain pans should have drain lines and traps to permit the condensate from the coils to drain freely. On all units with drain pans, the trap depth and the distance between the trap outlet and the drain pan outlet should be twice the static pressure in the drain pan section under normal operation to assure the trap remains sealed.

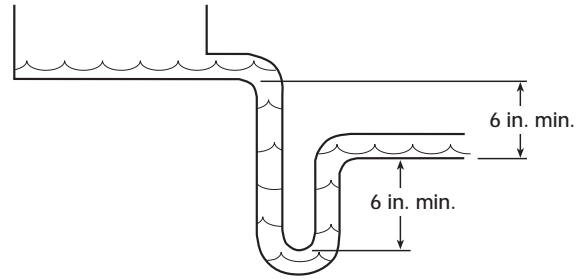


FIGURE 11: Drain pan trap dimensions.

Electric Heater Application/Operation

Factory installed electric post-heaters can be provided to warm 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).

Post-heaters are standard as 4-stage, step control. Step control heaters are designed with multiple stages made up of equal increments of heating capability. For example, an 80 kW heater with four stages will be composed of four 20-kW stages. Post-heaters come standard with a discharge temperature sensor (with

field adjustable set point). The four stages will come on one at a time until the discharge temperature set point is satisfied). Post-heaters are not single point wired (see **Electrical Connections**).

Post-heaters supplied with Greenheck temperature control package are 3-stage with binary control that provides 7 steps of heating. For example, a 35 kW heater with three stages will be composed of 5, 10, and 20 kW stages. The stages essentially 'mix and match' to provide heat output from 5 kW to 35 kW, in 5 kW increments.

Variable Frequency Drive for Fans (E7 Series by Yaskawa)

(see page 13 for VFD on energy recovery wheel)

Factory installed VFDs for the fans are programmed at the factory per the settings shown in **TABLE 1** below (see **FIGURE 12** for key pad). VFDs are shipped with a jumper between A1 to +V to allow the unit to turn on at full speed until the appropriate control signal can be applied. Remove the jumper when wiring the appropriate .0-10 Vdc control signal. See **FIGURE 13**. 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.



FIGURE 12: VFD key pad & LCD

	Parameters	Setting	Comment
A1-01	Access Level	2	Advanced Level
A1-04	Password	0	Leave as default
b1-01	(Frequency) Ref Source	1	Terminal - Analog Input A1
b1-02	Run (Command) Source	1	Contact Closure on S1
C1-01	Accl Time 1	30	Seconds
C1-02	Decel Time 2	30	Seconds
d2-01	Ref Upper Limit	100%	% of E1-04
d2-02	Ref Lower Limit	50%	% of E1-04
E1-04	Max Frequency	60 Hz	Ref for d2-01, d2-02, H3-03
E2-01	Motor Rated FLA	? A	Nameplate amps
H3-02	Terminal A1 Gain	100%	10V = 60 Hz, 100% of E1-04
H3-03	Terminal A1 Bias	50%	0V = 30 Hz, 50% of E1-04
L8-10	Cooling Fan Operation	0	Fan only during RUN
O2-03	User Defaults	1	Saves setting as user defaults
			Set defaults by A1-03 = 1110
A1-01	Access Level	0	Operation Only

TABLE 1: Factory settings for VFD used on fans

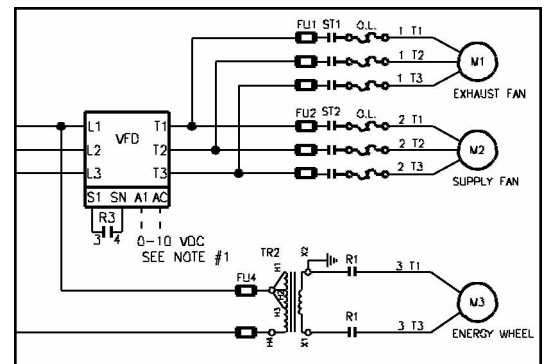


FIGURE 13: Control signal to VFD



Installation

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%	-10°F
30%	-5°F
40%	0°F

TABLE 2: Frost threshold temperatures

All of these options are provided with a thermostat (with probe) mounted in the supply air inlet compartment (see FIGURE 15) 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 Table 2 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. 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.

Testing (refer to FIGURE 14)

- 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.*

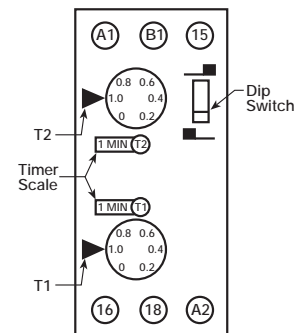


FIGURE 14

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. When electric preheat frost control is initiated, the electric pre-heater 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 set point, 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 set point, the wheel will run at minimum speed until the pressure differential falls below the set point. The temperature and pressure differential set points are set at the factory, but are field-adjustable. The variable frequency drive will be fully programmed at the factory.

Installation

Economizer Application/Operation

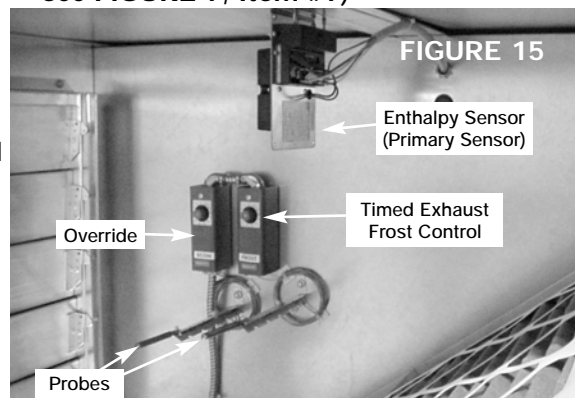
The energy recovery wheel operation can be altered to take advantage of economizer operation (free cooling). Two modes are available: 1) De-energizing the wheel or 2) Modulating the wheel.

