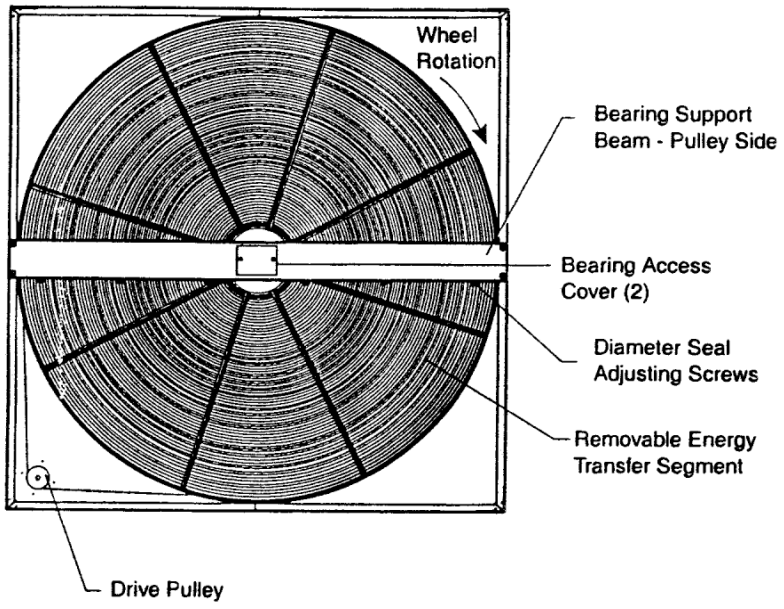
AAON®

Users Information Manual

AAONAIRE®

ENERGY RECOVERY UNITS

CONTENTS



Owner should pay particular attention to the words: **NOTE**, **CAUTION**, *and* **WARNING**. **NOTES** *are intended to clarify or make the installation easier.* **CAUTIONS** *are given to prevent equipment damage.* **WARNINGS** *are given to alert owner that personal injury and/or equipment damage may result if installation is not handled properly.*

IMPORTANT SAFETY INFORMATION

ONLY QUALIFIED PERSONNEL SHOULD PERFORM INSTALLATION, OPERATION, AND MAINTENANCE OF EQUIPMENT DESCRIBED IN THIS MANUAL.

AAON package units are designed for safe operation when installed, operated, and maintained within design specifications, and the instructions set forth in this manual. It is necessary to follow these instructions to avoid personal injury or damage to equipment or property during equipment installation, operation, and maintenance.

⚠ WARNING

RISK OF ELECTRICAL SHOCK -
Before attempting to perform any service or maintenance, turn the electrical power to the unit OFF at disconnect switch(es). Unit may have multiple power supplies.

⚠ NOTE

IMPORTANT!

This equipment is protected by a standard limited warranty under the condition that initial installation, service, and maintenance is performed according to the instructions set forth in this manual. This manual should be read in its entirety prior to installation, and before performing any service or maintenance work.

Units described in this manual are available with many optional accessories. If you have questions after reading this manual in its entirety, consult other factory documentation, or contact your sales representative to obtain further information before manipulating this equipment, or its optional accessories.

⚠ WARNING

RISK OF DAMAGE, INJURY, AND LOSS OF LIFE - Improper installation, adjustment, alteration, service or maintenance can cause property damage, personal injury, or loss of life. A qualified installer or service agency must perform installation and service.

⚠ WARNING

RISK OF INJURY FROM MOVING PARTS - Disconnect all power before servicing to prevent serious injury resulting from automatic starts. Unit may have multiple power supplies.

GENERAL INFORMATION

The units are designed as self-contained heating, cooling or combination units using refrigerant, chilled water, natural or propane gas, electric resistance, steam or hot water as shown on the unit rating plate.

This AAONAIRE® unit has been equipped with an energy recovery heatwheel. This booklet is furnished to assure the energy recovery feature will be properly setup to perform in accordance with the job specifications for your particular application.

The AAONAIRE® heatwheel option is designed to recover energy that would normally be lost through the ventilation required by today's codes and standards for comfort and health. The benefits of energy recovery are significant in that 35 to 40 percent of the unit heating and cooling capacity can be achieved by collecting this otherwise lost energy from the exhaust air and returning this energy to the building. The cost of removing humidity in the summer is also greatly reduced by the use of the desiccant coating on the energy wheel.

The Energy Recovery Cassette consists of a frame, wheel, wheel drive system and energy transfer segments. Segments are removable for cleaning or replacement. The segments rotate through counter flowing exhaust and outdoor air supply streams where they transfer heat and/or water vapor from the warm, moist air stream to the cooler and/or drier air stream. This energy recovery process can reduce cooling design loads by up to 4 tons per 1000 CFM of outdoor air ventilation while also reducing heating demand and humidification requirements. Operating savings, reduced demand charges and first cost equipment savings provide a rapid payback to the building owner.

The initial set-up and servicing of the heatwheel is very important to maintain proper operating efficiency and building occupant comfort.

Normal maintenance requires periodic inspection of filters, the cassette wheel, drive belts, air seals, wheel drive motor and its electrical connections.

