I4 ENERGY RECOVERY WHEEL

innergy tech

setting the standard
for energy recovery

innergytech.com

HEAT PIPES • PLATES
WHEELS • CORES

5 year warranty
parts & labor

AHRI CERTIFIED®
www.ahridirectory.org
Air-to-Air ERV
AHRI Standard 1060
Energy Recovery COMPONENT is certified. Actual performance in packaged equipment may vary.

* 8068_IT_Manual I4_V2_octobre 2019 Révision 01

TABLE OF CONTENTS

ABOUT THIS MANUAL

This manual should be used as your main reference through the installation, operation and maintenance of your new I4 energy recovery wheel unit.

By following the instructions listed in this document, years of economical and satisfactory operation will be obtained. Please read this manual thoroughly. Several models are described in this publication. Some details of your model may be slightly different than the ones shown as the illustrations are typical ones. For your convenience, a maintenance schedule is included at the end of the manual. Maintenance work should be completed as indicated by skilled personnel.

Please take note that this manual uses the following symbols to emphasize particular information:

WARNING: Identifies an instruction which, if not followed, might cause serious personal injuries including possibility of death.

CAUTION: Denotes an instruction which, if not followed, may severely damage the unit and/or its components.

NOTE: Indicates supplementary information needed to fully complete an instruction.

If more information is needed, please contact your local Innergy tech Sales Representative or the Innergy tech Service Department.

For more information:

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NOTE: This manual covers standard equipment included on Innergy tech energy recovery wheels (ERW). If optional equipment is included with your ERW, it may be discussed in a separate manual.

NOTE: Due to ongoing research and development, Innergy tech reserves the right to modify specifications and dimensions without prior notice.

WINNERGY PRO SELECTION SOFTWARE

The FREE Winnergy Pro selection software is a powerful tool developed by the Innergy tech sales and R&D teams. Based on your entering conditions (airflow, temperatures and humidity), this easy to use software gives you quick and complete results with just the click of a button. The program also lets you switch between our complete selection of AHRI certified products including plate exchangers, heat pipe exchangers and energy recovery wheels.

For the energy recovery wheel products, the WinnergyPro selection software enables you to get instant performance and pressure drop results. In addition, EATR and OACF values are given based on the wheel's pressure differential and desired purge angle. This neat feature makes it possible to change the purge angle until the desired OACF and EATR values are reached. Lastly, the Frost tab may be used to calculate real performances during frost control mode when using a VFD.

The Winnergy Pro selection software can be downloaded from our Website for free at the following address: www.Innergytech.com. Support can be easily found by contacting the Innergy tech sales team (sales@innergytech.com or 1-800-203-9015).

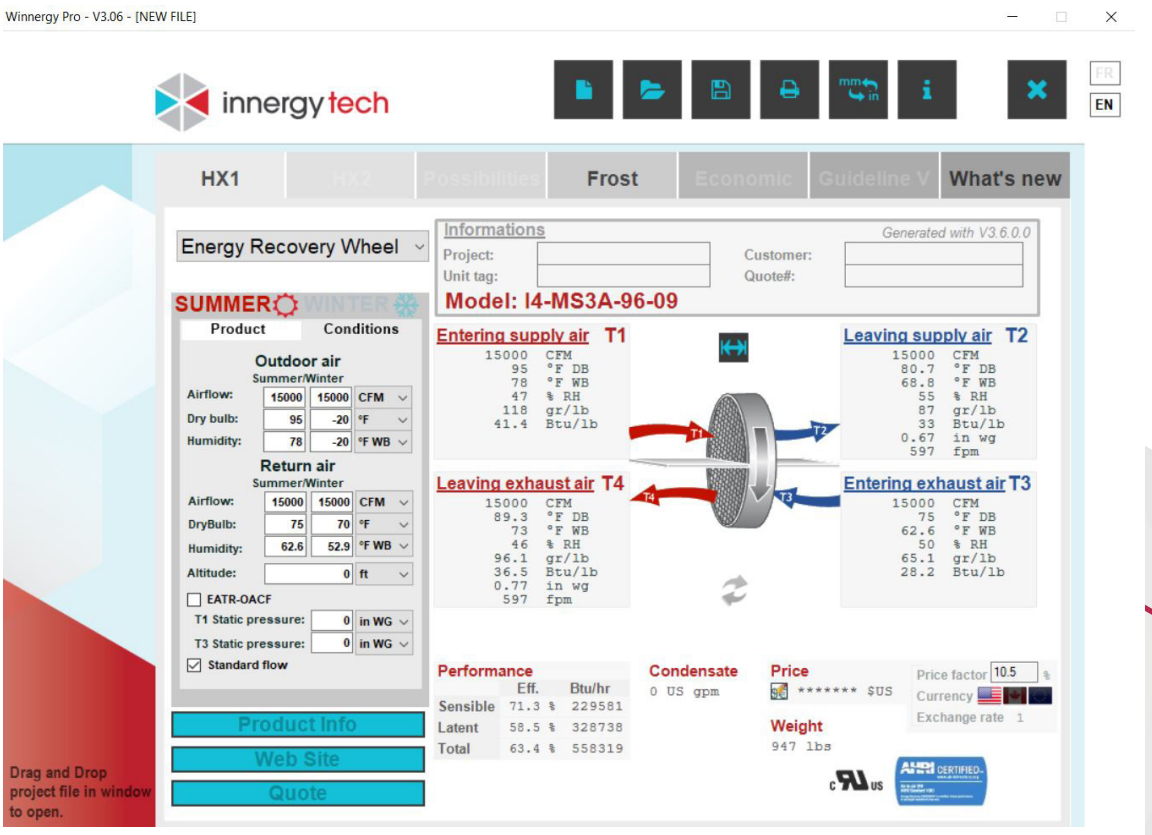


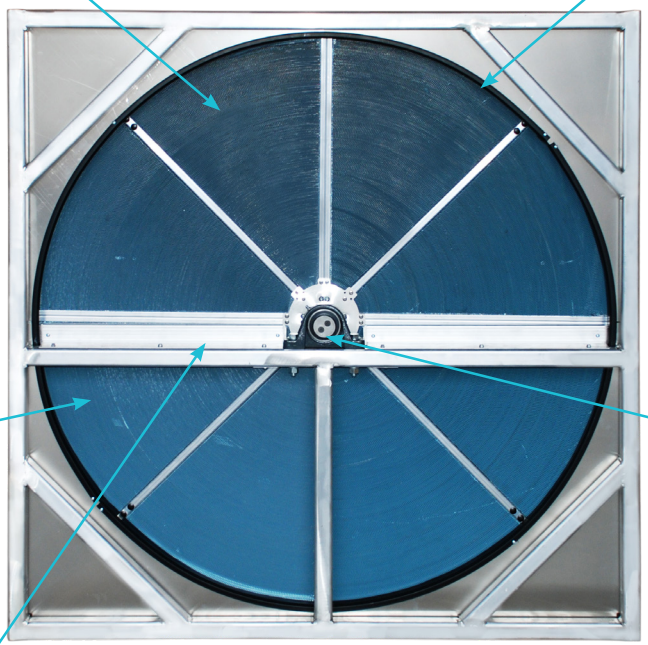
Figure 1.1
Winnergy Pro Selection Software

THE IMPROVED I4 WHEEL DESIGN

MS3A (ENTHALPY)
Or epoxy coating (sensible)

COMPACT FRAME
"Up to 6" off the square dimension"

NEW S-PERIMETER SEAL
"Improved seal performance up to 50%"



Fully installed **TEMPERTURE SENSORS***

NEW WHEEL MOTOR
"Thoroughly tested and designed for easy maintenance"

3 MATRIX OPTION
"LP, Std & HP matrix"

STAINLESS STEEL SHAFT
"Greater corrosion resistance"

PATENTED AIRLOOP™ SEAL
"25% less leakage than classic 4 pass labyrinth seal"

SOLID CONSTRUCTION
100% Redesigned frame for increased rigidity

100% ALUMINUM CASING
"Up to 34% total weight loss"

Figure 1.2
I4 energy recovery wheel highlights

* Provided with the purchase of Innergy tech VFD

THE I4R FIELD INSTALLED ENERGY RECOVERY WHEEL

SPLIT FRAME DESIGN

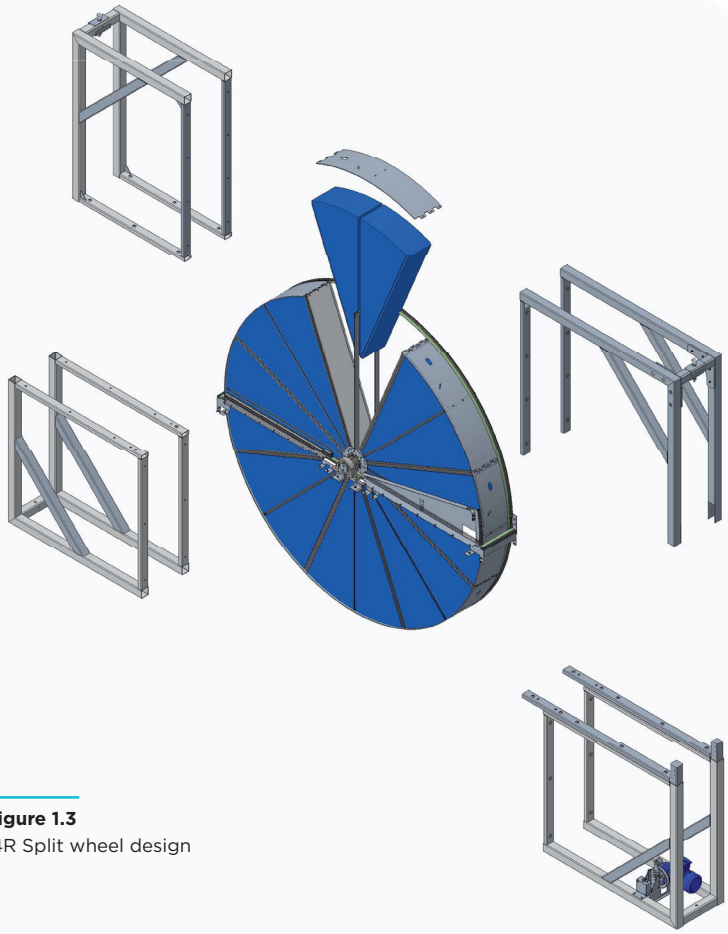


Figure 1.3
I4R Split wheel design

PERFECT FOR MECHANICAL ROOMS AND RETROFIT APPLICATIONS

While fully assembled energy recovery wheels are the logical choice for new roof-top HVAC units, they can face size problems for mechanical room or retrofit installations. For projects where a fully assembled wheel is just too large to reach the installation area, Innergy tech's field installed modular wheel option is the solution.

OTHER FIELD SERVICES

- Control system installation (VFD & sensors)
- Product start-up

FEATURES AND BENEFITS

- 5 year full parts and labor warranty
- Same quality and performance than factory assembled units
- Highly trained and experienced technicians
- Wheel frame separated in 2 or 4 sections to fit in tight spaces
- All parts fit easily through standard doors, elevators and stairways.

PRODUCT OVERVIEW

Features

- Wheel size available from 48"to 120" diameter
- Standard 5 year full parts and labor warranty. Optional 10 year warranty also available
- Wheel segmented rotor (4 or 8 section)
- Optional control package offered with VFD and temperature sensors for frost control and free-cooling mode
- Best seal on the market, including patented Airloop™ labyrinth seal
- 3 options of matrix size for different levels of performances
- Compatible for high pressure differential applications (up to 12" WC)

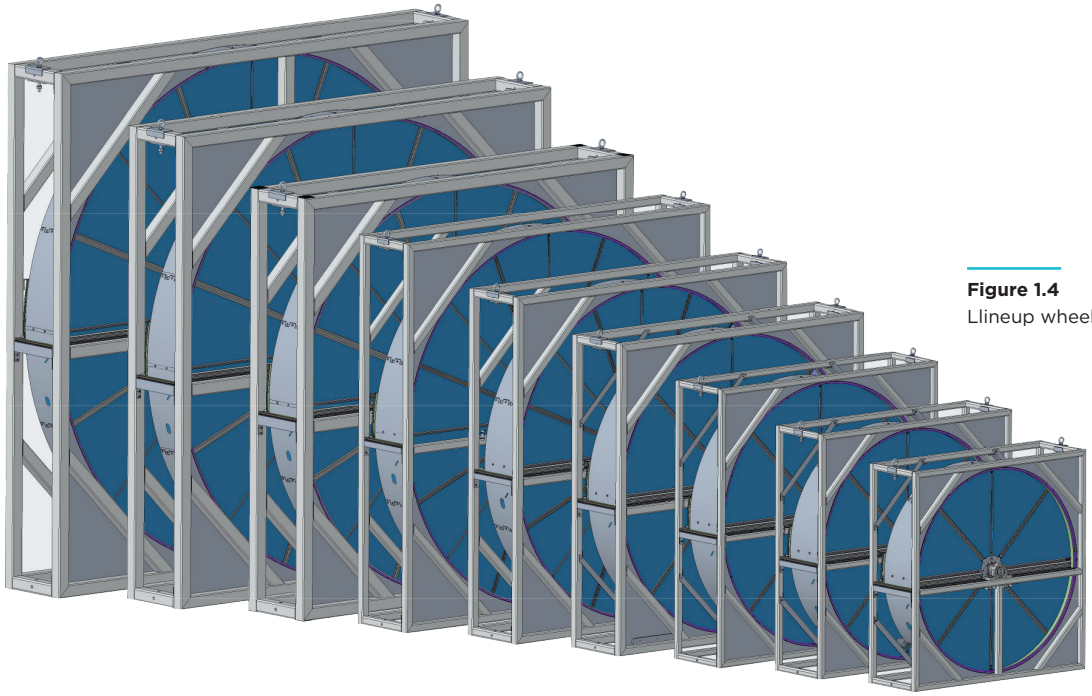


Figure 1.4
Llineup wheel

Bear the AHRI 1060 certified seal for performances, pressure drops, cross-leakage and seal effectiveness.

UL Recognized component and bears the UR label. In accordance with UL1995 standard, all electrical components and wires are UL Recognized.

The I4 wheel media passed the UL 723 test for fire and smoke development at the UL laboratory.

PRINCIPLE OF OPERATION

1.1 Energy recovery

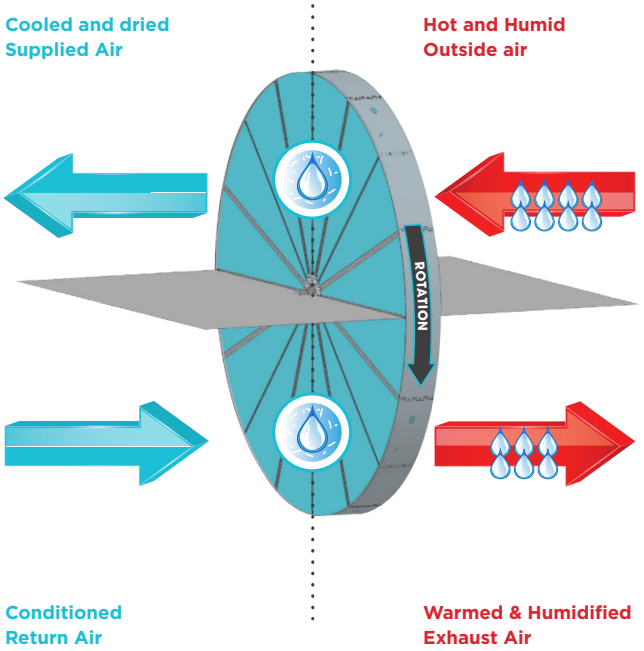


Figure 1.6
Cooling mode (summer)

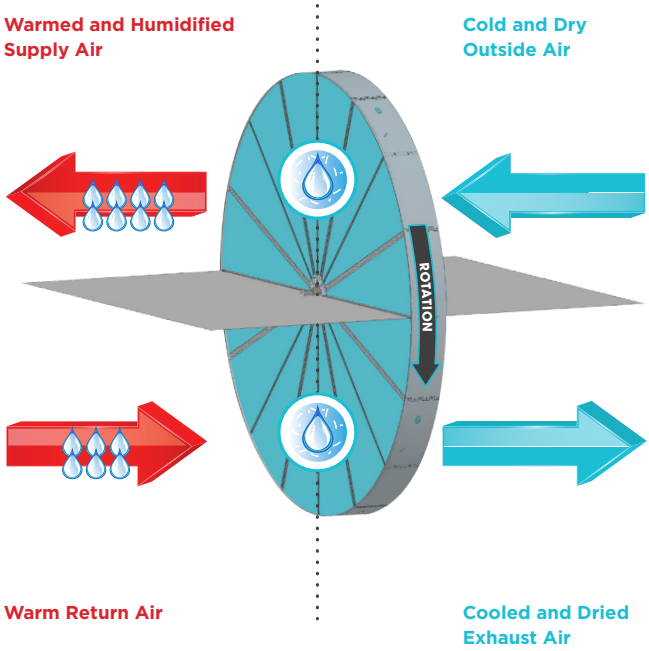


Figure 1.7
Heating mode (winter)

Energy recovery wheels, also known as enthalpy wheels or thermal wheels, are used to pre-conditions fresh outside air supplied to the building. The spinning rotor (20RPM standard) is separated between two (2) counterflows[1] airstreams. In cooling mode (figure 1.6), the wheel will greatly reduce the sensible (heat) and latent (moisture) energies leading to significant cooling and dehumidification cost reductions.

