



The Competitive Advantage of Energy Recovery Wheels with Polymer Energy Transfer Matrix and Segmented Design

Introduction

Airxchange, Inc. manufactures a variety of energy recovery wheels with outputs ranging from 100 to 60,000 cubic feet per minute (CFM). Airxchange wheels feature a segmented energy transfer matrix that provides a simple yet effective means of optimizing energy transfer performance.

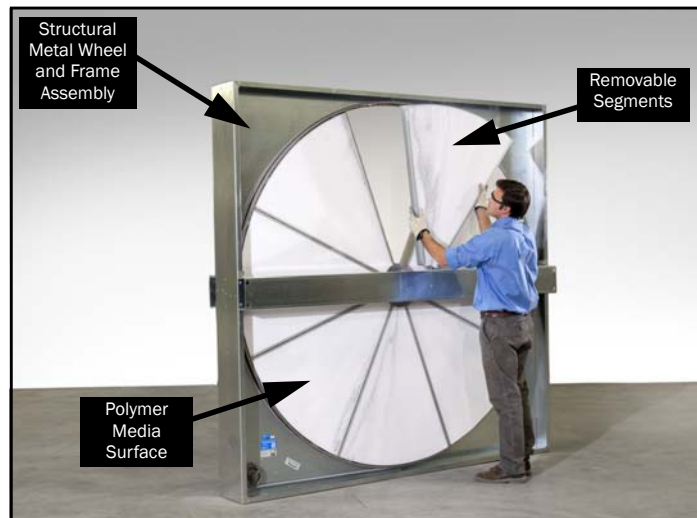


Figure 1 Airxchange structural metal wheel and frame assembly with removable polymer segments.

The energy transfer media of an Airxchange wheel is a durable and innovative polymer material that has proven to last for over 30 years in comfort HVAC applications. The polymer material is formed into a matrix and segmented for easy removal, making Airxchange wheels both light and serviceable. A supporting wheel structure is made of welded stainless steel or aluminum. Unlike monolithic wheels, the supporting wheel structure does not depend on the energy transfer matrix for structural integrity, enabling the wheel to independently withstand the rigors of operation for decades.

Polymer Energy Transfer Media

For over 30 years, the Airxchange polymer matrix has proven to be very durable in comparison to other materials, such as aluminum; the polymer matrix has superior resistance to mechanical impact, corrosion, scratches, and shifts in inertia. The use of polymer media allows the desiccants to be permanently bonded to the matrix without the use of an adhesive. The resultant mechanical bond ensures the desiccant will not rub off from normal wear, washing, or impact.

Aluminum based energy recovery wheels are typically made from rolls of .003-inch thick aluminum that are corrugated, wound, and fastened to a wheel frame to form a monolithic energy transfer wheel. Very large aluminum wheels are bolted together in sections to create an integrated wheel and energy transfer structure. Because the energy transfer material cannot be separated from the wheel structure, sections containing an aluminum wheel should be designed with a drain pan for cleaning in place. The desiccant is secured to the aluminum with epoxy glue, which has a tendency to weaken over time, resulting in a loss of performance.

Airxchange Wheel Construction and Options

Energy Recovery Matrix Segments

The Airxchange wheel matrix is constructed with parallel plates of .006-inch thick polymer film that can be coated with desiccant [based on application], wound, sliced into 4, 6, 8, or 16 pie shaped segments, and then reinforced with aluminum or galvanized steel frames and stiffeners.

Wheel and Cassette Frame

The polymer segments are retained inside an all-welded stainless steel or aluminum wheel with a positive metal locking system for ease of installation and removal. The wheel assembly is mounted into a G-90 galvanized rigid frame and supported by a stainless shaft and permanently lubricated outboard bearings with an L-10 life of 430,000 hours. Due to the rigid construction, Airxchange wheels can be operated in any orientation.

Desiccant Bonding

Airxchange polymer wheels use a proprietary process that chemically bonds the desiccant to the matrix, making it impossible for the desiccant to separate from the polymer. In most aluminum matrix wheels, the desiccant is bonded using an adhesive. Over time, or when rigorously washed, these adhesives can wear out, resulting in the delamination of the desiccant.

Insulation

The frame, or 'cassette', is insulated and offered in single or double-wall G-90 construction.

Motor and Drive Belt

A 6 or 8 pole electric motor is mounted in one corner of the cassette and uses a constant-tension urethane belt and pulley to drive the wheel on its perimeter.

Low Leakage Designs

Airxchange uses patented perimeter seals that limit bypass leakage. A labyrinth brush seal system coupled with patented channel matrix minimizes Exhaust Air Transfer Ratio (EATR) and resultant Outdoor Air Correction Factor (OACF) to 1-3%. An optional purge section can be provided to achieve leakage rates of less than 1%.

Options

Airxchange cassettes can be configured to include mechanical purge, a variety of motor voltage options, double-wall construction, and powder coating.

Desiccants

Airxchange uses Type A Silica Gel for its standard construction. Other desiccants, such as molecular sieves, are available as an option.

For conventional commercial ventilation applications, Type A Silica Gel achieves greater water adsorption and desorption capability per pound throughout the comfort A/C range of conditions than molecular sieves. The absorption characteristics of Type A Silica Gel are a result of its highly porous nature creating a relatively huge surface area. The Type A Silica Gel used by Airxchange has pore sizes averaging 22 angstroms (Å) in diameter, whereas other silica gels have pore sizes up to 100 Å or more. A single gram of Type A Silica Gel exhibits an internal surface area of approximately 800 square meters; a teaspoonful has an internal area equivalent to a football field, including the two end zones.

A Lifetime of Factory Performance

Airxchange first developed its energy recovery wheel cassette in the 1980's, and the technology has been installed in over 250,000 unitary and commercial Air Handling Units (AHU). Airxchange cassettes are designed to operate well in excess of the published limits to flow and pressure drop.

When necessary, Airxchange wheels are designed to make the cleaning process fast and effective. Like coils, all rotary air-to-air energy recovery devices require cleaning over time in order to maintain latent performance. Unlike stationary heat exchangers, rotary energy recovery wheels are self-cleaning from dry dust and dirt as they rotate between two counter flowing air streams. In dry conditions, surface dust can be vacuumed from the wheel.

When air streams are exposed to harsher compounds like oils, aerosols, or smoke, these contaminants will build on the surface of the matrix over time and reduce its effectiveness. In these cases, Airxchange's unique patented design allows for the segments to be easily removed and washed with no risk of losing performance.

Independent ADL/TIAX studies show that the Airxchange energy transfer matrix is durable and that the desiccant coating remains intact when washed or soaked, which restores the latent performance of the wheel. Challenging environments are easily handled by Airxchange's stainless steel structure and polymer matrix designs. Seacoast (salt air) or pools (corrosive acid condensate) can be handled without special coatings on the transfer matrix.

If necessary, Airxchange matrix segments are easily removed from the cabinet and can be soaked outside the unit instead of needing to spray a hose inside the unit, which requires special drain pans and places motor and electrical connections at some risk.

Warranty

Airxchange cassettes have a full 5-year warranty for all but the motor, which has a separate manufacturer's warranty.

AHRI Certification

The only universally accepted means to certify Air-to-Air energy recovery performance is AHRI 1060. Airxchange was a key participant in the development of this standard and has had every wheel family independently tested since implementation without failure.