Wiring diagrams are provided with each motor. When wired according to wiring diagram, motor rotates clockwise when viewed from the shaft/pulley side.

By carefully reviewing the information within this manual and following the instructions, the risk of improper operation and/or component damage will be minimized.

It is important that periodic maintenance be performed to help assure trouble free operation. Should equipment failure occur, contact a qualified service organization with qualified, experienced HVAC technicians to properly diagnose and repair this equipment.

INITIAL MECHANICAL CHECK & SETUP

Outdoor units equipped with outside air intake will have an outside air hood. The outside air hood must be opened prior to unit operation.

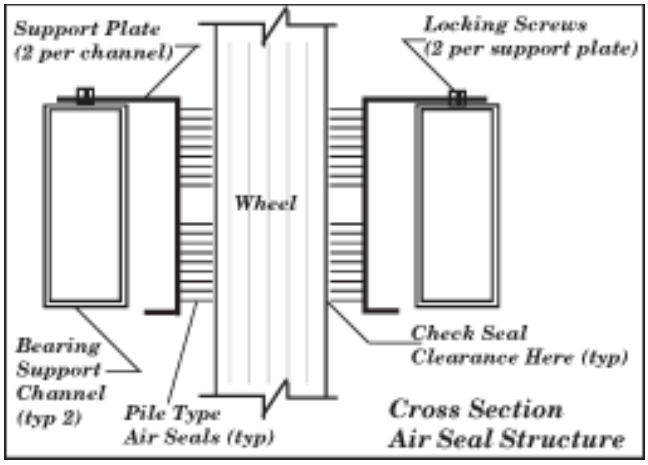
Remove shipping screws from each side of the hood in the “closed” position. Lift hood to the “open” position, seal flange, and secure with sheet metal screws.

Outdoor air intake adjustments should be made according to building ventilation, or local code requirements.

After the unit installation is complete, open the cassette access door and determine that the energy wheel rotates freely when turned by hand. Apply power and observe that the wheel rotates at approximately 30 RPM. If the wheel does not rotate when power is applied, it may be necessary to readjust the "diameter air seals".

AIR SEAL ADJUSTMENTS

Pile type air seals across both sides of the energy wheel diameter are factory adjusted to provide close clearance between the air seal and wheel. Racking of the unit or cassette during installation, and / or mounting of the unit on a non level support or in other than the factory orientation can change seal clearances. Tight seals will prevent rotation.



WHEEL-TO-AIRSEAL CLEARANCE

To check wheel-to-seal clearance; first disconnect power to the unit. In some units the heatwheel assembly can be pulled out from the cabinet to view the airseals. On larger units, the heatwheel may be accessible inside the walk-in cabinet.

A business card or two pieces of paper can be used as a feeler gauge, (typically each .004" thick) by placing it between the face of the wheel and the pile seal.

Using the paper, determine if a loose slip fit exist between the pile seal and wheel when the wheel is rotated by hand.

To adjust air seal clearance, loosen all seal plate retaining screws holding the separate seal retaining

plates to the bearing support channels and slide the seal plates away from the wheel. Using the paper feeler gauge, readjust and retighten one seal plate at a time to provide slip fit clearance when the wheel is rotated by hand.
Confirm that the wheel rotates freely. Apply power to the unit and confirm rotation.

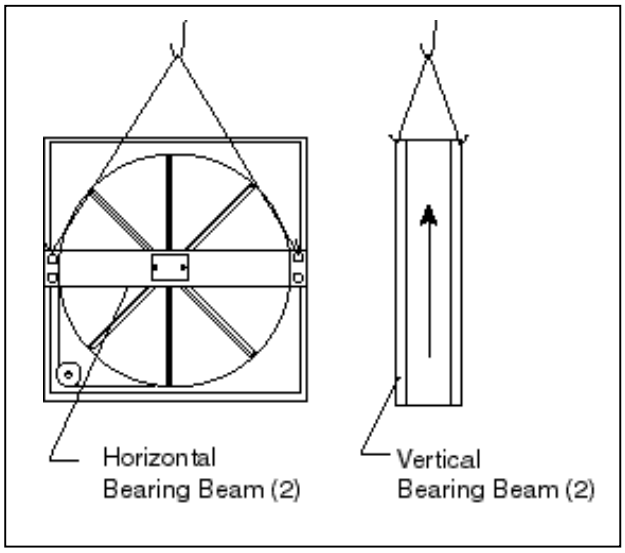
AIRFLOW BALANCING & CHECKING
High performance systems commonly have complex air distribution and fan systems. Unqualified personnel should not attempt to adjust fan operation, or air circulation, as all systems have unique operating characteristics. Professional air balance specialists should be employed to establish actual operating conditions, and to configure the air delivery system for optimal performance.

Controls
A variety of controls and electrical accessories may be provided with the equipment. Identify the controls on each unit by consulting appropriate submittal, or order documents, and operate according to the control manufacturer's instructions. If you cannot locate installation, operation, or maintenance information for the specific controls, then contact your sales representative, or the control manufacturer for assistance.