In heating mode (figure 1.7), the enthalpy wheel[2] will recover both the heat and moisture from the return air stream and transfer it to the cold outdoor air for great heating and humidification savings. This type of product offers the highest effectiveness in the most compact dimensions available on the market. The combination of different design elements determines the product performances (see section 1.2).

[1] Parallel flows are also possible, but reduces the effectiveness

[2] Sensible wheels are also available (sensible heat recovery only)

1.2 Key wheel effectiveness factors

Wheel size
The selected wheel size has a direct impact on the unit effectiveness. The airflow travels faster through a smaller wheel and generates higher pressure drops. Larger wheels offer higher performances but require larger air handling units and are more expensive. Note that energy recovery wheels are generally selected for 500 to 900FPM air velocity and 0.5" to 1.2"WC pressure drops.

Choice of desiccant & sensible only option
The most common desiccants are silica gel, polymer and molecular sieves (3 angstroms & 4 angstroms). Of all desiccants, molecular sieves are known to have the most stable affinity to water vapor no matter the relative humidity (%RH). Because of its pore opening nearly the size of water molecules (2.8 angstroms), the 3 angstroms molecular sieve (MS3A) is widely accepted as being the best choice for energy recovery wheels.

Innergy tech also offers an epoxy coated aluminum media for its sensible only I4 wheels. While having no desiccant and therefore not being able to transfer latent energy (moisture), these wheels can be of great use for reheat strategy on dual wheel units (see section 3.9) or any other application where latent recovery is not desired. *

*While our sensible wheels do not have desiccant, it should be noted that conditions that create condensation on the wheel media will result in latent energy transfer.

Seals
Often overlooked, seals play an immense role in reducing cross contamination between the supply and exhaust airflows. Air leakage is evaluated with OACF and EATR (section 3.5 & 3.6). These leakage indicators are the only results tested and certified under AHRI 1060. The most common seals are the 4-pass and brush seals. Innergy has developed the Airloop™ labyrinth seal for its superior sealing performances.

Shape and size of aluminum matrix
The wheel matrix design optimizes the active surface available for energy recovery. There are many methods for adding more surface area to the heat exchange. One may increase the width of the rotor or add more layers of corrugated liner (smaller matrix). This usually amounts to a tradeoff between air restriction (pressure drops) and product effectiveness. Innergy tech offers 3 different matrix sizes.

Wheel speed
The wheel speed is determined to optimize operation costs and performances. The standard speed in the HVAC industry is 20 RPM. Reducing the wheel speed directly decrease the product effectiveness. This control parameter allows for free-cooling and frost control with a variable frequency drive (VFD) (see section 3.10).

Material (Corrosion & fire resistance)
Common materials used to manufacture the wheel matrix are polymer, fiber-based membrane or aluminum sheets. Because the rotor is typically corrugated in thin layers of material, the choice of material has often little consequence on the product's effectiveness. However, it has a strong effect on the fire resistance, corrosion resistance and the durability of the product.

I4 CONSTRUCTION/PARTS

2.1 Construction details

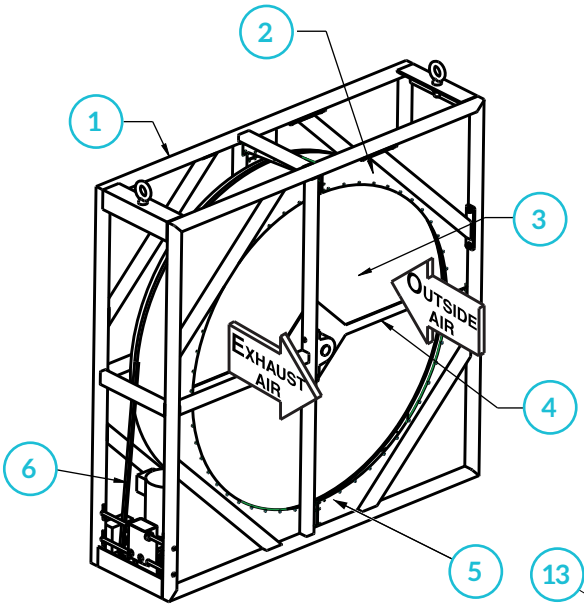


Figure 1.8
Outside air side

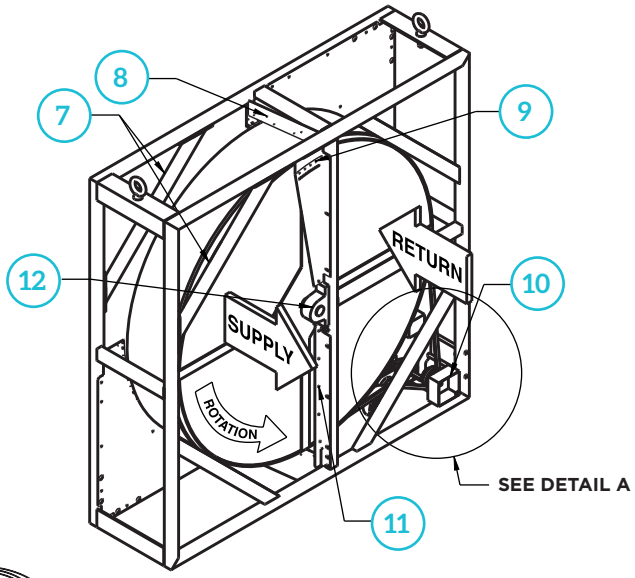


Figure 1.9
Return air side

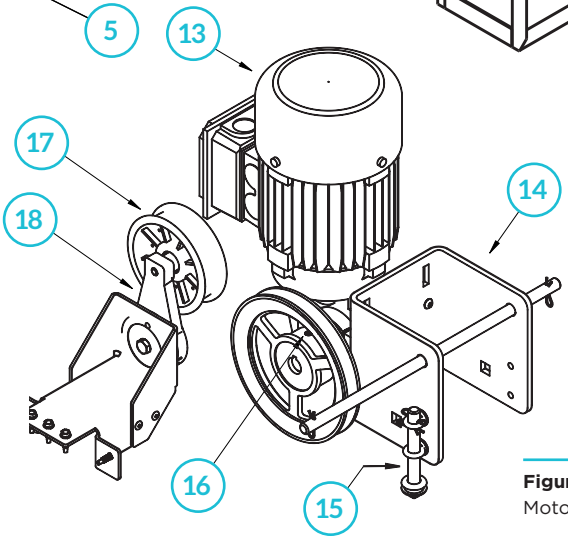


Figure 1.10
Motor Base

DETAIL A

No.	Description
1	Frame
2	Face Plate
3	Media
4	Spoke
5	Peripheral Seal
6	Driving Belt
7	Removable Corner Bracing
8	Side Seal
9	Purge

No.	Description
10	Electrical Box
11	Airloop™Labyrinth Seal
12	Pillow Block Bearing
13	Motor
14	Motor Base Holder
15	Locking pin
16	Gear Box
17	Idler Sheave
18	Tensioner

2.2 The wheel media

The I4 wheel media is built up of equal width, alternate layers of corrugated and flat aluminum sheet material. This creates a flat and smooth surface to ensure laminar airflow and thus prevents any dust or particles accumulation inside the rotor. The corrugated pattern also creates triangular shaped cells that isolates the supply air from the exhaust air, thus preventing cross leakage.

2.2.1 MS3A DESICCANT (ENTHALPY WHEEL)

Innergy tech uses molecular sieve 3 angstroms (MS3A) desiccant known to be more selective for water vapor. Its porous medium will not absorb any molecules larger than 3 angstroms, whereas the size of a water molecule is of 2.8 angstroms. With its great affinity to water vapor, the desiccant will chemically and mechanically adsorb only water molecules to its surface. By preventing water condensation, MS3A desiccant stands as an effective corrosion resistance coating.

2.2.2 ACTIVE MATRIX TECHNOLOGY

The development of our Active Matrix Technology involved careful calculations, CFD analysis and multiple laboratory tests. As a result, three (3) optimized designs are now offered for more versatility as well as the best effectiveness VS pressure drop ratios ever offered by Innergy tech.

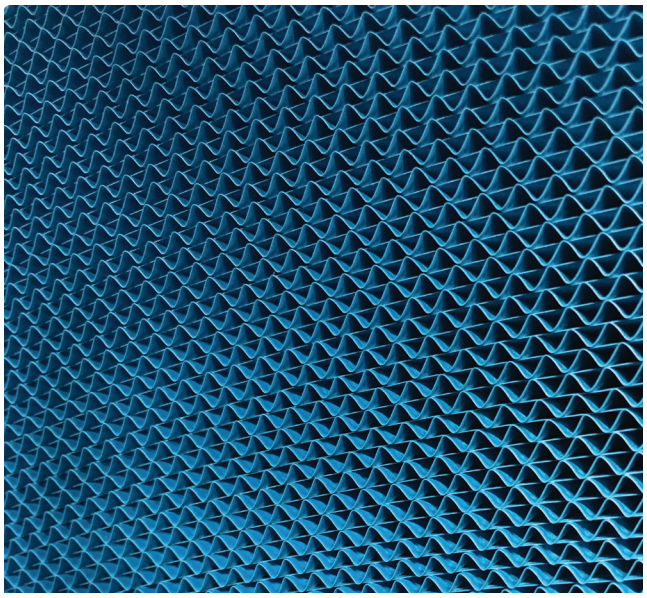


Figure 2.1
Wheel Matrix

Figure 2.2
Active matrix technology

1. LOW PRESSURE DROP MATRIX:

Our low pressure drop matrix was developped to meet ASHRAE 90.1 minimum energy requirements with the lowest pressure drops possible.

Perfect for the sensible wheel of a dual wheel unit or when space is limited and pressure drops must be minimized.

2. OPTIMIZED STANDARD MATRIX:

The best of both worlds. The optimized standard matrix offers the great effectiveness levels of our previous wheel models with a significantly reduced pressure drop.

3. HIGH PERFORMANCE MATRIX:

For the most demanding projects, our high performance matrix can offer effectiveness levels above 80%.

2.2.3 EPOXY COATING FACE OPTION

For higher corrosion resistance, Innergy tech offers a 2-part epoxy coating on both faces of our wheels. The coating protects the outer edges of the aluminum sheets that are not coated with MS3A desiccant. This option is recommended for coastal and marine environments.

Figure 2.2.3
Two-part epoxy paint

2.2.4 Media cleaning

Due to their inner laminar flow and self-cleaning feature, the I4 wheels are resistant to dust build-ups. As no particle will accumulate inside the media, only the edges need to be cleaned.

If the wheel application is such that cleaning is needed, a vacuum cleaner with soft brush tip and compressed air with a flat nozzle blowgun (70 psi) is recommended to clean both sides of the media.

As a last step, a microfiber humid cloth can be used to wipe the surface of the wheel.

It is not recommended to use any type of solvent or detergent on the energy recovery wheel.

Figure 2.2.4
Wheel media cleaning – Flat Nozzle blowgun

Figure 2.2.5
Wheel media cleaning – humid cloth

CAUTION: While cleaning the wheel media, take care not to apply too much pressure to avoid damaging the wheel surface. It is not recommended to use any type of solvent or detergent on the energy recovery wheel.

2.3 The I4 seal technology

The I4 energy recovery wheels are equipped with the best seals on the market. The patented AirLoop™ labyrinth seals face the media along the center line of the rotor. On the side of the wheel and under the middle pillow blocks, low friction seals are factory install and adjusted. Lastly, the S-type labyrinth peripheral seals are located on the outer edge of rotor and fixed on the face plate of the wheel. The overview drawing below shows the seal locations.

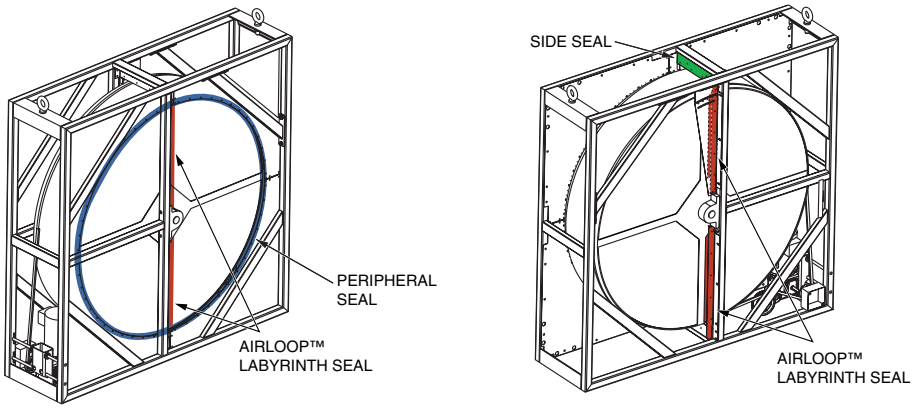


Figure 2.6
I4 seal locations

2.3.1 AIRLOOP™ SEAL

True labyrinth effect
The labyrinth effect is the result of the air expansion within the seal's cavity. When the air expands within the seal, all its kinetic energy is transformed into thermal energy.

The AirLoop™ Labyrinth Seal harnesses this effect by allowing the air to expand by using the whole depth of the seal. Consequently, the air velocity is greatly reduced through the seal which leads to real edge restrictions.

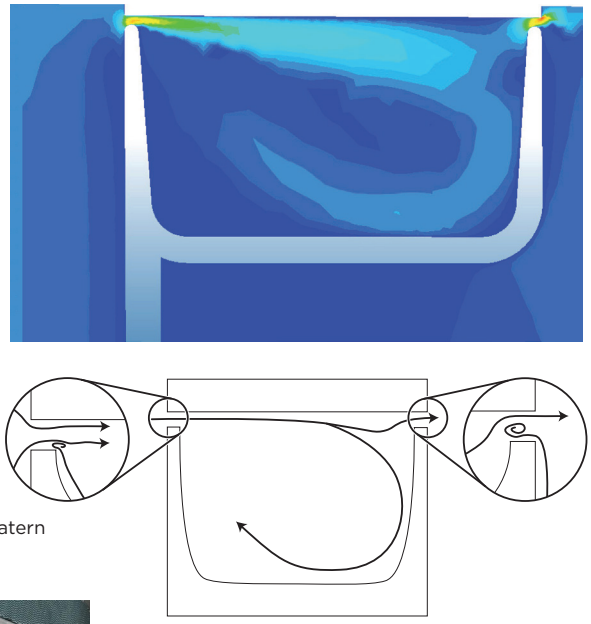


Figure 2.7
Airloop™ flow patern

Figure 2.8
Airloop™ seal installed on I4 wheel

Seal adjustment

The correct adjustment of the AirLoop™ labyrinth seal is obtained by allowing the seal to lightly touch the media before tightening the screws.

If an initial gap can be seen between the seal and media, the seal is installed too far and should be moved closer until it touches the media.

If deformation to the lips can be seen, the seal is installed too close and should be moved back until the lips are straight again.

The AirLoop™ labyrinth seal is made of a special material which was specifically chosen to ensure to never damage the media. While the best seal is obtained when the above steps are followed, if installed too close, the media will simply wear down the seal a little more. As the wheel turns, the seal will automatically adjust itself to the wheel's tolerance (approximately 1/32") for the smallest possible air leakage and become a non-contact seal that will last throughout the wheel life.

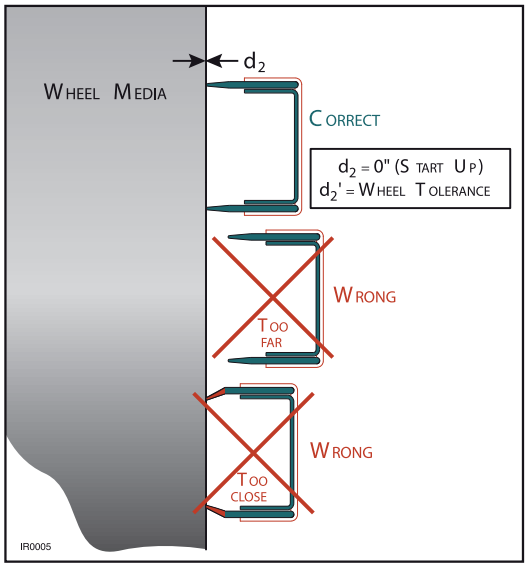


Figure 2.9
Airloop™ seal adjustement

The AirLoop™ labyrinth seals must be checked and adjusted if needed prior to start-up. The seals should be checked for any loose parts or screws after one month of operation. Further verifications should be done through a general overview every year.

2.3.2 PERIPHERAL S-TYPE SEAL

The S-type labyrinth peripheral seal is a non-contact seal fixed to the face plate of the unit. The seal overlaps inside the rotor casing for increase airtightness. It is factory installed and adjusted. No seal adjustment is required in the field.

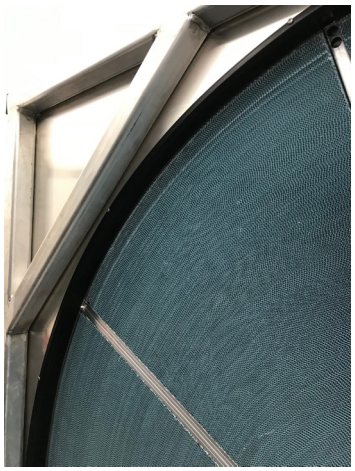


Figure 2.10
Peripheral seal face view

Figure 2.9
Peripheral seal inside view

2.3.3 LOW FRICTION SIDE & CENTER

The low friction side and center seal are contact seals fixed to the wheel frame. The middle seals are located behind the pillow block bearings. The side seals are installed on the side of the rotor, along the depth dimension. They are factory installed and adjusted. No seal adjustment is required in the field.