De-energizing the wheel is accomplished with a signal from a Temperature or Enthalpy sensor mounted in the supply air inlet compartment (see **FIGURE 15**). This Primary sensor will de-energize the energy wheel when the outdoor air temperature (factory default is 65°F) 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 (see **FIGURE 15**). The Override (with field adjustable set point) is set at some temperature lower than the Primary sensor (factory default is 50°F). 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 (terminals referenced below are in the unit control center — see **FIGURE 7, Item #7**)

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 65°F and 50°F, respectively).



Enthalpy sensor with Override

- A factory-installed 620 ohm resistor is connected across terminals SR and +. The Override sensor should be turned down below current temperature in unit. Turn the unit on; LED on the sensor should be off. Confirm continuity across terminals 1 and 2 and no continuity across terminals 2 and 3.
- Disconnect the 620 ohm resistor from terminals SR and +. LED should turn on. Confirm continuity across terminals 2 and 3 and no continuity across terminals 1 and 2.
- Turn Override sensor above current temperature in unit. Confirm continuity across terminals 3 and 6. Set the Override sensor to the desired point for economizer operation to end (factory default is 50°F).
- Reconnect the factory-installed jumper.

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 set point.

Sequence of Operation: The variable frequency drive is fully programmed at the factory. 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 set point (nominal 60°F - not adjustable).

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) to these contacts will notify maintenance personnel when a failure has occurred.

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 (set at factory), 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.

Temperature Control Package

Temperature control package allows for stand-alone operation of energy recovery units provided with supplemental cooling and heating. Controller can be ordered for discharge or room control. Room control would require a room thermostat (or other call for heat) be wired to the controller. A remote panel option is also available to allow set points and other controller parameters to be adjusted from a remote location. For additional information, refer to the following documents:

Catalog: Temperature Control Package

IOM: Temperature Control Package, Part #461468



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.

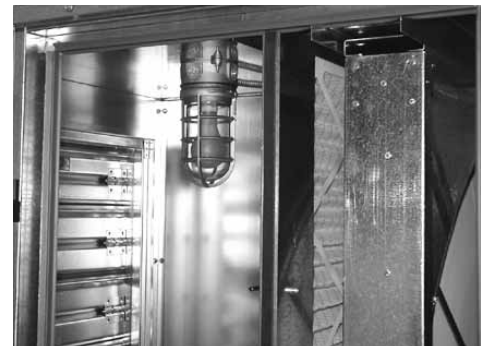
Service Outlet

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

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. Refer to "Remote Panel Wiring Schematics" (Part #461368) for instructions on wiring the remote panel to the 24 VAC terminal strip in the energy recovery unit control center.



The remote panel is available with the following options:

- 1) Unit on/off switch
- 2) Unit on/off light
- 3) 7-day time clock
- 4) Hand/off/auto switch
- 5) Time delay override
- 6) Exhaust air dirty filter light
- 7) Outdoor air dirty filter light
- 8) Economizer light
- 9) Frost control light
- 10) Wheel rotation sensor light

Variable Frequency Drive for Energy Recovery Wheel (GPD-305 Series by Yaskawa)

Factory installed VFD for the energy recovery wheel are programmed at the factory per the settings shown in **TABLE 4** 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.



VFD key pad & LCD

	Parameters	Setting	Comment
n01	Access Level	1	n01 - n79 can be read or set
n02	Operation Method	1	Terminal
n03	Reference Selection	2	0-10 Vdc (mod. wheel econ.)
n09	Max Frequency	60 Hz	
n16	Accl Time 1	10	Seconds
n17	Decel Time 2	10	Seconds
n29	Jog Frequency	6 Hz	
n30	Ref Upper Limit	100%	% of n09
n31	Ref Lower Limit	0%	% of n09
n32	Motor Rated FLA	? A	
n36	Multi-Function Input	10	
n40	Frequency Detection	4	
n41	Analog Freq. Ref. Gain	0	Inverse acting
n42	Analog Freq. Ref. Bias	99	Inverse acting
n58	Freq. Detection Level	5.9 Hz	
n01	Access Level	0	n01 read or set; n02-n79 read

TABLE 4: Factory settings for VFD used on energy recovery wheel

Unit Start-Up

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.

For proper unit function and safety, follow everything in this start-up procedure in the order presented. Perform procedure after the electrical connections are complete.