⚠ WARNING

Do not alter factory wiring. Deviation from the supplied wiring diagram will void all warranties, and may result in equipment damage or personal injury. Contact the factory with wiring discrepancies.

ROUTINE MAINTENANCE & HANDLING
Handle cassettes with care. All cassettes should be lifted by the bearing support beam. Holes are provided on both sides of the bearing support beams to facilitate rigging as shown in the following illustration.



Lifting Hole Locations

Routine maintenance of the Energy Recovery Cassettes includes periodic cleaning of the Energy Recovery Wheel as well as inspection of the Air Seals and Wheel Drive Components as follows:

Cleaning
The need for periodic cleaning of the energy recovery wheel will be a function of operating schedule, climate and contaminants in the indoor air being exhausted and the outdoor air being supplied to the building.
The heatwheel is "self-cleaning" with respect to dry particles due to its laminar flow characteristics. Smaller particles pass through; larger particles land on the surface and are blown clear as the flow direction is reversed. Any material that builds up on the face of the wheel can be removed with a brush or vacuum. The primary need for cleaning is to remove oil based aerosols that have condensed on energy transfer surfaces.

A characteristic of all dry desiccants, such films can close off micron sized pores at the surface of the desiccant material, reducing the efficiency by which the desiccant can adsorb and desorb moisture and also build up so as to reduce airflow.

In a reasonably clean indoor environment such as a school or office building, measurable reductions of airflow or loss of sensible (temperature) effectiveness may not occur for several years. Measurable changes in latent energy (water vapor) transfer can occur in shorter periods of time in applications such as moderate occupant smoking or cooking facilities. In applications experiencing unusually high levels of occupant smoking or oil based aerosols such as industrial applications involving the ventilation of machine shop areas for example, annual washing of energy transfer may be necessary to maintain latent transfer efficiency. Proper cleaning of the energy

recovery wheel will restore latent effectiveness to near original performance.

To clean, gain access to the energy recovery wheel and remove segments. Brush foreign material from the face of the wheel. Wash the segments or small wheels in a 5% solution of non-acid based coil cleaner or alkaline detergent and warm water.

Soak in the solution until grease and tar deposits are loosened (Note: some staining of the desiccant may remain and is not harmful to performance). Before removing, rapidly run finger across surface of segment to separate polymer strips for better cleaning action. Rinse dirty solution from segment and remove excess water before reinstalling in wheel.

CAUTION !

Do Not use acid based cleaners, aromatic solvents, steam or temperatures in excess of 170°F; damage to the wheel my occur!

Air Seals

Four adjustable diameter seals are provided on each cassette to minimize transfer of air between the counter flowing airstreams.

To adjust diameter seals, loosen diameter seal adjusting screws and back seals away from wheel surface. Rotate wheel clockwise until two opposing spokes are hidden behind the bearing support beam. Using a folded piece of paper as a feeler gauge, position paper between the wheel surface and diameter seals.

Adjust seals towards wheel surface until a slight friction on the feeler gauge (paper) is detected when gauge is moved along the length of the spoke. Retighten adjusting screws and recheck clearance with “feeler” gauge.

Wheel Drive Components

The **wheel drive motor** bearings are pre-lubricated and no further lubrication is necessary.

The **wheel drive pulley** is secured to the drive motor shaft by a combination of either a key or D slot and set screw.

The set screw is secured with removable locktite to prevent loosening. Annually confirm set screw is secure. The **wheel drive belt** is a urethane stretch belt designed to provide constant tension through the life of the belt. No adjustment is required. Inspect the drive belt annually for proper tracking and tension. A properly tensioned belt will turn the wheel immediately after power is applied with no visible slippage during start-up.

INSTALLATION CONSIDERATIONS

AAONAIRE® Energy recovery cassettes are incorporated within the design of packaged units, packaged air handlers and energy recovery ventilators. In each case, it is recommended that the following considerations be addressed:

Accessibility

The cassette and all its operative parts; i.e.: motor, belt, pulley, bearings, seals and energy transfer segments must be accessible for service and maintenance. This design requires that adequate clearance be provided outside the enclosure.

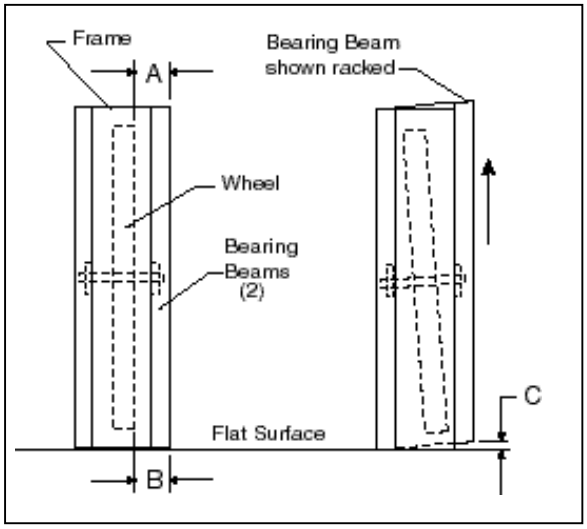
Where cassettes are permanently installed in a cabinet, access to both sides of the cassette must be provided.