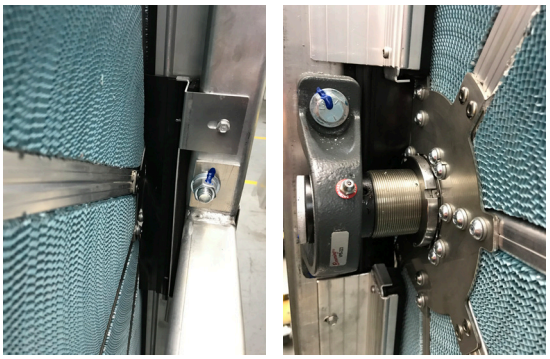


Figure 2.12
Center seal typical installation

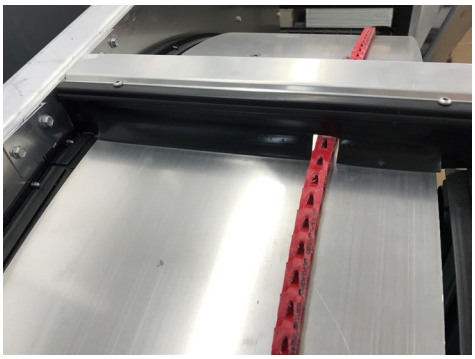


Figure 2.13
Side seal typical installation

2.4 Purge

2.4.1 THE PURGE EXPLAINED

Unless specifically requested, all I4 energy recovery wheels come with an integral purge section with adjustable angle from 0° to 11°. As shown on the purge diagram below, the goal of the purge section is to reduce or eliminate the carryover portion of the wheel's exhaust air transfer. This air carryover is the return air trapped within the media as it rotates back to the supply side. For proper purge operation, the static pressure on the leaving supply side (SP2) should always be higher than the static pressure of the entering return side (SP3).

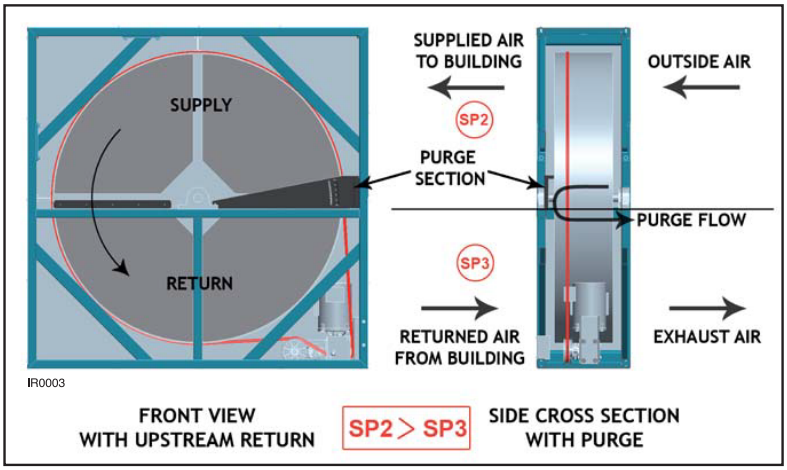


Figure 2.14
Purge section

The purge section, while reducing the wheel's exhaust transfer level, will also increase the required outdoor airflow rate and therefore will impact the fan operating costs. For this reason, the purge angle should not be increased unless required.

2.4.2 ADJUSTING THE PURGE

Adjusting the purge angle can be done by following the simple steps shown on our purge adjustment sticker.

The correct purge angle for your application can be found by entering your design conditions in our Winnergy Pro selection software and increasing the purge angle until one of the three following criteria is met:

1. The EATR value reaches the maximum acceptable value per ASHRAE 62.1.
2. The EATR value becomes 0% (no exhaust transfer).
3. Your upper acceptable OACF limit is reached.

More info on how to get your copy of our Winnergy Pro selection software can be found on page 5 of this manual. If you need assistance finding the correct purge angle for your project, don't hesitate to contact the Innergy tech sales team (1-800-203-9015 or sales@innergytech.com).

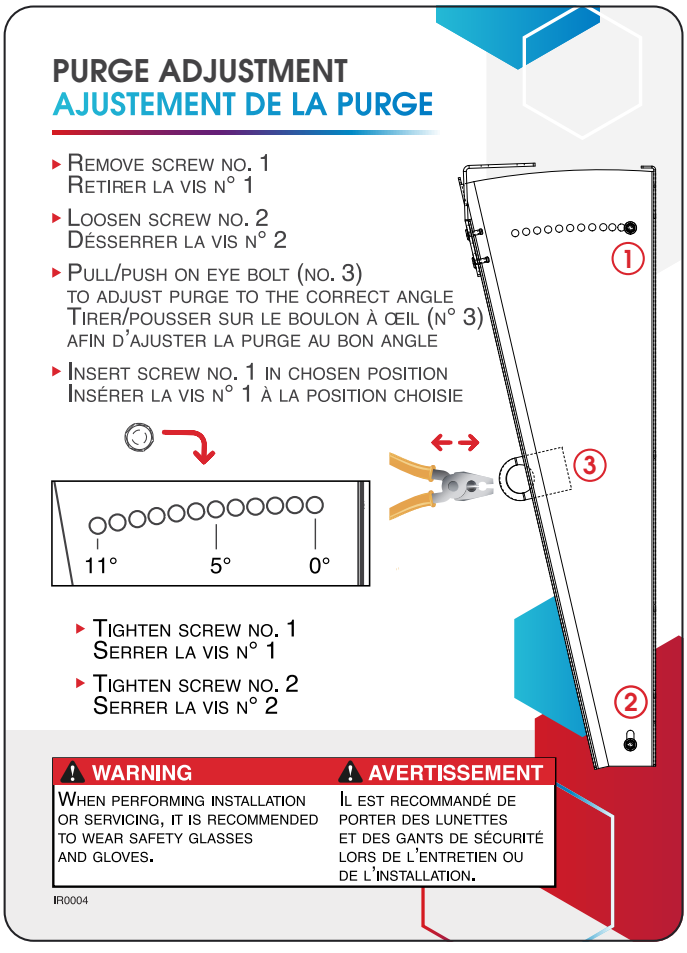


Figure 2.15
Purge adjustment

2.5 Driving system

2.5.1 MOTOR

The standard motors provided with the energy recovery wheels are 3 phases, inverter duty type. They are rated for 208 V, 230 V, 460 V or 600 V at 60 Hz, and they operate at 1725 RPM. All our motors are fully compatible with variable frequency drives (VFD) and can be operated at frequencies lower than 1 Hz.

2.5.2 SPECIAL CONSIDERATION FOR 1 PHASE MOTORS

Because 1 phase, 115 V, 208V or 230 V motors cannot be controlled with a VFD, Innergy tech does not recommend their use. If variable speed control is desired with 1 phase current input, please contact sales@innergytech.com for technical support.

WARNING: All electrical devices should be grounded.

					ERW DIAMETER								
HP	**Voltage**	**Phase**	**HZ**	**Full Load Amps (FLA)**	**48**	**54**	**62**	**70**	**78**	**88**	**96**	**108**	**120**
1/2	208-230	3	60	1,62	•	•	•	•	•	•			
1/2	460	3	60	0,81	•	•	•	•	•	•			
1/2	600	3	60	0,65	•	•	•	•	•	•			
3/4	208-230	3	60	2,3							•	•	•
3/4	460	3	60	1,15							•	•	•
3/4	600	3	60	0,92							•	•	•

For 1 phase motor application, please contact sales@innergytech.com

2.5.3 WIRING

The electrical connectors are located in the electric box near the motor in the bottom corner of the wheel frame. The wires are easily accessed by unscrewing the front plate of the box. The supply connections are wired to the motor as shown on the wiring diagram bellow.

Figure 2.16
Electric box

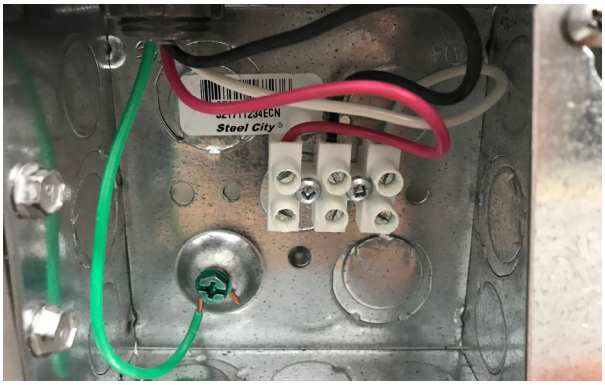


Figure 2.17
Motor wiring

WARNING: The power supply must be disconnected while completing the field wiring.

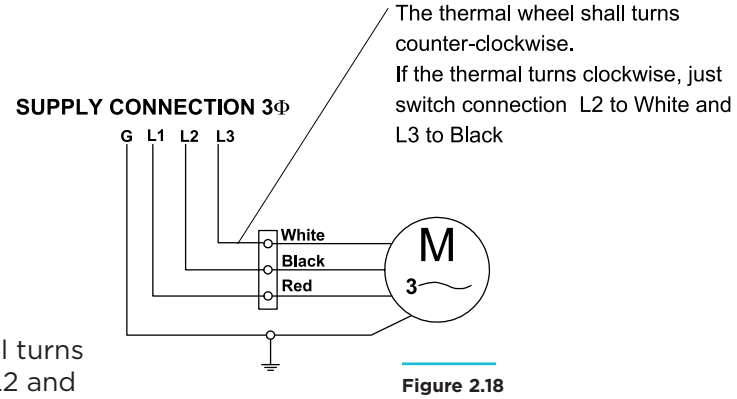
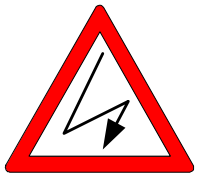


Figure 2.18
Wiring diagram thermal wheel

During the product start-up, if the wheel turns in the wrong direction, the connection L2 and L3 must be switched. The correct direction of rotation is indicated on the frame of the unit with 3 or 4 yellow arrows. Note that all motors are factory tested before shipping.



WARNING
ELECTRICAL
SHOCK HAZARD
Disconnect power before servicing / maintenance or field wiring. Replace all panels before operating Failure to do so can result in death or electrical shock.

NOTES

1. : For motor branch circuit, short-circuit and ground fault protection use UL Class CC fast-acting limiting type fuses. Select UL/CSA listed fuses with low I^2T values, rated at 200,00 AIC.

2. All wiring material must be UL recognized and CSA CSA certified (or UL recognized for Canada).

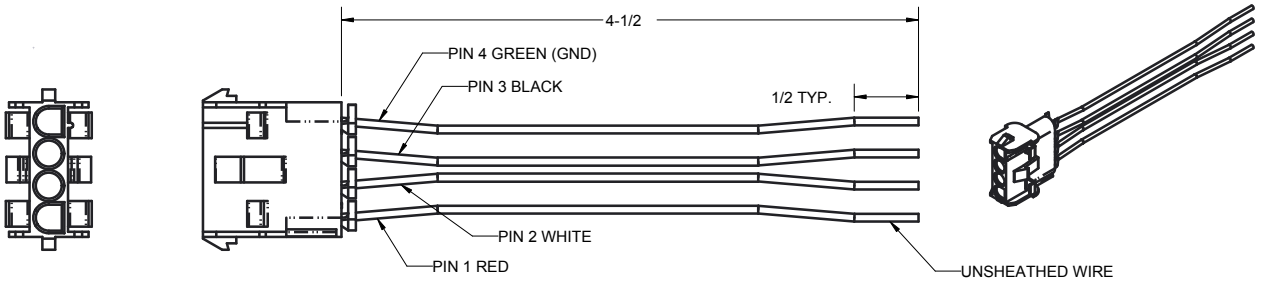


Figure 2.19
Connector wiring

2.5.4 MOTOR CONNECTOR OPTION

For quicker assembly, Innergy tech offers a quick connect solution for no additional cost. The electrical harness is compatible with connector plug 4 pins. TE AMP 350779-4 and connector crimps 305218-1 (not included). Please contact Innergy tech sales for more information on this option.

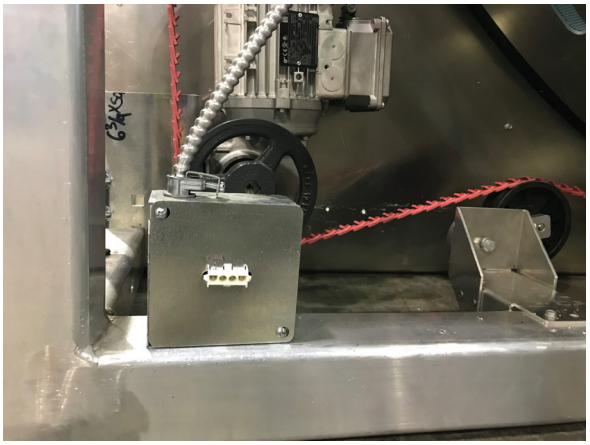


Figure 2.20
Motor quick connect option

2.5.5 GEAR REDUCER

The speed reducer is factory installed and permanently lubricated. No further lubrication is needed in the field.

The speed reducer on the wheel does not need any maintenance under normal use.

Please contact Innergy tech service team if you have any questions or concerns (1-800-203-9015 or service@innergytech.com).

Figure 2.21
Gear reducer

2.5.6 TENSIONER

The belt tensioner is fastened to an aluminum plate aligned with the wheel motor. The tensioner is installed perpendicular to the frame with a small angle inclined away from the motor (see figure 2.23c). The motor belt will push down on the tensioner when installed. For optimal belt tension, the final position of the tensioner should be under **45-degree angle** of the wheel frame, see figure 2.22 for details.

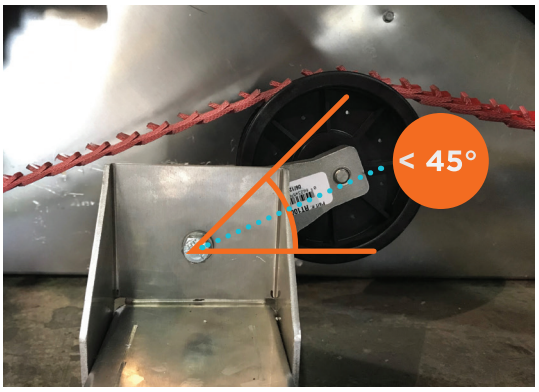


Figure 2.22
Tensioner

Belt tensioner replacement
The belt tensioner replacement is achieved by following these simple steps:

1. Lift the locking pin while pushing down on the motor to release the belt tension (2.23a).
2. Incline the motor to remove the belt around the tensioner (2.23b).
3. Unscrew the belt tensioner (2.23c).
4. Install a new tensioner with a small angle inclined away from the motor (about 5-degree angle).
5. Re-install the belt (2.23b), place the motor to its initial position (2.23a) and insert the locking pin.

Figure 2.23
Belt tensioner replacement

2.5.7 MULTI-LINK BELT

The wheel driving belt is a high-performance link belt designed for easy installation without the use of special tools. (for more information, go to: www.fennerdrives.com/high_performance_composite_vbelts/powertwist_home.aspx).

Innergy tech recommends checking the belt after a month of operation and once a year through a general maintenance check. The inspection should focus on belt wear and correct tension (see belt tensioner section). If improper tension is noticed, simply reduce the length of the belt by removing a few links.

If the belt needs replacement, contact Innergy tech for a new belt (Innergy tech will need the serial number and the size of the wheel).

The belt is directional; it must be installed with the directional arrows pointing in the direction of the wheel rotation.

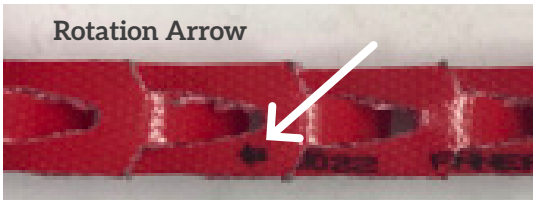


Figure 2.24
Innergy tech multi-link belt

Belt installation
To install a spare belt or reduce the length of the current belt, follow these 5 easy steps:

1. Open/separate the belt by twisting the link tabs sideways and pulling the surplus out of the belt (see image below). If needed, adjust the length of the belt by replacing or removing the undesired links.

a. Twist tab at a 90° angle

b. Pull link out

c. Twist belt end

d. Pull out belt end

Figure 2.25
Mutli-link belt adjustment instructions

2. Tape one end of the belt on the perimeter of the wheel (2.26). Turn the wheel by hand for one complete revolution.

NOTE: The tabs must be against the wheel with the belt's rotation arrows in the same direction of the yellow arrow on the wheel frame.

NOTE: The wheel should turn freely if the belt is removed.

Figure 2.26
Belt installation

3. Pull the belt tightly around the wheel and the gear reducer's pully. Connect both ends of the belt (see above image 2.25d. to a.).

4. Pass the belt over the tensioner idler sheave and place the motor to its initial position (2.23a).

5. Visually inspect that the belt is not twisted around the rotors and is properly located through the side seals. If the belt tension is too low (see figure 2.22), reduce the length of the belt.