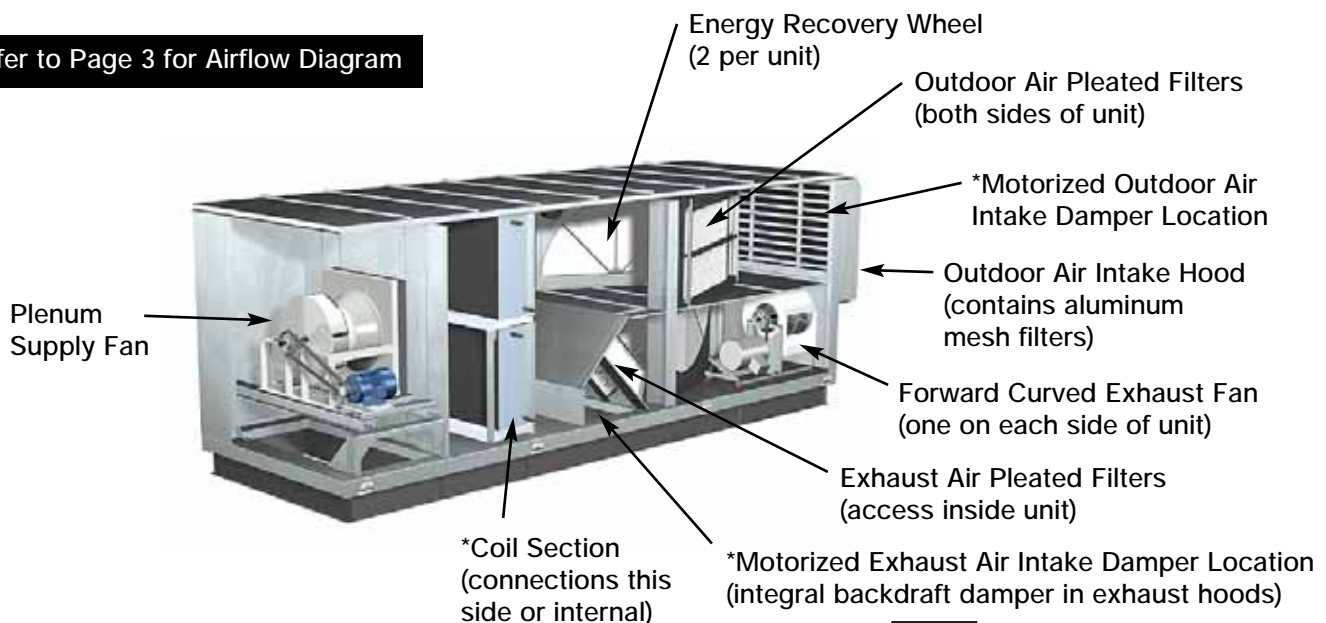
Pre-Start Check List

1. Disconnect and lock-out all power switches.
2. Remove any foreign objects that are located in the energy recovery unit.
3. Check all fasteners, set screws, and locking collars on the fans, bearings, drives, motor bases and accessories for tightness.
4. Rotate the fan wheels and energy recovery wheels by hand and ensure no parts are rubbing. If rubbing occurs, refer to the following Fan or Energy Recovery Wheel section.
5. Check the fan belt drives for proper alignment and tension (see following Fan Belt section).
6. Filters can load up with dirt during construction. Replace any dirty pleated filters and clean the aluminum mesh filters in the intake hood (refer to Routine Maintenance section).
7. Verify that dampers open and close properly.

Special Tools Required

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

Refer to Page 3 for Airflow Diagram



Unit Start-Up

Supply Fan (Plenum Type)

The APEX-200 contains one plenum supply fan located on the end of the unit opposite the outdoor air intake (see beginning of Unit Start-Up section for diagram of unit layout). Efficient fan performance can be maintained by having the correct radial gap and overlap. These items should be checked before start-up and after the fan has been in operation for 24 hours.

Radial Gap: Radial gap is adjusted by loosening the inlet cone/ring on the wheel. If additional adjustment is required to maintain a constant radial gap, loosening the bearing bolts and centering the wheel is acceptable as a secondary option.

Overlap: Proper overlap is obtained by loosening the wheel hub from the shaft and adjusting the wheel to maintain an 'A' dimension of $11 \frac{7}{16} \pm \frac{3}{8}$ inches (see FIGURE 16).

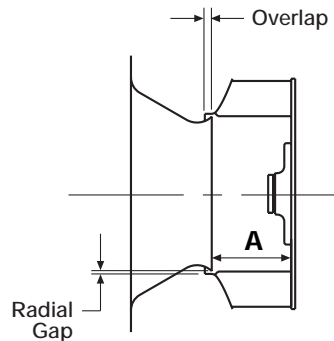


FIGURE 16: Radial gap and overlap



Spring Vibration Isolators on Supply Fan

Three to four Z-brackets prevent unwanted fan and isolator movement during shipping. Proper unit operation requires the removal of these brackets.

1. Remove the 5/16 in. hex head bolts from each Z-bracket and fan base.
2. Pull Z-bracket out from the fan base.
3. Replace the bolts to their original position in the fan base.

Exhaust Fans (Forward Curved Type)

The APEX-200 contains two forward curved exhaust fans located on either side of the unit (see Basic Unit Operation). 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.

Unit Start-Up

Fan Belt Drives

The fan belt drive components, when supplied by Greenheck Fan Corporation, 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 **FIGURES 17 & 18**).

Belt Drive Installation

1. Remove the protective coating from the end of the fan shaft and ensure 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.

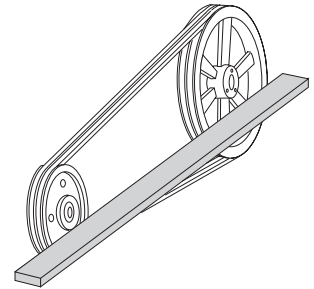


FIGURE 17: Aligning sheaves with a straight edge

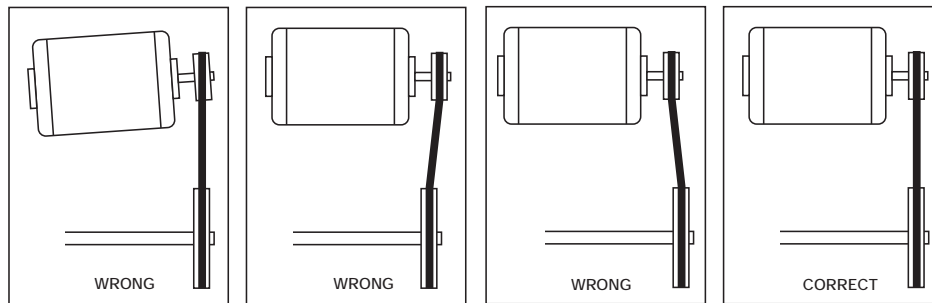
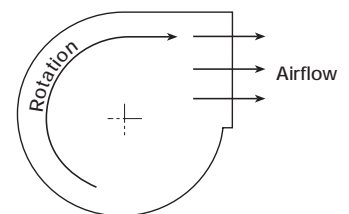


FIGURE 18: Proper alignment of motor and drive shaft.