Orientation & Support

The Energy Recovery Cassette may be mounted in any orientation. However, **Care must be taken to make certain that the cassette frame remains flat and the bearing beams are not racked.**

To verify, make certain that the distance between wheel rim and bearing beam is the same at each end of the bearing beam, to within 1/4 of an inch (dimension A & B). This amount of racking can be compensated for by adjusting the diameter seals.

If greater than 1/4 inch, racking must be corrected to ensure that drive belt will not disengage from wheel.



Avoid Racking Of Cassette Frame

OPERATION
CAUTION !
Keep hands away from rotating wheel!!
Contact with rotating wheel can cause physical injury.

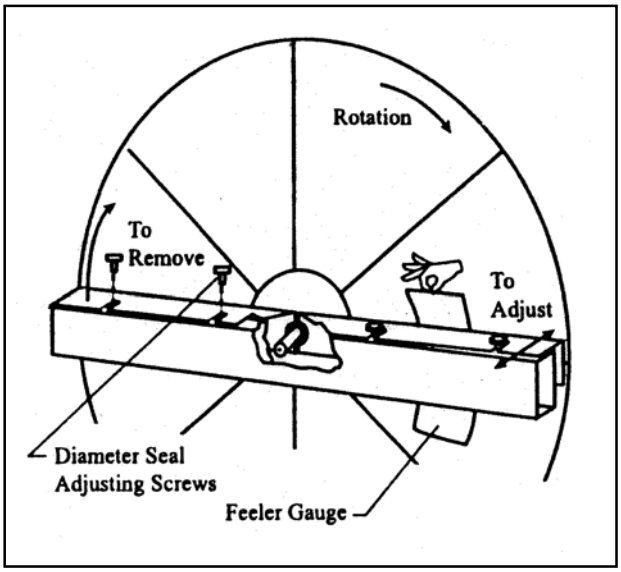
Start Up Procedure
1. By hand, turn wheel clockwise (as viewed from the pulley side), to verify wheel turns freely through 360º rotation.

2. Before applying power to drive motor, confirm wheel segments are fully engaged in wheel frame and segment retainers are completely fastened.
(See Segment Installation Diagram).

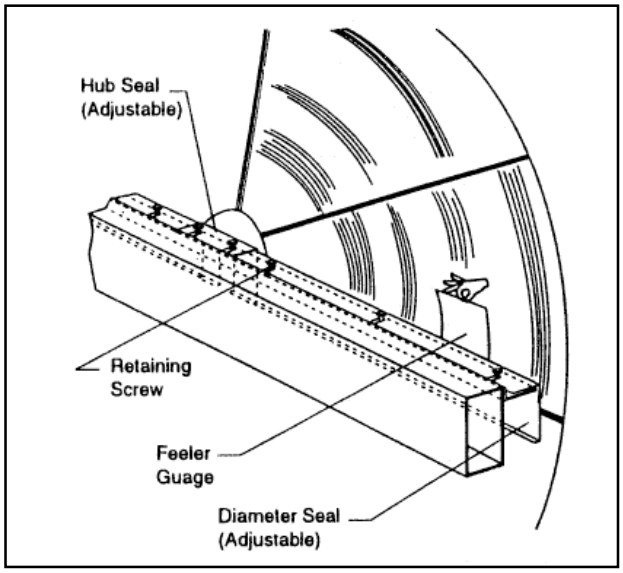
3. With hands and objects away from moving parts, activate unit and confirm wheel rotation. Wheel rotates clockwise (as viewed from the pulley side).

4. If wheel has difficulty starting, turn power off and inspect for excessive interference between the wheel surface and each of the four (4) diameter seals. To correct, loosen diameter seal adjusting screws and back adjustable diameter seals away from surface of wheel, apply power to confirm wheel is free to rotate, then re-adjust and tighten hub and diameter seals, as shown in hub seal adjustment diagram.

5. Start and stop wheel several times to confirm seal adjustment and to confirm belt is tracking properly on wheel rim (approximately 1/4" from outer edge of rim).



Diameter Seal Adjustment



Hub Seal Adjustment

SERVICE

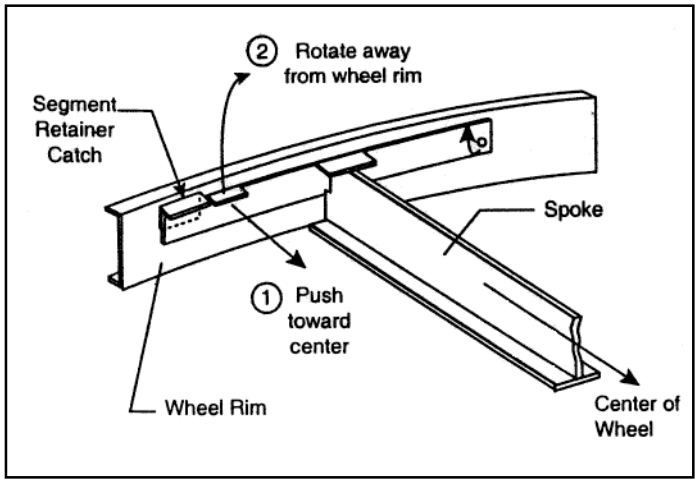
CAUTION !