2.6 Pillow block bearing

2.6.1 STANDARD BEARING

Wheel bearings are greased before shipping, but it is recommended to grease them again before start-up. Proper care and maintenance of the wheel bearings should allow it to last for up to twenty years.

The recommended lubrication interval is every 6 months. Innergy tech recommends a NLGI grade 2 consistency, mineral oil lithium or lithium complex base grease to be pumped into the bearing grease fitting (1/8" NPT) **(1)**.

The pillow block bolts shall be inspected where a special seal lacquer has been factory applied **(2)**. An inspection is required at the unit start-up and every 6 months. This is a visual aid will warn you if the pillow block bolts or the bearings set screws have loosen over time or during transport. A seal lacquer without cracks is the indication that bolts and screws have not loosen.

If a wheel bearing ever needs replacement, please consult Innergy tech for parts and instructions.

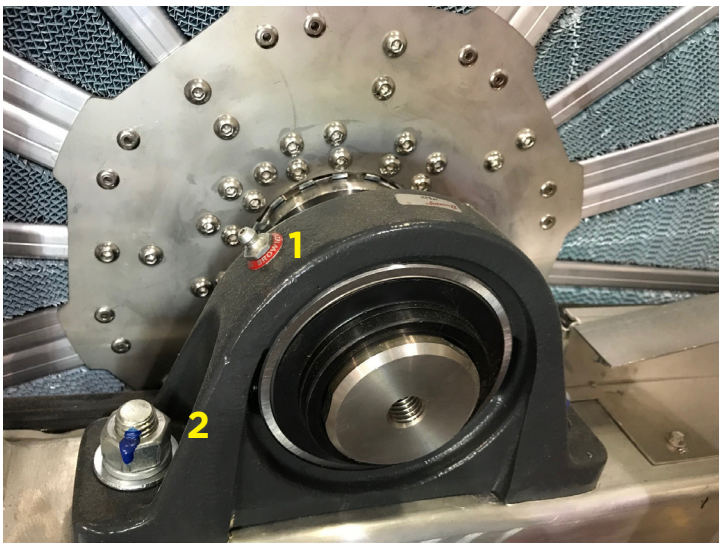


Figure 2.27
I4 wheel Pillow block

2.6.2 OPTIONAL PERMANENTLY GREASED BEARINGS

The no maintenance bearing is an option offered by Innergy tech. It is recommended for applications where accessibility to the bearings is limited. An advantage of permanently seal bearings is the time and labor cost saving related to reduced maintenance.

Figure 2.28
I4 Permanently seal bearing

2.7 Wheel frame

With the redesign I4 wheel, our team has developed a frame more compact and corrosion resistant than ever before. The smaller frames will help to keep down the overall dimension of the ventilation unit while keeping optimal performances (See section 2.8 for complete dimensions). In addition, the aluminum alloy frame offers higher oxidation and corrosion resistance than a standard steel frame. Unless the unit is in a corrosive environment, no additional protective measure is needed against exposure to air. Lastly, the aluminum frame is approximately 1/3 of the weight of a steel frame, thus reducing the overall weight of the unit of up to 34%.

2.7.1 EPOXY COATING ON FRAME OPTION

For higher corrosion resistance, Innergy tech offers a 2-part epoxy coating on the aluminum frame of the wheel. This option is recommended for coastal and marine environments. The 2-part epoxy coating has been tested for salt spray for 3500 hours and offers excellent chemical resistances.

2.7.2 SIDE PLATES

As an option, top, bottom and side aluminum plates can be added around the wheel frame. As shown in figure 1, the side plate option is not required if the wheel blank off is around the face plate of the wheel. The side plate option should however be selected if the blank off is installed on the back of the frame per figure 2.

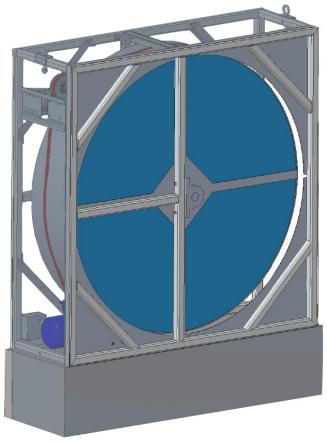


Figure 2.29
Blank off along the face plate
No need for the side plate option

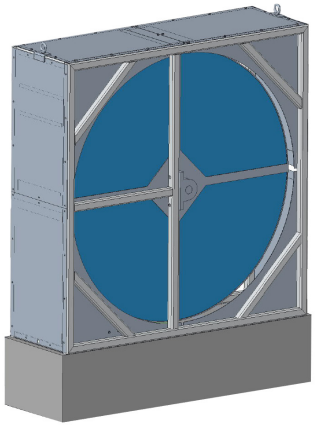


Figure 2.30
Blank off on building side
Side plate option required

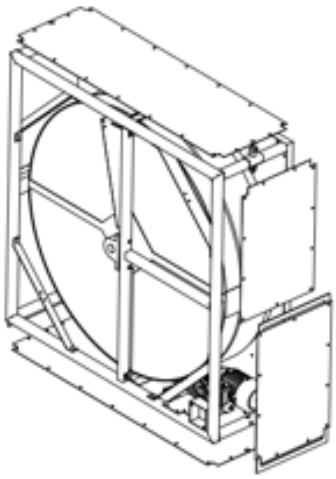


Figure 2.31
Top, bottom and side aluminum plate option

2.8 Wheel Dimensions

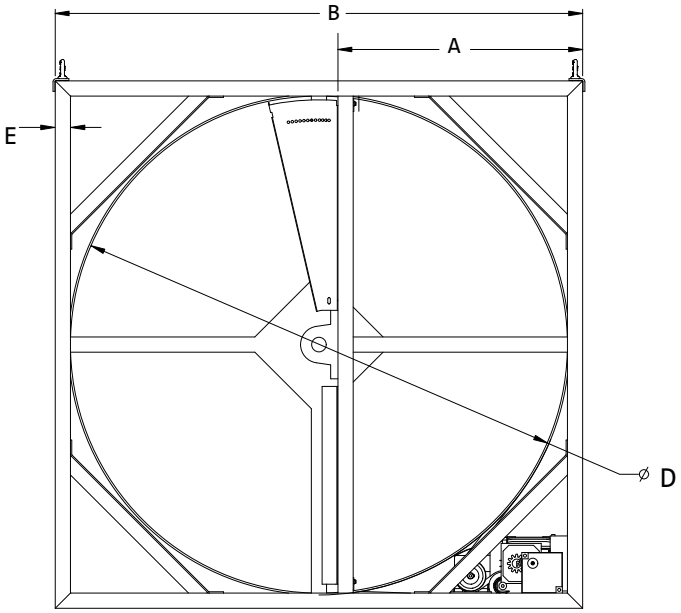


Figure 2.32
I4 dimensions

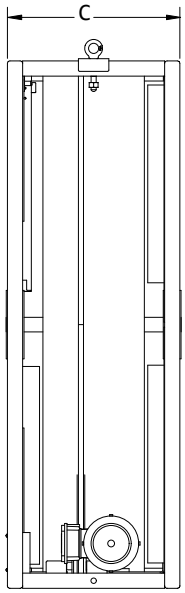


Figure 2.32
I4 dimensions

	OVERALL DIMENSIONS OF ENERGY RECOVERY WHEEL						
	Dimensions in INCHES (MM)					LB (KG)	CFM*
Model	D	A	B	C	E	AV. Weight	
I4-XX-48-13	48	22-5/8	52	17	1-1/2	265	-
I4-XX-48-09						300	4850
I4-XX-48-07						340	-
I4-XX-54-13	54	25-5/8	58	17	1-1/2	295	-
I4-XX-54-09						350	6200
I4-XX-54-07						395	-
I4-XX-62-13	62	29-5/8	66	17	1-1/2	335	-
I4-XX-62-09						400	8300
I4-XX-62-07						450	-
I4-XX-70-13	70	33-5/8	74	18	2	435	-
I4-XX-70-09						500	10600
I4-XX-70-07						570	-
I4-XX-78-13	78	37-5/8	82	18	2	540	-
I4-XX-78-09						650	12500
I4-XX-78-07						735	-
I4-XX-88-13	88	42-5/8	92	18	2	640	-
I4-XX-88-09						750	16500
I4-XX-88-07						860	-
I4-XX-96-13	96	46-5/8	100	20	3	870	-
I4-XX-96-09						1000	19300
I4-XX-96-07						1135	-
I4-XX-108-13	108	52-5/8	112	20	3	1040	-
I4-XX-108-09						1200	25000
I4-XX-108-07						1370	-
I4-XX-120-13	120	56-1/4	124	20	3	1240	-
I4-XX-120-09						1400	30500
I4-XX-120-07						1595	-

* Nominal CFM based on 0.85" pressure drop for supply airflow.

2.9 Field installed wheels

While fully assembled energy recovery wheels are the logical choice for new rooftop HVAC units, they can face size problems for mechanical room or retrofit installations. For projects where a fully assembled wheel is just too large to reach the installation area, the new I4R modular wheels for field installation are the solution. I4R modular wheels come in easy-carry kits that easily fit through all standard doors, elevators or stairways to reach the tightest locations. Supported by our team of highly trained installers, our field installed I4R wheels are subject to the same rigorous quality control as our in-house manufactured models. Please contact sales@innergytech.com for a quote and technical assistance.

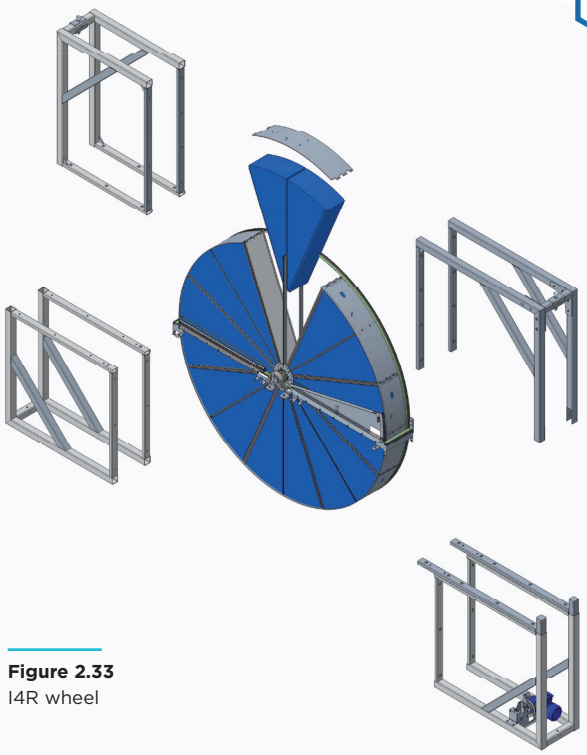


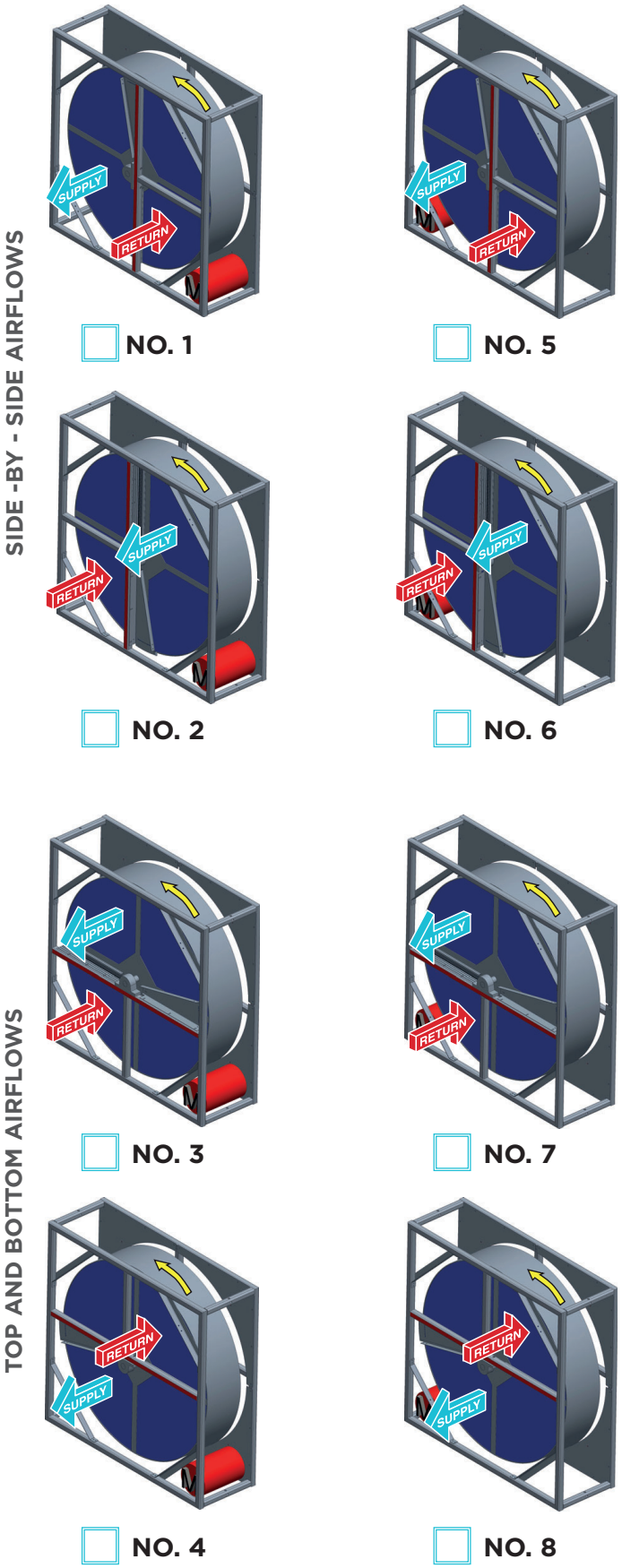
Figure 2.33
I4R wheel

2.10 I4 Wheel Terminology

I4	-	MS3A	-	48	-	07	-	P1	-	C1	-	460	-	OPTIONS

Wheel type	
Factory assembled	**I4**
Field installed (frame in 4 sections)	**I4R**
Desiccant type	
Molecular Sieve 3A (Enthalpy wheel)	MS3A
Epoxy coated Aluminum (Sensible wheel)	S
Wheel Diameter (inches)	
	48
	54
	62
	70
	78
	88
	96
	108
	120
Matrix type	
High Performance Matrix	07
Optimized Standard Matrix	09
Low Pressure Matrix	13
Purge Setup	
Without purge	NP
With purge plate *(Digit represents the angle from 0° to 11°)*	P1
Configuration	
8 different configurations (see illustration below)	C1 to C8
Motor Voltage	
120 Volts, 1 Phase (cannot be used with VFD)	120
208 or 230 Volts, 3 phases	230
460 Volts, 3 phases	460
575 Volts, 3 phases	575
Option codes (if more than one is selected, each must be separated with an hyphen)	
Motor Quick Connect at Jonction Box	MC
Aluminum sheet metal top, bottom and sides plates	SM
Epoxy coating on Frame	EF
Epoxy coating on Media	EM
Permanently Sealed Bearings	PB
Parallel Airflow arrangement	PF

Figure 2.34
I4 Wheel configurations



APPLICATION & DESIGN

3.1 Airflow configuration

The energy recovery wheel is more efficient in a counter airflows configuration than with parallel airflows. This design criteria should not be overlooked as it can lead to over 20% drop in effectiveness.

Top and bottom or side by side airflow configuration are both acceptable designs for heat wheels. For cleaning and maintenance purposes, side-by-side configurations for smaller wheels and top and bottom configurations for larger models are usually preferred.

3.2 Fan locations

The fan location in the HVAC unit represents the most important factor when designing air handling units around energy recovery wheels. As it will directly affect the magnitude of the pressure differential at the wheel, the locations of the fans (blow through if placed before the wheel or draw through if placed after the wheel) has a direct impact on the wheel cross leakage (EATR) and fan operating cost (OACF). There are 4 possible fan configurations:

3.2.1 BLOW THOUGH (OA) – DRAW THROUGH (EA)

This design ensures the highest pressure differential around the wheel while keeping a lower static pressure towards the exhaust. If a fan failure occurs, the static pressure will remain lower on the exhaust side. This is the best configuration for applications where cross leakage is a major concern. However, high pressure differential increases fan operating costs (OACF).

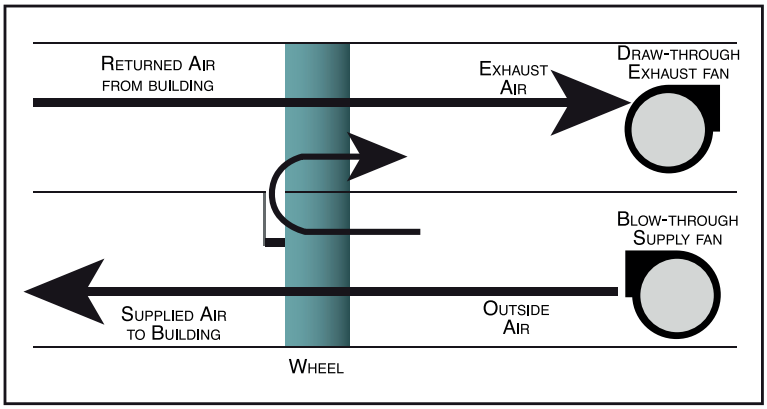


Figure 3.1.1
Fan configurations

3.2.2 DRAW THROUGH (OA) – DRAW THROUGH (EA)

If a low but positive pressure differential is created (1″ to 3″ is ideal), this arrangement results in the lowest pressure drops through the AHU, no cross leakage (EATR = 0) as well as low fan operating costs (OACF). Note that with this arrangement, a reduced CFM on the return air side or exhaust fan failure can result in a negative pressure differential at the wheel and increased cross-leakage.