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 **FIGURE 19**). 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 will have a fixed motor pulley. Exhaust fans 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. For the exhaust blowers, 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.

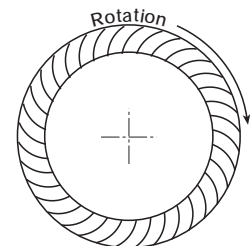


FIGURE 19

For Exhaust Fans. All access doors must be installed except the control center door. Close off as much of the exhaust blower access opening as possible while measuring the amp draw. *Do not operate units with access doors open or without proper ductwork in place as the exhaust motors will overload.*

Unit Start-Up

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.

Energy Recovery Wheel

The APEX contains two energy recovery wheels (see **FIGURES 20 & 21**). These wheels are inspected for proper mechanical operation at the factory. However, during shipping and handling, shifting can occur that may affect wheel operation. Wheels are accessible through the access doors marked "Energy Wheel Cassette Access". Due to the size and weight of these wheels, they remain stationary and all maintenance is performed in place. There is ample 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.

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.

Air seals which are too tight will prevent proper rotation of the energy recovery wheel. Air seal clearance may be checked by placing a sheet of paper, to act as a feeler gauge, against the wheel face. 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. These seals are located on each side of the wheel; be sure to check both of them. Adjust the seals such that they tug slightly on the sheet of paper as the wheel is turned. Tighten the retaining screws.

Replace access doors and apply power. Observe that the wheels rotate freely at about 60 RPM. If wheels do not rotate or are binding, contact your local representative.

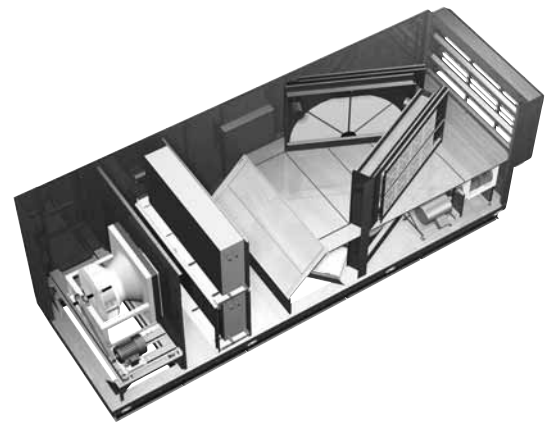


FIGURE 20: Inside layout of APEX unit

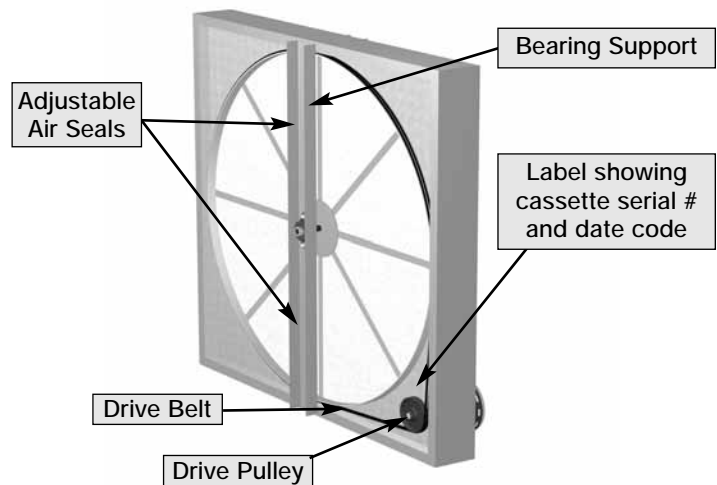


FIGURE 21: Energy recovery wheel components

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:

- Lubrication
- Dampers
- Fan Belts
- Motors
- Wheel & Fasteners

- Bearings
- Filter Maintenance
- Coil Maintenance
- Energy Wheel Cassette

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

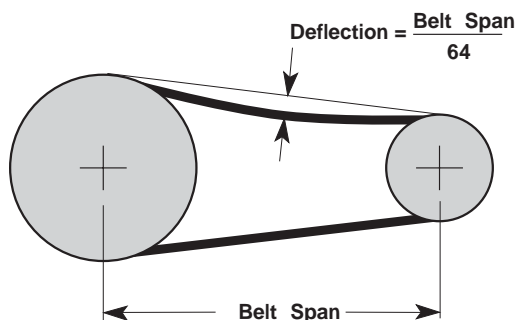
Check all dampers to ensure they open and close properly and without binding. Backdraft dampers can be checked by hand to determine if blades open and close freely. Apply power to motorized dampers to ensure the actuator opens and closes the damper as designed.

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, ensure 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.



The proper belt setting is the lowest tension at which the belts will not slip under peak load operation (see **FIGURE 22**). For initial tensioning, set the belt deflection at $\frac{1}{64}$ -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.

FIGURE 22: Proper fan belt settings

Routine Maintenance

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. Motors supplied with grease fittings should be greased in accordance with the manufacturer's recommendations. When motor temperature does not exceed 104°F (40°C), the grease should be replaced after 2000 hours of running time.