Disconnect electrical power before servicing energy recovery cassette.

Always keep hands away from bearing support beam when installing or removing segments. Failure to do so could result in severe injury to fingers or hand.

Segment Installation & Replacement

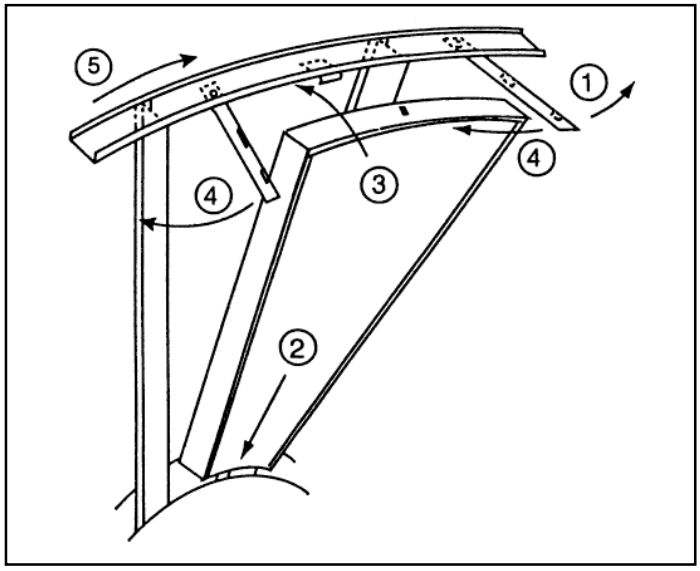
Wheel segments are secured to the wheel frame by a Segment Retainer which pivots on the wheel rim and is held in place by a Segment Retaining Catch.



Segment Retainer

To install wheel segments follow steps one through five below. Reverse procedure for segment removal.

1. Unlock two segment retainers (one on each side of the selected segment opening.
2. With the embedded stiffener facing the motor side, insert the nose of the segment between the hub plates.



Segment Installation

3. Holding segment by the two outer corners, press the segment towards the center of the wheel and inwards against the spoke flanges. If hand pressure does not fully seat the segment, insert the flat tip of a screw driver between the wheel rim and outer corners of the segment and apply downward force while guiding the segment into place.
4. Close and latch each Segment Retainer under Segment Retaining Catch.
5. Slowly rotate the wheel 180°. Install the second segment opposite the first for counterbalance. Rotate the two installed segments 90° to balance the wheel while the third segment is installed. Rotate the wheel 180° again to install the fourth segment opposite the third. Repeat this sequence with the remaining four segments.

Wheel Drive Motor & Pulley Replacement

1. Disconnect power to wheel drive motor.
2. Remove belt from pulley and position temporarily around wheel rim.
3. Loosen set screw in wheel drive pulley using a hex head wrench and remove pulley from motor drive shaft.
4. While supporting weight of drive motor in one hand, loosen and remove (4) mounting bolts.
5. Install replacement motor with hardware kit supplied.
6. Install pulley to dimension as shown and secure set screw to drive shaft.
7. Stretch belt over pulley and engage in groove.
8. Follow start-up procedure.

Belt Replacement

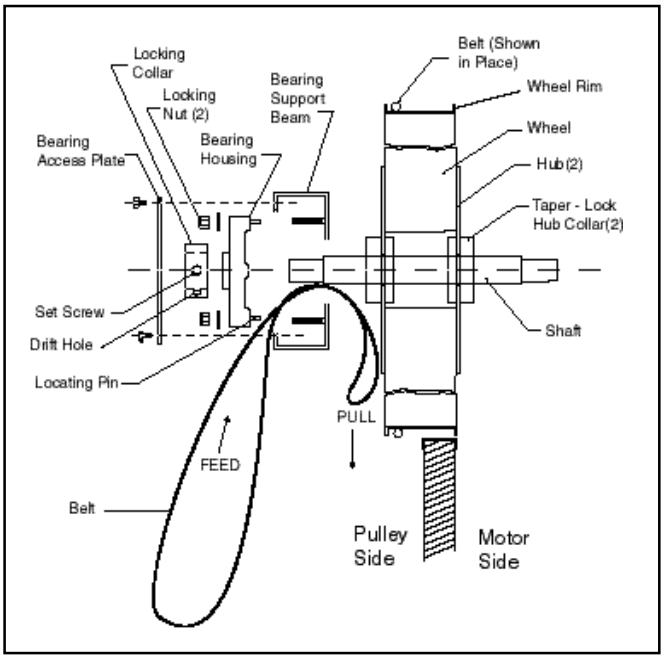
1. Obtain access to the pulley side bearing access plate if bearing access plates are provided. Remove two bearing access plate retaining screws and the access plate.
2. Using hexagonal wrench, loosen set screw in bearing locking collar. Using light hammer and drift (in drift pin hole) tap collar in the direction of wheel rotation to unlock collar. Remove collar.
3. Using socket wrench with extension, remove two nuts which secure bearing housing to the bearing support beam. Slide bearing from shaft. If not removable by hand, use bearing puller.
4. Form a small loop of belt and pass it through the hole in the bearing support beam. Grasp the belt at the wheel hub and pull the entire belt down.