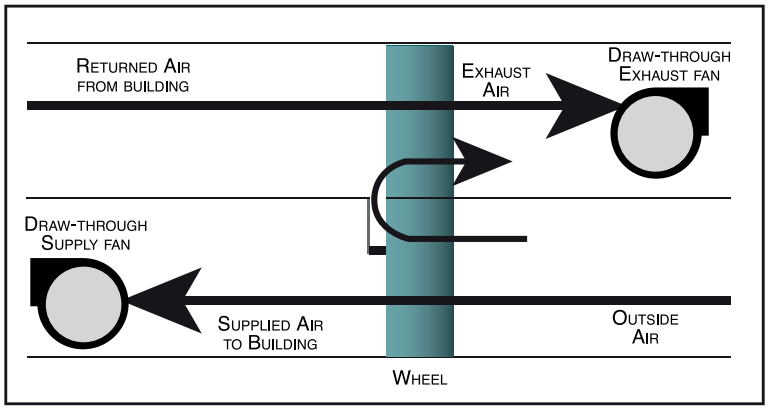


Figure 3.1.2
Fan configurations

3.2.3 BLOW THROUGH (OA) – BLOW THROUGH (EA)

If a low but positive pressure differential is created (1″ to 3″ is ideal), this arrangement can result in no cross leakage (EATR = 0) as well as low fan operating costs (OACF). Note that with this arrangement, a reduced CFM on the outside air side or supply fan failure can result in a negative pressure differential at the wheel and increased cross-leakage.

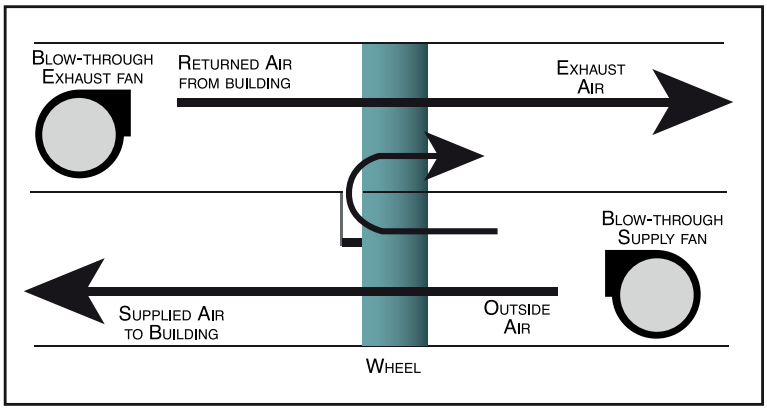


Figure 3.1.3
Fan configurations

3.2.4 DRAW THROUGH (OA) – BLOW THROUGH (EA)

Because it will lead to high cross leakage rates (EATR) and greater fan operating costs (OACF), this configuration should be avoided. EATR (cross leakage) hazard.

Please contact Innergy tech sales at sales@innergytech.com for technical support.

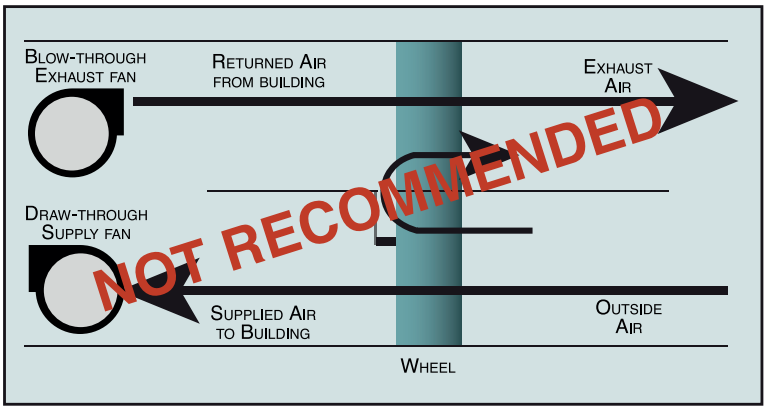


Figure 3.1.4
Fan configurations

3.3 High pressure differential applications

While lower pressure differential at the wheel under 5" W.C. is always recommended, some installations with specific space constraints can lead to much higher pressure differentials. For these applications, the improved Airloop™ seal technology of the I4 wheel was tested and showed greatly reduced leakage compared to the classic 4-pass labyrinth seal (-25%) and brush seals (-50%). This reduced leakage in turn results in inferior CFM loss through the wheel and therefore much lower fan operating costs. Note that the I4 wheel is recommended for applications of up to 12" pressure differential.

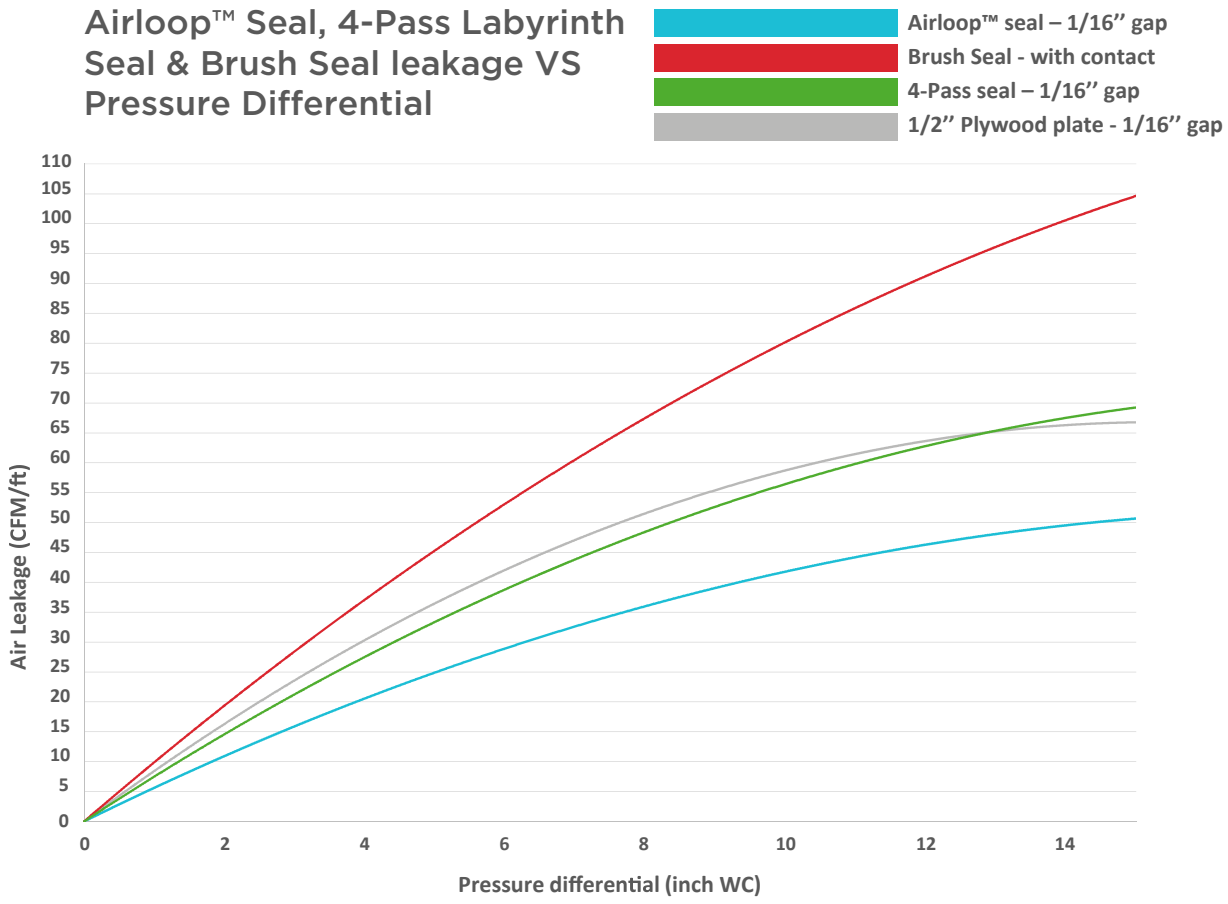


Figure 3.2
Airloop™ Seal, 4-Pass Labyrinth Seal & Brush Seal leakage chart

3.4 Exhaust air transfer ratio (EATR)

The Exhaust Air Transfer Ratio (EATR) is simply a measure of the wheel exhaust transfer level. As shown in the EATR figure below, it is measured by first introducing a certain tracer gas concentration in the Entering exhaust airflow (C3). The EATR result, expressed as a percentage, is calculated by dividing the concentration difference between the Leaving Supply Airflow (C2) and Entering Supply Airflow (C1) by the concentration difference between the Entering exhaust airflow (C3) and Entering Supply Airflow (C1).

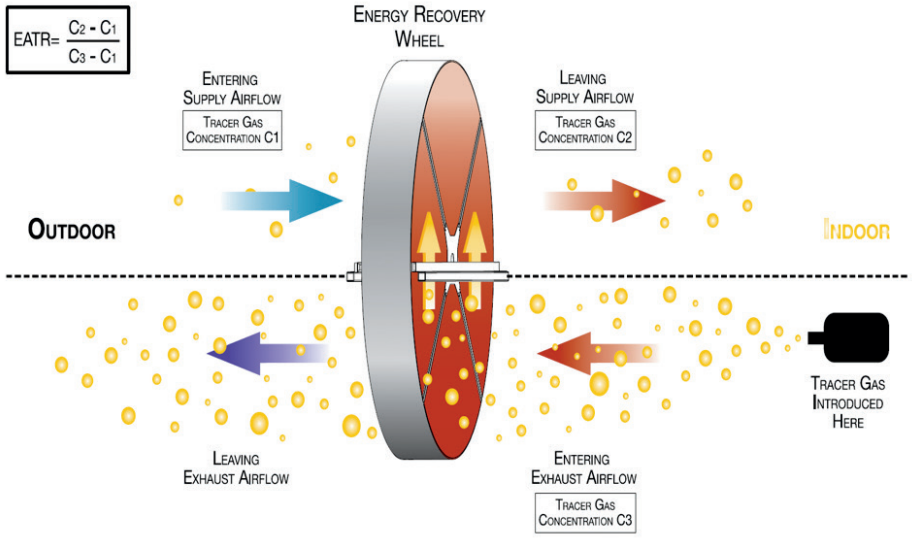


Figure 3.3
EATR measuring test

ASHRAE Standard 62.1 provides answers on the maximum acceptable exhaust transfer levels depending on your return air classification (please refer to ASHRAE 62.1 for more details).

Recirculation from leakage, carry-over or transfer in energy recovery devices (ASHRAE 62.1-2016)

Classification	Subjective criteria	Permitted recirculation
Class 2	Air with moderate contaminant concentration, mild sensory-irritation intensity or mildly offensive odors. (ex.: restaurant, gym floor, bathroom...)	10%
Class 3	Air with significant contaminant concentrations, significant sensory-irritation intensity or offensive odor. (ex.: chem/bio lab, machinery room...)	5%
Class 4	Air with highly objectionable fumes or gases or with potentially dangerous particles, bioaerosol, or gases at concentrations high enough to be considered as harmful. (ex.: laboratory or, commercial kitchen hoods, chemical storage...)	0%

NOTE: While the EATR is based on a gas concentration ratio and the ASHRAE 62.1 guideline is based on an airflow (CFM) ratio, it is generally accepted to use EATR values as a reference for the ASHRAE 62.1 recirculation limits.

The I4 wheels are AHRI 1060 certified for EATR of 3.9% on pressure differentials of 0 WC and 0° purge (no purge). A higher static pressure differential of the supply and a wheel purge can effectively eliminate cross leakage. However, both these strategies increase the fan operating cost (OACF).

3.5 Outside air correction factor (OACF)

The outside air correction factor (OACF) is also referred as the fan operation cost. It indicates the additional load on the fans needed to supply sufficient outside air to the building. The fans must work harder because of air leakage of the seals or/and the wheel purge.

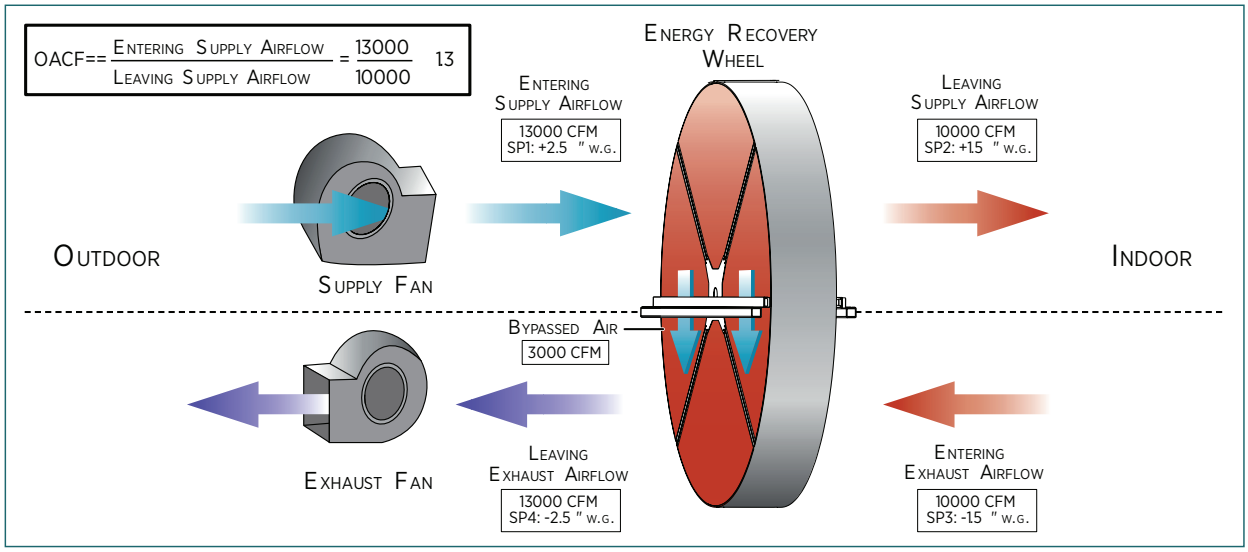


Figure 3.4
OACF created by seal leaks or wheel purge

The OACF is tested and certified AHRI 1060. To reduce operating costs, Innergy tech I4 wheels are equipped with the best seals on the market, including the Airloop™ patented seal. With the systems static pressures, the HVAC designer may analyze and consider the effect of lower OACF on the operation costs based on Fan laws.

FAN LAWS

$$\frac{BHP_2}{BHP_1} = \left[\frac{CFM_2}{CFM_1}\right]^3$$

CFM = Cubic feet/Minute
BHP = Break Horsepower

Pressure differential (WC)	Outside air correction factor (OACF)		Increased operation cost factor (Fan law)	
	Innergy tech I4 wheel	Competitors (mean value)	Innergy tech I4 wheel	Competitors (mean value)
1″	1.07	1.32	1.225	2.299
3″	1.12	1.38	1.405	2.628
	I4 air leakage reduction: 23%		I4 energy savings: 87%	

The relation between air flows and fan operating cost is exponential. Based on an average competitor OACF, by reducing 23% of air leakage, the I4 energy recovery wheels save 87% on fan operating costs.

3.6 Required filters

To achieve optimum performance of the energy recovery wheel, filters must be installed in the return and in the outdoor airstreams. These filters will help keep dirt and debris from entering the media.

Change filters as recommended by their manufacturer.

As per ASHRAE 62.1, a minimum of MERV 6 type filters (when rated in accordance to ANSI/ASHRAE 52.2) shall be installed before both wheel inlets (outdoor and return air sides). The filters are supplied by others.

3.7 Planning for a proper access

For easy access, maintenance and cleaning of your energy recovery wheel, it is recommended that doors or access panels be installed on all four ducts just off the energy recovery wheel (see figure 4.3).

3.8 Dual wheel in series configuration

More popular each year, the dual-wheel configuration is a great way to boost the total energy recovery of the system. The sensible wheel, placed after the cooling coil, adds free reheat to the system up to the setpoint and, by precooling the return air, increases the temperature delta at the enthalpy wheel. The enthalpy wheel, having access to a greater pool of energy, sees its precooling performance significantly increase. Finally, the work resulting from the wheels synergy can represent an increase of up to 70% compared to a single wheel system.