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 ensure 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.

Bearings

Shaft bearings are the most critical moving part of a fan. Therefore, special attention should be given to keeping the bearings clean and well lubricated. Proper lubrication provides for reduction in friction and wear, transmission and dissipation of heat, extended bearing life and prevention of rust.

In order for a lubricant to fulfill these tasks, the proper grease applied at regular intervals is required. See the recommended bearing lubrication schedule. If unusual conditions exist, such as temperatures below 32°F, temperatures above 200°F, moisture, or contaminants - more frequent lubrication is required.

With the unit off, add grease very slowly with a manual grease gun until a slight bead of grease forms at the seal. Be careful not to unseat the seal by over lubricating or using excessive pressure. A guide to the amount of grease to be used is to fill 30% to 60% of available space in the bearing and housing. Never mix greases made with different bases. This will cause a breakdown of the grease and possible failure of the bearing.

In addition to lubricating the bearings at specified intervals, set screws in the bearing collars should be checked for tightness. *A bearing collar which has loosened will cause premature failure of the fan shaft.* Fasteners attaching the bearings to the drive frame should also be checked.

Recommended Bearing Lubrication Schedule for APEX Fans

Relubrication Schedule in Months*

Fan RPM	Bearing Bore (inches)							
	1/2-1	1 1/8-1 1/2	1 5/8-1 7/8	1 15/16 - 2 3/16	2 7/16 - 3	3 3/16 - 3 1/2	3 15/16- 4 1/2	4 15/16 - 5 1/2
750	6	5	4	3	3	2	2	1
1000	6	4	3	2	2	1	1	0.5
1250	5	3	2	1	1	0.5	0.5	0.25
1500	5	2	1	1	0.5	0.5	0.25	0.25

* Suggested initial greasing interval is based on 12 hour per day operation. For continuous (24 hour) operation, decrease greasing interval by 50%.

- For ball bearings, add 1-2 shots of grease up to 2 inch bore sizes, and 4-5 shots of grease above 2 inch bore sizes with hand grease gun.
- For roller bearings, relubricate with 4 shots of grease up to 2 inch bore size and 8 shots for 2-5 inch bore size.
- Adjust lubrication frequency based on condition of purged grease.
- A high quality lithium base grease conforming to NLGI Grade 2 consistency, such as those listed below, should be used.

MOBILITH SHC 220
MOBILITH AW2

TEXACO MULTIFAK AFB2
TEXACO PREMIUM RB

SHELL ALVANIA #2
EXXON UNIREX N2

WARNING: Lubricate bearings prior to periods of extended shutdowns or storage and rotate shaft monthly to aid in preventing corrosion. If the fan is stored more than three months, the bearings should be purged with new grease prior to start-up.



Routine Maintenance

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 (one access door on each side of weatherhood). Slide the access door up and then pull bottom out to remove door. Then, slide the filters out (see **FIGURE 23**).

Clean filters by rinsing with a mild detergent in warm water. After the filters are dry, an adhesive spray, available at most filter distributors, may be applied to increase filter efficiency.

Internal Filter Maintenance

The APEX 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 4** for pleated filter size and quantity for each unit.

Outdoor Air Filters: Access to the outdoor air filters is through the doors labeled as "Filter Access" (both sides of unit). The filters are stacked two high and four deep. They can be removed by pulling on the strap mechanism (see **FIGURE 24**). Be sure to replace strap mechanism to assist with filter replacement for next maintenance interval.

Exhaust Air Filters: Access to the exhaust filters is through the door labeled "Coil Access". You must enter the unit to get at the exhaust filter access door. This door is located in the divider between the airstreams (see **FIGURE 25**). Open the door and pull the exhaust filters up and out of the "V" bank rack.

Door Seal Maintenance

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

FIGURE 23: Outdoor air intake hood mesh filter access.

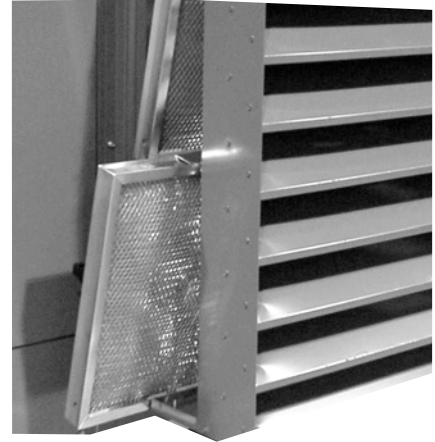


TABLE 4: Filter size and quantities.

Model	Internal Filter Size	Quantity Supply	Quantity Exhaust
APEX-200	20 in. x 20 in.	16	16

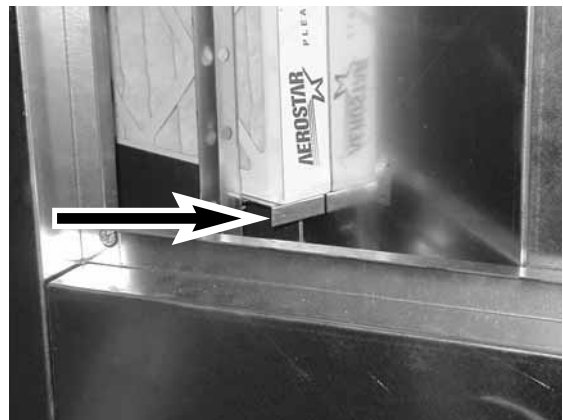


FIGURE 24: Strap mechanism used to remove outdoor air filters.