Note: Slight hand pressure against wheel rim will lift weight of wheel from inner race of bearing to assist bearing removal and installation.

CAUTION !

Protect hands and belt from possible sharp edges of hole in Bearing Support Beam.

5. Loop the trailing end of the belt over the shaft (belt is partially through the opening).
6. Reinstall the bearing onto the wheel shaft, being careful to engage the two locating pins into the holes in the bearing support beam. Secure the bearing with two self locking nuts.
7. Install the belts around the wheel and pulley according to the instructions provided with the belt.
8. Reinstall diameter seals or hub seal and tighten retaining screws. Rotate wheel in clockwise direction to determine that wheel rotates freely with slight drag on seals.
9. Reinstall bearing locking collar. Rotate collar by hand in the direction the wheel rotates (see label provided on each cassette for wheel rotation).
10. Lock in position by tapping drift pin hole with hammer and drift. Secure in position by tightening set screw.
11. Reinstall Bearing Access Cover.
12. Apply power to wheel and ensure that the wheel rotates freely without interference.



Belt Replacement

DESIGN CONDITIONS & CONTROL STRATEGIES

Standard temperature control

The unit can be configured with normal air flows and controls but still have the benefit of a large amount of makeup air, better humidity control and lower operating cost than a unit without a heat wheel. The energy recovery unit operates in four (4) basic modes; fan only; economizer; cooling and heating. Each of these modes has specific functions as defined below.

Fan only mode: When the unit supply fan is started, and there is no call for cooling or heating, the unit economizer moves to its minimum position, the heatwheel is activated and the heatwheel fan is started. If the unit is equipped with heatwheel bypass dampers, these are closed.

Economizer mode: With the unit supply fan in operation and a call for cooling is made, if the outdoor air temperature and humidity are below the enthalpy setpoint, the heatwheel exhaust fan is activated, the heatwheel is deactivated and the economizer modulates to maintain the mixed air setpoint. If the unit is equipped with heatwheel bypass dampers, these are opened to accommodate the increase in outside air volume.

Cooling mode: With the unit supply fan in operation and a call for cooling is made, if the outdoor air temperature and humidity are above the enthalpy setpoint, the economizer moves to its minimum position and mechanical cooling is activated. The heatwheel is activated and the heatwheel exhaust fan is started. If the unit is equipped with heatwheel bypass dampers, these are closed.

Heating mode: Upon a call for heat, the heating function is activated, the supply fan is activated and the economizer moves to its minimum position. The heatwheel is activated and the heatwheel exhaust fan is started. If the unit is equipped with heatwheel bypass dampers, these are closed.

Notice that in all four (4) basic above modes, the operation of the heatwheel is determined by the position of the economizer. With the exception of unit shutdown or a night setback mode, the heatwheel exhaust fan is in operation.
When control systems are "by others", all of the above modes of operation must be considered.

Ventilation of Occupied Spaces In Industrial Applications

General ventilation of occupied spaces in Industrial facilities is an excellent application for energy recovery. It can have many significant benefits including: odor control, a better working environment for employees, higher productivity, reduced risk from exposure to volatile compounds and particulates in the indoor air, improved humidity control (for process and people) and reduced energy costs to condition the ventilation air. General ventilation with energy recovery is not a substitute for fume hood exhaust. The success of the industrial application depends on proper design and an understanding of the performance characteristics of the enthalpy wheel.

Energy recovery wheels or enthalpy wheels have some inherent exhaust air transfer due to the volume of air carried by wheel rotation from one airstream to the other. In addition, while wheels are highly resistant to fouling due to the counter flowing airflow arrangement, they can be plugged by large amounts of semi-volatile compounds or aerosols, which are allowed to impinge and/or condense on the wheel surfaces. These characteristics affect the installation and application as follows:

1. Use energy recovery for general dilution ventilation of the occupied space, not for recovering energy from dedicated, highly concentrated or toxic exhaust.
Exhaust air transfer in the energy recovery system results in a small amount of the exhaust air, typically less than 5% for wheels operating in balanced flow, returning to the space. This amount of exhaust air transfer is appropriate to handling general exhaust in an environment where continuous exhaust and supply of outdoor air to the space achieves the required dilution of contaminants. In space conditioning applications, where the ventilation system is operating to maintain acceptable indoor air quality, there should not be contaminants in concentrations of concern. It is not appropriate for recovering energy from highly concentrated machine exhaust, such as hoods installed on the print heads themselves. Even a small amount of exhaust air transfer in this case can increase contaminants and odors in the space. This air is best exhausted directly outdoors and treated as may be required by local code. If energy recovery is desired in these environments, a “run around loop” approach is suggested.