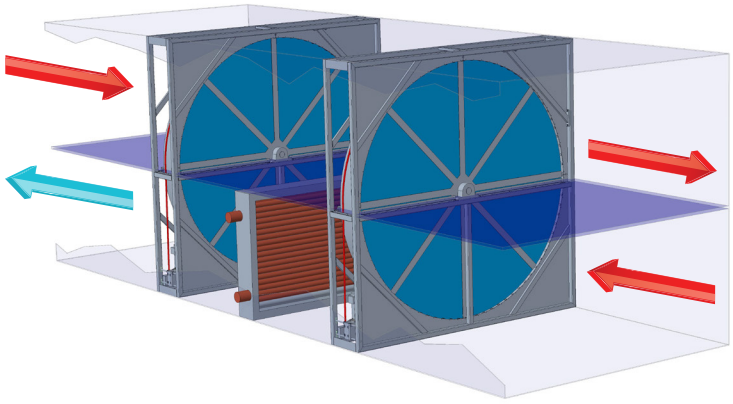


Figure 3.5
Dual wheel configuration

FEATURES AND BENEFITS OF THE I4 DUAL-WHEEL CONFIGURATION:

- The enthalpy and sensible wheels work in synergy for even more savings
- Eliminates the need of a reheat coil
- A simple VFD used on the sensible wheel enables easy control over the system's reheat setpoint
- Can be optimized by using our Low Pressure (LP) matrix for the sensible wheel (for extra low pressure drops) and High Performance (HP) matrix for the enthalpy wheel
- In cooling mode, the capacity of the dual-wheel system can be up to 70% higher than the single wheel approach
- In heating mode, the wheels work in series for a much greater effectiveness.

3.9 Performance controls

3.9.1 USING THE ACTIVE MATRIX TECHNOLOGY FOR DUAL-WHEEL CONFIGURATIONS:

While it's a fact that dual wheel configurations lead to a great energy recovery, such configurations do come with a drawback since two wheels instead of one will usually lead to twice the pressure drops (in turns leading to increased fan operating costs). Thankfully, the available I4 Active Matrix Technology solves this problem by offering a specific matrix size for each wheel used in the system. For dual-wheel units using I4 wheels, a sensible wheel using the Low Pressure (LP) Matrix alongside an enthalpy wheel using the High Performance (HP) matrix will only lead to a pressure drop increase of 28% compare to the single wheel approach.

3.9.2 THE DUAL-WHEEL CONFIGURATION AND FAN LOCATIONS:

As seen in section 3.2, fan locations is a very important factor because it directly impacts the pressure differential at the wheel. For dual wheel systems, the fan location is even more important since two wheels can lead to twice the cross-leakage for poorly designed systems.

Like single wheel systems, the goal is to create a positive pressure differential for both wheels (higher static on supply VS return) but not so high as to create important seal leakage. Below are four possible arrangements in more details:

Blow through (OA)/
Draw-through (EA):
Although both the enthalpy and sensible wheels will see a positive pressure differential, this arrangement will create a very high pressure differential at the enthalpy wheel and therefore increase the seal leakage and OACF of the system (increasing operating costs).

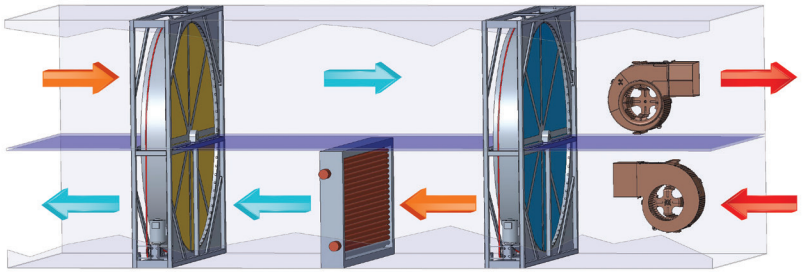


Figure 3.9.2.1
Fan configurations

Draw through (OA)/
Draw-through (EA):
Only possible if cross leakage is not a concern, the arrangement will create a positive pressure at the enthalpy wheel and a negative pressure at the sensible wheel. Since the leakage through both wheels are in opposite directions, the configuration may look appealing due to a lower system operating cost (lower OACF). What really happens however is the configuration replaces the fresh air leakage of the enthalpy wheel with the return air leakage of the sensible wheel. Total fresh air supplied to the building is therefore composed of true fresh air as well as the sensible wheel return air leakage (recirculated air).

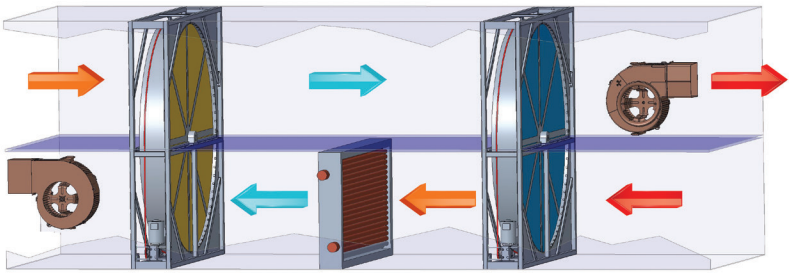


Figure 3.9.2.2
Fan configurations

Blow through (OA)/
Between wheels (EA):
Our recommended configuration, the arrangement will create positive pressures at both wheels for low cross leakage levels while avoiding very high pressure differentials like the Blow through/Draw through approach. As there is usually no component on the return side between wheels, placing the return fan does not influence the total length of the air handling unit.

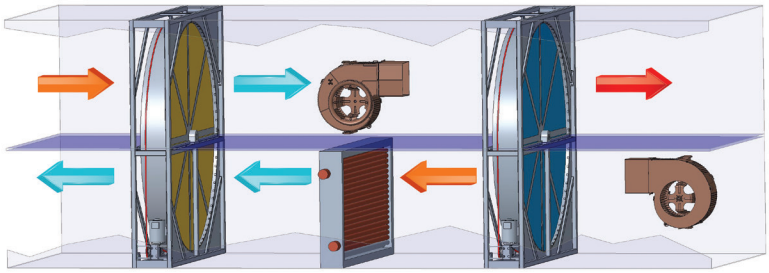


Figure 3.9.2.3
Fan configurations

Between wheels (OA)/
Draw-through (EA):
The arrangement will create positive pressures at both wheels for low cross leakage levels while avoiding very high pressure differentials like the Blow through/Draw through approach. Biggest drawback of the approach though is the air handling unit usually have to be lengthen to add room for the supply fan. 3.9. suite a venir...

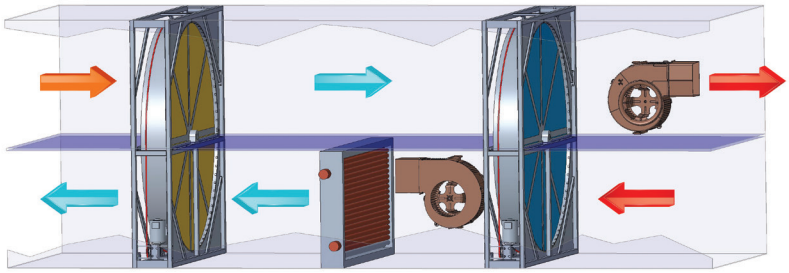


Figure 3.9.2.4
Fan configurations

3.10 Innergy tech control package option

This section reviews the different control strategies for the energy recovery wheel. Three control systems are examined: variable frequency drive (VFD), face & by-pass dampers, pre-heat.

3.10.1 WHY ENERGY WHEELS NEED TO BE CONTROLLED

To meet energy standards and ensure optimal operation, control is required to adapt the behavior of the system for frost control and free-cooling mode. Per ASHRAE 90.1, air economizers mode is required to "provide up to 100% of the design supply air as outdoor air for cooling". To comply with this standard, the unit's effectiveness must be reduced with a control strategy. Furthermore, frost control modes are essential to prevent frost build up in the unit that could damage the wheel for colder climates.

3.10.2 SEQUENCE OF OPERATION

The operation sequence of the variable frequency drive is discussed in this section to serve as an example. Four temperature sensors are installed at the entry and exit of the wheel (supply and exhaust). The speed of the wheel is modulated and adapted according to the temperatures readings of the sensor.

Cooling mode: When outdoor air temperature is greater than the return air temperature, the wheel operates in cooling mode at its full effectiveness and maximum speed (20 RPM).

Frost control: When the exhaust air (T4) temperature reaches the frost control setpoint (default 34°F), the wheel speed is modulated to avoid ice formation within the wheel media.

Free cooling mode (economizer): When outdoor air temperature (T1) is lower than the return air temperature (T3) but supplied air temperature (T2) reaches the free cooling setpoint (default 60°F), the wheel speed is modulated to prevent the supplied air (T2) from exceeding the free cooling setpoint.

Heating mode: When outdoor air temperature(T1) is lower than the return air temperature (T3); when the exhaust air (T4) temperature is above the frost setpoint (default 34°F) and supplied air temperature (T2) is below the free cooling setpoint (default 60°F), the wheel operates in heating mode at its full effectiveness and maximum speed (20 RPM).

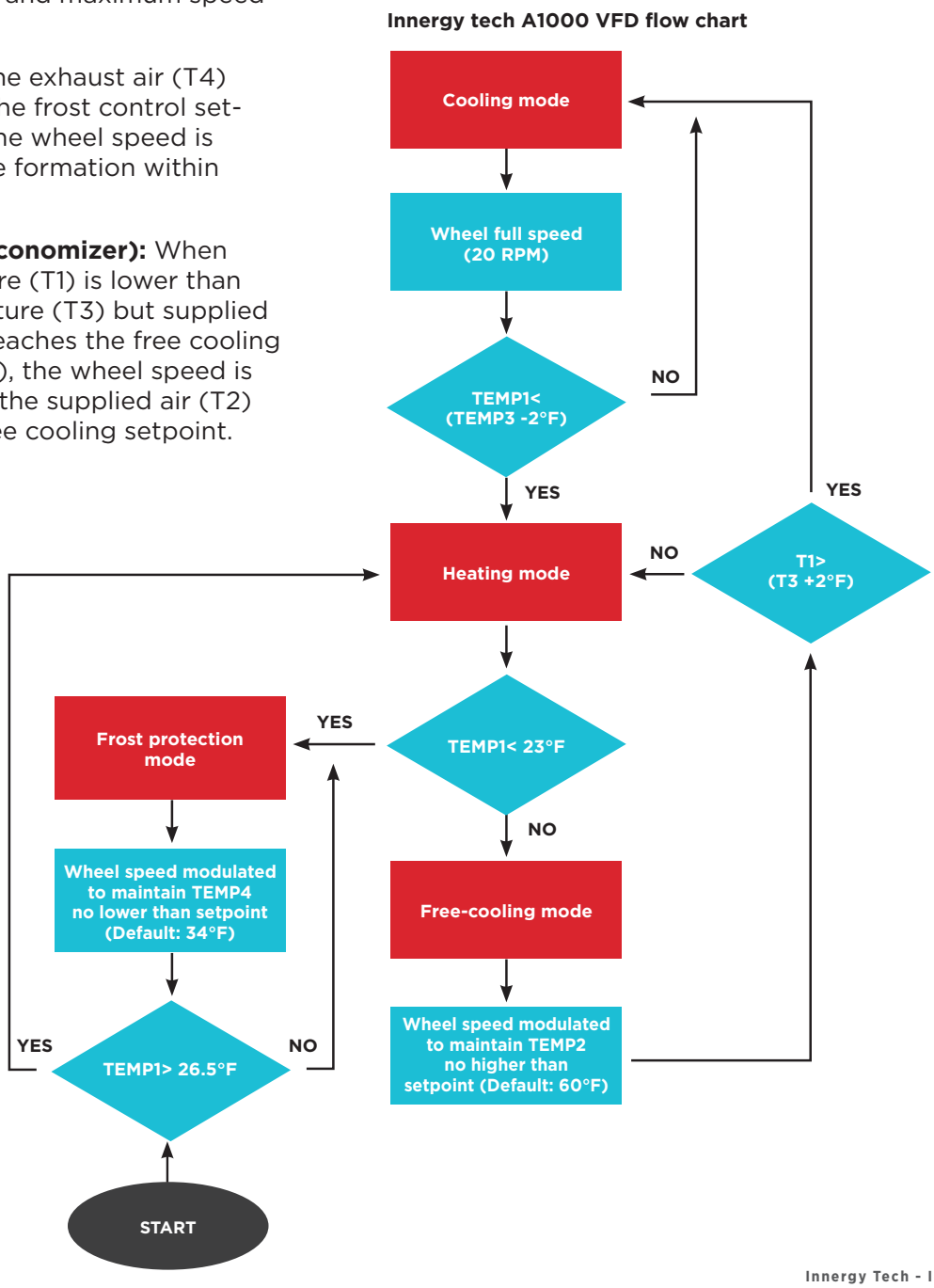


Figure 3.7
Innergy Tech A1000 VFD Flow Chart

3.10.3 THE VFD STRATEGY

The use of a variable frequency drive (VFD) allows to lower the effectiveness of the heat wheel by reducing the speed of the rotor. As the wheel is slowed down, the latent effectiveness drops more quickly than the sensible effectiveness. Once the wheel has reached its minimum speed of 0.25 RPM, the product effectiveness is almost null and thus is the minimum range for free-cooling and frost control mode. Keeping the wheel at 0.25 RPM for the minimum speed maintains an auto-cleaning feature. The VFD is the most compact control strategy for energy recovery wheels.

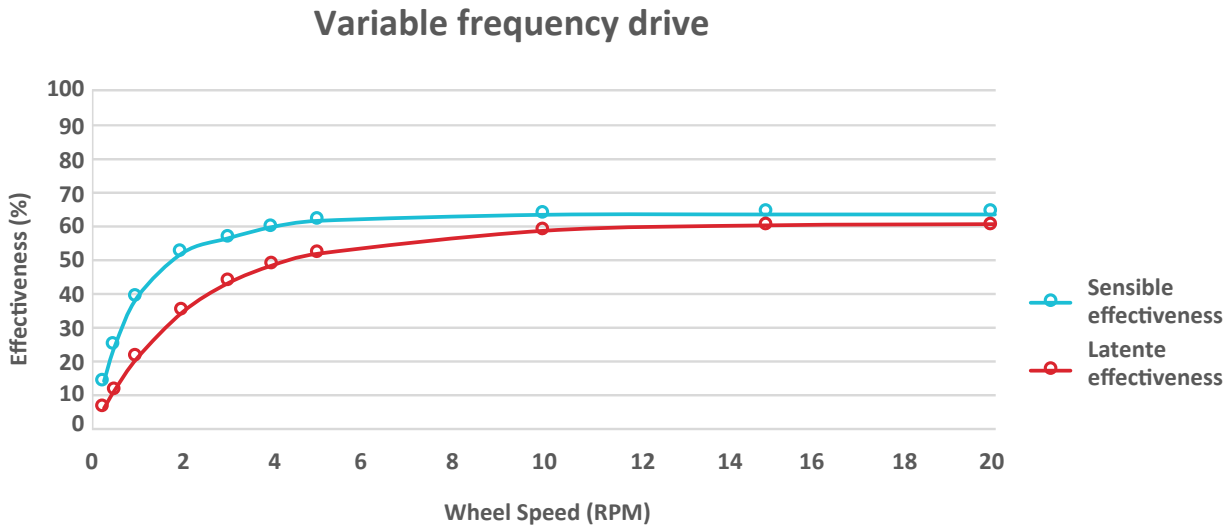


Figure 3.8
Effectiveness VS Wheel speed

3.10.4 THE FACE AND BYPASS STRATEGY

Like the VFD approach, a face and by-pass damper will reduce the energy recovery during frost control and free-cooling mode. When required, the outside air is partially or fully redirecting through a by-pass tunnel beside the wheel. Typically, face and by-pass dampers modulate the inflow according to the temperature sensor readings. The main advantage of this strategy is the reduction of the pressure drops while the air is bypassed. This is the only control strategy that reduces fan operating costs thanks to lower pressure drops.

3.10.5 THE PREHEAT STRATEGY

A heating coil is installed before the energy recovery in the supply airstream. During frost control mode, the coil heats the outside air to prevent the leaving exhaust air from creating condensation that could freeze within the unit. The setpoint of the pre-heat is determined according to the indoor air temperature and relative humidity (%RH) as well as wheel effectiveness. For standard application, the minimum leaving exhaust air temperature of an enthalpy wheel should be 34°F. Please contact sales@innergytech.com for technical assistance of a preheat strategy.

3.10.6 PRESSURE DIFFERENTIAL SENSORS

This strategy is not suitable for energy recovery wheel.

To detect frost control, a pressure sensor is installed before and after the energy recovery wheel to calculate the pressure differential across the rotor. When air restriction increases because of ice accumulation within the wheel, the system changes to its frost control mode. This strategy is not acceptable because of higher risks of damaging the wheel media.

3.10.7 INNERGY TECH CONTROL PACKAGE OPTION

The A1000 VFD Controller package from Innergy tech is designed to provide full energy recovery wheel control. Unlike other controllers which rely on a separate variable frequency drive and controller, the A1000 VFD Controller package benefits from the extensive Yaskawa A1000 programming capacity to eliminate the need of a separate controller entirely.

By using a total of four analog temperature sensors, the A1000 VFD Controller package will regulate the speed of the energy recovery wheel for full frost control and free-cooling (with summer changeover) operations. The drive package is fully compatible with Building Management Systems (BMS) with default S-422/485 MEMOBUS/Modbus or optional BACnet communication protocols. An induction rotation sensor is also available as a separate option.

With the purchase of all VFD or sensors only options, four temperature sensors are factory installed on the energy recovery wheel frame.

Figure 3.9
A1000 VFD control option

RECEIVING AND INSTALLATION

The following sections explains the main steps when receiving, storing, lifting and installing the I4 energy recovery wheel. The procedure also reviews the risks and recommended precautions to ensure safe handling techniques.