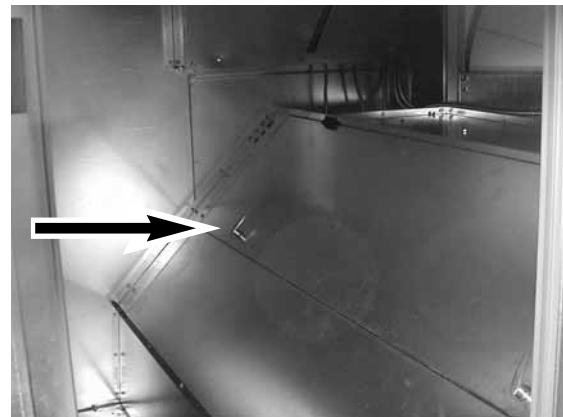


FIGURE 25: Access to exhaust air filters.

Routine Maintenance

Coil Maintenance

Filters upstream of the coil should be checked regularly. If the filters are dirty, they should be cleaned or replaced. It is important that the coils stay clean to maintain desired airflow (refer to Filters in this section).

1. Coils must be clean to obtain maximum performance. Check once a year under normal operating conditions and, if dirty, brush or vacuum clean. Soiled fins reduce the capacity of the coil, demand more energy from the fan, and create an environment for odor and bacteria to grow and spread through the conditioned zone. High pressure water (700 Psi or less) may be used to clean coils with fin thickness over 0.0095 inches thick. **TEST THE SPRAY PRESSURE** over a small corner of the coil to determine if the fins will withstand the spray pressure.

For coils with fragile fins or high fin density, foaming chemical sprays and washes are available. Many coil cleaners contain harsh chemicals, so they must be used with caution by qualified personnel only. Care must be taken not to damage the coils, including fins, while cleaning.

CAUTION: Fin edges are sharp.

2. Drain pans in any air conditioning unit will have some moisture in them, therefore, algae and other organisms will grow due to airborne spores and bacteria. Periodic cleaning is necessary to prevent this build-up from plugging the drain and causing the drain pan to overflow. Inspect twice a year to avoid the possibility of overflow. Also, drain pans should be kept clean to prevent the spread of disease. Cleaning should be performed by qualified personnel.

SAFETY CAUTION!

Biological hazard. May cause disease. Cleaning should be performed by qualified personnel.

Winterizing Coils

Coil freeze-up can be caused by such things as air stratification and failure of outdoor air dampers and/or preheat coils. Routine draining of water cooling coils for winter shutdown cannot be depended upon as insurance against freeze-up. Severe coil damage may result. It is recommended that all coils be drained as thoroughly as possible and then treated in the following manner.

Fill each coil independently with an antifreeze solution using a small circulating pump and again thoroughly drain. Check freezing point of antifreeze before proceeding to next coil. Due to a small amount of water always remaining in each coil, there will be diluting effect. The small amount of antifreeze solution remaining in the coil must always be concentrated enough to prevent freeze-up.

NOTE: Carefully read instructions for mixing antifreeze solution used. Some products will have a higher freezing point in their natural state than when mixed with water.



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.

ACCESSING ENERGY RECOVERY WHEEL

The APEX has two energy recovery wheels. Open the exhaust blower access doors to access each wheel (FIGURE 26). The energy recovery wheel cassettes do not slide out due to their size and weight.

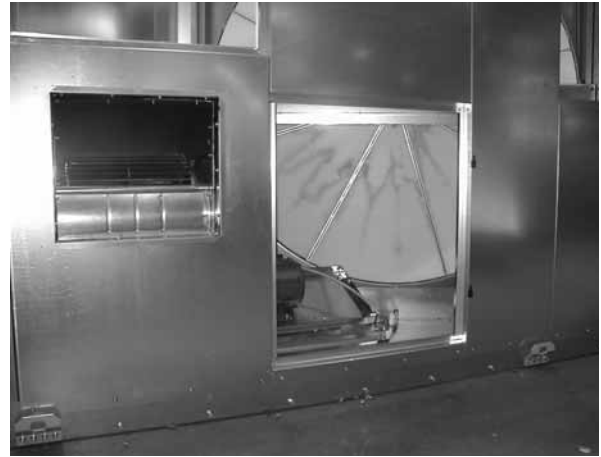


FIGURE 26: Access to wheel through exhaust blower door.

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

REMOVING THE ENERGY RECOVERY WHEEL SEGMENTS

Steel retainers are located on the inside of the wheel rim (FIGURE 27). Push the retainer toward center of wheel, then lift up and away to release segments (FIGURE 28 & 29).

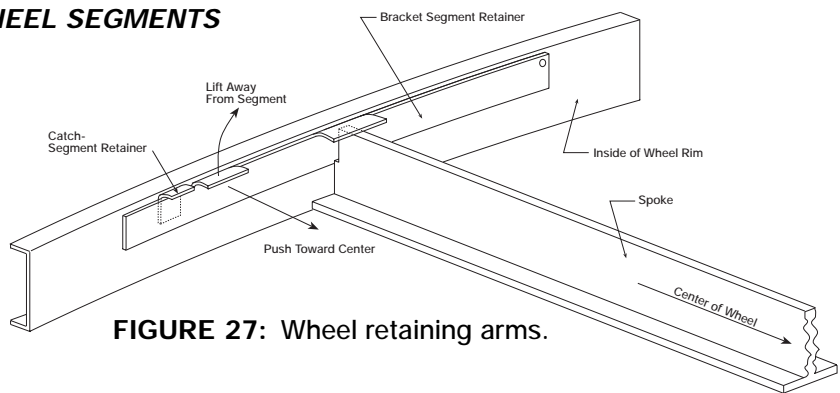


FIGURE 27: Wheel retaining arms.