2. **Take "return" air (air to be exhausted after recovering energy from it) from the occupied zone, not from areas containing a high concentration of dusts or aerosols such as the hood.**
If necessary, provide supplemental filtration of the return air at the inlets to the duct system. The goal of the dilution ventilation is to preserve a healthful and comfortable environment in the breathing zone. Supply and return diffusers and grilles should be located to achieve this end. Ceiling returns located directly above machinery can provide additional benefits by directing contaminants away from operators. In the industrial application this air may contain high levels of aerosols, which, once deposited and dried, would be difficult or impossible to clean from ductwork, fans, dampers and wheels. Therefore a filter of appropriate efficiency is recommended to be installed at the inlet or "return grille".

Experience in industrial applications from small facilities to large factories has shown that when these two recommendations are observed, successful application of energy recovery and its attendant benefits is the result. On the other hand, ignoring these common sense rules can result in reduced satisfaction and/or equipment damage and a maintenance challenge.

Cross Leakage in Energy Recovery Ventilation Systems
The issue of cross leakage in rotary wheel based Energy Recovery used in space conditioning applications is often misunderstood. As a result, many systems are installed with purge sectors and the additional fan capacity required to allow these sectors to function when in fact they are unnecessary. Understanding the rationale for the purge sector, its history, its added first cost, and the associated continuing cost of operation, the designer will rarely specify purge.

A purge sector minimizes the carry over cross leakage from exhaust into the supply airstream by shunting a portion of the supply air back into the exhaust airstream across the seal separating the exhaust and supply. This is required for industrial process applications where the exhaust contains contaminants which would be detrimental to the process. (Historically, heat wheels have been used primarily for dehumidification and process heat recovery.) The volume of air required for effective purge is listed at 10% to 20% of rated flow by manufacturers of industrial process wheels. In addition to the cost of providing the sector, the system must move 10 to 20% more air than is required by the application in order to purge.

By contrast, in space conditioning applications, where the ventilation system is operating to maintain acceptable indoor air quality, there should be no contaminants in concentrations of concern. Cross leakage in the energy recovery system results in a small amount of the exhaust air, typically less than 5% for wheels operating in balanced flow, returning to the space from which it came. This is not "contamination" as it is often labeled. It is air that effectively never left the space. The operating cost of moving this air is far less than that required to operate purge sector.

This amount of cross leakage is appropriate to handling bathroom exhaust in an environment where continuous exhaust of the restroom achieves an air quality on a par with the adjacent space. It is not appropriate for recovering energy from toxic environments, laboratory fume hoods, operating rooms, etc. These are not recommended applications for rotary based technology without a purge sector.

In fact, many of these environments should not tolerate any cross leakage and as such should not utilize rotary technology as even well designed purge sectors do not achieve zero cross leak.
If energy recovery is required in these environments, a "run around loop" approach is suggested.

The adjustable mechanical purge is capable of reducing cross leakage to a fraction of one percent. Nevertheless, purge should only be specified based on an engineering evaluation of the cost to provide, the cost to operate and the specific needs of the application.

Moisture Transfer and Fungal Growth in Desiccant Based Enthalpy Wheels
There is evidence that fungi germinate when water condenses onto surfaces of air handling systems where nutrients are present. Surfaces which remain wet for a period of 12 to 24 hours allow fungi and mold spores already present to "bloom", resulting in a potential IAQ problem.

This knowledge has led to questions of whether desiccant energy recovery ventilation wheels, which in fact transfer water from one airstream to another, could provide a medium for growth of mold and fungi. Such is not the case for AAONAIRE® technology, nor has it been reported in the literature for other enthalpy wheels.

In silica gel based desiccant wheels, the water molecules are transferred by sorption, individually, onto and off of the silica gel surface. Water is present on the wheel in a molecular layer only. Condensation does not occur. AAONAIRE® desiccant wheels experience "dry" moisture transfer in that there is no

bulk liquid water present which could support fungal growth or dissolve other chemical species. The transfer of water onto and off of the wheel's desiccant surfaces occurs in the vapor or gas phase. There are no "wet" surfaces and liquid water does not enter the air stream.

The sensible (non-desiccant coated) wheel can also transfer water through the different mechanism of condensation and re-evaporation, however; again, there is no accumulation of water, unless the frosting threshold is violated through misapplication of the component. In this case, the water is in the form of frost or ice which does not support fungal growth. Sensible (uncoated) wheels from all manufacturers are identical in this regard.

Both moisture and nutrients are required to support fungal growth. Therefore dirt accumulation on heat wheels is of potential concern. It is also true that any heat wheel can accumulate semi-volatile compounds like tars and grease which are deposited on surfaces. These surfaces can then become odor and contaminant sources, in the same way that a filter or any other element of an air handling system can become a source of compounds accumulated over time.

The heatwheel was designed to respond to these issues over the life of the system by providing for cleaning and maintenance with washable desiccant surfaces, removable segments and easy to access cassettes. Many aspects of this technology are patented and are unique in the industry.

Silica Gel Desiccant

Silica gel is an inert, highly porous solid adsorbent material that structurally resembles a rigid sponge. It has a very large internal surface composed of myriad microscopic cavities and a vast system of capillary channels that provide pathways connecting the internal microscopic cavities to the outside surface of the "sponge".