4.1 Receiving

- Inspect the complete unit for shipping damage. If damage is present, you have the right to either accept or reject the shipment. If the receiving party chooses to receive the equipment in a damaged condition, it then becomes its responsibility to note the extent of the damage on the bill of lading in the presence of the carrier's driver. It also becomes the receiving party's responsibility to file a freight claim with the freight carrier in accordance with the ICE regulations and work with the freight carrier to have the equipment repaired to the satisfaction of Innergy Tech so the warranty remains valid.
- Innergy tech must also be notified of shipping damage. Innergy tech has the right to void the warranty on any equipment that is not repaired to satisfaction.
- Check the packing list to confirm that all loose parts are present and in good condition before signing the shipper's documentation.
- Check the wheel media to ensure there is no damage. Although the media may have a few nicks and scratches, this will not impair its performance. If more than 5% of the energy recovery wheel media is damaged, you may see a decrease in performance. Innergy tech should be notified if the media has more than 5% of its surface damaged.

CAUTION: Be careful when working on or around the wheel media, as it is very thin material and can be nicked and scratched very easily.

WARNING: When unloading the energy recovery wheel, lift only with the lifting eye bolts located on top of the unit. DO NOT lift the unit from the bottom with a forklift or any other device. Lifting eye bolts are located on top of unit casing (see figure 4.1). When lifting and handling the unit, be sure that lifting forces are applied uniformly to all lifting points.

4.2 Storage

- The energy recovery wheel must be stored inside and protected from the elements. Moisture and extreme temperatures may damage the media.
- For more than 3 months storage or inactivity, it is necessary to manually rotate the wheel of a quarter turn. The rotation shall be done every 3 months and the wheel shall be kept at its new position.
- For storage between 3 and 6 months long, whether part of a packaged unit or simply the energy recovery wheel, it is necessary to grease the bearings and rotate the wheel.
- For storage over 6 months long, regardless whether it is a packaged unit or the wheel only, it is necessary to pump fresh grease into both wheel bearing grease points. Innergy tech recommends using NLGI grade 2 consistency, mineral oil lithium or lithium complex base grease.

4.3 Lifting and handling

- Before installing the unit, make sure all bearing bolts and set screws are tight.
- Be sure to use all lifting eye bolts when positioning energy recovery wheel into unit or ducting location, and that weight is evenly distributed.
- Before lifting, always ensure the chains or slings are vertical (see figure 4.1 and 4.2).

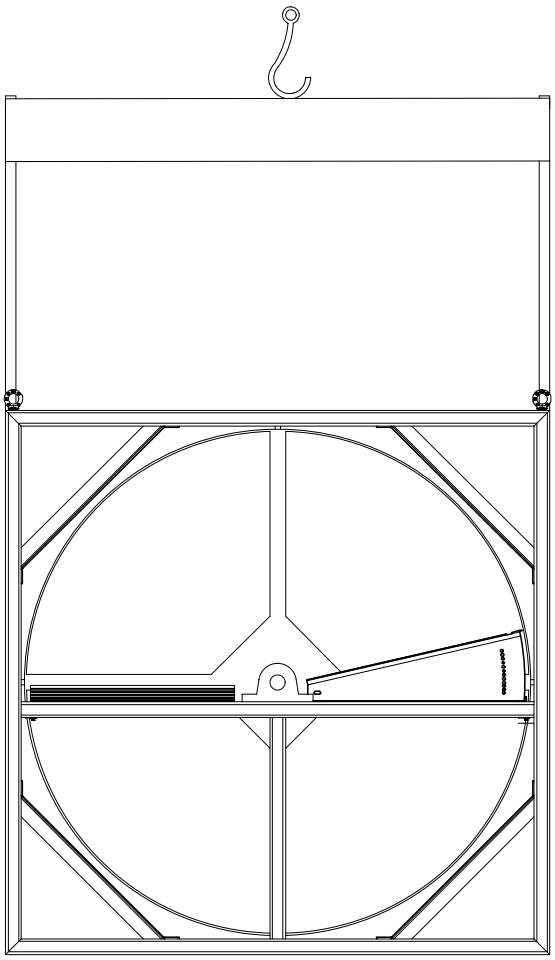


Figure 4.1
Recommended lifting method

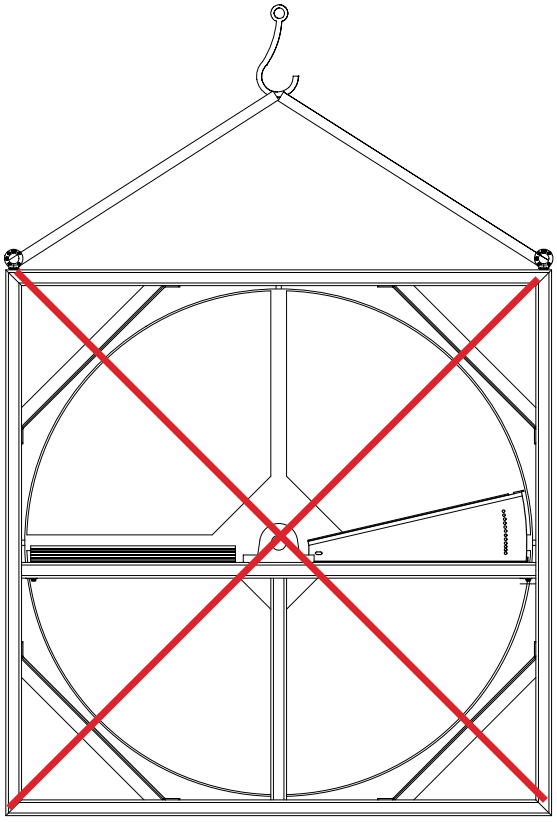


Figure 4.2
Incorrect lifting method

WARNING: Lifting the wheel from one point as shown on figure 4.2 is not recommended and may result in damage to the unit.

- If the eye bolts need to be removed, bolts or plugs should replace them in order to avoid any air leakage from these holes (required with top, bottom and side galvanized plate option only).

4.4 Preparing installation and ductwork

1. The purge should always be located on the supply air leaving side of the wheel (see section 2.4 for more details).

2. Notice the locations of the Outside Air, Supply Air, Return Air and Exhaust Air. Ensure that ductwork matches airflow arrows and locations indicated on the energy recovery wheel frame.

3. Four ducts will be required for the installation, 2 per energy recovery wheel sides.

4. The energy recovery wheel should have continuous bottom support.

5. Filters must be installed in the return and in the outdoor airstreams (minimum of MERV 6).

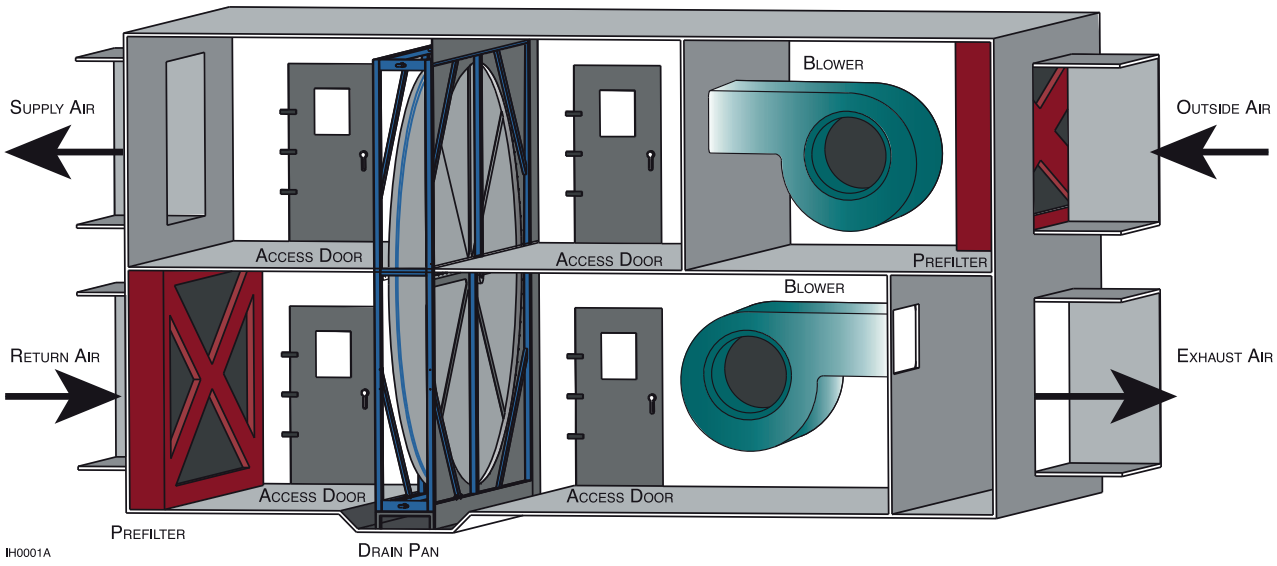


Figure 4.3
Typical energy recovery wheel installation

4.5 Wheel installation and attaching ductwork

- Prior to installing ducts to the energy recovery wheel, ensure that airflows match duct airflow, and that ductwork will not cover airflow and rotation arrows.
- All ductworks should be attached to the wheel frame using its 1.5″ square aluminum tubings for models 48″ to 62″ in diameter, 2″ square aluminum tubings for models 70″ to 88″ and 3″ square aluminum tubings for models 96″ and up.
- As shown on figure 4.3, wheel's top, bottom and side blank offs should be aligned with the frame's face plate (side facing the outside air). If not, the top, bottom and side galvanized plate option is required (see section 2.7.2).
- The energy recovery wheel cannot be used to support any ductwork; all ductwork must be self-supporting.
- Ductwork should be airtight; all leaks should be sealed.
- A final light inspection is recommended between the airstreams. No light should be visible through the ductwork itself.

4.6 Checking the wheel before start-up

- Before start-up, grease both pillow block bearings on the wheel, using a NLGI grade 2 consistency, mineral oil lithium or lithium complex base grease.
- Make sure the wheel turns by hand and does not bind. Some resistance to the rotation is expected and acceptable. If the wheel won't turn, recheck the AirLoop™ labyrinth seal for improper adjustments (see section 2.3.1). Although the seals are adjusted and tested before shipping, they should be inspected prior to start-up.
- Confirm if airflow arrows on the wheel frame matches the ducted airflow. If not, ductwork will have to be corrected.
- Validate if power supply matches the supply required by the electrical equipment. If not, the electrical equipment or the power supply must be changed. The wheel identification tag located near the electrical input gives the proper voltage to use.
- Verify if the belt is properly adjusted for the correct belt tension. This is achieved by visually inspecting the belt tensioner (see section 2.5.6). If the tension is insufficient, shorten the length of the belt (see section 2.5.7). Validated if the belt is positioned on the correct side for maximum grip on the wheel.
- A final light inspection is recommended between the airstreams. No light should be visible through the ductwork itself.

4.7 I4 wheel start-up

Supply the drive motor. Check the wheel rotation to ensure it is turning in the correct direction. If the wheel is turning backward, reverse the rotation by switching any two motor leads on the motor side of the starter or variable frequency controller (see section 2.5.3).

CAUTION: Nerver Star-up the energy recovery wheel when the temperature around the gearbox is below -34°F (-37°C)

MAINTENANCE/SERVICE

The Innergy tech I4 energy recovery wheel will provide years of effective and efficient service while requiring the lowest maintenance and operating costs. Basic maintenance consists in checking parts to ensure they are tight and working correctly. A maintenance summary chart, with required intervals, is included in this section.

5.1 Maintenance form

> RECOMMENDED MAINTENANCE SCHEDULE

		Following Months											
Service	**Start-up**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
Wheel Bearing lubrification	•						•						•
Bearing bolt tighness	•		•										
Driving belt tension and wear*	•	•			•			•			•		
AirLoop Seals adjustment	•	•		•			•			•			•

*Following any driving belt adjustments, the belt should be verified again after a month and every year thereafter.

Following the service schedule above and keeping close records on your energy recovery wheel will insure trouble-free operation for years to come. To keep your warranty in effect these services are required. This should be kept up-to-date during the warranty period.

> MAINTENANCE FORM

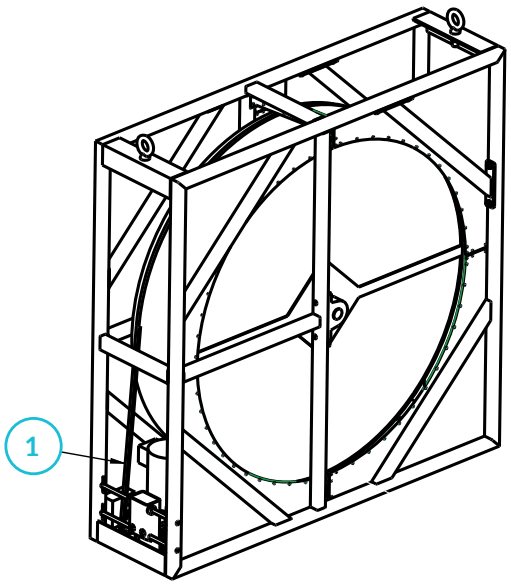
		Following Months											
Service	**Start-up**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
Wheel Bearing lubrification													
Bearing bolt tighness													
Driving belt tension and wear													
AirLoop Seals adjustment													

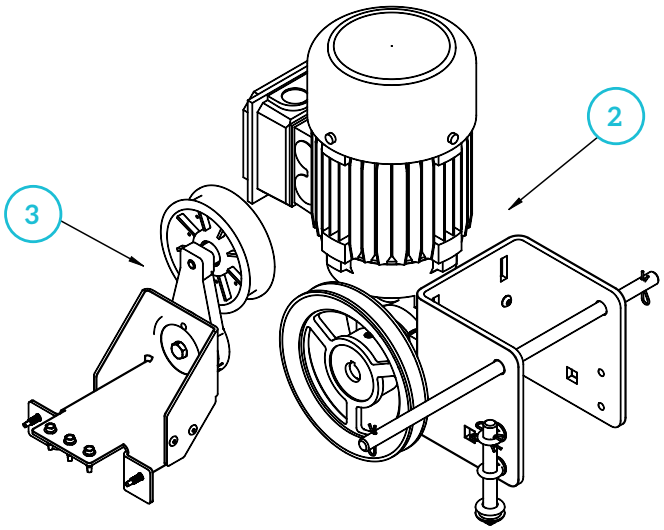
5.2 Service Parts

If part replacement is required, please contact service@innergytech.com or call 1-800-203-9015. For technical support, send pictures and summary explanation of the current situation. Innergy tech will quickly respond to your request.

			ERW DIAMETER							
Ref no.	**Seal**	**48**	**54**	**62**	**70**	**78**	**88**	**96**	**108**	**120**
1	Driving Belt	12’	14’	18’	20’	23’	25’	27’	30’	34’

	Electric Motor				
Ref no.	**HP**	**Voltage**	**Phase**	**HZ**	**Part no.**
2	1/3	208-230	3	60	08010
	1/3	460	3	60	08010
	1/3	600	3	60	04957
	1/3	115/208/230	1	60	05893
	1/2	208-230	3	60	08011
	1/2	460	3	60	08011
	1/2	600	3	60	04961
	1/2	115/208/230	1	60	09585
	3/4	600	3	60	05222
	3/4	115/208/230	1	60	05895
	1	208-230	3	60	09823
	1	460	3	60	09823
Other					
3	Driving Belt Tensioner				60553





REFERENCES

6.1 Glossary

Following are technical terms used throughout this manual.

DRIVING BELT: Multi-link polyurethane belt surrounding the wheel to make it turn.

ENERGY RECOVERY WHEEL (ERW): Device that exchanges sensible and latent energy. As the wheel rotates between the outdoor and return airstreams, the higher temperature and more humid airstream transfers its sensible and latent energy to the desiccant coated aluminum. That energy is then released to the cooler and/or dryer airstream during the second half of the revolution.

EXHAUST AIR (EA): The return indoor air that has passed through the ERW. This air is being ducted outdoors.

FACE PLATE: Sheet metal directing air flow into the media.

FRAME: Aluminum tubing assembly supporting the rotor.

GEAR BOX: Device that reduces the motor output RPM.

IDLER SHEAVE: Sheave used to maintain appropriate tension on the driving belt.

MEDIA: Corrugated aluminum that makes up the ERW, the corrugation allowing the airflow to pass through the wheel. The ERW is coated with a desiccant for sensible and latent transfer in the case of an enthalpy or total ERW and bare aluminum for sensible only wheels.

OUTDOOR AIR (OA): Fresh air that is brought in from the outside. This air goes through the ERW and then is ducted into the building.

PILLOW BLOCK BEARING: Device that supports the rotor and allows it to turn freely.

PURGE: Device allowing fresh outdoor air to pass through the wheel media on the return air side. This fresh air cleans the media before it goes from the return air to the supply air and prevents carryover. The purge should always be located on the Supply Air (SA) side and is easily recognizable with its triangular shape.

RETURN AIR (RA): Stale air from the building that is being ducted to the ERW.

REMOVABLE CORNER BRACING: Bolted frame section for easy access to the media in case of segment removal.

AIRLOOP™ LABYRINTH SEAL: Main seal facing the media to prevent cross-leakage.

SIDE SEAL: Seal located along the depth of the rotor to prevent cross-leakage.

PERIPHERAL SEAL: Seal located along the outer periphery of the rotor and preventing wheel bypass.

PRESSURE DIFFERENTIAL: Defined as the difference between the static pressure just after the wheel on the supply air stream (SP2) and the static pressure just before the wheel on the return air stream (SP3).

SEGMENTS: Media sections separated by the spokes.

SENSIBLE WHEEL: Term describing wheels capable of transferring sensible energy only from one airstream to another (see also energy recovery wheel).