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

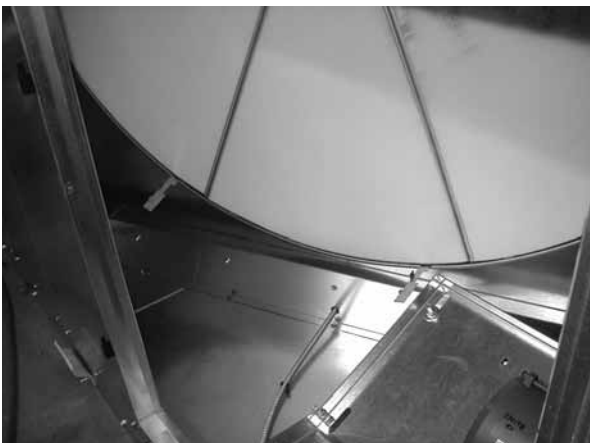


FIGURE 28: Wheel segment retaining arms rotated for removal.



FIGURE 29: Wheel segment removed to allow for cleaning.

Routine Maintenance

CLEANING ENERGY RECOVERY WHEEL SEGMENTS

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 140°F**
- ** **DO NOT DRY ENERGY RECOVERY WHEEL SEGMENTS IN AIR IN EXCESS OF 140°F.**

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.

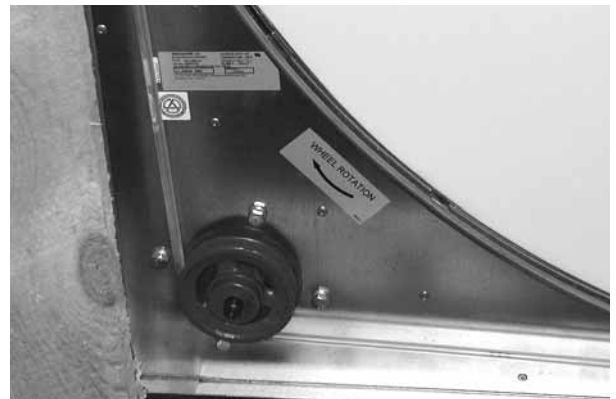


FIGURE 30: Wheel belt & pulley

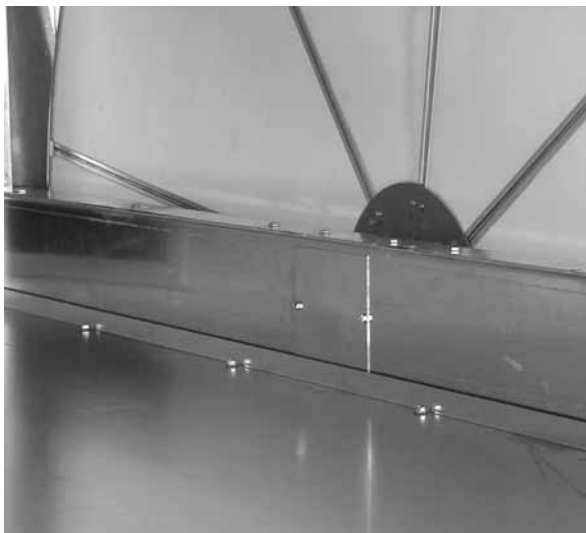
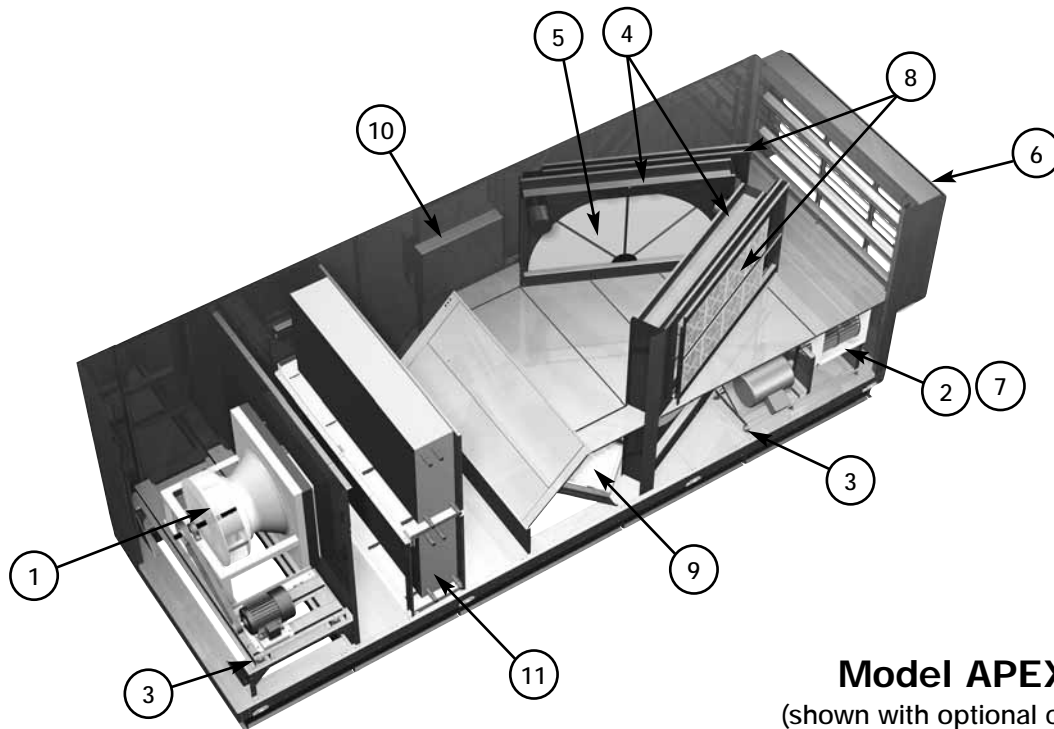


FIGURE 31: Wheel bearing access

Energy Recovery Wheel Bearings

In the unlikely event that a wheel bearing fails, access is available through the access door above the exhaust blower discharge. Remove the plate shown in Figure 31 to access bearing.