The characteristic curve for adsorption of water on silica gel is shown in Figure 1 (page 13), as % weight adsorbed versus relative humidity of the air stream in contact with the silica gel. The amount of water adsorbed rises almost linearly with increasing relative humidity until RH reaches about 60%. It then plateaus out at about 40% adsorbed as relative humidity approaches 100%. (The curve for molecular sieves, by contrast, rises rapidly to plateau at about 20% adsorbed at 20% relative humidity. This helps to explain why the molecular sieve is an excellent choice for regenerated applications such as desiccant cooling and dehumidification systems which are designed to reduce processed airstreams to very low relative humidity. On the other hand, silica gel has superior characteristics for the recovery of space conditioning energy from exhaust air.)

The use of silica gel on rotary regenerators for energy recovery ventilation applications involves a process cycle where the silica gel is alternately exposed to airstreams having nearly equal relative humidity somewhere in the mid range of this curve (typically between 40 and 60%). When the air stream with the higher relative humidity passes over the silica gel coated wheel, moisture is adsorbed from the air stream into the silica gel. Then when the air stream with the lower relative humidity contacts the silica gel, moisture is desorbed (removed) from the silica gel and put into the air stream.

In this ventilation energy recovery application, the silica gel has all of its surface area covered with at least a monomolecular layer of water because it has a greater affinity for water than any other chemical species. With all of the adsorption sites occupied by water, the silica gel will not be able to transfer other chemical species by adsorption and desorption in its normal form. Species that are soluble in water could become dissolved in the adsorbed water and then released when the water is desorbed but this process is limited by kinetics and does not present a very efficient mechanism for contaminant transfer.

An example of this phenomenon is formaldehyde, a gas which is very highly soluble in water.
In the early 1980's when energy recovery ventilators were being used to mitigate excessive formaldehyde levels in mobile homes, concern was expressed by some people that enthalpy type heat exchangers that transferred moisture as well as heat might also transfer excess amounts of formaldehyde gas due to its high solubility in water. Accordingly, tests were conducted by the Lawrence Berkeley Laboratories of the U.S.D.O.E., on two enthalpy type exchangers to determine whether this suspicion was justified. Results were presented in ASHRAE paper No. CH85-03 No. 3 which reported that the rotary type enthalpy heat exchanger transferred formaldehyde with only 3-6% efficiency. They concluded that "formaldehyde transfer between airstreams by processes other than air leakage does not seriously compromise the performance of these enthalpy exchangers".

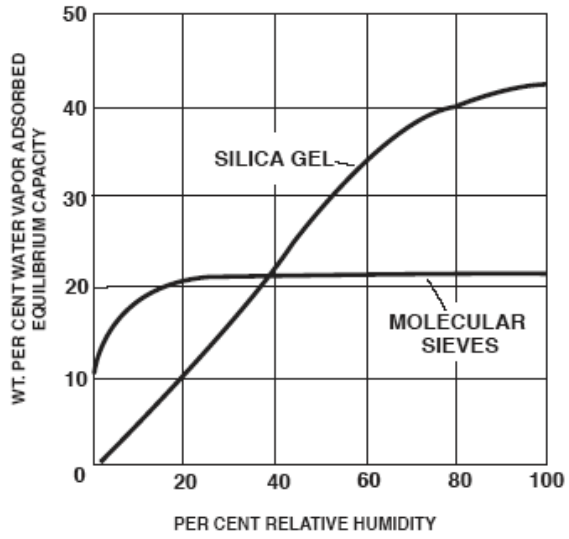


Fig. 1. Effect of relative humidity on desiccant capacity

(After W. R. Grace, Davison Chemical Division, "Silica Gel.")

ARI Performance Certification

The certified ratings program requires testing, rating and independent verification of component performance at standard conditions and rated flow. Testing is in accordance with ASHRAE Standard 84.

ARI certified ratings include very complete information, some of it previously unavailable, to allow designers to fully characterize thermal and airflow performance. In addition to separate sensible, latent, and total effectiveness at two airflows for both summer and winter test conditions, the standard requires information on pressure loss as well as air leakage. Airxchange publishes ARI certified ratings for all energy recovery ventilation components of their manufacture in accordance with the requirements of the ARI program. These ratings may be found on the ARI website www.ari.org. Application ratings are provided for the complete range of airflows and all Airxchange cassettes bear the ARI Certification Seal.

With the ARI industry performance certification program in place, engineers and building owners/operators no longer need accept self certification. It is important to point out that ratings from non-participating manufacturers are difficult to compare regardless of whether they are tested in house or by an “independent” testing agency. This is in part because the latent performance of a given unit can change significantly when tested at different outdoor air conditions and at less than rated airflows. A product can be made to look better by testing it “independently” at an easier condition. Lower relative humidity (lower wet bulb) and less than rated airflow improves the tested performance.

Also, self-certification does not include the necessary periodic verification tests and challenge procedures provided by the industry certification program. Specifications requiring ARI Certification in accordance with the latest revision of ARI Standard 1060 provide the best assurance that components and systems will perform as designed.

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It is the intent of AAON to provide accurate and current specification information. However, in the interest of product improvement, AAON, Inc. reserves the right to change pricing, specifications, and/or design of its products without notice, obligation, or liability.

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