SHAFT COLLAR: Device that prevents any axial movement of the motor base.

SPOKES: Assembled aluminum plates providing structural integrity for the wheel.

STATIC PRESSURE: Define as the design pressure at a specific location within the air handling unit (generally expressed in inch of water column, in reference to the atmosphere).

SUPPLY AIR (SA): Air that is brought in from the outside, has passed through the ERW and is ducted into the building.

TENSIONER: Spring-loaded device that keeps the appropriate tension on the driving belt and prevent slippage.

6.2 I4 Wheel specifications

1. GENERAL SPECIFICATIONS:

1.1 Furnish and install the I4 energy recovery wheel, to be manufactured by Innergy tech Inc.

1.2 The energy recovery wheel shall transfer both sensible and latent energies between outgoing and incoming air streams in a counter flow arrangement.

1.3 The energy recovery wheel shall be labeled for rotation direction and airflows (Outdoor air, Supplied air, Return Air & Exhaust air).

1.4 The energy recovery wheel must be manufactured in North America.

1.5 The energy recovery wheel manufacturer must have at least ten (10) years of experience in the manufacturing of energy recovery components.

2. QUALITY ASSURANCE SPECIFICATIONS:

2.1 General: The manufacturer's quality system shall be ISO 9001-2015 certified. The manufacturer to provide valid certificate upon request.

2.2 Performance: The energy recovery wheel shall bear the AHRI 1060 Certified Product Seal. Wheels tested in independent laboratories, whether according to AHRI Standard 1060 or not, are not acceptable unless actually certified by AHRI. Wheel manufacturer membership in AHRI is not an acceptable substitute for AHRI certified product.

2.3 Fire resistance: In accordance with UL1995 standard, the energy recovery wheel media shall have a flame spread index (FSI) of less than 25 and a smoke developed index (SDI) of less than 50 when rated in accordance with UL 723 by an accredited laboratory. I4 wheel media tested with success by UL Laboratories (FSI = 0, SDI = 5). Wheels only tested "in accordance to" UL723 shall be unacceptable.

2.4 Bacteria & mold resistance: The wheel media shall not promote the growth of mold or bacteria and must have successfully passed AATCC30-2013 testing procedures.

2.5 Electrical: The energy recovery wheel shall be a UL Recognized component and bears the UR label. In accordance with UL1995 standard, all electrical components and wires shall be UL Recognized.

2.6 Warranty: The energy recovery wheel shall carry a full parts and labor warranty of at least 5 years. An optional 10 years warranty shall be available as a separate option. Wheels with less than 5 years warranty shall not be acceptable.

3. PERFORMANCE SPECIFICATIONS:

3.1 Schedule compliance: Supplied air temperatures shall be no higher (cooling mode) or lower (heating mode) than the scheduled values. Supply and return pressure drops shall be no higher than the scheduled values.

3.2 Effectiveness: Sensible, latent and total effectiveness along with pressure drops shall be clearly documented in the AHRI 1060 Certified Product Directory (http://www.ahridirectory.org).

3.3 Cross-leakage (EATR): The energy recovery wheel, using an adequate purge angle, shall achieve an EATR rating of 0% (no cross-leakage) starting from positive 1" WC pressure differential.

3.4 Fan operating cost (OACF): To reduce fan operating costs, the energy recovery wheel shall not exceed an OACF of 1.15 for rotors of up to 70" (1778mm) and 1.08 for rotors of up to 120" (3048mm) at 5" WC pressure differential when no purge is used.

4. PRODUCT SPECIFICATIONS:

4.1 Rotor Media & desiccant:

4.1.1 The rotor media shall be made of 2 mils minimum thickness aluminum. The media shall be coated to prohibit corrosion and shall be suitable for seacoast applications. Non-metallic substrates made from paper, plastic, synthetic or glass fiber media are not acceptable.

4.1.2 Media coating:

4.1.2.1 Enthalpy wheels: All surfaces shall be coated with a non-migrating 3 angstroms molecular sieve (MS3A) desiccant specifically developed for water transfer in vapor phase. Etched or oxidized surfaces are not acceptable.

4.1.2.2 Sensible wheels: All surfaces shall be coated with a UV resistant epoxy coating for increased corrosion resistance. Bare aluminum wheels shall not be acceptable.

4.1.3 Corrugation pattern shall be of closed triangular shape to prevent any cross-leakage between airstreams. Open type corrugations or embossments, since they increase fan operating costs (OACF), are not acceptable.

4.1.4 Media shall be optimized for minimum pre-filtering requirements and pressure drops. It shall allow dry particles of diameters of up to 1390 microns (high performance matrix), 1750 microns (standard matrix) or 2475 microns (low pressure matrix) to freely pass through it. Wheels with media that will require shorter cleaning intervals due to smaller openings shall be unacceptable.

4.2 Seals:

4.2.1 The rotor shall be supplied with AirLoop™ labyrinth seals facing the media, polymer contact seal along the depth of the wheel and "S" type labyrinth seal along the wheel's periphery. Wheels using less effective seals like brush seals or standard 4 pass labyrinth seals are not acceptable.

4.2.2 The AirLoop™ labyrinth seals shall be installed with no gap between the seal and media. Labyrinth seals that require an installation gap or seals that will damage the media if they come in contact with it are not acceptable.

4.2.3 All seals shall be designed to withstand pressure differentials of up to 12"WC and shall have been tested for up to 20"WC pressure differential with no mechanical failure of the seal assembly.

4.2.4 The AirLoop™ labyrinth seals shall be factory adjusted. Field adjustments shall be possible using common tools.

4.2.5 Seals shall be held in place using adjustable aluminum brackets and ProCorr™ coated hardware.

4.3 Bearings and center shaft:

4.3.1 The rotor shall be supported by two pillow block bearings which can be maintained or replaced without removal of the rotor from its casing or the media from its spoke system. Inboard type bearings are not acceptable. Grease fittings shall be easily accessible.

4.3.2 Bearings shall be rated for a minimum L10 life of minimum 500,000 hours for standard wheel operation.

4.3.3 The center shaft shall be machined as to provide a shoulder against the bearing and prevent any axial movement of the rotor.

4.3.4 The center shaft shall be made of 300 series stainless steel to prevent corrosion. Center shafts that must protected with oil or a coating like black oxide for corrosion resistance are not acceptable.

4.4 Purge & Cassette Assembly:

4.4.1 The rotor shall be provided with a structural frame which limits the deflection due to air pressure drops to less than 1/32".

4.4.2 The framing shall be made of 6000 series aluminum for increased corrosion resistance and high strength. As an option, a high quality 2-part epoxy coating shall be available.

4.4.3 The cover panels shall be made of aluminum alloy (minimum thickness of 1/16") to prevent corrosion.

4.4.4 For easier parts inspection and maintenance, all major components (motor assembly, driving belt, seals) shall be easily accessible from at least one side of the wheel within the airstream. The components shall not require the removal of sheet metal for a visual inspection. Wheels with face plates on both sides are not acceptable.

4.4.5 Wheels up to 70" in diameter shall be supplied with removable corner bracings for easy replacement of media sections from the face of the wheel if ever required. Larger models shall be serviceable using common tools.

4.5 Rotor assembly:

4.5.1 Rotor spoke system shall be of segmented design to allow for field erection or replacement of one section at a time without requiring side access. Wheels up to 70" in diameter shall be made of 4 sections and wheels larger than 70" shall be made of 8 sections.

4.5.2 The rotor spoke system shall be made of strong aluminum extrusions providing the structural integrity required at design pressure differentials & pressure drops.

4.5.3 The rotor hub shall be made of machined, extruded aluminum (no welding), for reduced tolerance and increased stiffness.

4.5.4 All rotor parts shall be made of aluminum or stainless steel. Galvanized steel parts are not acceptable.

4.6 Drive system:

4.6.1 The rotor shall be perimeter driven with a multi-link V-belt made of high-tech polyurethane/polyester composite material for easier installation and replacement.

4.6.2 The belt shall be tensioned with a heavy duty belt tensioner. Gravity tensioned assemblies are not acceptable.

4.6.3 The wheel shall be supplied with a speed reducer resulting in a rotation speed of 20RPM without the use of a VFD. Wheels with rotation speed higher than 20RPM are not acceptable due to increased carryover cross leakage.

4.6.4 Speed reducer and belt tensioner shall be permanently lubricated and maintenance free.

4.7 Controls (optional):

4.7.1 The variable frequency drive (VFD) controller shall support full economiser and frost protection modes with the use of four temperature sensors located in all four air tunnels (Outdoor air, Supplied air, Return air & Exhaust air).

4.7.2 Frost control: VFD to modulate wheel speed in order to maintain the exhaust temperature above set point (default: 34°F, adjustable).

4.7.3 Economiser mode: When outdoor air temperature is below the return air temperature, the VFD shall modulate wheel speed in order to prevent the supply temperature from exceeding set point (default: 60°F, adjustable).

4.7.4 All sensors to be pre-assembled on wheel by the wheel manufacturer and linked to a single junction box with a quick connect AMP/MOLEX type connector. Matching connector to be supplied with 50 feet of wire for quick and easy connection at the VFD terminal.

4.7.5 The drive system shall allow for a turndown ratio of 80:1 (20 rpm to ¼ rpm).

4.7.6 The VFD shall be supplied with a NEMA 1 enclosure (NEMA 4, 3R or 3R with heater for outdoor installations optional).

4.7.7 The VFD standard communication protocol shall be: S-422/485 MEMOBUS/Modbus at 115.2 kbps (BACnetTM or LonworksTM optional).

4.7.8 VFD to be supplied with LCD display screen for easy monitoring of VFD parameters, inputs and outputs.

4.7.9 Communication Capabilities: VFD software to enable building automation system (BAS) to monitor temperatures, control discharge set point, wheel rotation speed and display alarms.

4.8 Options:

4.8.1 Full frost control and economiser VFD controller with 4 temperature sensors pre-installed on wheel.

4.8.2 Four temperature sensors pre-installed on wheel and linked to a single junction box (sensors only, VFD by others).

4.8.3 Physical induction rotor detection (standalone module or part of the VFD controller).

4.8.4 Top, bottom and sides aluminum panels (frame).

4.8.5 Permanently greased bearings.

4.8.6 High resistance 2 part epoxy paint (frame tubular assembly).

4.8.7 High resistance 2-parts epoxy coating on both side of media (edges).

4.8.8 Motor quick connect at junction box (AMP/MOLEX 4 Pos. 0.25″).

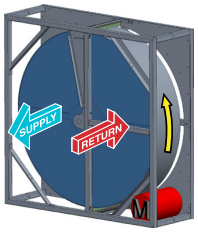
6.3 I4 wheel ordering form

innergy tech

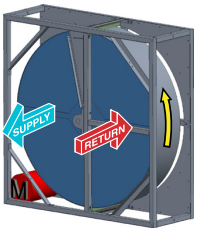
SELECTION FORM
I4 ENERGY RECOVERY WHEEL

CONFIGURATIONS

SIDE - BY - SIDE AIRFLOWS



☐ NO. 1



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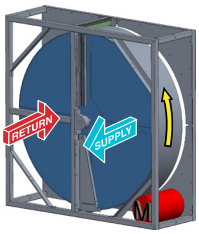

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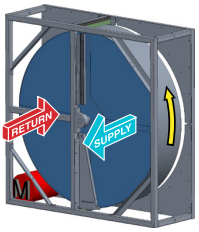
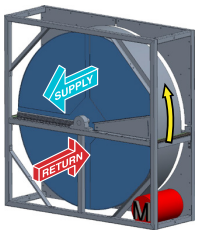


☐ NO. 6

TOP AND BOTTOM AIRFLOWS



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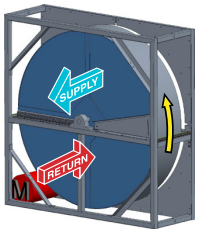

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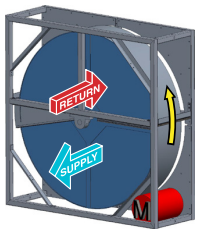
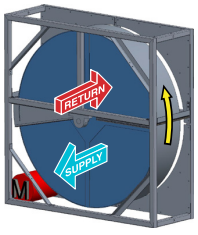


☐ NO. 4



☐ NO. 8

= Supply Air
= Return Air
= Wheel Rotation
= Motor Location

COMPANY NAME: _____

PROJECT NAME: _____

UNIT (AHU) NUMBER: _____

QUOTE NUMBER: _____

NOTE: _____

_____

Wheel Sizes

☐ 48 ☐ 54 ☐ 62 ☐ 70 ☐ 78
☐ 88 ☐ 96 ☐ 108 ☐ 120

Installation Type

☐ I4 Factory Assembled (std) ☐ I4R Field Installed

Rotor Type

☐ Total (MS3A desiccant) ☐ Sensible (Epoxy Coated)

Matrix

☐ High Perf. (07) ☐ Standard (09) ☐ Low Pressure (13)

Motor Characteristics

☐ 208/3/60 ☐ 460/3/60 (std) ☐ 120/1/60*
☐ 230/3/60 ☐ 575/3/60

*not compatible with VFD

Purge Angle

☐ 0° ☐ 1° ☐ 2° ☐ 3° ☐ 4° ☐ 5°
☐ 6° ☐ 7° ☐ 8° ☐ 9° ☐ 10° ☐ 11°

☐ No Purge Warning: No purge plate will be installed if this option is checked.

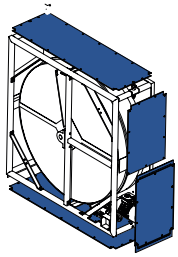
Flow Directions

☐ Counterflow (Standard) ☐ Parallel Flow

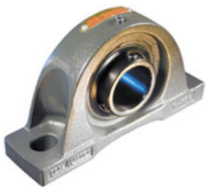
Note: If it is not Counterflow please check Parallel Flow. In that case, the return airflow will be inverted and in the same direction as supply airflow.

To select among available options, go to page 2

WHEEL OPTIONS

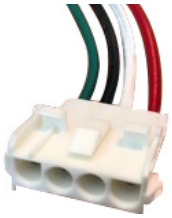


- [ ] Galvanized Sheet Metal Top Bottom And Sides Plates



- [ ] Permanently Sealed Bearings

- [ ] Two-Part Epoxy Paint (Casing)
- [ ] Two-Part Epoxy Coating (Media)



- [ ] Motor Quick Connect At Junction Box Amp/Molex 4 Pos. 0.25"

CONTROL OPTIONS

IB0010

- [ ] Variable Frequency Drive (with 4 temperature sensors installed on wheel)
- [ ] 4 Temperature sensors installed on wheel (sensors only, VFD by others)

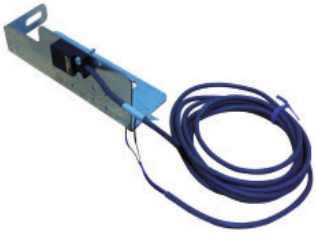
Communication Protocol

- [ ] Modbus (std)
- [ ] Bacnet
- [ ] Lonworks

Note: Standard control package includes frost protecton and freecooling with automatic summer changeover.

Casing According to Usage Temperature and Environment

- [ ] Nema 1 (std)
- [ ] 14°F (-10°C) Indoors
- [ ] Nema 12
- [ ] 14°F (-10°C) Indoors with Light water splashing
- [ ] Nema 3r
- [ ] 14°F (-10°C) Outdoors
- [ ] Nema 3r + Heater for Outdoors installation down to -40°F (-40°C)



Rotation Detection Alarm

- [ ] Rotation Detector With VFD
- [ ] Stand Alone Rotation Detector (If No VFD Is Used)

APPROVED BY: _____

ABOUT INNERGY TECH

For more than 20 years, Innergy tech has been providing state-of-the-art, air-to-air heat and energy recovery products to the HVAC industry. With over 1 million residential and commercial products sold in more than 20 countries around the globe, Innergy tech is recognized as a world market leader in the heat and energy recovery industry. Our company is known for the quality of its products, its highly skilled technical services and for its ability to meet its commitments to its customers.

Founded in 1995, Innergy tech has already moved 3 times to larger facilities in response to the increasing worldwide demand and is now operating in a 41,000 sq. feet modern facility. With the help of state-of-the-art manufacturing equipment, all the latest lean manufacturing concepts have been implemented and are supported by a comprehensive quality management system certified under the ISO 9001 standards. Visitors are always welcome to see for themselves how Innergy tech can help bring their company to new levels.

Innergytech factory (Drummondville, Canada)

Innergy tech expertise

Research and development of new products at the leading edge of technology has always been our strength. It is the reason why we are now offering, and constantly improving, the most complete product line in the heat and energy recovery industry. If you are looking for Energy Recovery Wheels (Heat Wheels), Heat Pipes, Sensible or Enthalpy Plates Exchangers we can fill your needs.

Certified performance at Innergy tech

At Innergy tech, we strongly believe in third party certified performances as the only way to insure quality products that will perform as designed. Based on this belief, we have been part of the AHRI1060 certification program from its very beginning as well as being an active AHRI (Air-Conditioning, Heating & Refrigeration Institute) member. This continuous effort resulted in a well-established industry certification program, which is now making the life of our customers far easier since they no longer have to accept self-certified products. This certification will give you peace of mind.

setting the standard
for **energy recovery**

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HEAT PIPES • PLATES
WHEELS • CORES

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