Parts List



Model APEX

(shown with optional chilled water and hot water coils)

1. Supply blower
 - Plenum fan
 - Adjustable motor mount for belt tensioning
 - Adjustable sheaves for speed control
2. Exhaust blower (2 per unit - each side)
 - Forward curved fan
 - Adjustable motor mount for belt tensioning
 - Adjustable sheaves for speed control
3. Vibrations isolators (4 per blower)
 - Neoprene (exhaust blowers)
 - Spring (supply blower)
4. Energy recovery wheel cassette (2 per unit)
5. Removable energy recovery wheel segments
6. Supply weatherhood with 2 in. aluminum mesh filters
7. Exhaust weatherhood with birdscreen and integral backdraft damper (2 per unit)
8. Supply air filter racks for 2 in. pleated, 30% efficient filters (2 straight racks for supply)
9. Exhaust air filter racks for 2 in. pleated, 30% efficient filters (v-bank rack accessed inside unit)
10. Electrical control box (standard features)
 - Single point power
 - Disconnect interlocked with access door
 - Motor starters for the supply blower, exhaust blowers and energy wheel motors
 - 24 VAC, control circuit with terminal strip
11. Coil section houses supply air tempering options
 - DX or chilled water for cooling
 - Electric or hot water heat for heating

Sequence of Operation

Basic Unit

The APEX unit is 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 APEX unit can be supplied with or without heating and cooling coils. For units with coils, controls can be supplied by Greenheck (refer to the Temperature Control IOM, Part #461468, for sequence of operation) 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

Outdoor air is preconditioned (temperature and moisture levels are decreased) by the transfer of energy from the cooler, drier exhaust air via the energy recovery wheel.

Units supplied with cooling coils can further cool the air coming off the wheel and strip out moisture to levels at or below room design. A heating coil downstream of the cooling coil can reheat the air to a more comfortable discharge temperature to the space.

Economizer Operation: See **Economizer Application/Operation** section

Winter Operation

Outdoor air is preconditioned (temperature and moisture levels are increased) by the transfer of energy from the warmer, more humid exhaust air via the energy 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:

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. Defective motor or capacitor. Motor starter overloaded. Electrical. Drive.	Replace fuse or reset circuit breaker and check amps. Replace. Reset starter and check amps. Check for On/Off switches. Check for correct supply voltage. 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). Incoming supply power is less than anticipated. Voltage supplied to starter coil must be within +10% / -15% of nominal voltage stated on the coil.	Shorten wiring run to mechanical room or install a relay which will turn unit on/off (C/F for relay information). 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. Static pressures are higher or lower than design. Blower rotation is incorrect. Motor voltage incorrect. Motor horsepower too low. Shorted windings in motor.	Check cfm and adjust drives if needed. If higher, ductwork should be improved. If lower, fan rpm should be lower. Check rotation and reverse if necessary. Check motor nameplate versus supplied voltage. See specifications and catalog for fan curves to determine if horsepower is sufficient. Replace motor.
Low Airflow (cfm)	Unit damper not fully open. System static pressure too high. Blower speed too low. Fan wheels are operating backwards. Dirty filter or energy wheel. Leaks in ductwork. Elbows or other obstructions may be obstructing fan outlet. Belt slippage.	Adjust damper linkage or replace damper motor. Improve ductwork to eliminate losses using good duct practices. Check for correct drives and rpm with catalog data. For 3-phase see Fan Wheel Rotation on page 16. Follow cleaning procedures on pages 20 and 23. Repair. Correct or improve ductwork. Adjust belt tension.
High Airflow (cfm)	Blower fan speed too high. Filter(s) not in place. Insufficient static pressure (Ps) (airflow resistance).	Check for correct fan rpm. Decrease fan speed if necessary. Install filters. 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. Exhaust Only frost control sensors are tripping.	Decrease fan speed. Adjust frost temperature sensor set point as needed.
Energy Wheel Does NOT Turn	Air seals are too tight. "Economizer" sensors are operating. No power to wheel motor. Wheel drive belt.	See Energy Recovery Wheel on page 17. Adjust temperature or enthalpy set points as needed. Make sure wheel drive is plugged in. Verify power is available. 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 on page 17.
Excessive Noise or Vibration	Fan wheel rubbing on inlet. Bearings. Wheel out of balance. Loose wheel on shaft. Loose motor or blower sheave. Belts too loose. Belts too tight. Worn belt. Motor base or blower loose. Buildup of material on wheel. Bearing and drive misaligned. Noise being transmitted by duct.	Adjust wheel and/or inlet cone. Tighten wheel hub or bearing collars on shaft. Replace defective bearing(s). Lubricate bearing(s). Tighten collars and fasteners. Replace or rebalance. Tighten wheel setscrew. Tighten sheave setscrew. Adjust belt tension after 24 hours of operation. Loosen to maintain a 3/8 inch deflection per foot of span between sheaves. Replace. Tighten mounting bolts. Clean wheel and housing. Realign. Make sure ductwork is supported properly. Make sure ductwork 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.



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